

Annexure – 19: SPECIAL CONDITIONS OF CONTRACT & BOM							Doc no. HY-MM:ATC-GEM:Rev 04			
BILL OF MATERIAL AND DISPATCHING SCOPE OF ITEMS FOR THIS RFQ/ENQUIRY ARE AS FOLLOWS:										
BHEL REF. NO:			B7B1Z44749							
Bill of Materials:		PIPE FITTINGS -				for	BHEL/HPEP/STOCK-PROJECT SPECIFIC			Project
ITEM SL. NO	PR	PR ITEM	MATERIAL CODE	DESCRIPTION	QTY/NOS.	SPECIFICATION -VAR	IBR REQUIREMENT	PQC REF. NO.	QP REF. NO.	REMARKS (QUOTED/NOT QUOTED)
1	5000044699	10	HY7242592135	LR ELBOWS 90DEG AS 2" SCH 80 BW	45.000	HY7242592	YES	TC56586	SQP-R07-PIPE-FITTING	
2	5000044749	10	TC9756550325	RDCR 4"X11/2" 10SX40S BW SS316L+IGC	12.000	TC56550-32	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
3		20	TC9756556099	ELBOW 1/2" 80S BW SA403 GR WP316L+IGC	300.000	TC56556-09	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
4		30	TC9756556110	ELBOW 3/4" 80S BW SA403 GR WP316L+IGC	600.000	TC56556-11	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
5		40	TC9756556145	ELBOW 1" 40S BW SA403 GR WP316L+IGC	700.000	TC56556-14	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
6		50	TC9756556200	ELBOW 2" BW SCH160S SS316L+IGC	20.000	TC56556-20	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
7		60	TC9756556218	ELBOW 3" 10S BW SA403 GR WP316L+IGC	350.000	TC56556-21	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
8		70	TC9756556250	ELBOW 4" 10S BW SA403 GR WP316L+IGC	80.000	TC56556-25	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
9		80	TC9756556293	ELBOW 6" 10S BW SA403 GR WP316L+IGC	200.000	TC56556-29	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
10		90	TC9756556455	ELBOW 3" SCH XXS BW SA403 GR WP316L	4.000	TC56556-45	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
11		100	TC9756556463	ELBOW 10" 10S BW SA403 GR WP316L	78.000	TC56556-46	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
12		110	TC9756562030	RDCR.CON3/4"X1/2" 80SX80S BW SS316L+IGC	114.000	TC56562-03	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
13		120	TC9756562056	RDCR.CON 1"X1/2" 40SX80S BW SS316L+IGC	60.000	TC56562-05	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
14		130	TC9756562072	RDCR.CON 1"X 3/4" 80SX80S BW SS316L+IGC	14.000	TC56562-07	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
15		140	TC9756562102	RDCR.CON 2" X 1" 40SX40S BW SS316L+IGC	36.000	TC56562-10	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
16		150	TC9756562129	RDCR.CON 3"X11/2" 10SX40S BW SS316L+IGC	30.000	TC56562-12	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
17		160	TC9756562161	RDCR.ECC 3"X2" 10SX40S BW SS316L+IGC	25.000	TC56562-16	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
18		170	TC9756562196	RDCR.CON 6"X3" 10SX10S BW SS316L+IGC	7.000	TC56562-19	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
19		180	TC9756562234	RDCR 11/2"X3/4" 160SX80S BW SS316L+IGC	9.000	TC56562-23	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
20		190	TC9756562242	RDCR.CON11/2"X1" 160SX80S BW SS316L+IGC	5.000	TC56562-24	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
21		200	TC9756562250	RDCR.CON 2"X11/2" SCH160S BW SS316L+IGC	8.000	TC56562-25	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
22		210	TC9756562340	RDCR CONC 1"X1/2" SCH80S BW SS316L	12.000	TC56562-34	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
23		230	TC9756562439	RDCR.CON 2" X 1" SCH80S BW SS316L	10.000	TC56562-43	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
24		240	TC9756562510	RDCR. ECC. 4"X2" SCH10SXSCH40S BW 316L	30.000	TC56562-51	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
25		250	TC9756562552	RDCR.ECC 3"X2" 40SX40S BW SS316L+IGC	8.000	TC56562-55	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
26		260	TC9756562560	RED.ECC 3" X 11/2"40SX40S BW SS316L+IGC	8.000	TC56562-56	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
27		270	TC9756562579	RDCR.ECC 2"X11/2" 40SX40S BW SS316L+IGC	72.000	TC56562-57	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
28		280	TC9756562587	RDCR.ECC 3"X2" SCH XXS X 160S BW SS316L	4.000	TC56562-58	NO	TC56586	SQP-R03-PIPE-FITTING-NH	

29		290	TC9756564075	TEE 1" SCH 80S BW SS316L	18.000	TC56564-07	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
30		300	TC9756564105	TEE 2" 40S BW SS316L+IGC	60.000	TC56564-10	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
31		310	TC9756564113	TEE 3" 10S BW SS316L+IGC	50.000	TC56564-11	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
32		320	TC9756564121	TEE 3" 40S BW SS316L+IGC	8.000	TC56564-12	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
33		330	TC9756564130	TEE 4" 10S BW SS316L+IGC	66.000	TC56564-13	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
34		340	TC9756564164	TEE 2" SCH160S BW SS316L+IGC	4.000	TC56564-16	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
35	5000044754	10	HY7242501415	ELBOW 90DEG 3/4" 6000 SW AS(A182F22)	45.000	AA7242501	YES	TC56586	SQP-R07-PIPE-FITTING	
36		20	HY7242581087	AS ELBOW-90DEG-LR-1-SCH80-F22-BW	12.000	HY7242581	YES	TC56586	SQP-R07-PIPE-FITTING	
37		30	HY7242582130	AS EQ. TEE 2" SCH 80 BW	6.000	HY7242582	YES	TC56586	SQP-R07-PIPE-FITTING	
38		40	HY7242582229	STRAIGHT TEES AS 4" SCH 40BW	18.000	HY7242582	YES	TC56586	SQP-R07-PIPE-FITTING	
39		50	HY7242582261	STRAIGHT TEES AS 6" SCH 40BW	6.000	HY7242582	YES	TC56586	SQP-R07-PIPE-FITTING	
40		60	HY7242583225	CR AS(SA234 WP11) 6"X4" SCH 40X40BW	12.000	HY7242583	YES	TC56586	SQP-R07-PIPE-FITTING	
41		70	HY7242583454	CR AS(SA234 WP11) 4"X2" SCH40X40BW	3.000	HY7242583	YES	TC56586	SQP-R07-PIPE-FITTING	
42		80	HY7242699126	RDCR CONTC 1" X 1/2" SCH 80 BW AS	15.000	HY7242699	YES	TC56586	SQP-R07-PIPE-FITTING	
43		90	HY7242699142	AS REDUCER 3" X 2" SCH 40S X 40S (WP22)	9.000	HY7242699	YES	TC56586	SQP-R07-PIPE-FITTING	
44		100	HY7242582199	STRAIGHT TEES AS 3" SCH 160BW	18.000	HY7242582	YES	TC56586	SQP-R07-PIPE-FITTING	
45		110	HY7242583136	AS CONC.REDUCER 3" X 2" SCH 40 X 80	6.000	HY7242583	YES	TC56586	SQP-R07-PIPE-FITTING	
46	5000044760	10	AA7242510350	TEE 1 1/2" CL6000LBS SW CS	21.000	AA7242510	YES	TC56588	SQP-R07-PIPE-FITTING	
47		20	AA7242520320	COUPLING 3/4" CL6000LBS SW CS	25.000	AA7242520	YES	TC56586	SQP-R07-PIPE-FITTING	
48		30	TC9767390014	STUB SLANTIMMER SS316LSCRW M33X2-F L=64	90.000	TC67390-01	NO	TC56681		
49		40	TC9767390022	STUB STRT SS316L SCR W M33X2-F L=64	63.000	TC67390-02	NO	TC56681		
50		50	TC9767390030	STUB STRT SS316L SCR W M33X2-F L=45	45.000	TC67390-03	NO	TC56681		
51	5000044761	10	TC9756556315	ELBOW 8" 10S BW SA403 GR WP316L+IGC	93.000	TC56556-31	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
52		20	TC9756556471	ELBOW 14" 10S BW SA403 GR WP316L+IGC	24.000	TC56556-47	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
53		30	TC9756562218	RDCR.CON 10"X8" 10SX10S BW SS316L+IGC	15.000	TC56562-21	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
54		40	TC9756562544	RDCR. ECC. 8"X6" SCH10SXSCH10S BW 316L	28.000	TC56562-54	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
55		50	TC9756564156	TEE 8" 10S BW SS316L+IGC	14.000	TC56564-15	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
56		60	TC9756564296	TEE 10" 10S BW SS316L+IGC	9.000	TC56564-29	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
57		70	TC9756556498	ELBOW 12" 10S BW SA403 GR WP316L+IGC	45.000	TC56556-49	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
58		10	TC9756556021	ELBOW 3/4" #3000 SW SS182F316L +IGC	100.000	TC56556-02	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
59		20	TC9756564024	TEE 3/4" #3000 SW SS316L+IGC	60.000	TC56564-02	NO	TC56586	SQP-R03-PIPE-FITTING-NH	

60	5000044763	30	TC9756564032	TEE 1" #3000 SW SS316L+IGC	60.000	TC56564-03	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
61		40	TC9756564040	TEE 1.1/2" #3000 SW SS316L+IGC	75.000	TC56564-04	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
62		60	TC9756565039	VERTICAL INSERT 1" #3000SW SS316L	85.000	TC56565-03	NO	TC56586	SQP-R07-PIPE-FITTING	
63		70	TC9756565055	VERTICAL INSERT 1/2"#6000 SW SS316L	150.000	TC56565-05	NO	TC56586	SQP-R07-PIPE-FITTING	
64		80	TC9756565063	VERTICAL INSERT 3/4" #6000SW SS316L	10.000	TC56565-06	NO	TC56586	SQP-R07-PIPE-FITTING	
65		90	TC9756731028	WELDOLET 1" #6000 BW 80S SS316L	26.000	TC56731-02	NO	TC56586	SQP-R07-PIPE-FITTING	
66		100	TC9756731036	WELDOLET 1.5" #6000 BW 160S SS316L	26.000	TC56731-03	NO	TC56586	SQP-R07-PIPE-FITTING	
67		110	TC9767389032	SOCKET REDUCER SS(WP 316L) 22/17.7	27.000	TC67389-03	NO	TC56586	SQP-R03-PIPE-FITTING-NH	
68	5000044764	10	AA7242510449	AS Tee 1 1/2" # 6000 SW (SA182 F22)	6.000	AA7242510	YES	TC56586	SQP-R07-PIPE-FITTING	
69		20	HY7242573122	REDUCER ECC 2"X1 1/2" SCH 80X80 BW CS	25.000	HY7242573	YES	TC56586	SQP-R07-PIPE-FITTING	
70		30	HY7242592089	LR ELBOWS 90DEG AS 1" SCH 80 BW	168.000	HY7242592	YES	TC56586	SQP-R07-PIPE-FITTING	
71		40	AA7242501172	AS ELBOW 90 DEG 11/2" # 3000 SW	36.000	AA7242501	YES	TC56586	SQP-R07-PIPE-FITTING	
72		50	HY7242698090	CAP AS(SA234WP11) NOM SIZE 4" SCH 40 BW	3.000	HY7242698	YES	TC56588	SQP-R07-PIPE-FITTING	
73		60	HY7242698111	CAP 4" SCH 80 BW AS(P22) HT	3.000	HY7242698	YES	TC56586	SQP-R07-PIPE-FITTING	
74		70	HY7242699380	AS RDCR 4"X2" SCH XXS BW(P 22)	9.000	HY7242699	YES	TC56586	HYQA/SQP/TC/20-21/09_R6	

Notes:

- 1 All items are to be supplied in line with BHEL specification only. Otherwise your offer will not be considered.
2 Supplier shall submit offer**FOR Destination. P&F,Freight and Insurance in supplier scope.**
3 Third party Inspection (TPI) is in BHEL scope (Charges to BHEL account). However, supplier shall coordinate with BHEL-TPI agency for inspection.
4 Suppliers shall submit complete compliance to BHEL specifications in their technical bid. Technical acceptance of the offers/ Bids is subject to BHEL/end customer approval only.
5 Evaluation is on **Itemwise** basis.
6 Item shall be delivered to below address.

For Item Sl. No. 1 to 74
- TC STORES
BHEL/HPEP/HYDERABAD

RAMACHANDRAPURAM

TELENGANA
PIN-502032

Annexure – 19: SPECIAL CONDITIONS OF CONTRACT & BOM

SL. NO.	Clause	Vendor Response	Comments
		Yes/No	
1	Penalty Clause:		Non Deviatable Clause
	18. LIQUIDATED DAMAGE/ PENALTY: In the event of delay in supply /part-supply of goods, Penalty as detailed below is leviable a. Penalty of 0.5% per week or part there of shall be levied, limited to a max of 10% (ten percent) of delayed portion value / order value as per PR. b. Penalty applicable for delay in documentation is as per PR. c. Date Reckoned for Penalty - Indigenous Orders with delivery terms FOR HPEP: C Note date. - Indigenous Orders (Others): Date of e-waybill. d. Timelines as mentioned in the Annexure 20 will be considered for reckoning delivery.		
	For Material:		
	However, C Note (In case of destination of goods is BHEL, Hyderabad) and MRC date (In case the destination of goods is Direct Dispatch to Site) shall be considered as a delivery date for Penalty Calculation. Note: Absence of enclosed Annexure-20 (Duly signed and stamped) will entail non processing of delivery extension cases in case of delay in supplies of goods owing to reason attributable to BHEL.		
	For Services:		
	Vendor has to specify the period of days prior intimation is required for mobilizing Field Service Engineer to Site. (If vendor fails to depute their service engineer with-in specified period , LD Clause will be applicable as mentioned in GeM T&C for Services). If no. of days is not specified, seven days will be considered as period of days of prior intimation		
	Guarantee / Warranty Period:		

2	Wherever required, and so provided in the specifications/Purchase Order, the seller shall guarantee that the goods supplied shall comply with the specifications laid down, for materials, workmanship and performance. If within the guarantee period, the delivery is found to be non-complaint, the seller shall on his own account, replace repair, or re-execute the delivery at Purchaser's discretion on the purchaser's first request or within the mutually agreed period, without prejudice to Purchaser's other legal rights. If the seller continues to default on their obligations, purchaser has the right to proceed to replace, repair or re- execute the order at the seller's expense, with or without help from third parties. Purchaser shall notify the seller of the exercise of this right in advance where ever possible. Unless otherwise specified, The guarantee period shall be 12 months from the date of commissioning or 18 months from the date of supply/replacement whichever is earlier. For bought out packages which are intended to be incorporated in installations or systems the guarantee period shall not start until the time the installations or systems are commissioned, provided always that the period ends not later than 30 months after the date of supply of the goods. The guarantee period shall be extended by the period during which the goods are not in compliance. A guarantee period as described above shall apply afresh to replaced, repaired or re-executed parts of a delivery.		Non Deviatable Clause
3	Detailed Billing Break up: Vendor has to provide detailed Price Breakup for the BHEL Material Codes after Price Bid Opening/Reverse Auction.		Non Deviatable Clause
4	Delivery: 84 Days from the date of GEM Purchase Order (PO). However, it may be noted that the delivery mentioned in the RFQ shall be meet by vendors. In case, the delivery mentioned in the tender is not met, BHEL reserves right to reject such offers.		Vendor to quote the best possible delivery period.

	Annexure 1 has to be duly filled and Signed. Vendor to note that dispatch of goods shall be done only after obtaining Dispatch Clearance from BHEL, Hyderabad.		
5	Following Duly Signed & Stamped Documents has to submitted along with your Technical Offer 1. Annexure-12 – Local Content 2. Annexure-13 – Restriction of procurement from Countries sharing land with India 3. Annexure – 19: SPECIAL CONTRACT CONDITIONS & BOM 4. Annexure-20 – Delivery timeline agreement		Non Deviatable Clause
6	Bill of Material: BOM is enclosed for your reference. Supplier has to quote for the complete Qty. of BOM Table. Supplier has to quote FOR Destination inclusive of all taxes, entire BOM as Single Package. Evaluation of offer will be done on ITEMWISE BASIS of this RFQ.		
7	Others: Following points shall be noted Ø Bidder to note in case any offer received from non-PMD of BHEL vendor & as well as PMD vendor, their price bid will be considered only after receipt of technical suitability acceptance from BHEL/END USER. Ø Approval of drawings is Applicable Ø Approval of QAP is applicable Ø Equipment Inspection is applicable		Non Deviatable Clause
8	Inspection: Third party inspection by BHEL empanelled TPI (Inspections calls shall be raised by supplier in the below portal cqir.bhel.in and mail us at rathod@bhel.in, veeru@bhel.in, sdsarkar@bhel.in & nagesht@bhel.in). End Customer/ End Customer Appointed TPI will also participate in Joint Inspection, Wherever applicable.		Non Deviatable Clause
11	All offers received through the GeM portal will be evaluated and are subject to the BHEL/End User's approval for technical suitability. Vendors quoting for this Enquiry shall be approved vendor of BHEL and Project details are mentioned in BOM list.		
13	Please note that vendors offer is liable for rejection, in case any deviation to Non Deviatable Clause. Any other terms mentioned anywhere in your offer will not be considered. Terms agreed in the Buyer ATC and Special Contract Conditions are final.		

14	Contact Details of Supplier (mandatory):		
	Name:	Email:	
	Mobile:	Land line:	



Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad 502032, India

Ref # TCEP/PQC/TEMP-STUBS/01

Dt: 03/07/2023

Pre- Qualifying criteria for the vendors participating in "Open Tender for enquiry no _____ – Reg.

Clause wise response of vendor is necessarily to be submitted for technical evaluation of technical bid

Sl. No.	Description	Vendor's Response	Details of Documents enclosed, if any
1.1. General Requirements			
1.1.1	1) Offers from traders (for the purpose of this tender, any agency who is keeping /buying/supplying materials from different manufacturers under the same company's name, will be treated as trader) will not be considered.		
1.1.2	The offer shall be accompanied with relevant list of the in-house manufacturing and testing facilities & their capacities / ranges etc. Company catalogue or website address which included these details may be provided as an alternative.		
1.1.3	Vendors to confirm that they will meet all the requirements of BHEL specification provided with the enquiry. In case of any, the requirements of Pre-qualification criteria will be applicable. dispute/contradictions with the requirement of Pre-qualification criteria (this document) with the specification		
1.1.4	The vendor must have experience of manufacturing and supplying Temp–Stubs of the corresponding standards and grades as mentioned in the enquiry. Test Certificates shall be submitted as evidence of experience. At least two copy (one for minimum size and rating and other for maximum size and thickness / rating) manufacturer test certificates (TC in IBR form for CS/AS items) for the same or similar grade supplied by them to other customers shall be submitted along with the offer. a) The date of the issue of "Test certificate" shall not be older than 3 years from the NIT date. b) The mill test certificate shall include the results / reports for all the tests like Chemical, Mechanical and NDT etc., as required by BHEL Specification applicable to the present enquiry.		



Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad 502032, India

	c) The test certificates submitted as an evidence of the past experience of the manufacturer must include test requirements as stipulated in BHEL specification.		
1.1.5	Evaluation of Experience Evidence: The experience will be evaluated against the test certificate provided by the vendor with respect to BHEL technical requirement of the specification.		
1.1.6	Prior to dispatch of the material, Test Certificates (English language only) shall be send to BHEL for review and dispatch clearance by BHEL. The photographs of the material with the traceability/ marking and condition of the material before dispatch may be provided for dispatch clearance.		
1.1.7	As per "Ministry of Steel Order (latest as applicable)," if any of the enquiry items fall under "List of Steel Products under Mandatory Bureau of Indian Standards Certification," BIS certificate is to be provided mandatorily. The BIS certificate submitted by the vendor shall be valid till the delivery of material. In case the BIS certificate is expiring before the material delivery date, Vendor shall confirm the renewal of the certificate in advance so that the timely supply of the material to BHEL is ensured.		



Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad 502032, India

Ref # TCEP/PQC/PIPE FITTINGS & FLANGES/02

Dt: 06/03/2021

Pre- Qualifying criteria for the vendors participating in "Open Tender for enquiry no _____ – Reg.

Clause wise response of vendor is necessarily to be submitted for technical evaluation of technical bid

Sl. No.	Description	Vendor's Response	Details of Documents enclosed, if any
1.1. General Requirements			
1.1.1	1) Offers from traders (for the purpose of this tender, any agency who is keeping /buying/supplying materials from different manufacturers under the same company's name, will be treated as trader) will not be considered.		
1.1.2	The offer shall be accompanied with relevant list of the in-house manufacturing and testing facilities & their capacities / ranges etc. Company catalogue or website address which included these details may be provided as an alternative.		
1.1.3	Vendors to confirm that they will meet all the requirements of BHEL specification provided with the enquiry. In case of any dispute/contradictions with the requirement of Pre-qualification criteria (this document) with the specification, the requirements of Pre-qualification criteria will be applicable.		
1.1.4	The vendor must have experience of manufacturing and supplying Pipe fittings, flanges of the corresponding standards and grades as mentioned in the enquiry. Test Certificates shall be submitted as evidence of experience. At least two copy (one for minimum size and rating and other for maximum size and thickness / rating) manufacturer test certificates (TC in IBR form for CS/AS items) for the same or similar grade supplied by them to other customers shall be submitted along with the offer. a) The date of the issue of "Test certificate" shall not be older than 3 years from the NIT date. b) The mill test certificate shall include the results / reports for all the tests like Chemical, Mechanical and NDT etc., as required by BHEL Specification applicable to the present enquiry.		



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Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-67389	
				Rev. No. 01	
				Page 1 of 3	
SPECIFICATION FOR REDUCERS 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of the reducers 2.0. Application: 2.1) These Reducers are intended to use in H2 service. 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0) Material: ASTM A182 F316L 4.0 Applicable Standards: The following standards shall be followed for the respective items. 4.1) Dimensions, tolerances and General requirements shall be as per ASME B16.11 latest edition. 4.2) Technical requirements shall be as per Annexure-1. 4.3) NACE requirement shall be as per NACE MR0103 5.0 Technical delivery conditions: 5.1) As per corporate standard AA0851402 (a copy to be enclosed) except IBR. IBR is not required for these items.					
Ref.Doc.	None	Revisions :	Prepared: Priyadarshini	Approved: Chandu	Date of 1 st Issue: 31.08.2021
		Refer to record of revisions:			

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PRODUCT STANDARD

HYDERABAD

Prod. Std. No. TC-67389

Rev. No. 01

Page 2 of 3

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VARIANT TABLE:

Sl no.	Spec variant	Material code	Description	Size (inch)
1.	01	TC9767389016	SOCKET REDUCER SS (WP 316L)17.7/10.7	17.7/10.7
2.	02	TC9767389024	SOCKET REDUCER SS (WP 316L)22/14	22/14
3.	03	TC9767389032	SOCKET REDUCER SS(WP 316L) 22/17.7	22/17.7
4.	04	TC9767389040	SOCKET REDUCER SS (WP 316L)27.5X22	27.5x22
5.	05	TC9767389059	SOCKET REDUCER SS (WP 316L)1" x 1/2"	1"x1/2"
6.	06	TC9767389067	SOCKET REDUCER SS (WP 316L)34.2/27.5	34.2/27.5

[illegible]

ANNEXURE-1

1. PURPOSE AND SCOPE

- 1.1 This specification covers additional requirements relating to components intended for operation in Hydrogen service.
- 1.2 Applicability : This specification applies to all components for which Hydrogen Service requirement is indicated on the component technical data sheets.

2. REQUIREMENTS FOR PIPES, FITTINGS & FLANGES :

2.1 GENERAL (applicable to all pipes, fittings, flanges & special parts)

- 2.1.1 Material identification stamps (cold stamping) including punch marks and large hardness impressions are not permitted on hydrogen contacted surfaces.
- 2.1.2 Cold stamping on the outside surface shall be performed before heat treatment. Depth and sharpness of indentation shall be compatible with wall thickness of the component. These requirements do not apply to the stamping of flanges on their circumference.
- 2.1.3 Stamping of fittings after heat treatment is not permitted.
- 2.1.4 For steels which need to be preheated for welding, the preheat temperatures shall be maintained in all cases such as temporary welding, auxiliary welds and thermal cutting. Preheating shall penetrate the entire cross-sectional area of the material and shall extend over a width of 300 mm on both sides of the weld. Thermocouples shall be attached to the item being heat treated and the temperature shall be recorded for confirmation of the heat treatment.
- 2.1.5 Evidence shall be furnished for the base metal, heat affected zone and weld metal that hardness limitations have been satisfied. For this purpose, measurements shall be taken on the procedure qualification specimens and on the item concerned. Hardness values shall be checked at least at three locations in a direction perpendicular to the weld.
- 2.1.6 Serrations on the flange face shall be concentric for hydrogen service. Spiral serration is not acceptable.

2.2 APPLICABLE TO CARBON STEEL (CS) PIPES, FITTINGS, FLANGES & SPECIAL PARTS:

- 2.2.1 All pipes, forgings and fittings having wall thickness 9.53 mm and thicker shall be normalized. Cold drawn pipes & fittings shall be normalized after the final cold draw pass for all thickness. The normalizing shall be a separate heating operation and not a part of the hot forming operation. In addition, fittings made from forgings shall have carbon – 0.35 % Max. and Silicon – 0.35 % Max.
- 2.2.2 Carbon equivalent shall not exceed the following value:

$$Ceq = \%C + \frac{\%Mn}{6} + \frac{\%(Cr + Mo + V)}{5} + \frac{\%(Ni + Cu)}{15} \leq 0.42$$

Under no condition Ni content shall be in excess of 1%.

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2.2.3 All full penetration weld joints shall be 100% radiographed in accordance with ASME SECTION-VIII, DIV.-I, UW-51 & ASME SECTION-V. Radiography shall be done before PWHT and 100% UT shall be done after PWHT.

2.2.4 The hardness of any pressure containing component, weld & heat affected zone (after heat treatment) shall be limited to 200 BHN max.

2.3 APPLICABLE TO ALLOY STEEL (Cr-Mo) PIPES, FITTINGS, FLANGES & SPECIAL PARTS :

2.3.1 All pipes, flanges and fittings shall be normalized and tempered. The normalizing and tempering heat treatment shall be a separate heating operation and not a part of hot forming operation.

2.3.2 All full penetration weld joints shall be 100% radiographed in accordance with ASME SECTION-VIII, DIV.-I, UW-51 & ASME SECTION V. 100% radiography & UT shall be performed after PWHT.

2.3.3 The hardness of any pressure containing component, weld & heat affected zone (after PWHT) shall be limited to 225 BHN max.

2.3.4 The alloy content of welds shall be verified by chemical analysis. Tests shall be conducted when changes in weld wire and/or weld flux are made, or when a new set of electrode is used.

2.3.5 Maximum room temperature tensile strength of all pressure containing components and welds shall not exceed 100,000 PSI.

2.3.6 Under no condition Ni content shall be in excess of 1%.

2.4 APPLICABLE TO STAINLESS STEEL PIPES, FITTINGS, FLANGES & SPECIAL PARTS :

2.4.1 All pipes, flanges & fittings shall be solution annealed after welding and pickled.

2.4.2 All stabilized grades of stainless steel (SS321, SS321H, SS347, SS347H) shall be given a stabilizing heat treatment in addition to solution heat treatment at 900 ± 10 Deg.C for 4 hours. For "H" grades C content shall be 0.04% minimum.

2.4.3 All full penetration weld joints shall be 100% radiographed in accordance with ASME SECTION-VIII, DIVISION I, UW-51 and ASME SECTION V.

2.4.4 For all austenitic stainless steels, weld deposits shall be checked for ferrite content. A ferrite number (FN) of not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment and high temperature service. FN shall be determined by use of a ferrite scope. Ferrite scope measurements must be made prior to post weld heat treatment to be meaningful.

2.4.5 The maximum hardness of any pressure containing component, weld & HAZ shall be 200 BHN.

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3 REQUIREMENTS FOR VALVES:

3.1 GENERAL (applicable to all valves)

3.1.1 Each valve body, bonnet & cover casting shall be subjected to examination by radiography in accordance with ASME SECTION VIII, DIVISION I, APPENDIX 7.

3.1.2 Valves shall be labelled "SUITABLE FOR HYDROGEN SERVICE"

3.1.3 Helium Leakage Test :

Body/bonnet/cover joints & stuffing box of all valves and special parts (both forged and cast) shall have low emission. One valve per metallurgy, per rating and per size shall be helium leak tested as per ASME SECTION V, SUBSECTION A, ARTICLE 10, APPENDIX IV. (Detector Probe Technique) at a minimum of 25% allowable cold (rated) working pressure. Selection of valve for test shall be random. Test duration shall be as follows.

TEST DURATION IN MINUTES				
Nominal Size (mm)	PRESSURE CLASS			
	Upto 300	600	800, 900	1500
Upto 2"	3	6	9	12
3" to 6"	6	9	12	15
8" to 16"	9	9	12	15
18" to 24"	9	12	15	18

Leakage rate shall be less than 0.0001 ml/sec of helium.

3.1.4 The design & geometry of valve internals shall remove crevices & stagnant areas.

3.1.5 Valves shall be internally cleaned & free from moisture and grease.

3.2 APPLICABLE TO CARBON STEEL & ALLOY STEEL VALVES :

3.2.1 Carbon steel castings / forgings shall be normalized & alloy steel castings / forgings shall be normalized and tempered.

3.2.2 Critical body, bonnet, cover casting sections, typically defined by ASME B16.34, shall be radiographed and shall meet ASTM E446 (up to 2" thick) Category A, B & CA-Level 2, Category CB, CC & CD-level 3, Category D, E & F level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 shall be used for recommended practice & controlling quality of radiography as guide. The entire surface of the castings shall be dye penetrant inspected.

3.2.3 Bend tests and magnetic particle inspection of the entire surface of body and bonnet castings shall be carried out in accordance with ASTM A217 supplementary requirements S3 & S4. Evaluation of magnetic particle inspection shall be in accordance with MSS SP-53 except that no linear discontinuities shall be allowed.

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- 3.2.4 The brinell hardness of heat treated casting shall not exceed 200 BHN for carbon steel and 225 BHN for alloy steel.
- 3.2.5 The tensile stress for A.S. shall be less than 100,000 PSI for alloy steel.
- 3.2.6 Repair of defective casting shall be outlined in writing to the purchaser before repair starts. Repair method to be approved prior to welding.

Castings shall be preheated to a minimum of 400F prior to welding and all Chromium-molybdenum alloys shall be postweld heat treated after welding is complete. Stress relieving is essential for welds.

Dye penetrant test of welds shall be in accordance with ASTM B165 procedure B-2. Interpretation as per appendix-8 of ASME – VIII Div.1.

Repair welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye penetration test shall be as per ASTM E165 procedure B-2, interpretation as per Appendix -8 of ASME-VIII Div.1.

3.3 APPLICABLE TO STAINLESS STEEL VALVES:

- 3.3.1 Casting shall be in the solution heat treated and pickled condition. All castings and test bars shall be heat treated together.
- 3.3.2 Critical body and bonnet casting sections, typically defined by ASME B16.34, shall be radiographed and shall meet ASTM E446 (up to 2" thick) Category A, B & CA-Level 2, Category CB, CC & CD-level 3, Category D, E & F level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 shall be used for recommended practice & controlling quality of radiography as guide. The entire surface of the castings shall be dye penetrant inspected after pickling.

Repair welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye penetration test shall be as per ASTM E165 procedure B-2, interpretation as per Appendix -8 of ASME-VIII Div.1.

4

IMPACT TESTING:

4.1

For all carbon steel and alloy steel pipes, flanges and fittings with thickness over 19 mm, Charpy V-notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div.-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and in accordance with ASTM A370. Impact energies at 0 Deg. C shall average greater than 27J (20ft-lb) per set of 3 specimens with a minimum of 19J (15 ft-lb)

If welding is used in manufacturing, impact test of heat affected zone (HAZ) and weld metal shall also be carried out.

Charpy V notch impact testing is to be done for all CS & AS valves material (average 20 ft-lb for set of 3 [minimum value 15 ft-lb] at 30 F).

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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted. Post Order Concession/Deviation Permit 5-0000-0180-F1 as mentioned in Cl. 5.18 of Specification for Quality Management System Requirements from Bidders (6-78-0001) is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR, Clauses 1.7.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Positive Material Identification (PMI) shall be performed as per scope and procedures defined in the Specification for Positive Material Identification (PMI) at Supplier's Works (6-81-0001).

1.2.3 Refer to specification no.6-81-0005 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Beveled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

- 1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- 1.7.3 Welded tees shall not be of fabricated (stub-in) type.
- 1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.
- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo" & "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.

1.8 Stainless Steel Fittings

- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.9 NACE/HIC Requirements

- 1.9.1 Fittings under "NACE" category or those designated as "HIC1" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.9.2 Fittings made from plates and designated as "HIC1" shall meet the HIC requirements of EIL specification 6-79-0013 unless otherwise specified.
- 1.10 Thickness/schedule lower or higher than specified for the finished product shall not be accepted.

For manufacturing of elbows from pipes, same size of pipe as that of elbow shall be used and the nominal wall thickness of the starting pipes shall have positive tolerance only. However, where the manufacturer has an established automatic/semi-automatic process for the manufacture of elbows, the starting pipe may be permitted to be of lower size with higher schedule as required. Starting pipe of higher size than that of the elbow shall not be permitted.

- 1.11** The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12** Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13** Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14** Threaded ends shall have NPT taper threads in accordance with ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.
- 1.15** Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16** Special fittings like weldolet, sockolet, sweepolet, latrolet, elbolet etc., the dimensions of which are not covered in ASME, MSS-SP & EIL Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17** Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18** For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19** All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below :

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
API 5L ASTM A358 TP 304, 304L, 304H, 318, 318L, 318H, 321, 347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
ASTM B725	ASTM B725
ASTM B517	ASTM B517
ASTM B514	ASTM B514

- 1.20** The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

1.21 Abbreviations for ends of swages and nipples shall be as follows:

PBE	:	Plain Both Ends
TBE	:	Threaded Both Ends
TOE	:	Threaded One End
TSE	:	Threaded Small End
TLE	:	Threaded Large End

1.22 All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.

1.23 For Hydrogen service fittings following special requirements shall also be met:

- All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon- 0.35 % max. and Silicon- 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation
- All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
- For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
- For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritoscope prior to post weld heat treatment.
- For all Carbon steel and Alloy steel fittings with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).

1.24 For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.

1.25 All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr-1Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.

1.26 Fitting material as per ASTM A234 Gr.WP5/WP9/WP91, wherever specified, shall be as per 'Cl.1', unless otherwise specified.

1.27 Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 IBR REQUIREMENTS

2.1 IBR Documentation Required

- 2.1.1 Fittings under the purview of "IBR" (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form III-C duly approved and countersigned by IBR authority / local authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.
- 2.1.2 For materials 1½Cr - ½Mo (ASTM A 234Gr.WP11 & ASTM A234 Gr.WP11W) & 2½Cr - 1Mo (ASTM A 234 Gr.WP22 & ASTM A234 Gr. WP22W) & 9Cr-1Mo-V (A234 Gr.WP91/ A234Gr.WP91W), where fittings are manufactured from pipe, Form III-C approved by IBR shall include the tabulation of E_t , S_e , & S_r values for the entire temperature range given below. E_t , S_e , & S_r values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t / 1.5 & \geq & \\ S_t / 1.5 & \geq & S_A \\ S_e & \geq & \end{array}$$

- S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature)
 S_e : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
 S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)												
Temp(F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
Material												
A234Gr.WP11/ A234Gr.WP11W	21700	20900	20500	20100	19700	19200	18700	13700	9300	6300	4200	2800
A234Gr.WP22 / A234Gr.WP22W	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A234Gr.WP91/ A234Gr.WP91W	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

- 2.2 For carbon steel pipes under IBR the chemical composition shall conform to the following:

- Carbon (max) : 0.25%
 Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 ACCEPTABLE DEVIATIONS

- 3.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought

fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.

3.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5Mo min.).

3.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

4.0 MARKING AND DESPATCH

4.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "IBR", "Cryo", "NACE" and "H2" etc.

4.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.

4.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.

4.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.

4.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

4.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

4.7 Fittings coming under the purview of "IBR", "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel/socket/screwed end for other fittings.

4.8 Each end of fitting shall be protected with a wood, metal or plastic cover.

4.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package/ container clearly identifying the contents.

5.0 REFERENCES

- | | | |
|-----------|---|--|
| 6-81-0001 | : | Specification for Positive Material Identification (PMI) at Supplier's Works |
| 6-81-0005 | : | Inspection & test plan for forged, seamless and welded fittings |
| 6-79-0013 | : | Material requirements for carbon steel components used in sour service for petroleum refinery environments |



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HY0851495

REV. NO. 01

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TECHNICAL DELIVERY CONDITIONS FOR ASME-PIPE FITTINGS

1.0 SCOPE:

This standard stipulates the technical delivery conditions for socket-welding and threaded fittings like elbow, tees, couplings etc. to ASME: B16.11 and seamless/welded construction butt-welding fittings like elbows, tees, reducers etc. to ASME: B16.9 and ASME B16.28.

2.0 TECHNICAL REQUIREMENTS:

The socket-welding & threaded forged fittings shall comply with ASME: B16.11 and butt-welding fittings with ASME: B16.9/ASME:B16.28 & with the following specific requirements. All the fittings shall be manufactured and supplied as per latest version of ASME codes.

2.1 **Pressure class, schedule and size:** Pressure class and size for socket-welding fittings, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 **Material Specification:** The material of the fittings shall be as per enquiry/order. The material specification shall generally comply with the following, unless otherwise specified.

a) **Socket welding fittings:** Socket welding & threaded forged fittings shall be manufactured to the following material specification (Refer enquiry/ordering specification).

Carbon steel (Low temperature service) : ASME: SA350 Gr: LF2

Carbon steel (High temperature service) : ASME: SA105

Alloy steel (High temperature service) : ASME: SA182 Gr: F22/F11/F91-as applicable

Stainless Steel : ASME: SA182 Gr: F321

b) **Butt - welding fittings:** Seamless and welded construction butt-welding fittings shall be manufactured to the following material specification (Refer enquiry/ordering specification).

Carbon steel (Low temperature service) : ASME: SA420 Gr: WPL6

Carbon steel (High temperature service) : ASME: SA234 Gr: WPB

: ASME : SA234 Gr: WPBW

Alloy steel (High temperature service) : ASME: SA234 Gr: WP11

: ASME: SA234 Gr: WP22

Revisions:

Clause 9.1 (h) and F91 added .

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Stainless steel

: ASME: SA403 Gr: WP321
: ASME: SA403 Gr: WP304
: ASME : SA403 Gr: WP304W
: ASME : SA403 Gr. WP304WX

2.3 Heat Treatment: The fittings shall be properly heat treated as per the applicable material specifications.

2.4 Dimensions, Tolerances & Finish: The dimensions and tolerances shall be ASME - strictly as per ASME: B16.11 for forged steel fittings - socket welding and threaded, ASME B16.9- for factory made wrought butt-welding fittings. For allowable imperfections and finish of the fittings, relevant clause as per ASME:SA234/ SA 403/ SA 420 shall be applicable for carbon, alloy and stainless steel fittings.

All fittings shall be blast cleaned both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

2.5 Edge preparation:

2.5.1 Butt Welding Fittings: Unless otherwise specified , the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edges shall be machined as per ASME: B16.25.

2.5.2 Socket Welding/Threaded Forged Fittings: Unless otherwise specified, the forged fittings shall be machined as per dimensions and tolerances specified in ASME B 16.11.

3.0 RAW MATERIAL:

3.1 The raw material for the fittings shall consist of killed steel forgings, bars, plates, seamless tubular products, conforming to the chemical composition requirements of the applicable finish product specification and material grade.

3.2 It is the responsibility of the supplier to select the appropriate raw material so that all the pipe fittings meet the dimensional & other requirements indicated in this standard.

3.3 All the plates used for manufacturing of fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per level -C of SA 578.



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4.0 CHEMICAL COMPOSITION AND PROCESS:

4.1 Carbon percentage shall be limited as specified in the following table:

Sl. No.	Grade	Connecting pipe wall thickness	C%
1.	A105	All	0.25
2.	WPB, WPBW	All	0.25

4.2 Fittings shall be of seamless construction only unless otherwise specified in the enquiry/ordering specification. Fittings of nominal bore NB 50 and below shall be of forged construction only.

4.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

5.0 INSPECTION AND CERTIFICATION:

5.1 The pipe fittings shall comply with the quality requirements as per BHEL standard quality plan latest revision (copy to be attached with this plant standard). **Vendor shall confirm in the offer the total compliance of this quality plan .**

5.2 Mechanical and chemical testing: Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as per relevant material standards.

5.3.1 The butt welded pipe fittings shall not have the thickness less than 87.5% of the specified wall thickness at any location. The minimum wall thickness of each fitting shall be measured by using D - meter and shall be reported in the test certificate (Refer **Annexure-2**) & along with value of acceptable minimum thickness as per standard requirements.

5.3.2 The body & socket wall thickness of socket welded fittings shall be as per ASME B16.11 & Body & end wall thickness of threaded fittings shall be as per ASME B16.11

5.4 Magnetic Particle Examination: Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASTM Standard -E 709 for all carbon steel and alloy steel fittings for all schedules for sizes 2" inclusive and above.

5.5 Liquid Penetrant Examination: Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASTM Standard - E165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.

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- 5.6** Acceptance Criteria for MPE and LPE Tests: The acceptance criteria for MPE and LPE tests shall be in accordance with appendix 6 and 8 of ASME: Sec. VII DIV. 1
All surfaces to be examined shall be free of:-

- a) Relevant linear indications.
- b) Relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge).
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

5.7 **POSITIVE MATERIAL IDENTIFICATION (PMI):**

All alloy steel and stainless steel pipe fittings shall be checked by a suitable equipment for the material grade (i.e major alloying elements) at the manufacturer's works and certified accordingly in the test certificate's (Refer **Annexure – 3**) before dispatch. Vendor shall ensure the availability of the suitable test facility at his works and the equipment shall have valid calibration certificate.

- 5.8** **Wrinkless:** The inner bend portion of elbows shall be free from wrinkles and tool marks.

6.0 **CERTIFICATION:**

- 6.1** All fittings shall be delivered along with three original copies of test certificates in english as per the format enclosed in Annexure - 1.

6.2 **IBR CERTIFICATION:**

All the carbon and alloy steel pipe fittings pertaining to the material specifications: ASME: SA 234 Gr WPB, Gr. WP11, Gr. WP22; Gr. WP91; ASME SA 105 and ASME SA 182 Gr. F11, F22 & F91 shall be supplied under inspection and certification by IBR or by an inspection agency approved by IBR. The test certificates shall be provided in IBR format, form III C (i.e. in addition the test certificates to be furnished as per annexure-1, annexure-2 & annexure 3).

- 6.3** In addition to the requirement specified at 6.2 above, all the pipe fittings supplied as per this specification shall be inspected and certified by BHEL nominated inspection agency at the manufacturer's works. Scope of inspection shall be as per BHEL approved quality plan.

7.0 **GUARANTEE CERTIFICATE:**

The supplier shall furnish a guarantee certificate for the supplied products. It shall confirm that the supplied product (s) are in conformity with applicable codes & standards. It shall also confirm that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.



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8.0 QUALITY ASSURANCE DURING MANUFACTURING AND INSPECTION OF PIPE FITTINGS:

- a) Vendor shall ensure strict Quality Assurance Process while selecting the source of Raw Materials & their procurement methods. Vendor shall produce documentary evidences accordingly of its QA process ensuring the correct sourcing - at any time to BHEL's inspection agency. It shall be the responsibility of the vendor to ensure that no mix up of materials & their identification occurs during all stages of procurement, marking, transport, stocking at its works & also before starting of the manufacturing.
- b) All steps shall be ensured by the vendor so that only required materials as per specifications are only made input to manufacturing process, kept documented process assurance methods during total cycle of manufacturing, Heat-Treatment, surface treatment, testing & final painting/marketing/colour coding.

9.0 MARKING, PRESERVATION AND PACKING:

9.1 **Marking:** The following details shall be punched on each fitting.

- a) Manufacturer's name or trade mark.
- b) Type of fittings.
- c) Item designation (as per ordering specification).
- d) Material specification grade.
- e) Melt No.
- f) Test certificate number.
- g) Mark of Inspection Authority.
- h) BHEL Des no. (As indicated in P.O./intimated from BHEL).

9.2 **Preservation:** Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

9.3 **Packing:** All fittings shall be provided with suitable HDPE End Covers to protect the ends (socket/threaded ends or weld edge preparation) and to protect the internal surfaces. All fittings shall be packed and despatched in suitable wooden boxes, so that no damages occur during transportation/storing.

10.0 COLOUR CODING:

All the pipe fittings shall be colour coded by painting a circumferential ring of 10 mm width at one end of the fitting at a distance of 20 mm from the end. The colour of the circumferential ring shall be according to the applicable material grade as given in the table below.

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Sl. No.	Material	Colour of the ring
1.	SA 350 LF2	Red
2.	SA 105	Red
3.	SA 420 Gr. WPL6	Red
4.	SA 234 WPB	Red
5.	SA 234 WP11	Green
6.	SA 234 WP22	Blue
7.	SA234 WP 91	Orange
8.	SA182 F91	Orange
9.	SA 182 F22	Blue
10.	SA182 F11	Green
11.	SA 182 F321	White
12.	SA 403 WP321	White
13.	SA 403 WP304	Yellow

Table: Colour coding requirements.

11.0 REFERENCE STANDARDS AND SPECIFICATIONS:

The latest versions of the below mentioned standards and specifications shall be used as reference for supplying pipe fittings as per this specification.

ASME: B16.9
ASME: B16.11
ASME: B16.28
ASME: SA234
ASME: SA403
ASME: SA420
ASME: B16.25
ASME: SA435
ASME: SA578
ASTM: E 709
ASTM: E 165



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**ANNEXURE – 1 : TEST CERTIFICATE PROFORMA
SUPPLIER'S NAME AND ADDRESS
TEST CERTIFICATE FOR FORGINGS**

1. Customer :
2. TC No. & Date :
3. P.O. No. :
4. Process of Melting Ingot :
5. Deoxidisation Process :
6. Forging Method :
7. Reduction Ratio :
8. Batch No. :
9. Heat Code No. :
10. Spec No. :
11. Test Bar size :
12. Supplier of the Ingot/billet/bloom :

13. FORGINGS COVERED BY T.C.

S. No.	Drawing No. & Item No.	Description	Quantity & Weight

14. CHEMICAL COMPOSITION (PERCENT)

Element	C	Mn	S	P										
As per Specn.	Min.													
	Max.													
Actual values														

15. HEAT TREATMENT

(To be accompanied by Record Chart)

Condition	Heating rate °C/hr	Temp °C	Soaking Time Hr	Heating rate °C/hr	Cooling Med.

16. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% E on 5.65 √So GL	% R.A. Min.	Hardness BHN Min. 3 values	Impact value joule	Sand Test		
							Angle of bend	Dia of mandrel	Rem arks
As per min									
Specn. max									
Actual alues									

17. SURFACE FINISH

(When called for in the order/drg.)

18. DIMENSIONAL INSPECTION

19. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other details
Ultrasonic					
Radiographic					
Dye Penetrant/ Magnetic Particle					

20. METALLOGRAPHIC EXAMINATION

(To be conducted if called for and photo micrographs to be attached along with a report)

Position of sample	Etohan used	Magnification	Constituent observed	Relative %	

21. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS ETC.)

22. IDENTIFICATION OF FORGINGS AS PER CPS / PPS

We hereby certify that the items mentioned above have been issued and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE & SEAL OF THE
INSPECTING OFFICER

SIGNATURE AND SEAL OF THE CHIEF OF QUALITY
CONTROL/CHIEF METALLURGIST OF THE SUPPLIER

DATE:

DATE:

INSTRUCTIONS:

- a) Details of all heat treatment processes carried out should be furnished in the format provided at point No.15.
- b) Test certificates are to be furnished as per Purchase Order and specification, in A4 size paper.
- c) All the entries should be in block letters.
- d) If heat treatment is done by outside agencies, the original HT charts shall be furnished.
- e) The actual TC may run into more than one A4 size paper, if needed to facilitate filling up of details.

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ANNEXURE-2

TEST CERTIFICATE PROFORMA FOR RECORDING

MINIMUM THICKNESS MEASURED USING D-METER

SL. No.	ITEM DESCRIPTION	BHEL's MATERIAL CODE	BHEL's DES No.	MINIMUM THICKNESS (mm) REQUIRED AS PER CLAUSE 5.3.1	ACTUAL THICKNESS (mm) AS MEASURED USING D-METER	REMARKS ACCEPTED (YES/NO)

ANNEXURE-3

TEST CERTIFICATE PROFORMA FOR

POSITIVE MATERIAL IDENTIFICATION (PMI)

SL. No.	ITEM DESCRIPTION	BHEL's MATERIAL CODE	BHEL's DES No.	MATERIAL STANDARD	PMI TEST OBSERVATION	REMARKS ACCEPTED (YES/NO)

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Form No:	 HPEP	PRODUCT STANDARD TC ENGINEERING TECHNICAL SPECIFICATION FOR WELDOLETS	TC56731
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1. SCOPE:
This standard cover requirement of Weldolets. These are welded on to the pipe lines for providing tapping connections for instruments, bypass lines, drains and vents.

2. MATERIAL SPECIFICATION
2.1 The raw material specification shall be ASTM A182 F316L(SS)

3. SIZES AND DIMENSIONS
3.1. All dimensions shall be as indicated in the MSS SP97.
3.2. Base part of the Weldolet shall have provision to use it on a Pipe Diameter from 2" to 32".
3.3. Weld Bevel angle at the bottom of the weldolet (Longitudinal and transverse sections) shall be as shown below.


Transverse Section


Longitudinal Section

4. PROCESS
These items shall be forged to shape. Machining from rounds is not permissible.

5. TESTS AND HEAT TREATMENT
Tests and heat treatment shall be as per relevant material standards. Acceptance to any deviations / options shall be obtained from purchaser.

6. SPECIAL REQUIREMENT
6.1 All fittings shall be supplied strictly as per BHEL technical delivery conditions for pipe fittings "HY0851495".
6.2 PMI shall be conducted for all the stainless steel and alloy steel fittings.

6.3 Stainless Steel Fittings (IGC/Annealing):

6.3.1 All stainless-steel fittings shall be supplied in solution heat treated condition.
6.3.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
6.3.3 For all stainless-steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:
ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".
(Or)
ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record
6.3.4 For the IGC test as described in Clauses 6.3.3 two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content & other set to the highest fitting thickness

7. TEST CERTIFICATES

Record of Proof test (Type test) for each enquired size of weldolet shall be submitted along with technical offer.

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Form No:	 HPEP	PRODUCT STANDARD TC ENGINEERING TECHNICAL SPECIFICATION FOR WELDOLETS				TC56731
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8. DESIGNATION
 Name of the part shall be as below.
 8.1 WELDOLET 1.5" #6000 BW 160S SS316L
 8.2 Material specification shall be as **TC 56731** Var No.03.

9 MARKING
 Each item shall be marked (by punch marking) giving the following details.

9.1 Manufacturer's trade mark
 9.2 TITLE as " WELDOLET"
 9.3 Size X X
 9.4 Rating XXXX
 9.5 Material specification
 9.6 Component code

10 PROTECTION
 Items shall be protected from rust preferably treated with plastic coating peel-off type.

11 PACKING AND DISPATCH
 All items shall be packed properly to protect from mechanical damage during transport and storage.

12. Variant table:

Var. No	Description	BHEL Material code
01	WELDOLET 3/4" #6000 BW 80S SS316L	TC9756731010
02	WELDOLET 1" #6000 BW 80S SS316L	TC9756731028
03	WELDOLET 1.5" #6000 BW 160S SS316L	TC9756731036

13. Reference standards
 I) MSS SP97 II) ASME B16.25

14. RECORD OF REVISIONS:

Rev. No.	Date	Revision Details	Revised	Checked	Approved
00	19-04-2025	First Issue	MCK	CHANDU	BNR

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Stainless steel : ASME: SA403 Gr: WP321
: ASME: SA403 Gr: WP304
: ASME : SA403 Gr: WP304W
: ASME : SA403 Gr. WP304WX

2.3 Heat Treatment: The fittings shall be properly heat treated as per the applicable material specifications.

2.4 Dimensions, Tolerances & Finish: The dimensions and tolerances shall be ASME - strictly as per ASME: B16.11 for forged steel fittings - socket welding and threaded, ASME B16.9- for factory made wrought butt-welding fittings. For allowable imperfections and finish of the fittings, relevant clause as per ASME:SA234/ SA 403/ SA 420 shall be applicable for carbon, alloy and stainless steel fittings.

All fittings shall be blast cleaned both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

2.5 Edge preparation:

2.5.1 Butt Welding Fittings: Unless otherwise specified , the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edges shall be machined as per ASME: B16.25.

2.5.2 Socket Welding/Threaded Forged Fittings: Unless otherwise specified, the forged fittings shall be machined as per dimensions and tolerances specified in ASME B 16.11.

3.0 RAW MATERIAL:

3.1 The raw material for the fittings shall consist of killed steel forgings, bars, plates, seamless tubular products, conforming to the chemical composition requirements of the applicable finish product specification and material grade.

3.2 It is the responsibility of the supplier to select the appropriate raw material so that all the pipe fittings meet the dimensional & other requirements indicated in this standard.

3.3 All the plates used for manufacturing of fittings shall be ultrasonically tested by either of the following:

i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.

ii) ASME SA 578 and acceptance standard shall be as per level -C of SA 578.



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4.0 CHEMICAL COMPOSITION AND PROCESS:

4.1 Carbon percentage shall be limited as specified in the following table:

Sl. No.	Grade	Connecting pipe wall thickness	C%
1.	A105	All	0.25
2.	WPB, WPBW	All	0.25

4.2 Fittings shall be of seamless construction only unless otherwise specified in the enquiry/ordering specification. Fittings of nominal bore NB 50 and below shall be of forged construction only.

4.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

5.0 INSPECTION AND CERTIFICATION:

5.1 The pipe fittings shall comply with the quality requirements as per BHEL standard quality plan latest revision (copy to be attached with this plant standard). **Vendor shall confirm in the offer the total compliance of this quality plan .**

5.2 Mechanical and chemical testing: Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as per relevant material standards.

5.3.1 The butt welded pipe fittings shall not have the thickness less than 87.5% of the specified wall thickness at any location. The minimum wall thickness of each fitting shall be measured by using D - meter and shall be reported in the test certificate (Refer **Annexure-2**) & along with value of acceptable minimum thickness as per standard requirements.

5.3.2 The body & socket wall thickness of socket welded fittings shall be as per ASME B16.11 & Body & end wall thickness of threaded fittings shall be as per ASME B16.11

5.4 Magnetic Particle Examination: Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASTM Standard -E 709 for all carbon steel and alloy steel fittings for all schedules for sizes 2" inclusive and above.

5.5 Liquid Penetrant Examination: Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASTM Standard - E165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.

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- 5.6** Acceptance Criteria for MPE and LPE Tests: The acceptance criteria for MPE and LPE tests shall be in accordance with appendix 6 and 8 of ASME: Sec. VII DIV. 1
All surfaces to be examined shall be free of:-

- Relevant linear indications.
- Relevant rounded indications greater than 3/16 inch.
- Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge).
- An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

5.7 **POSITIVE MATERIAL IDENTIFICATION (PMI):**

All alloy steel and stainless steel pipe fittings shall be checked by a suitable equipment for the material grade (i.e major alloying elements) at the manufacturer's works and certified accordingly in the test certificate's (Refer **Annexure – 3**) before dispatch. Vendor shall ensure the availability of the suitable test facility at his works and the equipment shall have valid calibration certificate.

- 5.8** **Wrinkless:** The inner bend portion of elbows shall be free from wrinkles and tool marks.

6.0 **CERTIFICATION:**

- 6.1** All fittings shall be delivered along with three original copies of test certificates in english as per the format enclosed in Annexure - 1.

6.2 **IBR CERTIFICATION:**

All the carbon and alloy steel pipe fittings pertaining to the material specifications: ASME: SA 234 Gr WPB, Gr. WP11, Gr. WP22; Gr. WP91; ASME SA 105 and ASME SA 182 Gr. F11, F22 & F91 shall be supplied under inspection and certification by IBR or by an inspection agency approved by IBR. The test certificates shall be provided in IBR format, form III C (i.e. in addition the test certificates to be furnished as per annexure-1, annexure-2 & annexure 3).

- 6.3** In addition to the requirement specified at 6.2 above, all the pipe fittings supplied as per this specification shall be inspected and certified by BHEL nominated inspection agency at the manufacturer's works. Scope of inspection shall be as per BHEL approved quality plan.

7.0 **GUARANTEE CERTIFICATE:**

The supplier shall furnish a guarantee certificate for the supplied products. It shall confirm that the supplied product (s) are in conformity with applicable codes & standards. It shall also confirm that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.



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8.0 QUALITY ASSURANCE DURING MANUFACTURING AND INSPECTION OF PIPE FITTINGS:

- a) Vendor shall ensure strict Quality Assurance Process while selecting the source of Raw Materials & their procurement methods. Vendor shall produce documentary evidences accordingly of its QA process ensuring the correct sourcing - at any time to BHEL's inspection agency. It shall be the responsibility of the vendor to ensure that no mix up of materials & their identification occurs during all stages of procurement, marking, transport, stocking at its works & also before starting of the manufacturing.
- b) All steps shall be ensured by the vendor so that only required materials as per specifications are only made input to manufacturing process, kept documented process assurance methods during total cycle of manufacturing, Heat-Treatment, surface treatment, testing & final painting/marketing/colour coding.

9.0 MARKING, PRESERVATION AND PACKING:

9.1 **Marking:** The following details shall be punched on each fitting.

- a) Manufacturer's name or trade mark.
- b) Type of fittings.
- c) Item designation (as per ordering specification).
- d) Material specification grade.
- e) Melt No.
- f) Test certificate number.
- g) Mark of Inspection Authority.
- h) BHEL Des no. (As indicated in P.O./intimated from BHEL).

9.2 **Preservation:** Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

9.3 **Packing:** All fittings shall be provided with suitable HDPE End Covers to protect the ends (socket/threaded ends or weld edge preparation) and to protect the internal surfaces. All fittings shall be packed and despatched in suitable wooden boxes, so that no damages occur during transportation/storing.

10.0 COLOUR CODING:

All the pipe fittings shall be colour coded by painting a circumferential ring of 10 mm width at one end of the fitting at a distance of 20 mm from the end. The colour of the circumferential ring shall be according to the applicable material grade as given in the table below.

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Sl. No.	Material	Colour of the ring
1.	SA 350 LF2	Red
2.	SA 105	Red
3.	SA 420 Gr. WPL6	Red
4.	SA 234 WPB	Red
5.	SA 234 WP11	Green
6.	SA 234 WP22	Blue
7.	SA234 WP 91	Orange
8.	SA182 F91	Orange
9.	SA 182 F22	Blue
10.	SA182 F11	Green
11.	SA 182 F321	White
12.	SA 403 WP321	White
13.	SA 403 WP304	Yellow

Table: Colour coding requirements.

11.0 REFERENCE STANDARDS AND SPECIFICATIONS:

The latest versions of the below mentioned standards and specifications shall be used as reference for supplying pipe fittings as per this specification.

ASME: B16.9
ASME: B16.11
ASME: B16.28
ASME: SA234
ASME: SA403
ASME: SA420
ASME: B16.25
ASME: SA435
ASME: SA578
ASTM: E 709
ASTM: E 165



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ANNEXURE – 1 : TEST CERTIFICATE PROFORMA SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- Customer :
- TC No. & Date :
- P.O. No. :
- Process of Melting Ingot :
- Deoxidation Process :
- Forging Method :
- Reduction Ratio :
- Batch No. :
- Heat Code No. :
- Spec No. :
- Test Bar size :
- Supplier of the Ingot/billet/bloom :

13. FORGINGS COVERED BY T.C.

S. No.	Drawing No. & Item No.	Description	Quantity & Weight

14. CHEMICAL COMPOSITION (PERCENT)

Element	C	Mn	S	P										
As per Specn.	Min.													
	Max.													
Actual values														

15. HEAT TREATMENT

(To be accompanied by Record Chart)

Condition	Heating rate °C/hr	Temp °C	Soaking Time Hr	Heating rate °C/hr	Cooling Med.

16. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% E on 5.65 √So GL	% R.A. Min.	Hardness BHN Min. 3 values	Impact value joule	Sand Test		
							Angle of bend	Dia of mandrel	Rem arks
As per min									
Specn. max									
Actual values									

17. SURFACE FINISH

(When called for in the order/drg.)

18. DIMENSIONAL INSPECTION

19. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other details
Ultrasonic					
Radiographic					
Dye Penetrant/ Magnetic Particle					

20. METALLOGRAPHIC EXAMINATION

(To be conducted if called for and photo micrographs to be attached along with a report)

Position of sample	Etohan used	Magnification	Constituent observed	Relative %	

21. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS ETC.)

22. IDENTIFICATION OF FORGINGS AS PER CPS / PPS

We hereby certify that the items mentioned above have been issued and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE & SEAL OF THE
INSPECTING OFFICER

SIGNATURE AND SEAL OF THE CHIEF OF QUALITY
CONTROL/CHIEF METALLURGIST OF THE SUPPLIER

DATE:

DATE:

INSTRUCTIONS:

- Details of all heat treatment processes carried out should be furnished in the format provided at point No.15.
- Test certificates are to be furnished as per Purchase Order and specification, in A4 size paper.
- All the entries should be in block letters.
- If heat treatment is done by outside agencies, the original HT charts shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed to facilitate filling up of details.

HY 085 14 95

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PLANT STANDARD HYDERABAD

TD218
Rev.00



ANNEXURE-2

TEST CERTIFICATE PROFORMA FOR RECORDING

MINIMUM THICKNESS MEASURED USING D-METER

SL. No.	ITEM DESCRIPTION	BHEL's MATERIAL CODE	BHEL's DES No.	MINIMUM THICKNESS (mm) REQUIRED AS PER CLAUSE 5.3.1	ACTUAL THICKNESS (mm) AS MEASURED USING D-METER	REMARKS ACCEPTED (YES/NO)

ANNEXURE-3

TEST CERTIFICATE PROFORMA FOR

POSITIVE MATERIAL IDENTIFICATION (PMI)

SL. No.	ITEM DESCRIPTION	BHEL's MATERIAL CODE	BHEL's DES No.	MATERIAL STANDARD	PMI TEST OBSERVATION	REMARKS ACCEPTED (YES/NO)

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Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56565
				Rev. No. 00
				Page 1 of 3
SPECIFICATION FOR VERTICAL INSERT 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of Vertical Insert 2.0. Application: 2.1) These Vertical Inserts are intended to use in Lube oil system. 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0 Applicable Standards: 3.1) The following specifications shall be followed 3.1.1) BHEL specification- TC56213 3.2) Technical requirements shall be as per Annexure 1 4.0 Technical delivery conditions: 4.1) As per corporate standard AA0851402 for butt weld fittings and HY0851495 for socket weld and threaded fittings (a copy to be enclosed) except IBR. IBR is not required for these items.				
Ref.Doc. None	Revisions : Refer to record of revisions :	Prepared : F.ALAM	Approved : M.A.HASEEB	Date: 08.06.2020

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PRODUCT STANDARD

HYDERABAD

Prod. Std. No. TC-56565

Rev. No. 00

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Variant table

VARIANT	NOMINAL BORE	PR CLASS	MATERIAL
1	1/2"	#3000	ASTM A182F316L
2	3/4"	#3000	ASTM A182F316L
3	1"	#3000	ASTM A182F316L
4	1.5"	#3000	ASTM A182F316L
5	1/2"	#6000	ASTM A182F316L
6	3/4"	#6000	ASTM A182F316L
7	1"	#6000	ASTM A182F316L
8	1.5"	#6000	ASTM A182F316L

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Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56564
				Rev. No. 00
				Page 1 of 3
SPECIFICATION FOR EQUAL TEE 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of the equal tees 2.0. Application: 2.1) These equal tees are intended to use in Lube oil system. 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0) Material: ASME SA182 Gr:F316L & ASME SA403 GR WP316L 4.0 Applicable Standards: The following standards shall be followed for the respective items. 4.1) Dimensions, tolerances and General requirements shall be as per ASME B16.9 latest edition for BW Tees and ASME B16.11 latest edition for Socket weld end Tees. 4.3) Technical requirements shall be as per Annexure-1. 4.4) NACE requirement shall be as per NACE MR0103 4.0 Technical delivery conditions: 4.1) As per corporate standard AA0851402 for butt weld fittings and HY0851495 for socket weld and threaded fittings (a copy to be enclosed) except IBR. IBR is not required for these items.				
Revisions : Refer to record of revisions:				
Ref.Doc.	None	Prepared: Priyadarshini	Approved: Chandu	Date of 1 st Issue: 31.08.2021

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Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56564	
				Rev. No. 00	
				Page 2 of 3	
Variant table					
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.	VARIANT	Nominal Bore	SCHEDULE/Pr class	MATERIAL	END CONN
	1	0.5"	#3000	SA182F316L	SW
	2	3/4"	#3000	SA182F316L	SW
	3	1"	#3000	SA182F316L	SW
	4	1 1/2"	#3000	SA182F316L	SW
	5	1/2"	80S	ASME SA403 GR WP316L	BW
	6	3/4"	80S	ASME SA403 GR WP316L	BW
	7	1"	80S	ASME SA403 GR WP316L	BW
	8	1"	40S	ASME SA403 GR WP316L	BW
	9	1.5"	40S	ASME SA403 GR WP316L	BW
	10	2"	40S	ASME SA403 GR WP316L	BW
	11	3"	10S	ASME SA403 GR WP316L	BW
	12	3"	40S	ASME SA403 GR WP316L	BW
	13	4"	10S	ASME SA403 GR WP316L	BW
	14	6"	10S	ASME SA403 GR WP316L	BW
	15	8"	10S	ASME SA403 GR WP316L	BW
	16	2"	160S	ASME SA403 GR WP316L	BW
	17	1 1/2"	160S	ASME SA403 GR WP316L	BW
	18	3/4"	40S	ASME SA403 GR WP316L	BW
	19	0.5"	XXS	ASME SA403 GR WP316L	BW
	20	3/4"	XXS	ASME SA403 GR WP316L	BW
	21	1"	XXS	ASME SA403 GR WP316L	BW
	22	1 1/2"	80S	ASME SA403 GR WP316L	BW
	23	1 1/2"	XXS	ASME SA403 GR WP316L	BW
	24	2"	80S	ASME SA403 GR WP316L	BW
	25	2"	XXS	ASME SA403 GR WP316L	BW
	26	3"	80S	ASME SA403 GR WP316L	BW
	27	3"	XXS	ASME SA403 GR WP316L	BW
Ref.Doc.	None				

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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted. Post Order Concession/Deviation Permit 5-0000-0180-F1 as mentioned in Cl. 5.18 of Specification for Quality Management System Requirements from Bidders (6-78-0001) is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR, Clauses 1.7.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Positive Material Identification (PMI) shall be performed as per scope and procedures defined in the Specification for Positive Material Identification (PMI) at Supplier's Works (6-81-0001).

1.2.3 Refer to specification no.6-81-0005 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Beveled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

- 1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- 1.7.3 Welded tees shall not be of fabricated (stub-in) type.
- 1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.
- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo" & "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.

1.8 Stainless Steel Fittings

- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.9 NACE/HIC Requirements

- 1.9.1 Fittings under "NACE" category or those designated as "HIC1" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.9.2 Fittings made from plates and designated as "HIC1" shall meet the HIC requirements of EIL specification 6-79-0013 unless otherwise specified.
- 1.10 Thickness/schedule lower or higher than specified for the finished product shall not be accepted.

For manufacturing of elbows from pipes, same size of pipe as that of elbow shall be used and the nominal wall thickness of the starting pipes shall have positive tolerance only. However, where the manufacturer has an established automatic/semi-automatic process for the manufacture of elbows, the starting pipe may be permitted to be of lower size with higher schedule as required. Starting pipe of higher size than that of the elbow shall not be permitted.

- 1.11** The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
 125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12** Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13** Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14** Threaded ends shall have NPT taper threads in accordance with ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.
- 1.15** Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16** Special fittings like weldolet, sockolet, sweepolet, latrolet, elbolet etc., the dimensions of which are not covered in ASME, MSS-SP & EIL Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17** Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18** For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19** All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below :

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
API 5L ASTM A358 TP 304, 304L, 304H, 318, 318L, 318H, 321, 347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
ASTM B725	ASTM B725
ASTM B517	ASTM B517
ASTM B514	ASTM B514

- 1.20** The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

- 1.21** Abbreviations for ends of swages and nipples shall be as follows:
- | | | |
|-----|---|--------------------|
| PBE | : | Plain Both Ends |
| TBE | : | Threaded Both Ends |
| TOE | : | Threaded One End |
| TSE | : | Threaded Small End |
| TLE | : | Threaded Large End |
- 1.22** All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.
- 1.23** For Hydrogen service fittings following special requirements shall also be met:
- All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon- 0.35 % max. and Silicon- 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation
 - All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
 - For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
 - For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritoscope prior to post weld heat treatment.
 - For all Carbon steel and Alloy steel fittings with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.24** For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.
- 1.25** All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr-1Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.
- 1.26** Fitting material as per ASTM A234 Gr.WP5/WP9/WP91, wherever specified, shall be as per 'Cl.1', unless otherwise specified.
- 1.27** Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 IBR REQUIREMENTS

2.1 IBR Documentation Required

- 2.1.1 Fittings under the purview of "IBR" (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form III-C duly approved and countersigned by IBR authority / local authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.
- 2.1.2 For materials 1¼Cr - ½Mo (ASTM A 234Gr.WP11 & ASTM A234 Gr.WP11W) & 2¼Cr - 1Mo (ASTM A 234 Gr.WP22 & ASTM A234 Gr. WP22W) & 9Cr-1Mo-V (A234 Gr.WP91/ A234Gr.WP91W), where fittings are manufactured from pipe, Form III-C approved by IBR shall include the tabulation of E_t , S_e , & S_t values for the entire temperature range given below. E_t , S_e , & S_t values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t / 1.5 & \geq & \\ S_t / 1.5 & \geq & S_A \\ S_e & \geq & \end{array}$$

- S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature)
 S_e : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
 S_t : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)												
Temp(F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
Material												
A234Gr.WP11/ A234Gr.WP11W	21700	20900	20500	20100	19700	19200	18700	13700	9300	6300	4200	2800
A234Gr.WP22 / A234Gr.WP22W	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A234Gr.WP91/ A234Gr.WP91W	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

- 2.2 For carbon steel pipes under IBR the chemical composition shall conform to the following:

- Carbon (max) : 0.25%
 Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 ACCEPTABLE DEVIATIONS

- 3.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought

fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.

3.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5Mo min.).

3.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

4.0 MARKING AND DESPATCH

4.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "IBR", "Cryo", "NACE" and "H2" etc.

4.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.

4.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.

4.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.

4.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

4.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

4.7 Fittings coming under the purview of "IBR", "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel/socket/screwed end for other fittings.

4.8 Each end of fitting shall be protected with a wood, metal or plastic cover.

4.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package/ container clearly identifying the contents.

5.0 REFERENCES

- | | | |
|-----------|---|--|
| 6-81-0001 | : | Specification for Positive Material Identification (PMI) at Supplier's Works |
| 6-81-0005 | : | Inspection & test plan for forged, seamless and welded fittings |
| 6-79-0013 | : | Material requirements for carbon steel components used in sour service for petroleum refinery environments |



CORPORATE STANDARD

AA0851402

Rev. No. 04

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TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ANSI B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ANSI B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ANSI B16.11 and butt-welding fittings with ANSI 16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA350 Gr: LF1

Carbon Steel (High Temperature Service) : ASME SA105

Alloy Steel (High Temperature Service) : ASME SA182 Gr: F22

Stainless Steel : ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA420 Gr:WPL6

Carbon Steel (High Temperature Service) : ASME SA234 Gr:WPB

Alloy Steel (High Temperature Service) : ASME SA234 Gr:WP11

ASME SA234 Gr:WP22

Stainless Steel

: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification:

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ANSI B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions:

Clause 20.8.13 of MOM of WG-SMC+RP

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

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Dt:

Year: 2016

HPEP, Hyderabad

Corp. R&D

01-08-1980



All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ANSI B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



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4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criteria for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- relevant lines indications.
- relevant rounded indications greater than 3/16 inch.
- Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

5 CERTIFICATE

5.1 All fittings shall be delivered along with test certificates in English.

5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr.WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.

5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr.WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.

5.4 Three original Test certificates shall be submitted.

6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- Manufacturer's name and trade mark
- Pressure class (in case of socket welding fittings)
- Nominal size
- Schedule No. (in case of butt welding fittings)
- Type of fitting
- Material specification grade
- Melt No.
- Test certificate number
- Mark of inspection authority

**8.2 Presentation**

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- 1) ANSI B16.9, B16.11, B16.25 & B16.28
- 2) ASME SA105, SA182, SA234, SA350, SA403, SA420, SA435, SA578, SE165 & ASME SE709



CORPORATE STANDARD

AA0851402

Rev. No. 04

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ANNEXURE – 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No. | |
| 4. Process of Melting Ingot: | 12. Spec. No. | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos. | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P										
As per Min.															
Specn. Max.															
Actual Values															

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65/So GL	% R.A. Min.	Hardness BHN (Min. 3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Min.									
Specn. Max.									
Actual Values									

19. SURFACE FINISH
(When called for in the
order / drg.)20. DIMENSIONAL
INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56562
				Rev. No. 01
				Page 1 of 4
SPECIFICATION FOR REDUCERS 1.0. General: 1.1) This standard cover designation, Material, size and dimensions of the reducers 2.0. Application: 2.1) These Reducers are intended to use in H2 service. 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0 Material: ASME SA 403 Gr: WP316L – Seamless construction for sizes less than 14” ASME SA 403 Gr: WP316L-W – Welded Construction for sizes 14” and Above Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought fittings. 4.0 Applicable Standards: The following standards shall be followed for the respective items. 4.1) Dimensions, tolerances and General requirements shall be as per ASME B16.9 latest edition. 4.2) NACE requirement shall be as per NACE MR0103 (ISO 17945) 4.3) IGC test as per BHEL Corporate standard AA0851402 is applicable. 4.4) Positive Material Identification (PMI) shall be performed. 4.5) All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6mm. Welds shall be ground smooth at atleast 25 mm from the ends. 4.6) For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with addition of filler metal. 4.7) Welded Tees (if applicable) shall not be fabricated (stub-in) type. 4.8) All welded fittings shall be normalised & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials. 4.9) Welded pipes employed for manufacture of fittings shall be made by automatic welding only. 4.10) Hydrogen Service Requirements – the weld deposit shall be checked for ferrite content. A Ferrite No. (FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior to post weld heat treatment. 4.11) All other technical delivery conditions as per AA0851402 except IBR. IBR is not required for these items. 4.12) Engraving of Fitting type, Fitting size, MOC, NACE, H2 service, BHEL material code, Vendor name/vendor code are mandatory.				
Revisions : Refer to record of revisions:		Prepared: Priyadarshini	Approved: Chandu	Date of 1 st Issue: 31.08.2021

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None



PRODUCT STANDARD

HYDERABAD

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Variant table

VARIANT	NOMINAL BORE		SCHEDULE		MATERIAL	END CONN
	ARRIVE	LEAVE	ARRIVE	LEAVE		
1	0.5"	3/8"	80S	80S	ASME SA403 GR WP316L	BW
2	3/4"	3/8"	80S	80S	ASME SA403 GR WP316L	BW
3	3/4"	0.5"	80S	80S	ASME SA403 GR WP316L	BW
4	3/4"	0.5"	40S	40S	ASME SA403 GR WP316L	BW
5	1"	1/2"	40S	80S	ASME SA403 GR WP316L	BW
6	1"	3/4"	40S	80S	ASME SA403 GR WP316L	BW
7	1"	3/4"	80S	80S	ASME SA403 GR WP316L	BW
8	1 1/2"	3/4"	40S	80S	ASME SA403 GR WP316L	BW
9	1 1/2"	1"	40S	40S	ASME SA403 GR WP316L	BW
10	2"	1"	40S	40S	ASME SA403 GR WP316L	BW
11	2"	1 1/2"	40S	40S	ASME SA403 GR WP316L	BW
12	3"	1 1/2"	10S	40S	ASME SA403 GR WP316L	BW
13	3"	1 1/2"	40S	40S	ASME SA403 GR WP316L	BW
14	3"	2"	10S	40S	ASME SA403 GR WP316L	BW
15	3"	2"	40S	40S	ASME SA403 GR WP316L	BW
16	3"	2"	10S	40S	ASME SA403 GR WP316L	BW(ECCENTRIC)
17	4"	2"	10S	40S	ASME SA403 GR WP316L	BW
18	4"	3"	10S	10S	ASME SA403 GR WP316L	BW
19	6"	3"	10S	10S	ASME SA403 GR WP316L	BW
20	6"	4"	10S	10S	ASME SA403 GR WP316L	BW
21	10"	8"	10S	10S	ASME SA403 GR WP316L	BW
22	8"	6"	10S	10S	ASME SA403 GR WP316L	BW
23	1 1/2"	3/4"	160S	80S	ASME SA403 GR WP316L	BW
24	1 1/2"	1"	160S	80S	ASME SA403 GR WP316L	BW
25	2"	1 1/2"	160S	160S	ASME SA403 GR WP316L	BW
26	3"	2"	XXS	160S	ASME SA403 GR WP316L	BW
27	12"	10"	10S	10S	ASME SA403 GR WP316L	BW
28	6"	4"	10S	10S	ASME SA403 GR WP316L	BW(ECCENTRIC)
29	4"	3"	10S	10S	ASME SA403 GR WP316L	BW(ECCENTRIC)
30						
31	6"	3"	10S	10S	ASME SA403 GR WP316L	BW(ECCENTRIC)
32	4"	1 1/2"	10S	40S	ASME SA403 GR WP316L	BW
33						
34	1"	1/2"	80S	80S	ASME SA403 GR WP316L	BW
35	1"	3/4"	XXS	80S	ASME SA403 GR WP316L	BW
36	1"	3/4"	XXS	XXS	ASME SA403 GR WP316L	BW
37	1 1/2"	3/4"	80S	80S	ASME SA403 GR WP316L	BW
38	1 1/2"	3/4"	XXS	80S	ASME SA403 GR WP316L	BW
39	1 1/2"	3/4"	XXS	XXS	ASME SA403 GR WP316L	BW

[illegible]



PRODUCT STANDARD

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None

Record of Revisions

Rev No	Revision Details	Revised By	Approved By
00	First Issue	Priyadarshini	Chandu
01	Specification revised completely. Variant table revised as per material codes created and variants 51 to 58 added	MCK	BNR



CORPORATE STANDARD

AA0851402

Rev. No. 06

PAGE 1 of 5

TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ASME B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ASME B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ASME B16.11 and butt-welding fittings with ASME B16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service)	: ASME SA350 Gr: LF1
Carbon Steel (High Temperature Service)	: ASME SA105
Alloy Steel (High Temperature Service)	: ASME SA182 Gr: F22
Stainless Steel	: ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service)	: ASME SA420 Gr:WPL6
Carbon Steel (High Temperature Service)	: ASME SA234 Gr:WPB
Alloy Steel (High Temperature Service)	: ASME SA234 Gr:WP11, ASME SA234 Gr:WP22
Stainless Steel	: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification.

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ASME B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions: Clause 8.1

APPROVED:INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

Rev. No. 06

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt: 31-03-2022

Dt:

Year:

HPEP, Hyderabad

Corp. R&D

01-08-1980

All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ASME B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



CORPORATE STANDARD

AA0851402

Rev. No. 06

PAGE 3 of 5

4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criterion for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- a) relevant lines indications.
- b) relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

4.6 Inter Granular Corrosion (IGC) Test for Austenitic Stainless Steel

4.6.1 All stainless steel fittings shall be supplied in solution heat-treated condition.

4.6.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.

4.6.3 For all stainless steel fittings IGC test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

4.6.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (e.g. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.

4.6.5 For the IGC test as described in Clauses 4.6.3 & 4.6.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.

4.6.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

5 CERTIFICATE

5.1 All fittings shall be delivered along with test certificates in English.

5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr. WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.

5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr. WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.

5.4 Three original Test certificates shall be submitted.



6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- a) Manufacturer's name and trade mark
- b) Pressure class (in case of socket welding fittings)
- c) Nominal size
- d) Schedule No. (in case of butt welding fittings)
- e) Type of fitting
- f) Material specification grade
- g) Melt No.
- h) Test certificate number
- i) Mark of inspection authority
- j) BHEL Material Code

8.2 Presentation

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- | | |
|----------------|----------------|
| 1) ASME B16.9 | 8) ASME SA350 |
| 2) ASME B16.11 | 9) ASME SA403 |
| 3) ASME B16.25 | 10) ASME SA420 |
| 4) ASME B16.28 | 11) ASME SA435 |
| 5) ASME SA105 | 12) ASME SA578 |
| 6) ASME SA182 | 13) ASME SE165 |
| 7) ASME SA234 | 14) ASME SE709 |



CORPORATE STANDARD

AA0851402

Rev. No. 06

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Annexure - 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No.: | |
| 4. Process of Melting Ingot: | 12. Spec. No.: | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos.: | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % ; Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P										
As per Specn.	Min.														
	Max.														
Actual Values															

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65√So GL	% R.A. Min.	Hardness BHN (Min.3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Specn.	Min.								
	Max.								
Actual Values									

19. SURFACE FINISH (When called for in the order / drg.)

20. DIMENSIONAL INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, IGC ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE. SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56556
				Rev. No. 01
				Page 1 of 4
SPECIFICATION FOR ELBOWS 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of elbows 2.0. Application: 2.1) These elbows are intended to use in H2 service 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0) Material: ASME SA182 Gr:F316L & ASME SA403 GR WP316L 4.0 Applicable Standards: The following standards shall be followed for the respective items. 4.1) Dimensions, tolerances and General requirements shall be as per ASME B16.9 latest edition for BW elbows and ASME B16.11 latest edition for Socket weld end elbows 4.2) Dimensional standard for Elbow short radius shall be as per ASME B16.9 4.3) Technical requirements shall be as per Annexure-1. 4.4) NACE requirement shall be as per NACE MR0103 4.1 Technical delivery conditions: 4.1) As per corporate standard AA0851402 except IBR. IBR is not required for these items.				
Ref.Doc. None	Revisions : Refer to record of revisions :	Prepared: Priyadarshini	Approved: Chandu	Date of 1st Issue: 31.08.2021

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PRODUCT STANDARD

HYDERABAD

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Variant table

VARIANT	Nominal Bore	SCHEDULE/Pr class	MATERIAL	END CONN
1	0.5"	#3000	SA182F316L	SW
2	3/4"	#3000	SA182F316L	SW
3	1"	#3000	SA182F316L	SW
4	1 1/2"	#3000	SA182F316L	SW
5	0.5"	#6000	SA182F316L	SW
6	3/4"	#6000	SA182F316L	SW
7	1"	#6000	SA182F316L	SW
8	1 1/2"	#6000	SA182F316L	SW
9	0.5"	80S	ASME SA403 GR WP316L	BW
10	0.5"	160S	ASME SA403 GR WP316L	BW
11	3/4"	80S	ASME SA403 GR WP316L	BW
12	3/4"	160S	ASME SA403 GR WP316L	BW
13	1"	80S	ASME SA403 GR WP316L	BW
14	1"	40S	ASME SA403 GR WP316L	BW
15	1.5"	40S	ASME SA403 GR WP316L	BW
16	1.5"	80S	ASME SA403 GR WP316L	BW
17	1.5"	160S	ASME SA403 GR WP316L	BW
18	2"	40S	ASME SA403 GR WP316L	BW
19	2"	80S	ASME SA403 GR WP316L	BW
20	2"	160S	ASME SA403 GR WP316L	BW
21	3"	10S	ASME SA403 GR WP316L	BW
22	3"	40S	ASME SA403 GR WP316L	BW
23	3"	80S	ASME SA403 GR WP316L	BW
24	3"	160S	ASME SA403 GR WP316L	BW
25	4"	10S	ASME SA403 GR WP316L	BW
26	4"	40S	ASME SA403 GR WP316L	BW
27	4"	80S	ASME SA403 GR WP316L	BW
28	4"	160S	ASME SA403 GR WP316L	BW
29	6"	10S	ASME SA403 GR WP316L	BW
30	6"	40S	ASME SA403 GR WP316L	BW
31	8"	10S	ASME SA403 GR WP316L	BW
32	8"	SHORT RADIUS 10S	ASME SA403 GR WP316L	BW
33	6"	45 DEG. 10S	ASME SA403 GR WP316L	BW
34	4"	45 DEG. 10S	ASME SA403 GR WP316L	BW
35	3"	45 DEG. 10S	ASME SA403 GR WP316L	BW
36	2"	45 DEG. 40S	ASME SA403 GR WP316L	BW
37	1"	160S	ASME SA403 GR WP316L	BW
38	0.5"	40S	ASME SA403 GR WP316L	BW

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TD -106 -2

Rev. No. 5
Form No.

PRODUCT STANDARD

HYDERABAD

Prod. Std. No. TC-56XXX

Rev. No. 01

Page 3 of 4

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VARIANT	Nominal Bore	SCHEDULE/Pr class	MATERIAL	END CONN
39	3/4"	40S	ASME SA403 GR WP316L	BW
40	0.5"	XXS	ASME SA403 GR WP316L	BW
41	3/4"	XXS	ASME SA403 GR WP316L	BW
42	1"	XXS	ASME SA403 GR WP316L	BW
43	1.5"	XXS	ASME SA403 GR WP316L	BW
44	2"	XXS	ASME SA403 GR WP316L	BW
45	3"	XXS	ASME SA403 GR WP316L	BW
46	10"	10S	ASME SA403 GR WP316L	BW

Ref.Doc. None	TD -106 -2 Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56556																																
					Rev. No. 01																																
					Page 4 of 4																																
<u>Record of Revisions</u> <table border="1"> <thead> <tr> <th>Rev No</th> <th>Revision Details</th> <th>Revised By</th> <th>Approved By</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>First Issue</td> <td>Priyadarshini</td> <td>Chandu</td> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>						Rev No	Revision Details	Revised By	Approved By	00	First Issue	Priyadarshini	Chandu																								
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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted. Post Order Concession/Deviation Permit 5-0000-0180-F1 as mentioned in Cl. 5.18 of Specification for Quality Management System Requirements from Bidders (6-78-0001) is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR, Clauses 1.7.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Positive Material Identification (PMI) shall be performed as per scope and procedures defined in the Specification for Positive Material Identification (PMI) at Supplier's Works (6-81-0001).

1.2.3 Refer to specification no.6-81-0005 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Beveled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

- 1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- 1.7.3 Welded tees shall not be of fabricated (stub-in) type.
- 1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.
- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo" & "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.

1.8 Stainless Steel Fittings

- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.9 NACE/HIC Requirements

- 1.9.1 Fittings under "NACE" category or those designated as "HIC1" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.9.2 Fittings made from plates and designated as "HIC1" shall meet the HIC requirements of EIL specification 6-79-0013 unless otherwise specified.
- 1.10 Thickness/schedule lower or higher than specified for the finished product shall not be accepted.

For manufacturing of elbows from pipes, same size of pipe as that of elbow shall be used and the nominal wall thickness of the starting pipes shall have positive tolerance only. However, where the manufacturer has an established automatic/semi-automatic process for the manufacture of elbows, the starting pipe may be permitted to be of lower size with higher schedule as required. Starting pipe of higher size than that of the elbow shall not be permitted.

- 1.11** The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12** Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13** Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14** Threaded ends shall have NPT taper threads in accordance with ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.
- 1.15** Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16** Special fittings like weldolet, sockolet, sweepolet, latrolet, elbolet etc., the dimensions of which are not covered in ASME, MSS-SP & EIL Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17** Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18** For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19** All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below :

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
API 5L ASTM A358 TP 304, 304L, 304H, 318, 318L, 318H, 321, 347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
ASTM B725	ASTM B725
ASTM B517	ASTM B517
ASTM B514	ASTM B514

- 1.20** The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

- 1.21** Abbreviations for ends of swages and nipples shall be as follows:
- | | | |
|-----|---|--------------------|
| PBE | : | Plain Both Ends |
| TBE | : | Threaded Both Ends |
| TOE | : | Threaded One End |
| TSE | : | Threaded Small End |
| TLE | : | Threaded Large End |
- 1.22** All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.
- 1.23** For Hydrogen service fittings following special requirements shall also be met:
- All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon- 0.35 % max. and Silicon- 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation
 - All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
 - For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
 - For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritoscope prior to post weld heat treatment.
 - For all Carbon steel and Alloy steel fittings with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.24** For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.
- 1.25** All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr-1Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.
- 1.26** Fitting material as per ASTM A234 Gr.WP5/WP9/WP91, wherever specified, shall be as per 'Cl.1', unless otherwise specified.
- 1.27** Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 IBR REQUIREMENTS

2.1 IBR Documentation Required

- 2.1.1 Fittings under the purview of "IBR" (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form III-C duly approved and countersigned by IBR authority / local authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.
- 2.1.2 For materials 1¼Cr - ½Mo (ASTM A 234Gr.WP11 & ASTM A234 Gr.WP11W) & 2¼Cr - 1Mo (ASTM A 234 Gr.WP22 & ASTM A234 Gr. WP22W) & 9Cr-1Mo-V (A234 Gr.WP91/ A234Gr.WP91W), where fittings are manufactured from pipe, Form III-C approved by IBR shall include the tabulation of E_t , S_e , & S_r values for the entire temperature range given below. E_t , S_e , & S_r values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t / 1.5 & \geq & \\ S_r / 1.5 & \geq & S_A \\ S_e & \geq & \end{array}$$

- S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature)
 S_e : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
 S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)												
Temp(F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
Material												
A234Gr.WP11/ A234Gr.WP11W	21700	20900	20500	20100	19700	19200	18700	13700	9300	6300	4200	2800
A234Gr.WP22 / A234Gr.WP22W	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A234Gr.WP91/ A234Gr.WP91W	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

- 2.2 For carbon steel pipes under IBR the chemical composition shall conform to the following:

- Carbon (max) : 0.25%
 Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 ACCEPTABLE DEVIATIONS

- 3.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought

fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.

3.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5Mo min.).

3.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

4.0 MARKING AND DESPATCH

4.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "IBR", "Cryo", "NACE" and "H2" etc.

4.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.

4.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.

4.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.

4.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

4.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

4.7 Fittings coming under the purview of "IBR", "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel/socket/screwed end for other fittings.

4.8 Each end of fitting shall be protected with a wood, metal or plastic cover.

4.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package/ container clearly identifying the contents.

5.0 REFERENCES

- | | | |
|-----------|---|--|
| 6-81-0001 | : | Specification for Positive Material Identification (PMI) at Supplier's Works |
| 6-81-0005 | : | Inspection & test plan for forged, seamless and welded fittings |
| 6-79-0013 | : | Material requirements for carbon steel components used in sour service for petroleum refinery environments |



CORPORATE STANDARD

AA0851402

Rev. No. 04

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TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ANSI B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ANSI B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ANSI B16.11 and butt-welding fittings with ANSI 16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA350 Gr: LF1

Carbon Steel (High Temperature Service) : ASME SA105

Alloy Steel (High Temperature Service) : ASME SA182 Gr: F22

Stainless Steel : ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA420 Gr:WPL6

Carbon Steel (High Temperature Service) : ASME SA234 Gr:WPB

Alloy Steel (High Temperature Service) : ASME SA234 Gr:WP11

ASME SA234 Gr:WP22

Stainless Steel

: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification:

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ANSI B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions:

Clause 20.8.13 of MOM of WG-SMC+RP

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

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Prepared

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Dt:

Year: 2016

HPEP, Hyderabad

Corp. R&D

01-08-1980



All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ANSI B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



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4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criteria for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- a) relevant lines indications.
- b) relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

5 CERTIFICATE

5.1 All fittings shall be delivered along with test certificates in English.

5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr.WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.

5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr.WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.

5.4 Three original Test certificates shall be submitted.

6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- a) Manufacturer's name and trade mark
- b) Pressure class (in case of socket welding fittings)
- c) Nominal size
- d) Schedule No. (in case of butt welding fittings)
- e) Type of fitting
- f) Material specification grade
- g) Melt No.
- h) Test certificate number
- i) Mark of inspection authority

**8.2 Presentation**

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- 1) ANSI B16.9, B16.11, B16.25 & B16.28
- 2) ASME SA105, SA182, SA234, SA350, SA403, SA420, SA435, SA578, SE165 & ASME SE709



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ANNEXURE – 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No. | |
| 4. Process of Melting Ingot: | 12. Spec. No. | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos. | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P										
As per Min.															
Specn. Max.															
Actual Values															

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65/So GL	% R.A. Min.	Hardness BHN (Min. 3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Min.									
Specn. Max.									
Actual Values									

19. SURFACE FINISH
(When called for in the
order / drg.)20. DIMENSIONAL
INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC.)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56556
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SPECIFICATION FOR ELBOWS 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of elbows 2.0. Application: 2.1) These elbows are intended to use in H2 service 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0) Material: ASME SA182 Gr:F316L & ASME SA403 GR WP316L 4.0 Applicable Standards: The following standards shall be followed for the respective items. 4.1) Dimensions, tolerances and General requirements shall be as per ASME B16.9 latest edition for BW elbows and ASME B16.11 latest edition for Socket weld end elbows 4.2) Dimensional standard for Elbow short radius shall be as per ASME B16.9 4.3) Technical requirements shall be as per Annexure-1. 4.4) NACE requirement shall be as per NACE MR0103 4.1 Technical delivery conditions: 4.1) As per corporate standard AA0851402 except IBR. IBR is not required for these items.				
Ref.Doc. None	Revisions : Refer to record of revisions :	Prepared: Priyadarshini	Approved: Chandu	Date of 1st Issue: 31.08.2021

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PRODUCT STANDARD

HYDERABAD

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Variant table

VARIANT	Nominal Bore	SCHEDULE/Pr class	MATERIAL	END CONN
1	0.5"	#3000	SA182F316L	SW
2	3/4"	#3000	SA182F316L	SW
3	1"	#3000	SA182F316L	SW
4	1 1/2"	#3000	SA182F316L	SW
5	0.5"	#6000	SA182F316L	SW
6	3/4"	#6000	SA182F316L	SW
7	1"	#6000	SA182F316L	SW
8	1 1/2"	#6000	SA182F316L	SW
9	0.5"	80S	ASME SA403 GR WP316L	BW
10	0.5"	160S	ASME SA403 GR WP316L	BW
11	3/4"	80S	ASME SA403 GR WP316L	BW
12	3/4"	160S	ASME SA403 GR WP316L	BW
13	1"	80S	ASME SA403 GR WP316L	BW
14	1"	40S	ASME SA403 GR WP316L	BW
15	1.5"	40S	ASME SA403 GR WP316L	BW
16	1.5"	80S	ASME SA403 GR WP316L	BW
17	1.5"	160S	ASME SA403 GR WP316L	BW
18	2"	40S	ASME SA403 GR WP316L	BW
19	2"	80S	ASME SA403 GR WP316L	BW
20	2"	160S	ASME SA403 GR WP316L	BW
21	3"	10S	ASME SA403 GR WP316L	BW
22	3"	40S	ASME SA403 GR WP316L	BW
23	3"	80S	ASME SA403 GR WP316L	BW
24	3"	160S	ASME SA403 GR WP316L	BW
25	4"	10S	ASME SA403 GR WP316L	BW
26	4"	40S	ASME SA403 GR WP316L	BW
27	4"	80S	ASME SA403 GR WP316L	BW
28	4"	160S	ASME SA403 GR WP316L	BW
29	6"	10S	ASME SA403 GR WP316L	BW
30	6"	40S	ASME SA403 GR WP316L	BW
31	8"	10S	ASME SA403 GR WP316L	BW
32	8"	SHORT RADIUS 10S	ASME SA403 GR WP316L	BW
33	6"	45 DEG. 10S	ASME SA403 GR WP316L	BW
34	4"	45 DEG. 10S	ASME SA403 GR WP316L	BW
35	3"	45 DEG. 10S	ASME SA403 GR WP316L	BW
36	2"	45 DEG. 40S	ASME SA403 GR WP316L	BW
37	1"	160S	ASME SA403 GR WP316L	BW
38	0.5"	40S	ASME SA403 GR WP316L	BW

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PRODUCT STANDARD

HYDERABAD

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VARIANT	Nominal Bore	SCHEDULE/Pr class	MATERIAL	END CONN
39	3/4"	40S	ASME SA403 GR WP316L	BW
40	0.5"	XXS	ASME SA403 GR WP316L	BW
41	3/4"	XXS	ASME SA403 GR WP316L	BW
42	1"	XXS	ASME SA403 GR WP316L	BW
43	1.5"	XXS	ASME SA403 GR WP316L	BW
44	2"	XXS	ASME SA403 GR WP316L	BW
45	3"	XXS	ASME SA403 GR WP316L	BW
46	10"	10S	ASME SA403 GR WP316L	BW

Ref.Doc. None	TD -106 -2 Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-56556																																
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<u>Record of Revisions</u> <table border="1"> <thead> <tr> <th>Rev No</th> <th>Revision Details</th> <th>Revised By</th> <th>Approved By</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>First Issue</td> <td>Priyadarshini</td> <td>Chandu</td> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>						Rev No	Revision Details	Revised By	Approved By	00	First Issue	Priyadarshini	Chandu																								
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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted. Post Order Concession/Deviation Permit 5-0000-0180-F1 as mentioned in Cl. 5.18 of Specification for Quality Management System Requirements from Bidders (6-78-0001) is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR, Clauses 1.7.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Positive Material Identification (PMI) shall be performed as per scope and procedures defined in the Specification for Positive Material Identification (PMI) at Supplier's Works (6-81-0001).

1.2.3 Refer to specification no.6-81-0005 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Beveled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

- 1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- 1.7.3 Welded tees shall not be of fabricated (stub-in) type.
- 1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.
- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo" & "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.

1.8 Stainless Steel Fittings

- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.9 NACE/HIC Requirements

- 1.9.1 Fittings under "NACE" category or those designated as "HIC1" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.9.2 Fittings made from plates and designated as "HIC1" shall meet the HIC requirements of EIL specification 6-79-0013 unless otherwise specified.
- 1.10 Thickness/schedule lower or higher than specified for the finished product shall not be accepted.

For manufacturing of elbows from pipes, same size of pipe as that of elbow shall be used and the nominal wall thickness of the starting pipes shall have positive tolerance only. However, where the manufacturer has an established automatic/semi-automatic process for the manufacture of elbows, the starting pipe may be permitted to be of lower size with higher schedule as required. Starting pipe of higher size than that of the elbow shall not be permitted.

- 1.11** The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12** Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13** Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14** Threaded ends shall have NPT taper threads in accordance with ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.
- 1.15** Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16** Special fittings like weldolet, sockolet, sweepolet, latrolet, elbolet etc., the dimensions of which are not covered in ASME, MSS-SP & EIL Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17** Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18** For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19** All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below :

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
API 5L ASTM A358 TP 304, 304L, 304H, 318, 318L, 318H, 321, 347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
ASTM B725	ASTM B725
ASTM B517	ASTM B517
ASTM B514	ASTM B514

- 1.20** The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

- 1.21** Abbreviations for ends of swages and nipples shall be as follows:
- | | | |
|-----|---|--------------------|
| PBE | : | Plain Both Ends |
| TBE | : | Threaded Both Ends |
| TOE | : | Threaded One End |
| TSE | : | Threaded Small End |
| TLE | : | Threaded Large End |
- 1.22** All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.
- 1.23** For Hydrogen service fittings following special requirements shall also be met:
- All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon- 0.35 % max. and Silicon- 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation
 - All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
 - For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
 - For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritoscope prior to post weld heat treatment.
 - For all Carbon steel and Alloy steel fittings with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.24** For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.
- 1.25** All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr-1Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.
- 1.26** Fitting material as per ASTM A234 Gr.WP5/WP9/WP91, wherever specified, shall be as per 'Cl.1', unless otherwise specified.
- 1.27** Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 IBR REQUIREMENTS

2.1 IBR Documentation Required

- 2.1.1 Fittings under the purview of "IBR" (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form III-C duly approved and countersigned by IBR authority / local authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.
- 2.1.2 For materials 1¼Cr - ½Mo (ASTM A 234Gr.WP11 & ASTM A234 Gr.WP11W) & 2¼Cr - 1Mo (ASTM A 234 Gr.WP22 & ASTM A234 Gr. WP22W) & 9Cr-1Mo-V (A234 Gr.WP91/ A234Gr.WP91W), where fittings are manufactured from pipe, Form III-C approved by IBR shall include the tabulation of E_t , S_e , & S_r values for the entire temperature range given below. E_t , S_e , & S_r values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t / 1.5 & \geq & \\ S_r / 1.5 & \geq & S_A \\ S_e & \geq & \end{array}$$

- S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature)
 S_e : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
 S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)												
Temp(F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
Material												
A234Gr.WP11/ A234Gr.WP11W	21700	20900	20500	20100	19700	19200	18700	13700	9300	6300	4200	2800
A234Gr.WP22 / A234Gr.WP22W	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A234Gr.WP91/ A234Gr.WP91W	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

- 2.2 For carbon steel pipes under IBR the chemical composition shall conform to the following:

- Carbon (max) : 0.25%
 Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 ACCEPTABLE DEVIATIONS

- 3.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought

fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.

3.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5Mo min.).

3.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

4.0 MARKING AND DESPATCH

4.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "IBR", "Cryo", "NACE" and "H2" etc.

4.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.

4.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.

4.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.

4.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

4.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

4.7 Fittings coming under the purview of "IBR", "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel/socket/screwed end for other fittings.

4.8 Each end of fitting shall be protected with a wood, metal or plastic cover.

4.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package/ container clearly identifying the contents.

5.0 REFERENCES

- | | | |
|-----------|---|--|
| 6-81-0001 | : | Specification for Positive Material Identification (PMI) at Supplier's Works |
| 6-81-0005 | : | Inspection & test plan for forged, seamless and welded fittings |
| 6-79-0013 | : | Material requirements for carbon steel components used in sour service for petroleum refinery environments |



CORPORATE STANDARD

AA0851402

Rev. No. 04

PAGE 1 of 5

TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ANSI B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ANSI B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ANSI B16.11 and butt-welding fittings with ANSI 16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA350 Gr: LF1

Carbon Steel (High Temperature Service) : ASME SA105

Alloy Steel (High Temperature Service) : ASME SA182 Gr: F22

Stainless Steel : ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA420 Gr:WPL6

Carbon Steel (High Temperature Service) : ASME SA234 Gr:WPB

Alloy Steel (High Temperature Service) : ASME SA234 Gr:WP11

ASME SA234 Gr:WP22

Stainless Steel

: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification:

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ANSI B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions:

Clause 20.8.13 of MOM of WG-SMC+RP

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

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Prepared

Issued

Dt. of 1st Issue

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Year: 2016

HPEP, Hyderabad

Corp. R&D

01-08-1980



All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ANSI B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



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4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criteria for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- a) relevant lines indications.
- b) relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

5 CERTIFICATE

5.1 All fittings shall be delivered along with test certificates in English.

5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr.WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.

5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr.WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.

5.4 Three original Test certificates shall be submitted.

6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- a) Manufacturer's name and trade mark
- b) Pressure class (in case of socket welding fittings)
- c) Nominal size
- d) Schedule No. (in case of butt welding fittings)
- e) Type of fitting
- f) Material specification grade
- g) Melt No.
- h) Test certificate number
- i) Mark of inspection authority

**8.2 Presentation**

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- 1) ANSI B16.9, B16.11, B16.25 & B16.28
- 2) ASME SA105, SA182, SA234, SA350, SA403, SA420, SA435, SA578, SE165 & ASME SE709



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ANNEXURE – 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No. | |
| 4. Process of Melting Ingot: | 12. Spec. No. | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos. | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P										
As per Min.															
Specn. Max.															
Actual Values															

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65/So GL	% R.A. Min.	Hardness BHN (Min. 3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Min.									
Specn. Max.									
Actual Values									

19. SURFACE FINISH
(When called for in the
order / drg.)20. DIMENSIONAL
INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC.)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC56550	
				Rev. No. 00	
				Page 1 of 3	
SPECIFICATION FOR REDUCERS (NACE+H2 service) 1.0. General: 1.1) This standard covers designation, Material, size and dimensions of the reducers 2.0. Application: 2.1) These Reducers are intended to use in Hydrogen sulphide (H₂S) bearing fuel Gas service. These pipe fittings should provide resistance to sulphide stress cracking (SSC) and for stress corrosion cracking in sour environments. 2.2) The supplier shall strictly comply with this standard in all respects. No deviation shall be allowed, unless written permission of BHEL is obtained before finalization of order. 3.0 Applicable Standards: The following standards shall be followed for the respective items. 3.1) Dimensions, tolerances and General requirements shall be as per ASME B16.9 latest edition. 3.2) Technical requirements shall be as per Annexure-1. 3.3) NACE requirement shall be as per NACE MR0103 4.0 Technical delivery conditions: 4.1) As per corporate standard AA0851402 (a copy to be enclosed) except IBR. IBR is not required for these items.					
Ref.Doc. None		Revisions : Refer to record of revisions :	Prepared : CHANDU	Approved : HASEEB	Date: 16.04.2020

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PRODUCT STANDARD

HYDERABAD

Prod. Std. No. TC-5-6550

Rev. No. 00

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None

Variant table

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TD -106 -2 Rev. No. 5 Form No.		PRODUCT STANDARD HYDERABAD		Prod. Std. No. TC-5-6531																																
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<u>OWNER</u>  IndianOil	<u>PMC</u>  TOYO ENGINEERING	PIPING MATERIAL SPECIFICATION	<u>CONTRACTOR</u>  T.EN TECHNIP ENERGIES
ISSUED : 11.03.2021		DOC NO. : EPCC06-TIL-C00-PIP-SPC-000-0001 Revision No. 0	PAGE 32 OF 46

APPENDIX - A

SPECIAL SERVICE REQUIREMENTS

These requirements are applicable in addition to the requirements specified in the Piping Material Specification.

1.0 HYDROGEN SERVICE

1.1 PIPES, FITTINGS & FLANGES

1.1.1 METHOD OF MANUFACTURE

All carbon steel pipes, fittings & flanges having wall thickness 9.53mm and above shall be normalized. Cold drawn pipes & fittings shall be normalized after the final cold draw pass for all thickness. In addition, fittings made from forgings shall have carbon - 0.35% maximum and silicon -0.35% maximum. The normalizing heat treatment shall be a separate heating operation & not a part of the hot forming operation.

All alloy steel (Cr-Mo) pipes, forgings & fittings shall be normalized and tempered. The normalizing and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.

1.1.2 POST WELD HEAT TREATMENT (PWHT)

All carbon steel pipes & fittings post weld heat-treatment shall be carried out as per table 331.1.1, 331.1.2 & 331.1.3 of ASME B31.3 2018 edition.

All alloy steel (Cr-Mo) pipes & fittings shall be post weld heat treated irrespective of type or thickness of weld. 100% radiography of welded joints shall be done both before and after PWHT.

All austenitic SS grades shall be solution annealed after welding.

1.1.3 FERRITE NO. TEST

For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No. (FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior to post weld heat treatment.

1.1.4 IMPACT TEST

For carbon steel and alloy steels pipes, fittings & flanges of thickness over 19mm, Charpy-V notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and in accordance with ASTM A370. Impact energies at 00C shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).

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If welding is used in manufacturing, impact test of Heat Affected Zone (HAZ) and weld metal shall also be carried out.

1.1.5 HARDNESS

For carbon steel pipes & fittings, hardness of weld and HAZ shall be limited to 200 BHN (max.). For alloy steel pipes & fittings, hardness of weld and HAZ shall be limited to 225 BHN (max.).

1.1.6 RADIOGRAPHY

All girth welded joints (longitudinal & circumferential) shall be 100% radiographed in accordance with UW-51 of ASME Section VIII, Div-1 and ASME Section V.

1.1.7 JACKETED PIPING

For Jacketed piping, shop fabricated jacketed spools to be used.

1.2 VALVES

1.2.1 All valve castings shall be of radiographic quality.

1.2.2 All cast valve flanges and bodies of rating class 900 or greater shall be examined in accordance with paragraph 7.2 through 7.5 of Appendix 7 of ASME Section VIII, Div-1, regardless of casting quality factor.

1.2.3 Only normalized and tempered material shall be used in the following specifications:

Casting : A217Gr.WC1, A217Gr.WC4, A217Gr.WC5, A217Gr.WC6,
A217Gr.WC9, A217Gr.C5, A217Gr.C12.

Forging : A182 Gr.F11 CL.2, A182 Gr.F22 CL.3, A182 Gr.F5, A182 Gr.F9

1.2.4 Body/ bonnet/ cover joints & stuffing box of valves shall have low emission. One valve per metallurgy, per rating, per size shall be helium leak tested as per ASME Section V, Subsection A, article 10 (Detector probe technique), Appendix IV at a minimum of 25% of the allowable (rated) cold working pressure. Selection of valves for helium leak test shall be at random. Test duration shall be as follows:-

Test Duration in minutes					
Nominal size	Pressure class				
	Up to 300	600	800 & 900	1500	2500
Up to 2"	3	6	9	12	12
3" to 6"	6	9	12	15	18
8" to 16"	9	9	12	15	18
18" to 24"	9	12	15	18	21

The valve shall show no leakage. No leakage is defined as total leakage rate of less than 0.0001 ml/s of helium.

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1.3 C.S. & A.S. VALVES

Bend test and magnetic particle inspection of the entire surface of body and bonnet casting shall be in accordance with ASTM A217. Supplementary requirement S3 & S4 evaluation of magnetic particle inspection shall be in accordance with MSS-SP-53 except that no linear discontinuities shall be allowed.

The Brinell hardness of heat-treated casting shall not exceed 200 BHN for carbon steel & 225 for alloy steel.

Repair of defective casting shall be outlined in writing to the purchaser before repair starts. Repair method to be approved prior to welding.

Casting shall be preheated to a minimum of 400°F prior to welding and all chromium molybdenum alloys shall be post weld heat treated after welding is complete. Stress relieving is essential for welds.

Carbon steel shall be normalized and alloy steel shall be normalized and tempered. Dye penetrant test of welds shall be in accordance with ASTM E165 Procedure B-2.

Interpretation as per Appendix-8 of ASME-VIII Div.1.

The tensile stress for AS shall be less than 100,000 psi.

Charpy V-notch impact testing is to be done for valve material (average 20 ft-lb for set of 3 (min. value 15 ft-lb) at 300F).

For radiography and acceptance criteria for valve casting refer Para.15

1.4 S. S. VALVES

Casting and test bar shall be heat treated together. Valve casting shall be in the solution heat treated and pickled condition.

Critical body and bonnet casing section typically defined by ASME B16.34 shall be radiographed and shall meet the requirement of ASTM E446 (up to 2" thick) category A, B & CA Level 2, category CB, OC & CD Level 3, category D, B & F Level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 & ASTM E142 shall be used for recommended practice & controlling quality of radiography as a guide. The entire surface of all casting shall be dye-penetrant inspected after pickling.

Repair welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye-penetration Test shall be as per ASTM E-165 Procedure B-2, Interpretation as per Appendix 8 of ASME VIII Div 1.

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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted. Post Order Concession/Deviation Permit 5-0000-0180-F1 as mentioned in Cl. 5.18 of Specification for Quality Management System Requirements from Bidders (6-78-0001) is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR, Clauses 1.7.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Positive Material Identification (PMI) shall be performed as per scope and procedures defined in the Specification for Positive Material Identification (PMI) at Supplier's Works (6-81-0001).

1.2.3 Refer to specification no.6-81-0005 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Beveled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

- 1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- 1.7.3 Welded tees shall not be of fabricated (stub-in) type.
- 1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.
- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo" & "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.

1.8 Stainless Steel Fittings

- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.9 NACE/HIC Requirements

- 1.9.1 Fittings under "NACE" category or those designated as "HIC1" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.9.2 Fittings made from plates and designated as "HIC1" shall meet the HIC requirements of EIL specification 6-79-0013 unless otherwise specified.
- 1.10 Thickness/schedule lower or higher than specified for the finished product shall not be accepted.

For manufacturing of elbows from pipes, same size of pipe as that of elbow shall be used and the nominal wall thickness of the starting pipes shall have positive tolerance only. However, where the manufacturer has an established automatic/semi-automatic process for the manufacture of elbows, the starting pipe may be permitted to be of lower size with higher schedule as required. Starting pipe of higher size than that of the elbow shall not be permitted.

- 1.11** The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12** Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13** Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14** Threaded ends shall have NPT taper threads in accordance with ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.
- 1.15** Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16** Special fittings like weldolet, sockolet, sweepolet, latrolet, elbolet etc., the dimensions of which are not covered in ASME, MSS-SP & EIL Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17** Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18** For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19** All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below :

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
API 5L ASTM A358 TP 304, 304L, 304H, 318, 318L, 318H, 321, 347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T = Nom. Wall Thickness D = O.D. of Pipe.
ASTM B725	ASTM B725
ASTM B517	ASTM B517
ASTM B514	ASTM B514

- 1.20** The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

1.21 Abbreviations for ends of swages and nipples shall be as follows:

PBE	:	Plain Both Ends
TBE	:	Threaded Both Ends
TOE	:	Threaded One End
TSE	:	Threaded Small End
TLE	:	Threaded Large End

1.22 All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.

1.23 For Hydrogen service fittings following special requirements shall also be met:

- All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon- 0.35 % max. and Silicon- 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation
- All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
- For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
- For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritoscope prior to post weld heat treatment.
- For all Carbon steel and Alloy steel fittings with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).

1.24 For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.

1.25 All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr-1Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.

1.26 Fitting material as per ASTM A234 Gr.WP5/WP9/WP91, wherever specified, shall be as per 'Cl.1', unless otherwise specified.

1.27 Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 IBR REQUIREMENTS

2.1 IBR Documentation Required

- 2.1.1 Fittings under the purview of "IBR" (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form III-C duly approved and countersigned by IBR authority / local authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.
- 2.1.2 For materials 1½Cr - ½Mo (ASTM A 234Gr.WP11 & ASTM A234 Gr.WP11W) & 2½Cr - 1Mo (ASTM A 234 Gr.WP22 & ASTM A234 Gr. WP22W) & 9Cr-1Mo-V (A234 Gr.WP91/ A234Gr.WP91W), where fittings are manufactured from pipe, Form III-C approved by IBR shall include the tabulation of E_t , S_e , & S_r values for the entire temperature range given below. E_t , S_e , & S_r values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t / 1.5 & \geq & \\ S_t / 1.5 & \geq & S_A \\ S_e & \geq & \end{array}$$

- S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature)
 S_e : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
 S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)												
Temp(F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
Material												
A234Gr.WP11/ A234Gr.WP11W	21700	20900	20500	20100	19700	19200	18700	13700	9300	6300	4200	2800
A234Gr.WP22 / A234Gr.WP22W	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A234Gr.WP91/ A234Gr.WP91W	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

- 2.2 For carbon steel pipes under IBR the chemical composition shall conform to the following:

- Carbon (max) : 0.25%
 Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 ACCEPTABLE DEVIATIONS

- 3.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought

fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.

3.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5Mo min.).

3.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

4.0 MARKING AND DESPATCH

4.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "IBR", "Cryo", "NACE" and "H2" etc.

4.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.

4.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.

4.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.

4.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

4.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

4.7 Fittings coming under the purview of "IBR", "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel/socket/screwed end for other fittings.

4.8 Each end of fitting shall be protected with a wood, metal or plastic cover.

4.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package/ container clearly identifying the contents.

5.0 REFERENCES

- | | | |
|-----------|---|--|
| 6-81-0001 | : | Specification for Positive Material Identification (PMI) at Supplier's Works |
| 6-81-0005 | : | Inspection & test plan for forged, seamless and welded fittings |
| 6-79-0013 | : | Material requirements for carbon steel components used in sour service for petroleum refinery environments |



CORPORATE STANDARD

AA0851402

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TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ANSI B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ANSI B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ANSI B16.11 and butt-welding fittings with ANSI 16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA350 Gr: LF1

Carbon Steel (High Temperature Service) : ASME SA105

Alloy Steel (High Temperature Service) : ASME SA182 Gr: F22

Stainless Steel : ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service) : ASME SA420 Gr:WPL6

Carbon Steel (High Temperature Service) : ASME SA234 Gr:WPB

Alloy Steel (High Temperature Service) : ASME SA234 Gr:WP11

ASME SA234 Gr:WP22

Stainless Steel

: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification:

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ANSI B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions:

Clause 20.8.13 of MOM of WG-SMC+RP

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

Rev. No. 04

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt: 15-12-2004

Dt:

Year: 2016

HPEP, Hyderabad

Corp. R&D

01-08-1980

All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ANSI B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



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4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criteria for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- a) relevant lines indications.
- b) relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

5 CERTIFICATE

- 5.1 All fittings shall be delivered along with test certificates in English.
- 5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr.WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.
- 5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr.WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.
- 5.4 Three original Test certificates shall be submitted.

6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- a) Manufacturer's name and trade mark
- b) Pressure class (in case of socket welding fittings)
- c) Nominal size
- d) Schedule No. (in case of butt welding fittings)
- e) Type of fitting
- f) Material specification grade
- g) Melt No.
- h) Test certificate number
- i) Mark of inspection authority

**8.2 Presentation**

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- 1) ANSI B16.9, B16.11, B16.25 & B16.28
- 2) ASME SA105, SA182, SA234, SA350, SA403, SA420, SA435, SA578, SE165 & ASME SE709



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ANNEXURE – 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No. | |
| 4. Process of Melting Ingot: | 12. Spec. No. | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos. | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % ; Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P										
As per Min.															
Specn. Max.															
Actual Values															

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65/So GL	% R.A. Min.	Hardness BHN (Min.3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Min.									
Specn. Max.									
Actual Values									

19. SURFACE FINISH
(When called for in the
order / drg.)20. DIMENSIONAL
INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

	PLANT STANDARD HYDERABAD	HY7242592 REV. NO: 02 PAGE 1 OF 1																		
<u>ELBOW 90°, LONG RADIUS, BUTTWELDING, ALLOY STEEL (SA 234 WP 11).</u> <u>ORDERING SPECIFICATION</u> 1.0 COMPLIANCE WITH STANDARDS: 1.1 Dimensions, Tolerances, and other requirements: ASME: B16.9- (Latest revision). 2.0 MATERIAL: Alloy steel as per ASME SA234 WP 11 CL-2 (Latest revision). 3.0 SIZES: As specified in the order. 4.0 TECHNICAL DELIVERY CONDITIONS: As per plant standard no. HY0851495 (Latest revision). (A copy to be enclosed with this ordering specification). 5.0 MARKING AND COLOUR CODING: Marking and colour coding shall be done on all the pieces as per plant standard HY0851495 -as above. 6.0 DESIGNATION: Typically an Elbow 90 deg-Long Radius, Butt Welding, Alloy steel material, nominal size 8", schedule 80, shall be designated as follows: ELBOW-90 DEG-LR-8"-SCH 80-AS (SA 234 WP11-CL 2) or, e.g. For higher sizes - (16" & above) - ELBOW-90 DEG-LR-20"-SCH 40-AS (SA 234 WP11-CL 2W) 7.0 REFERENCE STANDARDS: i) ASME B36.10 M ii) ASME B36.19 M																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 5px;"> Revisions: As per MOM dtd. 6.11.2004. </td> <td colspan="3" style="padding: 5px; text-align: center;"> Issued : STANDARDS ENGINEERING DEPARTMENT </td> </tr> <tr> <td style="width: 16.6%; padding: 5px;">Rev. No. 02</td> <td style="width: 16.6%; padding: 5px;">Amd. No.</td> <td style="width: 16.6%; padding: 5px;">Reaffirmed:</td> <td style="width: 16.6%; padding: 5px;">Prepared:</td> <td style="width: 16.6%; padding: 5px;">Approved:</td> <td style="width: 16.6%; padding: 5px;">Date:</td> </tr> <tr> <td style="padding: 5px;">Dt. NOV.2004</td> <td style="padding: 5px;">Dt.</td> <td style="padding: 5px;">Year:</td> <td style="padding: 5px; text-align: center;">PDP</td> <td style="padding: 5px; text-align: center;">KLM</td> <td style="padding: 5px; text-align: center;">JAN. 1985</td> </tr> </table>			Revisions: As per MOM dtd. 6.11.2004.			Issued : STANDARDS ENGINEERING DEPARTMENT			Rev. No. 02	Amd. No.	Reaffirmed:	Prepared:	Approved:	Date:	Dt. NOV.2004	Dt.	Year:	PDP	KLM	JAN. 1985
Revisions: As per MOM dtd. 6.11.2004.			Issued : STANDARDS ENGINEERING DEPARTMENT																	
Rev. No. 02	Amd. No.	Reaffirmed:	Prepared:	Approved:	Date:															
Dt. NOV.2004	Dt.	Year:	PDP	KLM	JAN. 1985															



**PLANT STANDARD
HYDERABAD**

HY 724 26 99

REV. NO: 00

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REDUCER, CONCENTRIC, ALLOY STEEL

(A 234 WP 22, BUTT WELDING)

PART 1 : ORDERING DESCRIPTION

1.0 COMPLIANCE WITH STANDARDS :

1.1 Dimensions, Tolerances and other requirements: ANSI: B16.9-1986

2.0 MATERIAL :

Alloy steel to SA 234 Gr: WP 22.

3.0 SIZES :

As specified in the order.

4.0 TECHNICAL DELIVERY CONDITIONS :

As per corporate standard No. AA 085 14 02
(A copy to be enclosed).

Revisions:

Issued :

**STANDARDS ENGINEERING
DEPARTMENT**

Rev.No.

Amd.No.

Reaffirmed:

Prepared:
DY.MNGR.
(PPE)

Approved:
MANAGER,
STDS. ENGG.

Date:

SEP. 2001

Dt.

Dt.

Year:

CONCENTRIC REDUCER

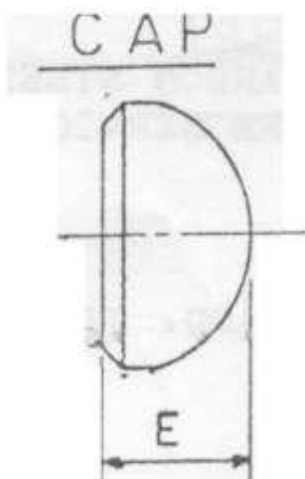


All dimensions are in 'mm' unless otherwise specified

NOMINAL PIPE SIZE INCHES	SCHE- DULE	PIPE SIZE		OD OF LARGE END		OD OF SMALL END		END TO END LENGTH 'H'		Wt. Kg.	PREF. SYM- BOL	MATERIAL CODE
		LARGE END ODxTH	SMALL END ODxTH	NOM.	TOL.	NOM.	TOL.	NOM.	TOL.			
12x8	120x120											HY7242699010
10x8	120x120											HY7242699029
6x3	40x80											HY7242699037
3x2	160x160											HY7242699045
3x1½	160x160											HY7242699053
2x1½	160x160											HY7242699061

[illegible]

	PLANT STANDARD HYDERABAD	HY 724 26 98		
		REV. NO: 01		
		PAGE 1 OF 4		
CAPS, BUTT WELDING, ALLOY STEEL (SA 234 WP11 & SA234 WP 22) (HIGH TEMPERATURE SERVICE)				
1.0 <u>SCOPE :</u>				
This standard covers designation, material, dimensions and sizes of butt welding caps.				
2.0 <u>DESIGNATION :</u>				
A cap to this standard of nominal size 1” and schedule 40 shall be designated as follows :				
2.1 <u>On Drawings :</u>				
i) Material specification column: HY 724 26 98				
ii) Description column: CAP 4” SCH 80 BW AS (SA 234 WP 22) HT. CAP 6” SCH 40 BW AS (SA 234 WP 11) HT.				
2.2 <u>For placing indents on purchase :</u> Cap, butt welding, alloy steel (SA 234 WP11 & SA 234 WP 22) (High temp. services), nominal size 4”, Sch 40, HY724 26 98.				
2.3 <u>For issuing enquiries and purchase orders :</u> For issuing enquiries and Purchase orders, delete the corporate standard no. from clause 2.2 and add the information given under clause 3 and 4.				
3.0 <u>COMPLIANCE WITH STANDARDS :</u>				
3.1 Dimensions, tolerances and : ANSI: B16.9 – Latest Edition other requirements				
3.2 Material : Alloy steel to a) SA 234 Gr: WP 11 b) SA234 Gr: WP 22.				
4.0 <u>TECHNICAL DELIVERY CONDITIONS:</u>				
As per corporate standard AA 085 14 02 (a copy to be enclosed).				
Revisions: 1.Spec. Description updated (P11 added). 2. Cl. no. 2.1, 2.2,3.1 and 3.2 revised.		Issued: STANDARDS ENGINEERING		
Rev. No. 01	Reaffirmed:	Prepared: DGM (T&C Engg)	Approved: AGM (R&D and EC)	Date of 1st Issue: SEP. 2001
Date: 20-03-2026	Date:			

**TABLE - 1**

(All dimensions are in 'mm' unless otherwise specified)

Nom Size	Sch/Th	ANSI Pipe size OD x Th	Outside Dia. at bevel D		Length E		12 digit code 10 digit code	Material	User Depts
			Nom.	Tol.	Nom.	Tol.			
3"	80	88.9x7.62	89	± 1	51	± 4	HY7242698014	P22	PPE
8"	120	219.1x18.30	219	± 2	102	± 7	HY7242698022	P22	PPE
8"	80	219.1x12.7			102		HY7242698030	P22	
3"	80	88.9x7.62			51		HY7242698049	P22	
6"	40	168.3x7.11			89		HY7242698073	P11	
8"	160	219.1x23.01			127		HY7242698081	P22	
4"	40	114.3x6.02			64		HY7242698090	P11	
12"	80	323.9x17.48			178		HY7242698103	P11	
4"	80	114.3x8.56			64		HY7242698111	P22	

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**PLANT STANDARD
HYDERABAD****TABLE - 1**

(All dimensions are in 'mm' unless otherwise specified)

Nom Size	Sch/Th	ANSI Pipe size OD x Th	Outside Dia. at bevel D		Length E		12 digit code 10 digit code	Material	User Depts
			Nom.	Tol.	Nom.	Tol.			
6"	80	168.3x10.97			89		HY7242698120	P22	
8"	80	219.1x12.7			102		HY7242698138	P22	
12"	20	323.9x6.35			152		HY7242698146	P22	
2"	40	60.3x3.91			38		HY7242698154	P22	
½"	160	21.3x4.78			25		HY7242698162	P22	
¾"	160	26.7x5.56			25		HY7242698170	P22	
1"	160	33.4x6.35			38		HY7242698189	P22	
1 ½"	XXS	48.3x10.15			38		HY7242698197	P22	
2"	XXS	60.3x11.07			44		HY7242698200	P22	
3"	XXS	88.9x15.24			64		HY7242698219	P22	
4"	XXS	114.3x17.12			76		HY7242698227	P22	
6"	160	168.3x18.26			89		HY7242698235	P22	
10"	160	273.0x28.58			152		HY7242698243	P22	
12"	160	323.9x33.32			178		HY7242698251	P22	
14"	160	355.6x35.71			191		HY7242698260	P22	
16"	160	406.4x40.49			203		HY7242698278	P22	
8"	20	219.1x6.35			102		HY7242698286	P11	
3"	160	88.9x11.13			64		HY7242698294	P22	
3"	40	88.9x5.49			51		HY7242698308	P22	

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**PLANT STANDARD
HYDERABAD**

**TABLE - 1**

(All dimensions are in 'mm' unless otherwise specified)

Nom Size	Sch/Th	ANSI Pipe size OD x Th	Outside Dia. at bevel D		Length E		12 digit code	Pref Sym- bol	User Depts
			Nom.	Tol.	Nom.	Tol.	10 digit code		
4"	160	114.3x13.49			76		HY7242698316	P22	
1 ½"	80	48.3x5.08			38		HY7242698324	P22	
2"	80	60.3x5.54			38		HY7242698332	P22	
2"	160	60.3x8.74			44		HY724269340	P22	
10"	60	273.0x12.7			127		HY7242698359	P22	
6"	80	168.3x10.97			89		HY7242698367	P11	
8"	Thk.31. 4mm				127		HY7242698375	P22	

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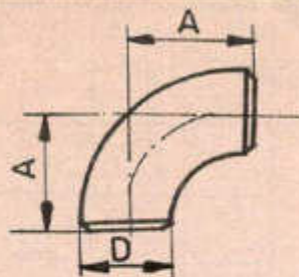
	PLANT STANDARD HYDERABAD	HY7242581 REV. NO: 01 PAGE 1 OF 1
ELBOW 90°, LONG RADIUS, ALLOY STEEL (A 234 WP 22), BUTTWELDING <u>PART 1 : ORDERING DESCRIPTION</u> 1.0 COMPLIANCE WITH STANDARDS: 1.1 Dimensions, tolerances, and other requirements: ANSI: B16.9 - 1986 2.0 MATERIAL: Alloy steel to SA 234 WP 22. 3.0 SIZES: As specified in the order. 4.0 TECHNICAL DELIVERY CONDITIONS: As per corporate standard No. AA0851402 . (A copy to be enclosed).		
Revisions: Revised as per ANSI: B16.9-1986		Issued : STANDARDS ENGINEERING DEPARTMENT
Rev. No. 01	Rev.Date: Feb.1992	Revised: MGR (STDS)
Prepared: PDP	Approved: KLM	Date: JAN. 1985



PLANT STANDARD
HYDERABAD

HY7242581

PAGE 1 OF 2



PART II: DIMENSIONS AND RATIONALIZED
SIZES

CONTROLLED COPY

Size codes as per
AA1061030

LONG RADIUS ELBOW 90°

ALL DIMENSIONS ARE IN 'mm' UNLESS OTHERWISE SPECIFIED

Nominal pipe size (inches)	Sch/Th	Outside dia at bevel D		Centre-to- end A		Wt/ piece kg	pref. sym- bol	12 DIGIT CODE	User divisions	
		Nom.	Tol.	Nom.	Tol.			10 DIGIT CODE	TC	
OD 14mm	Th 3	14					△			
1/2	40	21		38			○	HY7242581 044		
1/2	80						○	HY7242581 052		
1/2	160						○	HY7242581 044		
1/2	XXS						○			
3/4	80	27		29			○			
3/4	160						○	HY7242581 077		
3/4	XXS						○	HY 060		
1	40	33	± 1	38	± 2		○			
1	80						○	HY7242581 087		
1	160						⊗	HY7242581 079	✓	✓
1	XXS						○			
1 1/2	40	48		57			○			
1 1/2	80						○	HY7242581 109	✓	IP
1 1/2	160						○	HY7242581 83		
1 1/2	XXS						○	117		
2	80	60		76			○	HY7242581 133	✓	
2	160						⊗	HY7242581 141		
2	XXS						○	HY7242581 150	✓	GP

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PLANT STANDARD
HYDERABAD

PAGE 2 OF 2

Nominal pipe size (inches)	Sch/Th	Outside dia at bevel D		Centre-to- end A		Wt/ piece kg	Pref. sym- bol	12 DIGIT CODE	User divisions		
		Nom.	Tol.	Nom.	Tol.			10 DIGIT CODE			
2	Th12.5	60		76			○				
2 1/2	40						○	17			
2 1/2	160	73		95			○				
2 1/2	XXS		± 1				○				
OD 76.1 mm	Th 5	76					△				
OD 76.1 mm	Th 12.5						△				
3	40	89		114			○	22			
OD 108 mm	Th 20	108	+2 -1				△				
OD 159 mm	Th 30	159	+3 -1			± 2	△				
6	40	168		229			○	25			
8	60						○				
8	Th 32	219	± 2	305			○				
8	Th 36						○				
10	Th 45						○				
10	Th 50	273		381			○				
14	30	356		533			○				
16	Th 16						○				
16	Th 22.23	406	+4 -3	610	± 3		○				
16	Th 25						○				
18	Th 25						○				
18	Th 32	457		686			○				

DESIGNATION: An elbow 90° long
radius, butt welding, alloy steel
material, nominal size T, schedule
160, shall be designated as follows

ELBOW 90 DEG LR T SCH 160 AS

- 4
- STANDARD AND PREFERRED SIZE
 - ◐ STANDARD AND NON-PREFERRED SIZE
 - STANDARD SIZE NOT USED
 - △ NON-STANDARD SIZE NOT USED
 - ▲ NON-STANDARD AND NON-PREFERRED SIZE
 - ▲ NON-STANDARD AND PREFERRED SIZE

H47242581

4"	SCH 40	—	370 ✓
3"	SCH 160	—	389
5"	SCH 40	—	397
4"	SCH 160	—	40
6"	SCH 160	—	41
8"	SCH 160	—	42
10"	SCH 160	—	43
12"	SCH 160	—	44
20"	SCH 160	—	45
8"	24mm Thk	—	46.
6"	24mm Thk	—	47
2"	SCH 40	—	48
10"	SCH 60	—	49
24"	SCH XS	—	50.
4"	Sch-80	—	516 2P
6"	Sch-80	—	524 "
8"	Sch-80	—	532 "
10"	Sch-80	—	540 "
12"	Sch-80	—	559. "
6"	Sch 120	—	265 "
3/4"	Sch 160	—	1060
1 1/2"	Sch xxs	—	117
3"	Sch xxs	—	567
4"	Sch xxs	—	575
14"	Sch 160	—	583
16"	Sch 160	—	591

	PLANT STANDARD HYDERABAD	HY7242583 REV. NO: 02 PAGE 1 OF 1															
<u>REDUCER, CONCENTRIC, ALLOY STEEL</u> <u>(A 234 WP 11), BUTTWELDING</u> <u>ORDERING SPECIFICATION</u> 1.0 COMPLIANCE WITH STANDARDS: 1.1 Dimensions, Tolerances, and other requirements: ASME: B16.9 - (latest revision). 2.0 MATERIAL: Alloy steel to SA 234 Gr: WP11-CL 2 (latest revision). 3.0 SIZES: As specified in the order. 4.0 TECHNICAL DELIVERY CONDITIONS: As per plant standard no. HY0851495 (latest revision). (A copy to be enclosed with this ordering specification). 5.0 MARKING AND COLOUR CODING: Marking and colour coding shall be done on all the pieces as per plant standard HY0851495 as above. 6.0 DESIGNATION: Typically a Concentric Reducer, Butt Welding, Alloy steel material, nominal size 10" x 6", schedule 160 x 120 shall be designated as follows: CON-RDCR-10" x 6" SCH 160 x 120-AS (SA234 WP11-CL 2) or e.g. for higher sizes (16" and above)- CON-RDCR-24" x 20"-SCH 20 x 20-AS (SA234 WP11-CL 2W) 7.0 REFERENCE STANDARDS: i) ASME B36.10 M ii) ASME B36.19 M																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 5px;"> Revisions: As per MOM dtd. 6.11.2004. </td> <td colspan="3" style="padding: 5px;"> Issued : STANDARDS ENGINEERING DEPARTMENT </td> </tr> <tr> <td style="padding: 5px;">Rev. No. 02</td> <td style="padding: 5px;">Amd. No.</td> <td style="padding: 5px;">Reaffirmed:</td> <td rowspan="2" style="padding: 5px; vertical-align: middle;">Prepared: PDP</td> <td rowspan="2" style="padding: 5px; vertical-align: middle;">Approved: KLM</td> <td rowspan="2" style="padding: 5px; vertical-align: middle;">Date: JAN. 1985</td> </tr> <tr> <td style="padding: 5px;">Dt. NOV.2004</td> <td style="padding: 5px;">Dt.</td> <td style="padding: 5px;">Year:</td> </tr> </table>			Revisions: As per MOM dtd. 6.11.2004.			Issued : STANDARDS ENGINEERING DEPARTMENT			Rev. No. 02	Amd. No.	Reaffirmed:	Prepared: PDP	Approved: KLM	Date: JAN. 1985	Dt. NOV.2004	Dt.	Year:
Revisions: As per MOM dtd. 6.11.2004.			Issued : STANDARDS ENGINEERING DEPARTMENT														
Rev. No. 02	Amd. No.	Reaffirmed:	Prepared: PDP	Approved: KLM	Date: JAN. 1985												
Dt. NOV.2004	Dt.	Year:															

	PLANT STANDARD HYDERABAD	HY7242582 REV. NO. 02 PAGE 1 OF 1																		
TEE, STRAIGHT ALLOY STEEL (SA 234 WP 11), BUTTWELDING <u>ORDERING SPECIFICATION</u>																				
1.0 COMPLIANCE WITH STANDARDS: 1.1 Dimensions, tolerances, and other requirements: ASME: B16.9 (latest revision). 2.0 MATERIAL: Alloy steel to SA 234 WP 11 (latest revision). 3.0 SIZES: As specified in the order. 4.0 TECHNICAL DELIVERY CONDITIONS: As per plant standard No. HY0851495 latest revision. (A copy to be enclosed with this ordering specification). 5.0 MARKING AND COLOUR CODING: Marking and colour coding on all the pieces as per plant standard no. HY0851495 latest revision. 6.0 DESIGNATION: Typically a tee straight, alloy steel material, butt welding nominal size 8", schedule 80 shall be designated as: TEE-STRT- 8" – SCH 80 – AS (SA234 WP11) 'OR' For higher sizes of 16" and above - typically TEE-STRT-16"-SCH 40-AS (SA234 WP11CL1W) 7.0 REFERENCE STANDARDS: i) ASME B36.10 M ii) ASME B36.19 M																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 5px;"> Revisions: Revised as per ASME: B16.9. </td> <td colspan="3" style="padding: 5px;"> Issued : STANDARDS ENGINEERING DEPARTMENT </td> </tr> <tr> <td style="padding: 5px;">Rev. No. 02</td> <td style="padding: 5px;">Amd. No.</td> <td style="padding: 5px;">Reaffirmed:</td> <td style="padding: 5px;">Prepared:</td> <td style="padding: 5px;">Approved:</td> <td style="padding: 5px;">Date:</td> </tr> <tr> <td style="padding: 5px;">Dt. JUN. 06</td> <td style="padding: 5px;">Dt.</td> <td style="padding: 5px;">Year:</td> <td style="padding: 5px;">PDP</td> <td style="padding: 5px;">KLM</td> <td style="padding: 5px;">JAN. 1985</td> </tr> </table>			Revisions: Revised as per ASME: B16.9.			Issued : STANDARDS ENGINEERING DEPARTMENT			Rev. No. 02	Amd. No.	Reaffirmed:	Prepared:	Approved:	Date:	Dt. JUN. 06	Dt.	Year:	PDP	KLM	JAN. 1985
Revisions: Revised as per ASME: B16.9.			Issued : STANDARDS ENGINEERING DEPARTMENT																	
Rev. No. 02	Amd. No.	Reaffirmed:	Prepared:	Approved:	Date:															
Dt. JUN. 06	Dt.	Year:	PDP	KLM	JAN. 1985															

STRAIGHT TEE

PART II: DIMENSIONS AND RATIONALIZED SIZES

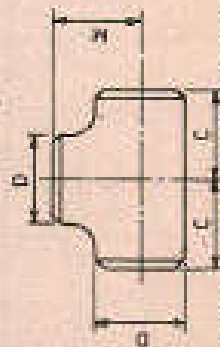
HY 724 25 82

PAGE 1 OF 4

PLANT STANDARD
HYDERABAD



Size index as per
Hy 1061032



ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

NOMINAL PIPE SIZE INCHES	SCHEDULE AT BEVEL D	OUT SIDE DIA.		CENTRE TO END		WT/ PIECE Kg	PREF. SYM-	12 DIGIT CODE	USER DIVISIONS	
		NOM.	TOL.	RUN C	OUTLET M				10 DIGIT CODE	TC TG
1/2	40	21		25	25		●	HY 724 25 82 016		✓
1/2	80	21		25	25	0.23	●	HY 724 25 82 024		✓
1/2	160	21		25	25	0.25	●	772 20 41 232		✓
25 mm	Th 3.5 mm						△	HY 724 25 82 032		✓
25 mm	Th 5 mm						△	772 20 41 632		✓
3/4	40	27	±1	29	29		○			
1	40	33		38	38		○			
1	80	33		38	38	0.35	●	HY 724 25 82 083		✓
1	160	33		38	38	0.44	●	772 20 61 232		✓
1 1/2	40	48		57	57		○	HY 724 25 82 091		✓
1 1/2	80	48		57	57	0.96	●	772 20 61 632		✓
2	40	60		64	64	1.80	●	HY 724 25 82 113		✓
							●	772 20 81 232		✓
							●	HY 724 25 82 121		✓
							●	772 20 91 032		✓



PLANT STANDARD HYDERABAD

HY 724 25 82

PAGE 2 OF 4

NOMINAL PIPE SIZE INCHES	SCHEDULE AT BEVEL D	OUT SIDEDIA		CENTRE TO END		WT/ PIECE Kg	PREF. SYM- BOL	12 DIGIT CODE 10 DIGIT CODE	USER DIVISIONS	
		NOM.	TOL.	RUN C	OUTLET M				TC	
2	80	60		64	64	1.96	●	HY 724 25 82 130 772 20 91 232	✓	
2	160	60		64	64	2.26	●	HY 724 25 82 148 772 20 91 632	✓	
76.1mm	Th 4 mm						△			
3	Th 3.6mm	89	±1	86	86		○			
3	40	89		86	86	3.80	●	HY 724 25 82 172 772 21 11 032	✓	
3	80	89		86	86	4.50	●	HY 724 25 82 180 772 21 11 232	✓	
3	160	89		86	86	6.25	●	HY 724 25 82 199 772 21 11 632	✓	
108 mm	Th 16mm						△			
4	Th 4.5mm	114	+2	105	105		○			
4	40	114	-1	105	105	6.10	●	HY 724 25 82 229 772 21 21 032	✓	
4	80	114		105	105	8.40	●	HY 724 25 82 237 772 21 21 232	✓	
139.7 mm	Th 5 mm						△			
6	Th 4.78mm	168	+3	143	143		○			
6	40	168	-1	143	143	16.5	●	HY 724 25 82 261 772 21 31 032	✓	
	160	168		143	143		●	HY 724 25 82 270 772 21 31 632	✓	

HY 724 25 82

PAGE 3 OF 4

PLANT STANDARD
HYDERABAD

NOMINAL PIPE SIZE INCHES	SCHEDULE	OUT SIDE A		CENTRE TO END				WT/ PIECE Kg	PREF. SYM - BOL	12 DIGIT CODE	USER DIVISIONS		
		AT BEVEL D		RUN C	OUTLET M		10 DIGIT CODE			PC			
		NOM.	TOL		NOM.	TOL							NOM.
8	20	219		178		178		24.0	⊗	HY724 25 82 288	✓		
8	30	219		178		178			○	772 21 41 132			
8	60	219	±2	178		178			●	HY 724 25 82 300	✓		
8	80	219		178		178		39.0	⊗	HY724 25 82 318	✓		
8	120	219		178		178		52.0	●	772 21 41 232	✓		
10	(20)22	273		216	±2	216	±2	33.0	⊗	HY 724 25 82 326	✓		
10	40	273		216		216			○	772 21 41 432	✓		ST
10	60	273		216		216			⊗	HY 724 25 82 334	✓		
10	80	273		216		216		66.0	⊗	772 21 51 132	✓		
10	120	273	±4	216		216			⊗	HY 724 25 82 369	✓		
12	30	324	±3	254		254			○	772 21 51 232	✓		
12	140	324		254	±3	254	±3		⊗	HY 724 25 82 377	✓		
14	60	356		279		279			⊗	772 21 51 432	✓		
16	Th:7.5mm	406		305		305			○	HY 724 25 82 393	✓		
8	40	219	±2	178	±2	178	±2		⊗	772 21 61 532	✓		
									○	HY 724 25 82 407	✓		
									⊗	772 21 71 132	✓		
									○	HY 724 25 82 423	✓		
									⊗	772 21 41 032	✓		

HY 724 25 82 311 ✓
 HY 724 25 82 410 ✓
 HY 724 25 82 418 ✓

HY 724 25 82 416 ✓
 HY 724 25 82 474 ✓

20 10
 12 90



DESIGNATION: A TEE STRAIGHT, BUTT WELDING, ALLOY STEEL MATERIAL, NOMINAL SIZE 1",
SCHEDULE 80, SHALL BE DESIGNATED AS FOLLOWS:

TEE STRT 1" SCH 80 AS

SYMBOLS:

- STANDARD AND PREFERRED SIZE.
- ◐ STANDARD AND NON-PREFERRED SIZE.
- STANDARD SIZE NOT USED.
- △ NON-STANDARD SIZE NOT USED.
- ▲ NON-STANDARD AND PREFERRED SIZE.
- ◑ NON-STANDARD AND NON-PREFERRED SIZE.

NOTE: WEIGHTS GIVEN IN THE TABLE ARE FOR GENERAL REFERENCE ONLY AND ARE NOT MEANT
FOR COMMERCIAL TRANSACTIONS.

Hy 7242582

10" sch. 20 - Hy 7242582504 ✓

12" sch. 40 - Hy 7242582512 23/1/204 2P



CORPORATE STANDARD

AA 724 25 01

Rev. No. 02

PAGE 1 OF 3

ELBOWS 90° SOCKET WELDING

1.0. SCOPE :

This standard covers designation, materials, dimensions and sizes of socket welding 90° Elbows suitable for pressure classes 3000 and 6000 lbs.

- 1.1 3000 lbs Elbows can be used upto 900 pressure class and 6000 lbs El bow can be used for 1500 and 2500 pressure classes.

2.0 DESIGNATION:

(Eg :) A 90° E1 bow to this standard of pressure class 3000 lbs, carbon steel material and nominal size 1/2" shall be designated as follows:

2.1 On drawings

- i) Material specification column: AA 724 25 01.
- ii) Description column: ELBOUS 90 OEG 1/2" 3000 SU CS.

- 2.2 For placing indents on purchase: Elbow 90° socket welding, carbon steel, pressure class 3000 lbs, nominal size 1/2". AA 724 25 01.

- 2.3 For issuing enquiries and purchase orders: While issuing enquiries and purchase order's, delete the Corporate Standard No. From clause 2.2 and add the information given under clauses 3.0 (deleting the materials not applicable in clause 3. 2) and 4.0

3.0 COMPLIANCE WITH STANDARDS:

- 3.1 Dimensions, tolerances and other requirements

ANSI B16. 11-1991.

3.2 Material :

Carbon steel : to ASME: SA 105
Alloy steel : to ASME: SA 182 Gr: F 22
Stainless steel :to ASME :SA 182 Gr: F 321

4.0 TECHNICAL DEL(VERY CONDITIONS:

As per Corporate Standard AA 085 14 02 (a copy to be enclosed).

5.0 NOTE:

- 5.1 Weights given in the table are for general reference only and are not meant for commercial transactions.
- 5.2 Corporate sub codes are shown in the table against corporate rationalized sizes.
- 5.3 Sizes used by individual plants are covered in the Annexure along with complete code numbers.

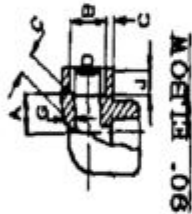
Revisions:

Revised as per ANSI B16.11-1991

APPROVED:

**INTERPLANT STANDARDIZATION
COMMITTEE- (IPSC-SMC+RP)**

Rev. No. 02	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st. Issue
Dt: 1-12-95	Dt:	Year:	HYDERABAD	Corp. R&D	FEB. '81



90° ELBOW

(All dimensions are in mm unless otherwise specified)

Pressure class designation : 3000lbs

[illegible]

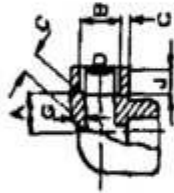


CORPORATE STANDARD

AA 724 25 01

REV. No. 02

PAGE 3 OF 3



90° ELBOW

(All dimensions are in mm unless otherwise specified)

Pressure class designation : 3000lbs

Nom. Pipe size inches	Socket bore dia. B		Bore dia of fitting D		Socket wall thickness C		Body wall G min.	Depth of socket J min	Center-to-bottom of socket-A		Wt/piece kg	Sub code		
	Max.	Min.	Max.	Min.	Ave.	Min.			Max.	Min.		Carbon steel	Alloy steel	Stainless steel
1/8	11.15	10.65	4.8	3.2	3.95	3.45	3.10	10	12	10		288	377	466
1/4	14.60	14.10	7.1	5.6	4.6	4.0	3.70	10	17	13		296	385	474
3/8	18.05	17.55	9.9	8.4	5.05	4.35	4.00	10	17	14		300	393	482
1/2	22.20	21.70	12.5	11.0	5.95	5.2	4.80	10	21	18	0.40	318	407	490
3/4	27.55	27.05	16.3	14.8	6.95	6.05	5.55	13	24	21	0.63	326	415	504
1	34.30	33.80	21.5	19.9	7.9	6.95	6.35	13	29	25	1.0	334	423	512
1 1/4	43.05	42.55	30.2	28.7	7.9	6.95	6.35	13	34	30	1.40	342	431	520
1 1/2	48.15	48.65	34.7	33.2	8.9	7.80	7.15	13	40	36	2.35	350	420	539
2	61.60	61.10	43.6	42.1	10.9	9.50	8.75	16	43	39	3.0	369	458	547



PLANT STANDARD

HYDERABAD

HY 724 25 73

PAGE 1 OF 1

REDUCER , ECCENTRIC, CARBON STEEL (SA 234 GR WPB) BUTT WELDING

PART 1 : ORDERING DESCRIPTION

CONTROLLED COPY

- 1.0 COMPLIANCE WITH STANDARDS
- 1.1 Dimensions, tolerances and other requirements : ANSI : B16.9.1986
- 2.0 MATERIAL
- Carbon steel to SA 234 Gr. WPB.
- 3.0 SIZES
- As specified in the order.
- 4.0 TECHNICAL DELIVERY CONDITIONS.
- As per corporate standard No. AA 085 14 02
(a copy to be enclosed)

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Revisions:

Revised on per ANSI: B16-9-1986

Issued:

STANDARDS SECTION
ENGINEERING DEPARTMENT

Rev. No.

Rev. Date:

Revised:

Approved:

Prepared:

Approved:

Date:

01

Feb. 1992

MGR
(STDS)

GM
(E&CC)

PDP

KLM

JAN. 1985

4" x 2" - H47242573319 SW 40x46

14" x 12" - H47242573572 SW 10x20

20" x 16" - H47242573718 SW 40x46.

20" x 16" - H47242573726

Sch. Std. (PPE) 24/10/12

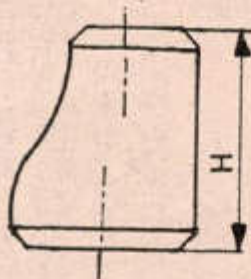
20" x 18" H47242573734

Sch-Std - "

PLANT STANDARD HYDERABAD



PART II: DIMENSIONS AND RATIONALIZED SIZES



ALL DIMENSIONS IN 'mm' UNLESS OTHERWISE SPECIFIED.

ECCENTRIC REDUCER

NOMINAL PIPE SIZE INCHES	SCHEDULE	PIPE SIZE		O D OF Large end		O D OF Small end		End to end length of reducers H		Weight/ Piece kg	Pref. Symbol	12 DIGIT CODE		User divisions	
		Large end OD x th	Small end OD x th	NOM.	TOL.	NOM.	TOL.	NOM.	TOL.			10 DIGIT CODE	F P		
1 x 1/2				33		21		51			○	04			
2 x 1				60		33		76			○	14			
2 x 1 1/2	80 x 80	60.3 x 5.54	48.3 x 5.08	60		48		76			⊗	HY 724 25 73122	✓		
2 1/2 x 2	80 x 80	73.0 x 7.01	60.3 x 5.54	73	±1	60		89			⊗	HY 724 25 73165	✓	HY 130	
3 x 1 1/2	40 x 80			89		48	±1	89	±2		○	N72 42 50064	✓	CP 24	
3 x 2	40 x 40			89		60		89			○	211		PEO	
4 x 2	40 x 40			114	±3	60		102			○	344		PEO	
4 x 3	40 x 40			114		89		102			○	300	✓	344	
6 x 3				168	+3 -1	89		140			○	42			
6 x 4	40 x 40			168		114	+2 -1	140			⊗	408	✓	434	
8 x 4	40 x 40			219	±2	114		152			○	467	✓	CP 344	
8 x 6	40 x 40			219		168	+3 -1	152			⊗	HY 724 25 73140	✓	GT	

8 x 6 20 x 40

- 457

456

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NOMINAL PIPE SIZE INCHES		SCHEDULE	PIPE SIZE		OD OF LARGE END		OD OF SMALL END		LENGTH OF REDUCERS		Weight of Piece kg	Symbol	12 DIGIT CODE	10 DIGIT CODE	USER DIVISIONS
			LARGE END OD x TH	SMALL END OD x TH	NOM.	TOL.	NOM.	TOL.	NOM.	TOL.					
10 x 6	20 x 40				273		168	+3 -1	178	±2	○		HY 7242573521		
10 x 8	20 x 20				273		219		178		⊗		HY 7242573530	GP	124
12 x 8	20 x 20				324		219	±2	203		⊗		HY 7242573548	GP	124
12 x 10	80 x 20				324		273		203		⊗		HY 7242573551	GP	124
14 x 10	10 x 20				356		273	+4	330		⊗		HY 7242573552	GP	124
14 x 12	16 x 20				356	+4 -3	324	-3	330		○		572 PED		
16 x 8					406		219	±2	356		○		564		
16 x 10					406		273		356		○		72		
16 x 12	30 x 20				406		324		356		○		HY 7242573580	GP	
16 x 14	10 x 10				406		356		356	±3	⊗		HY 7242573560	5T	
18 x 14	10 x 16				457		356	+4 -3	381		○		HY 7242573510	GP	
18 x 16	570 x 30				457		406		381		⊗		HY 7242573529	GP	
20 x 16	40 x 40				508	+6 -5	406		508		⊗		718 PED		
20 x 18					508		457		508		○		64		

4 x 2 1/280

HY 7242573553 GP

DESIGNATION: AN ECCENTRIC REDUCER, BUTT WELDING, CARBON STEEL MATERIAL, NOMINAL SIZE 2"x1 1/2", SCH 80x80, SHALL BE DESIGNATED AS FOLLOWS:

ECC RDCR 2"x1 1/2" SCH80x80

● STANDARD AND PREFERRED SIZE

⊗ STANDARD AND NON-PREFERRED SIZE

○ STANDARD SIZE NOT USED

▲ NON-STANDARD AND PREFERRED SIZE

▲ NON-STANDARD AND NON-PREFERRED SIZE

DESIGNATION: AN ECCENTRIC REDUCER,
BUTT WELDING, CARBON STEEL MATE-
RIAL, NOMINAL SIZE 2"x1 1/2", SCH 80x80,
SHALL BE DESIGNATED AS FOLLOWS:

ECC RDCR 2"x1 1/2" SCH80x80

● STANDARD AND PREFERRED SIZE

⊗ STANDARD AND NON-PREFERRED SIZE

○ STANDARD SIZE NOT USED

▲ NON-STANDARD AND PREFERRED SIZE

▲ NON-STANDARD AND NON-PREFERRED SIZE

PLANT STANDARD
HYDERABAD

HY 724 25 73

PAGE 2 OF 2



CORPORATE STANDARD

AA 724 25 20

REV.No. 02

PAGE 1 OF 3

COUPLING, SOCKET WELDING

1.0 SCOPE:

This standard covers designation, materials, dimensions and sizes of socket welding couplings suitable for pressure classes 3000 and 6000 lbs.

- 1.1 3000 lbs couplings can be used upto 900 pressure class and 6000 lbs couplings can be used for 1500 and 2500 pressure classes.

2.0 DESIGNATION:

(Eg:) A coupling to this standard of pressure class 3000 lbs, carbon steel material and nominal size 1/2" shall be designated as follows:

2.1 On drawings:

- i) Material specification column: AA 724 25 20.
ii) Description column: COUPLING 1/2" 3000 SW CS.

- 2.2 For placing indents on purchase: Coupling socket welding, carbon steel, pressure class 3000 lbs, nominal size 1/2" AA 724 25 20.

2.3 For issuing enquiries and purchase orders:

While issuing enquiries and purchase orders, delete the Corporate Standard No. from clause 2.2 and add the information given under clauses 3.0 (deleting the materials not applicable in clause 3.2) and 4.0

3.0 COMPLIANCE WITH STANDARDS:

3.1 Dimensions, tolerances and other requirements:

ANSI B16.11-1991.

3.2 Material:

Carbon steel : to ASME: SA 105
Alloy steel : to ASME: SA 182 Gr: F 22
Stainless steel : to ASME: SA 182 Gr: F 321

4.0 TECHNICAL DELIVERY CONDITIONS:

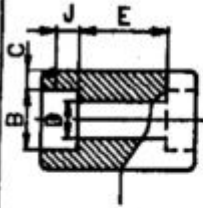
As per Corporate Standard AA 085 14 02 (a copy to be enclosed).

5.0 NOTE:

- 5.1 Weights given in the table are for general reference only and are not meant for commercial transactions.
- 5.2 Corporate sub codes are shown in the table against corporate rationalized sizes.
- 5.3 Sizes used by individual plants are covered in the Annexure along with complete code numbers.

Revision:			Approved:		
Revised as per ANSI B16.11-1991			INTERPLANT STANDARDIZATION COMMITTEE-WG (IPSC-SMC+RP)		
Rev.No. 02	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st issue
DL 1-12-95	DL	Year:	HYDERABAD	CORP. R&D	10-Feb.'81

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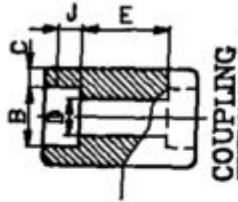


COUPLING

(All dimensions are in mm unless otherwise specified)

Pressure class designation : 3000lbs.

[illegible]



COUPLING

Pressure class designation : 6000lbs.

(All dimensions are in mm unless otherwise specified)

Nom. pipe size inches	Socket bore dia. B		Bore dia of fitting D		Socket wall thickness C		Depth of socket J	Laying length E		Wt/ piece kg	Sub code		
	max.	min.	max.	min.	Ave.	min.		max.	min.		Carbon steel	Alloy steel	Stainless steel
1/8	11.15	10.65	4.8	3.2	3.95	3.45	10	8	5		282	371	460
1/4	14.60	14.1	7.1	5.6	4.6	4.0	10	8	5	0.09	290	380	479
3/8	18.05	17.55	9.9	8.4	5.05	4.35	10	9	3	0.13	309	398	487
1/2	22.20	21.7	12.5	11.0	5.95	5.2	10	13	6	0.21	312	401	495
3/4	27.55	27.05	16.3	14.8	6.95	6.05	13	13	6	0.28	320	410	508
1	34.30	33.8	21.5	19.9	7.9	6.95	13	17	9	0.46	339	428	517
1 1/4	43.05	42.55	30.2	28.7	7.9	6.95	13	17	9	0.68	347	436	525
1 1/2	49.15	48.65	34.7	33.2	8.9	7.8	13	17	9	1.05	355	444	533
2	61.60	61.1	43.6	42.1	10.9	9.5	16	23	15	1.95	363	452	541



CORPORATE STANDARD

AA 724 25 10

REV. No. 02

PAGE 1 OF 3

TEES, SOCKET WELDING

1.0 SCOPE :

This standard covers designation, materials, dimensions and sizes of socket welding Tees suitable for pressure classes 3000 and 6000 lbs.

- 1.1 3000 lbs Tees can be used upto 900 pressure class and 6000 lbs Tees can be used for 1500 and 2500 pressure classes.

2.0 DESIGNATION :

Eg: A Tee to this standard of pressure classes 3000 lbs, carbon steel material and nominal size 1/2" shall be designated as follows :

2.1 On drawings :

- i) Material specification column : AA 724 25 10
iii) Description column : TEE 1/2, 3000 SW CS

- 2.2 For placing indents on purchase : Tee, socket welding, carbon steel, pressure class 3000 lbs, nominal size 1/2" AA 724 25 10.

- 2.3 For issuing enquiries and purchase orders : While issuing enquires and purchase orders, delete the Corporate Standard No. from clause 2.2 and add the information given under clauses 3.0 (deleting the materials not applicable in clause 3.2) and 4.0

3.0 COMPLIANCE WITH STANDARDS :

- 3.1 Dimensions, tolerances and other requirements :
ANSI B16. 11-1991.

3.2 Material :

Carbon steel : to ASME: SA 105
Alloy steel : to ASME: SA 182 Gr: F 22
Stainless steel : to ASME: SA 182 Gr: F 321

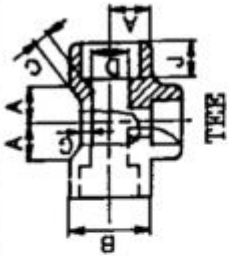
4.0 TECHNICAL DELIVERY CONDITIONS :

As per Corporate Standard AA 085 14 02 (a copy to be enclosed).

5.0 NOTE :

- 5.1 Weights given in the table are for general reference only and are not meant for commercial transactions.
5.2 Corporate sub codes are shown in the table against corporate rationalized sizes.
5.3 Sizes used by individual plants are covered in the Annexure along with complete code numbers.

Revision: Revised as per ANSI B16.11-1991			Approved: INTERPLANT STANDARDIZATION COMMITTEE-WG (IPSC-SMC+RP)		
Rev.No. 02	Amd.No.	Reaffirmed	Prepared HYDERABAD	Issued CORP. R&D	Dt. of 1st issue 10 Feb. '81
Dt. 1-12-95	Dt.	Year:			

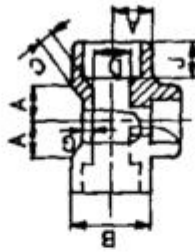


THE

(All dimensions are in mm unless otherwise specified)

Pressure class designation : 3000lbs.

[illegible]

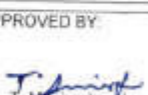


TEE

(All dimensions are in mm unless otherwise specified)

Pressure class designation : 6000lbs.

Nom. pipe size inches	Socket bore dia. B		Bore dia of fitting D		Socket wall thickness C		Body wall G	Depth of socket J	Center-to- bottom of socket-A		Wt/ piece kg	Sub code		
	max.	min.	max.	min.	Ave.	min.			max.	min.		Carbon steel	Alloy steel	Stainless steel
1/8	11.15	10.65	4.8	3.2	3.95	3.45	3.15	10	12	10		287	376	465
1/4	14.60	14.1	7.1	5.6	4.6	4.0	3.70	10	17	13		295	384	473
3/8	18.05	17.55	9.9	8.4	5.05	4.35	4.00	10	17	14		309	392	481
1/2	22.20	21.7	12.5	11.0	5.95	5.2	4.8	10	21	18	0.58	317	406	490
3/4	27.55	27.05	16.3	14.8	6.95	6.05	5.55	13	24	21	1.20	325	414	503
1	34.30	33.8	21.5	19.9	7.9	6.95	6.35	13	29	25	1.58	333	422	511
1 1/4	43.05	42.55	30.2	28.7	7.9	6.95	6.35	13	34	30	1.60	341	430	520
1 1/2	49.15	48.65	34.7	33.2	8.9	7.8	7.15	13	40	36	3.01	350	449	538
2	61.60	61.1	43.6	42.1	10.9	9.5	8.75	16	43	39	3.60	368	457	548

Bharat Heavy Electricals Limited R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS						QP. NO: HYQA/SQP/TC/20-21/09A Rev. No. : 03 DATE: 26.08.2026 VALID UPTO: 25.08.2029 PAGE 1 OF 5					
Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	Agency				Remarks
1.0 RAW MATERIALS													
1.1	Pipes/ Plates/ Bars	a) Reviewing & Correlating MILL TC (Chemical Analysis & Mechanical Properties Including Hardness, Impact test (as applicable), Heat Treatment, UT#)	Major	Verification	As per Spec.	BHEL Spec. / PO	BHEL Spec. / PO	MILL TC	✓	2	-	1	Refer Note-4 # plates, bars used for manufacturing fittings as per the raw material specification.
		b) In case of marking on pipes/plates are not clear	Critical	Chemical Analysis & Mechanical Properties	One Sample each pipe selected	BHEL Spec. / PO	BHEL Spec. / PO	Lab Test Report	✓	2	-	1	Material shall not be used unless identification/traceability is established. Where identification is lost/illegible, retesting shall be carried out.
2.0 IN PROCESS INSPECTION													
2.1	a) Cutting of Pipes	Attestation/ Transfer of Correct No.	Major	Stamping of Control No. on every piece	100%	Manufacturer's Std.		Job card	-	2	-	1	See Note-1
	b) Forming & Welding	Forming Steps & Welding parameters	Major	As per process plan	100%	Manufacturer's Std.			-	2	-	-	
	c) Welding @	WPS, PQR, WQR	Major	Verification	100%	ASME SEC IX		WPS, PQR, WQR	-	2	-	1	@ for welded fittings Witness for New & Review for existing
2.2	Heat Treatment of forgings, PWHT (as applicable)	Heat treatment batches- Time & Temp cycle	Major	Review	100%	BHEL Spec. / PO	BHEL Spec. / PO	TC, HT Chart	✓	2	-	1	Refer Note-5
2.3	Test Piece Identification	Test Piece Identification	Critical	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	IR	✓	2	1		
LEGEND: P. - PERFORM, W. - WITNESS, V. - VERIFICATION. INDICATING 1 - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2 - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D. RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.						PREPARED BY:  Sachin Katiyar Manager / QA		REVIEWED BY:  M. L. Rajam Sr. Manager / QA		APPROVED BY:  T. Meniraghavulu AGM / QA			

BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS						QP. NO: HYQA/SQP/TC/20-21/09A Rev. No. : 03 DATE: 26.08.2026 VALID UPTO: 25.08.2029 PAGE 2 OF 5						
Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	Agency				Remarks	
									D	P	W	V		
3.0 FINAL INSPECTION & TESTING														
3.1.1	Mechanical Testing	Mechanical Properties (UTS, YS & Elongation) Including Impact Test (as applicable) @ & Hardness check@	Major	Mech. Test	One test Sample from finished product per HT Batch	BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2	1	-	See Note-2 @ including on weld & HAZ (as applicable) Refer Note-9	
3.1.2	Hardness Test	Hardness test on fittings	Major	Testing	Random 10%	BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2	1			
3.2	IGC Test (as applicable)	IGC Test for stainless steel material	Major	IGC Test	100%	BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2		1	Refer Note-6	
3.3	Ferrite Number (FN) (as applicable)	Ferrite Number	Major	Ferrite Number Test	100%	BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2		1	@ on weld deposits of Austenitic SS, Refer Note-7	
3.4	Non-destructive testing on welds & BW ends/bevels (as applicable)	RT, UT on welds LPI/MPI on BW ends/bevels	Major	NDT	100%	BHEL Spec. / PO	BHEL Spec. / PO	NDT Report	√	2	1	-	See Note-3	
3.5	Non-destructive testing on Fittings	LPI	Major	LPI	100%	ASME E165	ASME Sec VIII Div. 1 Appex 8	LPI Report	√	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
		MPI	Major	MPI	100%	ASME E709	ASME Sec VIII Div. 1 Appex 6	MPI Report	√	2	1	-		
3.6	PMI test	Material Identification	Major	PMI	100%	BHEL Spec. / PO	BHEL Spec. / PO	PMI Report	√	2	1	-	Refer Note-8 Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
3.7	Visual, Dimensions including thickness, edge preparation, Surface Roughness, Thread, Ovality of pipe/fitting Check as applicable		Major	Visual & Measrt.	100%	BHEL Spec. / PO	BHEL Spec. / PO	IR	√	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	

LEGEND:
P: - PERFORM, W: - WITNESS, V: - VERIFICATION.
INDICATING 1: - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V.
* D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.

PREPARED BY:
Sachin Katiyar
Sachin Katiyar
Manager / QA

REVIEWED BY:
M. L. Rajam
M. L. Rajam
Sr. Manager / QA

APPROVED BY:
T. Murugavulu
T. Murugavulu
AGM / QA

Format no. : HYQA/QPV/SQP Rev.02

 BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS						QP. NO: HYQA/SQP/TC/20-21/09A Rev. No. : 03 DATE: 26.08.2026 VALID UPTO: 25.08.2029 PAGE 3 OF 5						
		ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) (Special Service (NACE+H2 + HIC+ Wet H2S Resistant etc.), IGC, FN etc.) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1 - AS APPLICABLE												
Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	*	Agency				Remarks
									D	P	W	V		
3.8	Marking Preservation and packing	Surface Preparation Painting/Caps Packing	Major	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	-	-	2	1	-	Refer Note-24	
3.9	Colour Coding	Colour Code	Major	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	-	-	2		1		
4.0 DOCUMENTATION REVIEW AND DISPATCH CLEARANCE														
4.1	Completeness of QA Documentation w.r.t PO, QAP, Drg./DS		Major	Document Review	100%	PO, QAP, Drg./DS	PO, QAP, Drg./DS	IR	✓	1	-	-		
4.2	QAP Sign Off, Issue of CQIR (Material and Dispatch Photographs shall be included in CQIR Report essentially)							CQIR		1	-	-	Refer Note-25	

ABBREVIATIONS:

MTC - MILL TEST CERTIFICATE	MPI - MAGNETIC PARTICLE INSPECTION	TC - TEST CERTIFICATE
HT - HEAT TREATMENT	UT - ULTRASONIC TEST	TPIA - THIRD PARTY INSPECTION AGENCY APPOINTED BY BHEL
IR - INSPECTION REPORT	RT - RADIOGRAPHY TEST	COC - CERTIFICATE OF CONFORMITY
MEASRT - MEASUREMENT	WPS - WELDING PROCEDURE SPECIFICATION	PQR - WELDING PROCESS QUALIFICATION RECORD
WQR - WELDER QUALIFICATION RECORDS	PO - PURCHASE ORDER	LPI - LIQUID PENETRANT INSPECTION
PMI - POSITIVE MATERIAL IDENTIFICATION	SS - STAINLESS STEEL	AS - ALLOY STEEL
COC - CERTIFICATE OF CONFORMITY	CQIR - CORPORATE QUALITY INSPECTION REPORT	DS - DATA SHEET

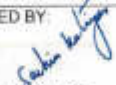
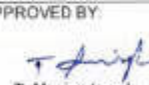
Notes:

- TRANSFER OF ATTESTATION BY BHEL/BHEL NOMINATED INSPECTION AGENCY FOR ALLOY STEEL MATERIALS.
- IN-CASE OF SMALL SIZE FITTINGS, WHERE TEST SAMPLES CANNOT BE PREPARED FROM FINISHED PRODUCT, SUPPLIER TO MAINTAIN THE SAMPLE PIECE OF REQUIRED SIZE FROM MOTHER PIPE THROUGHOUT THE MANUFACTURING PROCESS TO MEET MECHANICAL TESTING REQUIREMENT.
- MPI FOR CS & AS FOR SIZES 2" INCLUSIVE AND ABOVE, DPT FOR SS FOR SIZES 2" INCLUSIVE AND ABOVE. (ELBOWS: OUTER BEND PORTION, TEES: NECK PORTION, REDUCERS: KNUCKLE PORTION). NDT on welds & BW ends/bevels as per BHEL Specification (Refer Annexures enclosed with BHEL Specs for details).
- Material shall conform to NACE/HIC requirements as per MR0175 / MR0103 (as applicable). Technical requirements as applicable (Requirements in addition to NACE MR0175 / MR0103, Inspection etc.), H2 Service, HIC, Wet H2S resistant material requirement etc. as applicable as per BHEL Specification (Refer Annexures enclosed with BHEL Specs for details). Supplier is required to furnish Compliance certificate for BHEL Records. Verification of MTC (including Heat Treatment chart, Hardness, Impact testing, Carbon equivalent, Ni content, NDT etc. as applicable) by TPJA.
- All types of 321, 321H or 347, 347H stainless steel fittings shall be in a stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively. Verification of Heat Treatment chart & report by TPJA. Supplier is required to submit of Heat Treatment chart & report to BHEL for records.

LEGEND: P: - PERFORM, W: - WITNESS, V: - VERIFICATION, INDICATING 1: - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2: - VENDOR / SUB-VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.	PREPARED BY:  Sachin Katiyar Manager / QA	REVIEWED BY:  M. L. Rajam Sr. Manager / QA	APPROVED BY:  T. Muniragavadu AGM / QA
	Format no.: HYQA/QP/VSQP Rev.02		

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD	STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) (Special Service (NACE+H2 + HIC+ Wet H2S Resistant etc.), IGC, FN etc.) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1- AS APPLICABLE						QP. NO: HYQA/SQP/TC/20-21/09A Rev. No. : 03 DATE: 26.08.2026 VALID UPTO: 25.08.2029 PAGE 4 OF 5			
		SI No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	* D

6. For all austenitic stainless steel fittings intergranular corrosion test (IGC) shall have to be conducted as per following:
 ASTM A262 Practice 'B' with acceptance criteria of "60 mils/year (max.)".
 OR
 ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures.
 When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
Supplier is required to submit detailed inspection report for IGC test (with microstructure photographs) mentioning spec requirement as above. - Verification by TPIA.
7. For all austenitic stainless steels, weld deposits shall be checked for ferrite content. A ferrite number (FN) of not less than 3% and more than 10% is required to avoid sigma phase embrittlement during Heat Treatment and high temperature service. FN shall be determined by use of a ferrite scope. Ferrite scope measurements must be made prior to post weld heat treatment to be meaningful.
8. Positive Material Identification (PMI) shall be performed as per the scope and procedures as defined in BHEL Specification (Refer enclosed Annexures for details).
9. If welding is used in manufacture, impact test (as applicable) & Hardness of Heat Affected Zone (HAZ) and weld metal shall also be carried out.
10. LATEST VERSION OF STANDARDS/DRAWINGS /TOLERANCES ETC TO BE MENTIONED IN STD. QUALITY PLAN/DRAWING. THIS QP SHOULD BE READ ALONG WITH BHEL SPEC, BHEL DRAWINGS / APPROVED DRAWINGS, DATA SHEET, BOM AND PO.
11. DRAWING / DATA SHEET/ SPECIFICATION SHALL PREVAIL OVER STD. QUALITY PLAN IN CASE OF ANY CONTRADICTION.
12. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
13. BHEL APPROVED INSPECTION ENGINEERS TO BE DEPLOYED FOR INSPECTION.
14. ONLY LEVEL II & ABOVE QUALIFIED PERSON IN RESPECTIVE NDE TO VERIFY OR WITNESS THE NDT TEST REPORT/RESULTS.
15. INSPECTION TO BE OFFERED ONLY AFTER ENSURING THAT ALL DOCUMENTS (STD. QUALITY PLAN, DRAWINGS, DATA SHEET, PURCHASE SPECIFICATIONS, ETC) ARE AVAILABLE AS PER PURCHASE ORDER.
16. VENDOR TO ENSURE WITH TPIA THAT A NOTE "COMPARED WITH ORIGINAL TEST CERTIFICATE. REVIEWED, VERIFIED AND FOUND IN ORDER" SHALL CONTAIN WITH EVERY INSPECTION REPORT.
17. ONLY VALID AND CALIBRATED MEASURING INSTRUMENTS AND EQUIPMENT SHALL BE USED - TPIA TO VERIFY.
18. VENDOR TO ENSURE WITH TPIA THAT MATERIAL TEST CERTIFICATE & TRACEABILITY RECORDS ARE AVAILABLE FOR USE OF CORRECT MATERIAL.
19. QUALIFICATION OF EQUIPMENT, PROCESS & PERSONNEL FOR SPECIAL PROCESSES LIKE WELDING, BRAZING, PAINTING & METAL COATING ETC. (AS APPLICABLE AS PER PO) SHALL BE ENSURED.
20. VENDOR TO ENSURE THAT ALL CERTIFICATES ARE ENDORSED BY TPIA WITH COMMENTS (WITNESSED OR VERIFIED) AS PER STD. QUALITY PLAN.
21. VENDOR SHALL OFFER LOG SHEETS CONTAINING ACTUAL MEASURED VALUES INSTEAD OF SAYING OK/NOT OK TO TPIA.
22. VENDOR SHALL SUBMIT COMPLETE INSPECTION AND TEST DOCUMENTATION WHICHEVER IS IDENTIFIED WITH (V) UNDER COLUMN 'D' OF STD. QUALITY PLAN SHALL BE ENCLOSED WITH THE INSPECTION REPORT.
23. VENDOR SHALL SUBMIT ORIGINAL COPIES OF ALL INSPECTION AND TEST CERTIFICATES (ISSUED BY THIRD PARTY LABORATORIES OR SUPPLIERS) AUTHENTICATED BY TPIA.
24. ALL FITTINGS > 2 INCHES: SHALL BE PROVIDED WITH SUITABLE HDPE END COVERS TO PROTECT THE ENDS (SOCKET / THREADED ENDS OR WELD EDGE PREPARATIONS) AND TO PROTECT THE INTERNAL SURFACES. ALL FITTINGS SHALL BE PACKED AND DESPATCHED IN SUITABLE WOODEN BOXES, SO THAT NO DAMAGE OCCURS DURING TRANSPORTATION
25. TPIA TO SIGN OFF ALL INDIVIDUAL QAP STAGES AND SAME SHALL BE UPLOADED WHILE CLOSING CQIR.

LEGEND: P: - PERFORM, W: - WITNESS, V: - VERIFICATION, INDICATING 1: - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.	PREPARED BY:  Sachin Katiyar Manager / QA	REVIEWED BY:  M. L. Rajam Sr. Manager / QA	APPROVED BY:  T. Muniraghavulu AGM / QA
	Format no.: HYQA/QPVSQP Rev.02		

 BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) (Special Service (NACE+H2 + HIC+ Wet H2S Resistant etc.), IGC, FN etc.) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1 - AS APPLICABLE				QP. NO: HYQA/SQP/TC/20-21/09A Rev. No. : 03 DATE: 26.08.2026 VALID UPTO: 25.08.2029 PAGE 5 OF 5							
Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	* D	Agency P W V			Remarks

HISTORY OF REVISIONS:

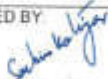
Sl No.	Revision	Revision Details	Date of Revision	Prepared By	Reviewed By	Approved By
1	00	First Issue	28.08.2021	SK	BAK	BAK
2	01	Note-6 modified.	22.09.2021	SK	BAK	BAK
3	02	Reaffirmed.	15.03.2024	SK	MLR	TMR
4	03	Sl No. 4.0 & Note-24,25 added.	26.08.2026	SK	MLR	TMR

Annexure - I

Sampling Plan for Inspection

Sl NO.	Lot Size (Numbers)	Sample Size	Acceptance Number (Maximum number of permissible defectives)
1.	2 - 8	Sample size = Lot Size	0
2.	9 - 15	Sample size = Lot Size	0
3.	16 - 25	8	0
4.	26 - 50	13	0
5.	51 - 90	20	0
6.	91 - 150	32	0
7.	151 - 280	50	0
8.	281 - 500	80	0
9.	501 - 1200	125	0
10.	1201 - 3200	200	0

Visual Inspection: Vendor: 100%
 BHEL / BHEL TPIA:
 A) 1 - 200 numbers lot size, 100% to be visually inspected.
 B) > 200 numbers lot size, 200 numbers to be visually inspected.

LEGEND: P - PERFORM, W - WITNESS, V - VERIFICATION. INDICATING 1 - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2 - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.	PREPARED BY:  Sachin Katiyar Manager / QA	REVIEWED BY:  M. L. Rajam Sr. Manager / QA	APPROVED BY:  T. Muniraghavulu Addl. General Manager / Quality Control BHEL R.C.PURAM, HYD-32, BHEL PGP, HYD-32
	Format no. : HYQA/QP/VSQP Rev.02		

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1 - AS APPLICABLE					QP. NO: HYQA/SQP/TC/20-21/09 Rev. No. : 07 DATE: 27.08.2026 VALID UPTO: 26.08.2029 PAGE 1 OF 5				
SI No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	Agency				Remarks
1.0 RAW MATERIALS													
1.1	Pipes/ Plates/ Bars	a) Reviewing & Correlating MILL TC (Chemical Analysis & Mechanical Properties, Including Hardness, Impact test (as applicable), Heat Treatment, UT#)	Major	Verification	As per Spec.	BHEL Spec. / PO	BHEL Spec. / PO	MILL TC	✓	2	-	1	# plates, bars used for manufacturing fittings as per the raw material specification.
		b) In case of marking on pipes/plates are not clear	Critical	Chemical Analysis & Mechanical Properties	One Sample each pipe selected	BHEL Spec. / PO	BHEL Spec. / PO	Lab Test Report	✓	2	-	1	Material shall not be used unless identification/traceability is established. Where identification is lost/illegible, retesting shall be carried out.
2.0 IN PROCESS INSPECTION													
2.1	a) Cutting of Pipes	Attestation/ Transfer of Correct No.	Major	Stamping of Control No. on every piece	100%	Manufacturer's Std.		Job card	-	2	-	1	See Note-1
	b) Forming & Welding	Forming Steps & Welding parameters	Major	As per process plan	100%	Manufacturer's Std.			-	2	-	-	
	c) Welding @	WPS, PQR, WQR	Major	Verification	100%	ASME SEC IX		WPS, PQR, WQR	-	2	-	1	@ for welded fittings Witness for New & Review for existing
2.2	Heat Treatment of forgings, PWHT (as applicable)	Heat treatment batches- Time & Temp cycle	Major	Review	100%	BHEL Spec. / PO	BHEL Spec. / PO	TC, HT Chart	✓	2	-	1	Refer Note-5
2.3	Test Piece Identification	Test Piece Identification	Critical	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	IR		2	1		
LEGEND: P: - PERFORM, W: - WITNESS, V: - VERIFICATION. INDICATING 1: - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2: - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.						PREPARED BY:  Sachin Katiyar Manager / QA		REVIEWED BY:  M. L. Rajam Sr. Manager / QA		APPROVED BY:  T. Muniraghavulu AGM / QA			
Format no. : HYQA/QP/VSOP Rev.02													

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1.- AS APPLICABLE				QP. NO: HYQA/SQP/TC/20-21/09 Rev. No. : 07 DATE: 27.08.2026 VALID UPTO: 26.08.2029 PAGE 2 OF 5							
Sl No	Component & Operations		Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	*	Agency				Remarks
										D	P	W	V		
3.0	FINAL INSPECTION & TESTING														
3.1.1	Mechanical Testing	Mechanical Properties (UTS, YS & Elongation) Including Impact Test (as applicable) @ & Hardness check@	Major	Mech. Test	One test Sample from finished product per HT Batch		BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2	1	-	See Note-2 @ including on weld & HAZ (as applicable) Refer Note-8	
3.1.2	Hardness Test	Hardens test on fittings	Major	Testing	Random 10%		BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2	1			
3.2	IGC Test (as applicable)	IGC Test for stainless steel material	Major	IGC Test	100%		BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2		1	Refer Note-6	
3.3	Ferrite Number (FN) (as applicable)	Ferrite Number	Major	Ferrite Number Test	100%		BHEL Spec. / PO	BHEL Spec. / PO	TC	√	2		1	@ on weld deposits of Austenitic SS. Refer Note-7	
3.4	Non-destructive testing on welds & BW ends/bevels (as applicable)	RT, UT on welds LPI/MPI on BW ends/bevels	Major	NDT	100%		BHEL Spec. / PO	BHEL Spec. / PO	NDT Report	√	2	1	-	See Note-3	
3.5	Non-destructive testing on Fittings	LPI	Major	LPI	100%	ASME E165	ASME Sec VIII Div. 1 Appex 8	LPI Report	√	2	1	-		Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
		MPI	Major	MPI	100%	ASME E709	ASME Sec VIII Div. 1 Appex 6	MPI Report	√	2	1	-			
3.6	PMI test	Material Identification	Major	PMI	100%		BHEL Spec. / PO	BHEL Spec. / PO	PMI Report	√	2	1	-	Refer Note-8 Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
3.7	Visual, Dimensions including thickness, edge preparation, Surface Roughness, Thread, Ovality of pipe/fitting Check as applicable		Major	Visual & Measrt.	100%		BHEL Spec. / PO	BHEL Spec. / PO	IR	√	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	

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* D. RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.

PREPARED BY:

Sachin Katiyar
Manager / QA

REVIEWED BY:

M. L. Rajam
Sr. Manager / QA

APPROVED BY:

T. Muniraghavulu
AGM / QA

Format no.: HYQA/QP/VSQP Rev.02

 BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.2B, HY0851495 (TDC), ANSI B16.11, ANSI B16.2B., HY0851497 (TDC), ANSI B16.11, ANSI B2.1.- AS APPLICABLE						QP. NO: HYQA/SQP/TC/20-21/09 Rev. No. : 07 DATE: 27.08.2026 VALID UPTO: 26.08.2029					
								PAGE 3 OF 5					
Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	Agency				Remarks
									D	P	W	V	
3.8	Marking Preservation and packing	Surface Preparation Painting/Caps Packing	Major	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	-	-	2	1	-	Refer Note-24
3.9	Colour Coding	Colour Code	Major	Visual	100%	BHEL Spec. / PO	BHEL Spec. / PO	-	-	2		1	
4.0 DOCUMENTATION REVIEW AND DISPATCH CLEARANCE													
4.1	Completeness of QA Documentation w.r.t PO, QAP, Drg. /DS		Major	Document Review	100%	PO, QAP, Drg. /DS	PO, QAP, Drg. /DS	IR	✓	1	-	-	Refer Note- 4
4.2	QAP Sign Off, Issue of CQIR (Material and Dispatch Photographs shall be Included in CQIR Report essentially)							CQIR		1	-	-	Refer Note-25

ABBREVIATIONS:

MTC – MILL TEST CERTIFICATE	MPI – MAGNETIC PARTICLE INSPECTION	TC – TEST CERTIFICATE
HT – HEAT TREATMENT	UT – ULTRASONIC TEST	TPIA – THIRD PARTY INSPECTION AGENCY APPOINTED BY BHEL.
IR – INSPECTION REPORT	RT – RADIOGRAPHY TEST	COC – CERTIFICATE OF CONFORMITY
MEASRT – MEASUREMENT	WPS – WELDING PROCEDURE SPECIFICATION	PQR – WELDING PROCESS QUALIFICATION RECORD
WQR – WELDER QUALIFICATION RECORDS	PO – PURCHASE ORDER	LPI – LIQUID PENETRANT INSPECTION
PMI – POSITIVE MATERIAL IDENTIFICATION	SS – STAINLESS STEEL	AS – ALLOY STEEL
COC – CERTIFICATE OF CONFORMITY	CQIR – CORPORATE QUALITY INSPECTION REPORT	DS- DATA SHEET

Notes:

- TRANSFER OF ATTESTATION BY BHEL/BHEL NOMINATED INSPECTION AGENCY FOR ALLOY STEEL MATERIALS.
- IN-CASE OF SMALL SIZE FITTINGS, WHERE TEST SAMPLES CANNOT BE PREPARED FROM FINISHED PRODUCT, SUPPLIER TO MAINTAIN THE SAMPLE PIECE OF REQUIRED SIZE FROM MOTHER PIPE THROUGHOUT THE MANUFACTURING PROCESS TO MEET MECHANICAL TESTING REQUIREMENT.
- MPI FOR CS & AS FOR SIZES 2" INCLUSIVE AND ABOVE, DPT FOR SS FOR SIZES 2" INCLUSIVE AND ABOVE. (ELBOWS: OUTER BEND PORTION, TEES: NECK PORTION, REDUCERS: KNUCKLE PORTION). NDT on welds & BW ends/bevels as per BHEL Specification (Refer Annexures enclosed with BHEL Specs for details).
- SIS CERTIFICATION, IIR CERTIFICATION ALONG WITH STAMPING (AS APPLICABLE) SHALL BE FURNISHED FOR BHEL RECORDS.
- All types of 321, 321H or 347, 347H stainless steel fittings shall be in a stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900 C and 4 hours respectively. Verification of Heat Treatment chart & report by TPJA. Supplier is required to submit of Heat Treatment chart & report to BHEL for records.
- For all austenitic stainless steel fittings intergranular corrosion test (IGC) shall have to be conducted as per following:
 ASTM A262 Practice 'B' with acceptance criteria of "60 mls/year (max.)".
 OR
 ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
 Supplier is required to submit detailed inspection report for IGC test (with microstructure photographs) mentioning spec requirement as above. – Verification by TPJA.

LEGEND: P. - PERFORM, W. - WITNESS, V. - VERIFICATION, INDICATING 1. - BHEL / BHEL NOMINATED INSPECTION AGENCY, 2. - VENDOR / SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTICS UNDER THE COLUMNS P, W & V. * D: RECORDS IDENTIFIED WITH TICK (✓) SHALL BE ESSENTIALLY INCLUDED IN QA DOCUMENTATION.	PREPARED BY:  Sachin Katiyar Manager / QA	REVIEWED BY:  M. L. Rajam Sr. Manager / QA	APPROVED BY:  T. Muniraghavulu AGM / QA
	Format no. : HYQA/QP/VSQP Rev.02		

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Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check	Ref Document	Acceptance Norms	Format of Record	* D	Agency P W V	Remarks

7. For all austenitic stainless steels, weld deposits shall be checked for ferrite content. A ferrite number (FN) of not less than 3% and more than 10% is required to avoid sigma phase embrittlement during Heat Treatment and high temperature service. FN shall be determined by use of a ferrite scope. Ferrite scope measurements must be made prior to post weld heat treatment to be meaningful.
8. Positive Material Identification (PMI) shall be performed as per the scope and procedures as defined in BHEL Specification (Refer enclosed Annexures for details).
9. If welding is used in manufacture, impact test (as applicable) & Hardness of Heat Affected Zone (HAZ) and weld metal shall also be carried out.
10. LATEST VERSION OF STANDARDS/DRAWINGS /TOLERANCES ETC TO BE MENTIONED IN STD. QUALITY PLAN/DRAWING. THIS QP SHOULD BE READ ALONG WITH BHEL SPEC, BHEL DRAWINGS / APPROVED DRAWINGS, DATA SHEET, BOM AND PO.
11. DRAWING / DATA SHEET / SPECIFICATION SHALL PREVAIL OVER STD. QUALITY PLAN IN CASE OF ANY CONTRADICTION.
12. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
13. BHEL APPROVED INSPECTION ENGINEERS TO BE DEPLOYED FOR INSPECTION.
14. ONLY LEVEL II & ABOVE QUALIFIED PERSON IN RESPECTIVE NDE TO VERIFY OR WITNESS THE NDT TEST REPORT/RESULTS.
15. INSPECTION TO BE OFFERED ONLY AFTER ENSURING THAT ALL DOCUMENTS (STD. QUALITY PLAN, DRAWINGS, DATA SHEET, PURCHASE SPECIFICATIONS, ETC) ARE AVAILABLE AS PER PURCHASE ORDER.
16. VENDOR TO ENSURE WITH TPIA THAT A NOTE 'COMPARED WITH ORIGINAL TEST CERTIFICATE. REVIEWED, VERIFIED AND FOUND IN ORDER' SHALL CONTAIN WITH EVERY INSPECTION REPORT.
17. ONLY VALID AND CALIBRATED MEASURING INSTRUMENTS AND EQUIPMENT SHALL BE USED - TPIA TO VERIFY.
18. VENDOR TO ENSURE WITH TPIA THAT MATERIAL TEST CERTIFICATE & TRACEABILITY RECORDS ARE AVAILABLE FOR USE OF CORRECT MATERIAL.
19. QUALIFICATION OF EQUIPMENT, PROCESS & PERSONNEL FOR SPECIAL PROCESSES LIKE WELDING, BRAZING, PAINTING & METAL COATING ETC. (AS APPLICABLE AS PER PO) SHALL BE ENSURED.
20. VENDOR TO ENSURE THAT ALL CERTIFICATES ARE ENDORSED BY TPIA WITH COMMENTS (WITNESSED OR VERIFIED) AS PER STD. QUALITY PLAN.
21. VENDOR SHALL OFFER LOG SHEETS CONTAINING ACTUAL MEASURED VALUES INSTEAD OF SAYING OK/NOT OK TO TPIA.
22. VENDOR SHALL SUBMIT COMPLETE INSPECTION AND TEST DOCUMENTATION WHICHEVER IS IDENTIFIED WITH (V) UNDER COLUMN 'D' OF STD. QUALITY PLAN SHALL BE ENCLOSED WITH THE INSPECTION REPORT.
23. VENDOR SHALL SUBMIT ORIGINAL COPIES OF ALL INSPECTION AND TEST CERTIFICATES (ISSUED BY THIRD PARTY LABORATORIES OR SUPPLIERS) AUTHENTICATED BY TPIA.
24. ALL FITTINGS >= 2 INCHES: SHALL BE PROVIDED WITH SUITABLE HDPE END COVERS TO PROTECT THE ENDS (SOCKET / THREADED ENDS OR WELD EDGE PREPARATIONS) AND TO PROTECT THE INTERNAL SURFACES. ALL FITTINGS SHALL BE PACKED AND DESPATCHED IN SUITABLE WOODEN BOXES, SO THAT NO DAMAGE OCCURS DURING TRANSPORTATION
25. TPIA TO SIGN OFF ALL INDIVIDUAL QAP STAGES AND SAME SHALL BE UPLOADED WHILE CLOSING CQIR.

HISTORY OF REVISIONS:

Sl No.	Rev.	Revision Details	Date of Revision	Prepared By	Reviewed By	Approved By
1	00	First Issue	28.12.2020	SK	BAK	BAK
2	01	Sl No. 3.9 Colour coding added.	03.08.2021	SK	BAK	BAK
3	02	Sl No. 3.1.2 Hardens test on fittings added.	28.08.2021	SK	BAK	BAK
4	03	Sl No. 3.2 IGC & 3.4 NDT added.	15.08.2022	SK	BAK	BAK
5	04	NPT Fitting Spec. HY0851497 (TDC), ANSI B16.11, ANSI B2.1 & Thread check added.	21.07.2023	SK	BAK	BAK
6	05	Sl No. 1.1 Remark updated.	26.12.2024	SK	MLR	TMR
7	06	Sl No. 1.1 & Note -4 updated, Note - 24	27.02.2025	SK	MLR	TMR
8	07	Sl No. 4.0 & Note-25 added.	27.08.2026	SK	MLR	TMR

LEGEND:

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PREPARED BY:

Sachin Katiyar
 Sachin Katiyar
 Manager / QA

REVIEWED BY:

M. L. Rajam
 M. L. Rajam
 Sr. Manager / QA

APPROVED BY:

T. Murugan
 T. Murugan
 AGM / QA

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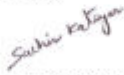
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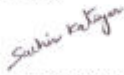
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Visual Inspection: Vendor: 100%
 BHEL / BHEL TPJA:
 A) 1 - 200 numbers lot size, 100% to be visually inspected.
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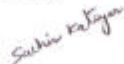
		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS				QP. NO: HYQA/SQP/TC/20-21/09 Rev. No. : 06 DATE: 27.02.2026 VALID UPTO: 26.02.2029 PAGE 1 OF 6						
				ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1 - AS APPLICABLE										
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										P	W	V		
1.0	RAW MATERIALS													
1.1	Pipes/ Plates/ Bars	a) Reviewing & Correlating MILL TC	Major	Chemical Analysis & Mechanical Properties, UT#	As per Spec.	ASME Spec. / BHEL Spec./PO	ASME Spec. / BHEL Spec./PO	MILL TC	√	2	-	1	# plates, bars used for manufacturing fittings as per the raw material specification	
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2.0	IN PROCESS INSPECTION													
2.1	a) Cutting of Pipes	Attestation/ Transfer of Correct No.	Major	Stamping of Control No. on every piece	100%	Manufacturer's Std.		Job card	-	2	-	1	See Note-1	
	b) Forming	Forming Steps	Major	As per process plan	100%	Manufacturer's Std.			-	2	-	-		
	c) Welding @	WPS, PQR, WQR	Major	Verification	100%	ASME SEC IX		WPS, PQR, WQR	-	2	-	1	@ for welded fittings	
2.2	Heat Treatment of forgings, PWHT (as applicable)	Heat treatment batches	Major	Time & Temp Recorder	100%	BHEL Spec./PO	BHEL Spec./PO	TC, HT Chart	√	2	-	1		
2.3.1	Test Piece Identification	Test Piece Identification	Critical	Visual	100%	BHEL Spec./PO	BHEL Spec./PO	IR		2	1			
2.3.2	Testing	Mechanical Properties	Major	UTS, YS & Elongation	One test Sample from finished product per HT Batch	BHEL Spec./PO	BHEL Spec./PO	TC	√	2	1	-	See Note-2	
		Hardness	Major	Hardness BHN		BHEL Spec./PO	BHEL Spec./PO	TC	√	2	1	-		
2.3.3	Hardness Test	Hardens test on fittings	Major	Testing	Random 10%	BHEL Spec./PO	BHEL Spec./PO	TC	√	2	1	-		
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Format no. : HYQA/QP/VSQP Rev.02														

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD		STANDARD QUALITY PLAN FOR VENDOR ITEMS				QP. NO: HYQA/SQP/TC/20-21/09 Rev. No. : 06 DATE: 27.02.2026 VALID UPTO: 26.02.2029 PAGE 2 OF 6						
				ITEM: SOCKET & BUTT WELD PIPE FITTINGS, NPT FITTING (SEAMLESS/WELDED SS, CS & AS) BHEL SPEC: AS PER PO, AA0851402 (TDC), ANSI B16.11, ANSI B16.28, HY0851495 (TDC), ANSI B16.11, ANSI B16.28, HY0851497 (TDC), ANSI B16.11, ANSI B2.1 - AS APPLICABLE										
Sl No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency				Remarks
										P	W	V		
2.3.4	IGC Test (as applicable)	IGC Test for stainless steel material	Major	IGC Test	100%	BHEL Spec./PO	BHEL Spec./PO	TC	✓	2	-	1	Refer Note-5	
2.4	Machining	Machining bevels	Major	Measrt.	100%	BHEL Spec./PO	BHEL Spec./PO	Job card	-	2	-	-		
2.5.1	Non-destructive testing on welds & BW ends/bevels (as applicable)	RT, UT on welds LPI/MPI on BW ends/bevels	Major	NDT	100%	BHEL Spec./PO	BHEL Spec./PO	NDT Report	✓	2	1		See Note-3	
2.5.2	Non-destructive testing on fittings	a) NDT	Major	LPI	100%	ASME E165	ASME Sec VIII Div. 1 Appex 8	LPI Report	✓	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
		b) NDT	Major	MPI	100%	ASME E709	ASME Sec VIII Div. 1 Appex 6	MPI Report	✓	2	1	-		
3.0 FINAL INSPECTION & TESTING														
	a) PMI test for AS & SS	Alloying Elements (PMI)	Major	PMI	100%	BHEL Spec./PO	BHEL Spec./PO	IR	✓	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
	b) Visual, Dimensions including thickness, edge preparation, Surface Roughness, Thread Check as applicable		Major	Visual & Measurement	100%	BHEL Spec./PO	BHEL Spec./PO	IR	✓	2	1	-	Refer Annexure -I for Sampling Plan for BHEL TPI witness.	
	c) Marking Preservation and packing	Surface Preparation Painting/Caps Packing	Major	Visual	100%	BHEL Spec./PO	BHEL Spec./PO	-	-	2	1	-	See Note 21	
	d) Colour Coding	Colour Code	Major	Visual	100%	BHEL Spec./PO	BHEL Spec./PO	-	-	2		1		
	e) Documentation	Test Certificates / Inspection Reports	Major	Compiling	100%	BHEL Spec./PO	BHEL Spec./PO	-	-	2		1	See Note-4	
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									D	P	W	V	

Refer Annexure-II for Notes.

ABBREVIATIONS:		
MTC – MILL TEST CERTIFICATE	MPI - MAGNETIC PARTICLE INSPECTION	TC – TEST CERTIFICATE
HT – HEAT TREATMENT	UT - ULTRASONIC TEST	TPIA - THIRD PARTY INSPECTION AGENCY APPOINTED BY BHEL.
IR - INSPECTION REPORT	RT – RADIOGRAPHY TEST	COC – CERTIFICATE OF CONFORMITY
MEASRT - MEASUREMENT	WPS – WELDING PROCEDURE SPECIFICATION	PQR – WELDING PROCESS QUALIFICATION RECORD
WQR – WELDER QUALIFICATION RECORDS	PO – PURCHASE ORDER	LPI – LIQUID PENETRANT INSPECTION
PMI – POSITIVE MATERIAL IDENTIFICATION	SS – STAINLESS STEEL	AS – ALLOY STEEL

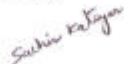
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		SI No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	* D	Agency P W V	

Annexure – I
Sampling Plan for Inspection

SI NO.	Lot Size (Numbers)	Sample Size	Acceptance Number (Maximum number of permissible defectives)
1.	2 - 8	Sample size = Lot Size	0
2.	9 - 15	Sample size = Lot Size	0
3.	16 - 25	8	0
4.	26 - 50	13	0
5.	51 - 90	20	0
6.	91 - 150	32	0
7.	151 - 280	50	0
8.	281 - 500	80	0
9.	501 - 1200	125	0
10.	1201 - 3200	200	0

Visual Inspection:
 Vendor: 100%
 BHEL / BHEL TPIA:
 A) 1 – 200 numbers lot size, 100% to be visually inspected.
 B) > 200 numbers lot size, 200 numbers to be visually inspected.

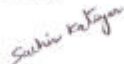
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SI No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	*	Agency				Remarks
									D	P	W	V		

Annexure – II

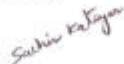
Notes:

- TRANSFER OF ATTESTATION BY BHEL/BHEL NOMINATED INSPECTION AGENCY FOR ALLOY STEEL MATERIALS.
- IN-CASE OF SMALL SIZE FITTINGS, WHERE TEST SAMPLES CANNOT BE PREPARED FROM FINISHED PRODUCT, SUPPLIER TO MAINTAIN THE SAMPLE PIECE OF REQUIRED SIZE FROM MOTHER PIPE THROUGHOUT THE MANUFACTURING PROCESS TO MEET MECHANICAL TESTING REQUIREMENT.
- MPI FOR CS & AS FOR SIZES 2" INCLUSIVE AND ABOVE, DPT FOR SS FOR SIZES 2" INCLUSIVE AND ABOVE. (ELBOWS: OUTER BEND PORTION, TEES: NECK PORTION, REDUCERS: KNUCKLE PORTION). NDT on welds & BW ends/bevels as per BHEL Specification. (Refer Annexures enclosed with BHEL Specs for details).
- BIS CERTIFICATION**, IBR CERTIFICATION ALONG WITH STAMPING (AS APPLICABLE) SHALL BE FURNISHED FOR BHEL RECORDS.
- For all austenitic stainless-steel fittings intergranular corrosion test (IGC) shall have to be conducted as per following:
 ASTM A262 Practice 'B' with acceptance criteria of "60 mils/year (max.)".
 OR
 ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
Supplier is required to submit detailed inspection report for IGC test (with microstructure photographs) mentioning spec requirement as above. – Verification by TPIA.
- LATEST VERSION OF STANDARDS/DRAWINGS /TOLERANCES ETC TO BE MENTIONED IN QUALITY PLAN/DRAWING. THIS QP SHOULD BE READ ALONG WITH BHEL SPEC, BHEL DRAWINGS / APPROVED DRAWINGS, DATA SHEET, BOM AND PO.
- DRAWING / DATA SHEET/ SPECIFICATION SHALL PREVAIL OVER QUALITY PLAN IN CASE OF ANY CONTRADICTION.
- BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
- BHEL APPROVED INSPECTION ENGINEERS TO BE DEPLOYED FOR INSPECTION.
- ONLY LEVEL II & ABOVE QUALIFIED PERSON IN RESPECTIVE NDE TO VERIFY OR WITNESS THE NDT TEST REPORT/RESULTS.
- INSPECTION TO BE OFFERED ONLY AFTER ENSURING THAT ALL DOCUMENTS (QUALITY PLAN, DRAWINGS, DATA SHEET, PURCHASE SPECIFICATIONS, ETC) ARE AVAILABLE AS PER PURCHASE ORDER.
- VENDOR TO OFFER ORIGINAL TEST CERTIFICATES ISSUED BY THIRD PARTY LABORATORIES OR SUPPLIERS.
- VENDOR TO ENSURE WITH TPIA THAT A NOTE 'COMPARED WITH ORIGINAL TEST CERTIFICATE. REVIEWED, VERIFIED AND FOUND IN ORDER' SHALL CONTAIN WITH EVERY INSPECTION REPORT.
- ONLY VALID AND CALIBRATED MEASURING INSTRUMENTS AND EQUIPMENT SHALL BE USED – TPIA TO VERIFY.
- VENDOR TO ENSURE WITH TPIA THAT MATERIAL TEST CERTIFICATE & TRACEABILITY RECORDS ARE AVAILABLE FOR USE OF CORRECT MATERIAL.

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		SI No	Component & Operations	Characteristics	Class	Type Of Check	Quantum Of Check	Ref Document	Acceptance Norms	Format Of Record	*	Agency		
										D	P	W	V	

16. QUALIFICATION OF EQUIPMENT, PROCESS & PERSONNEL FOR SPECIAL PROCESSES LIKE WELDING, BRAZING, PAINTING & METAL COATING ETC. (AS APPLICABLE AS PER PO) SHALL BE ENSURED.
17. VENDOR TO ENSURE THAT ALL CERTIFICATES ARE ENDORSED BY TPJA WITH COMMENTS (WITNESSED OR VERIFIED) AS PER QUALITY PLAN.
18. VENDOR SHALL OFFER LOG SHEETS CONTAINING ACTUAL MEASURED VALUES INSTEAD OF SAYING OK/NOT OK TO TPJA.
19. VENDOR SHALL SUBMIT COMPLETE INSPECTION AND TEST DOCUMENTATION WHICHEVER IS IDENTIFIED WITH (v) UNDER COLUMN 'D' OF APPROVED QULAITY PLAN SHALL BE ENCLOSED WITH THE INSPECTION REPORT.
20. VENDOR SHALL SUBMIT ORIGINAL COPIES OF ALL INSPECTION AND TEST DOCUMENTS AUTHENTICATED BY TPJA.
21. ALL FITTINGS >= 2 INCHES: SHALL BE PROVIDED WITH SUITABLE HDPE END COVERS TO PROTECT THE ENDS (SOCKET / THREADED ENDS OR WELD EDGE PREPARATIONS) AND TO PROTECT THE INTERNAL SURFACES. ALL FITTINGS SHALL BE PACKED AND DESPATCHED IN SUITABLE WOODEN BOXES, SO THAT NO DAMAGE OCCURS DURING TRANSPORTATION

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CORPORATE STANDARD

AA0851402

Rev. No. 06

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TECHNICAL, DELIVERY CONDITIONS FOR ANSI-PIPE FITTINGS

1 SCOPE

This standard stipulates the technical delivery conditions for socket-welding fittings like elbows, tees, couplings etc. to ASME B16.11 and seamless butt-welding fittings like elbows, tees, reducers etc. to ASME B16.28.

2 TECHNICAL REQUIREMENTS

This socket-welding fitting shall comply with ASME B16.11 and butt-welding fittings with ASME B16.28 with the following specific requirements.

2.1 Pressure class, schedule and size

Pressure class and size for socket-welding fitting, schedule and size for butt-welding fittings shall be as specified in the enquiry/order.

2.2 Material Specification

The material of the fittings shall be as per enquiry/order. The material shall generally comply with the following, unless otherwise specified.

a) Socket welding fittings

Socket welding fittings shall be manufactured by forging to the following material specification:

Carbon Steel (Low Temperature Service)	: ASME SA350 Gr: LF1
Carbon Steel (High Temperature Service)	: ASME SA105
Alloy Steel (High Temperature Service)	: ASME SA182 Gr: F22
Stainless Steel	: ASME SA182 Gr: F321

b) Butt-Welding fittings

Butt-welding fittings shall be manufactured as per the relevant standards to the following material specification:

Carbon Steel (Low Temperature Service)	: ASME SA420 Gr:WPL6
Carbon Steel (High Temperature Service)	: ASME SA234 Gr:WPB
Alloy Steel (High Temperature Service)	: ASME SA234 Gr:WP11, ASME SA234 Gr:WP22
Stainless Steel	: ASME SA403 Gr:WP321

2.3 Heat treatment

The fittings shall be properly heat treated as per the relevant material specification.

2.4 Dimensions, Tolerances and Finish

The dimensions and tolerances, shall be strictly as per ASME B16.11 for forged steel fittings, socket welding and threaded, B16.9 for factory made wrought steel Butt-Welding fittings. For allowable imperfections and finish of the fittings relevant clause as per ASME SA234/ SA403/ SA420 shall be applicable for carbon alloy and stainless steel fittings.

Revisions: Clause 8.1

APPROVED:INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (SMC+RP)

Rev. No. 06

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt: 31-03-2022

Dt:

Year:

HPEP, Hyderabad

Corp. R&D

01-08-1980



All fittings shall be shot blasted both inside and outside to remove rust, scale and other foreign materials. The surface shall be clean, smooth and without any scales, burrs etc.

Vendor shall note the method to be employed in their Quality Assurance Plan for approval by BHEL representative/Customers.

2.5 Edge Preparation

Unless otherwise specified, the butt welding fittings shall be supplied with edge preparation for welding with the connecting pipe. The edge preparation shall be as per ASME B 16.25.

3 CHEMICAL COMPOSITION AND PROCESS

3.1 Carbon percentage shall be limited as specified in the following table

Sl No.	Grade	Connecting pipe wall thickness	C%
1	A105, WPC	All	0.25
2	WPB, WPBW	All	0.25

3.2 Fittings shall be of seamless construction only unless otherwise specified in the purchase order. Fittings of nominal bore NB 50 and below shall be of forged construction only.

3.3 Fittings shall be forged, wherever specified in the purchase order. The forgings must be as close as possible to the final shape and size.

3.4 All the plates used for manufacturing of plate formed fittings shall be ultrasonically tested by either of the following:

- i) ASME SA 435 and acceptance standards as in SA 435 except that adjacent discontinuity indications shall be separated from each other by a distance equal to or no longer than the larger of the indications, unless both the adjacent defects can be contained in a circle of diameter equal to the acceptance standards of a single defect.
- ii) ASME SA 578 and acceptance standard shall be as per Level-1 of SA 578

4 INSPECTION AND CERTIFICATION

4.1 Mechanical and Chemical Testing

Material used for manufacture of the fittings shall be tested for mechanical properties and chemical composition as relevant material standards.

4.2 Magnetic particle Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be magnetic particle examined after final heat treatment in accordance with practice ASME SE709 for all carbon steel and alloy steel fittings for all schedule for sizes 2" inclusive and above.

4.3 Liquid Penetrant Examination

Knuckle of reducers, outer bend portion of elbows and neck portion of tees shall be liquid penetrant examined after final heat treatment in accordance with practice ASME SE165 for all stainless steel fittings for all schedules for sizes 2" inclusive and above.



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4.4 Acceptance Criteria for MPE and LPE Tests

The acceptance criterion for MPE and LPE tests shall be in accordance with Appendix 6 and 8 of ASME, Sec. VIII Div. 1

All surfaces to be examined shall be free of:

- a) relevant lines indications.
- b) relevant rounded indications greater than 3/16 inch.
- c) Four or more relevant rounded indications in a line separated by 1/16 inch or less (edge to edge)
- d) An indication of imperfection may be larger than the imperfection that causes it, however, the size of the indication is the basis for acceptance evaluation.

4.5 Wrinkles

The inner bend portion of Elbows shall be free from wrinkles and Tool marks.

4.6 Inter Granular Corrosion (IGC) Test for Austenitic Stainless Steel

4.6.1 All stainless steel fittings shall be supplied in solution heat-treated condition.

4.6.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.

4.6.3 For all stainless steel fittings IGC test shall have to be conducted as per the following:

ASTM A 262 Practice "B" with acceptance criteria of "60 mils/year (max.)".

Or

ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.

4.6.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (e.g. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils/year" shall have to be conducted.

4.6.5 For the IGC test as described in Clauses 4.6.3 & 4.6.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness.

4.6.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

5 CERTIFICATE

5.1 All fittings shall be delivered along with test certificates in English.

5.2 Fittings to material specification ASME SA105, SA182 Gr.F22, SA234 Gr. WPB and WP22 shall be inspected and the test certificates shall be countersigned by an inspecting authority approved under Appendix "C" of Indian Boiler Regulations.

5.3 Fittings to material specification ASME 350 Gr.LF1, SA 182 Gr.F321, SA 420 Gr.WPL6 and SA 403 Gr. WP 321 shall be subjected to inspection by authorities nominated by BHEL and the test certificates shall be countersigned by them.

5.4 Three original Test certificates shall be submitted.



6 GUARANTEE CERTIFICATE

The supplier shall furnish a guarantee certificate stating that fittings supplied are capable of withstanding without failure, leakage or impairment of their serviceability, a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material.

7 QUALITY PLAN

A quality plan incorporating the process adopted by the supplier and conforming to the requirements of this specification shall be submitted for approval. Manufacturing shall commence only after the approval of the quality plan by BHEL.

8 MARKING, PRESERVATION AND PACKING

8.1 Marking

The following details shall be punched on each fitting:

- a) Manufacturer's name and trade mark
- b) Pressure class (in case of socket welding fittings)
- c) Nominal size
- d) Schedule No. (in case of butt welding fittings)
- e) Type of fitting
- f) Material specification grade
- g) Melt No.
- h) Test certificate number
- i) Mark of inspection authority
- j) BHEL Material Code

8.2 Presentation

Before despatch, the fittings shall be dried and cleaned and the entire surface shall be well coated with a good quality rust preventive coating that will not become fluid and run-off at 65°C.

8.3 Packing

All fittings shall be provided with HDPE end covers to protect the weld edge preparation and to protect the internal surfaces. The fittings shall be wrapped by bitumen paper/tar paper/ Polyethylene paper to avoid water ingress during transit/handling in transporter's godown.

Fittings shall be packed in a sound closed wooden/steel box.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- | | |
|----------------|----------------|
| 1) ASME B16.9 | 8) ASME SA350 |
| 2) ASME B16.11 | 9) ASME SA403 |
| 3) ASME B16.25 | 10) ASME SA420 |
| 4) ASME B16.28 | 11) ASME SA435 |
| 5) ASME SA105 | 12) ASME SA578 |
| 6) ASME SA182 | 13) ASME SE165 |
| 7) ASME SA234 | 14) ASME SE709 |



CORPORATE STANDARD

AA0851402

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Annexure - 1: TEST CERTIFICATE PROFORMA FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR FORGINGS

- | | | |
|---|--|-------------------------------------|
| 1. Customer: | 9. Reduction Ratio | } Ingot to Bloom,
Bloom to Blank |
| 2. TC No. & Date: | 10. Batch No.: | |
| 3. PO No.: | 11. Heat/Melt No. | |
| 4. Process of Melting Ingot: | 12. Spec. No. | |
| 5. Deoxidisation Process: | 13. Test Bar Size & Nos. | |
| 6. Forging Method: | 14. Supplier of the ingot / billet / Bloom and TC reference. | |
| 7. BHEL's Reference for Approval of Bloom | | |
| 8. Discard: Top % ; Bottom % | | |

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element	C	Si	Mn	S	P													
As per Specn.	Min.																	
	Max.																	
Actual Values																		

17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)

Condition	Heating Rate, °C/hr	Temp. °C	Soaking Time, Hrs.	Cooling rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

	T.S. N/mm ²	Y.S. 0.5/0.2% Proof N/mm ²	% Elongation 5.65√So GL	% R.A. Min.	Hardness BHN (Min.3 values)	Impact value Joules	Bend Test		
							Angle of bend	Dia of mandrel	Result
As per Specn.	Min.								
	Max.								
Actual Values									

19. SURFACE FINISH (When called for in the order / drg.)

20. DIMENSIONAL INSPECTION

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION (To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative%	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, IGC ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE
INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE
CHIEF OF QUALITY CONTROL /
CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

- Details of all heat treatment processes carried out should be furnished sequentially in 17.
- Test certificates are to be furnished as per purchase order and specification, in A4 size preferably in transparent paper.
- All the entries including signature should be in block colour ink.
- If testing is done by outside agencies, the original TCs shall be furnished.
- The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

BHEL-HYD:	PURCHASE SPECIFICATION TURBINES & COMPRESSORS	TC-6-7390
		REV NO: 00
		PAGE 1 OF 1

**SPECIFICATION OF STAINLESS STEEL TEMPERATURE STUB SCREWED
TYPE, FOR MEDIUM PRESSURE (UP TO 40 Kg/cm²)**

SCOPE:

This standard specifies the requirement of Stainless Steel temperature stub screwed type.

TECHNICAL REQUIREMENTS:

All technical requirements as per Specification: AA7326101 except the material as per ASTM A182 F316L.

VARIANT TABLE:

Si. no.	Spec variant	Material code	Description	Material
1.	01	TC9767390014	STUB SLANT IMMER SS316L SCRW M33X2-F L=6	A182 F316L
2.	02	TC9767390022	STUB STRT IMMER SS316L SCRW M33X2-F L=64	A182 F316L
3.	03	TC9767390030	STUB STRT IMMER SS316L SCRW M33X2-F L=45	A182 316L

REF-DOC	PREPARED BY: BASAVARAJU	APPROVED BY: B.S/M.A.H	DATE: 22.09.2018
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CORPORATE STANDARD

AA 732 61 01

Rev. No. 01

PAGE 1 OF 4

TEMPERATURE STUB, SCREWED TYPE, FOR MEDIUM PRESSURE (UP TO 40 Kg/cm²)

1.0 SCOPE:

- 1.1 This standard specifies the requirements of temperature stubs for nominal pressure up to 40 Kg/cm², for slant immersion for main pipe O.D's 88.9 to 159 mm and for straight immersion for main pipe O.D's of 168.3 mm and above with carbon steel materials.
- 1.2 These stubs are used for insertion of thermowells of temperature measuring instruments for media demineralised water, oil, fuel gas etc.

2.0 DESIGNATION:

A temperature stub for straight immersion carbon steel material length 45 mm pressure 40 kg/cm² to this standard shall be designated as follows.

2.1 On Drawings and Indents :

Material specification column : AA 732 61 01

Description column : TEMP STUB STRT IMRTN L45 PR. 40

Material code column : AA 732 61 01 329

2.2 On Enquiries and Purchase orders:

In addition to incorporating the above details, a copy of this standard shall be enclosed.

3.0 TECHNICAL REQUIREMENTS:

3.1 **Material:** Carbon steel material of ASTM A105 up to temperature of 0 – 425° C.

3.2 The dimensions of temperature stub for slant immersion are given in table 1. These stubs are used for main pipe O.D's of 88.9 to 159 mm.

3.3 The dimensions of temperature stub for straight immersion are give in table 2. These stubs are used for the main pipe O.D's of 168.3 mm and above.

3.4 For installation of thermowells in pipe O.D's 88.9 mm below larger pipe section of O.D 88.9 mm should be used. The mounting details are given in Annexure – 1.

3.5 The treading connection of the stub is M33 x 2 (6g)

4.0 TEST CERTIFICATES:

Three copies of the material test certificates, counter-signed by an authority recognized by IBR are to be supplied.

Revisions :

CL. 18.6.10 of MOM of WG-M&CD

APPROVED :

INTERPLANT
STANDARDIZATION COMMITTEE- (WG-M&CD)

Rev. No. 01

Amd.No.

Prepared

Issued

Dt. of 1st Issue

Dt: 01.10.2005

Dt :

Year :

HYDERABAD

Corp. R&D

MARCH, 1986

5.0 MARKING

5.1 The following details shall be marked on each stub

- Manufacturer's name or trade mark.
- Material specification
- Thread size

6.0 PACKING

Each stub shall be applied with suitable rust preventive coating and suitably packed in batches of ten numbers each and supplied with plastic end caps.

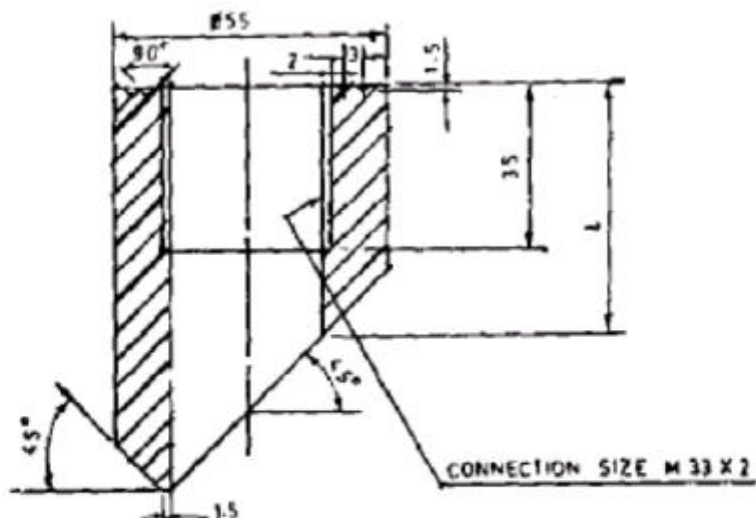


FIG - 1- TEMPERATURE STUB FOR
SLANT IMMERSION

TABLE 1. TEMPERATURE STUB FOR SLANT IMMERSION

O.D. of Main pipe (mm)	Thermowell insertion Length (L1)	Length of The stub (1)	Material	Sub Code
88.9 mm to 159 mm	150	64	ASTM A105	019

NOTE: 1) These stubs are used for O.D's of main pipe 88.9 to 159 mm.

2) In case a suitable pipe bend is available, a straight stub can be used instead of slant stub to this standard.

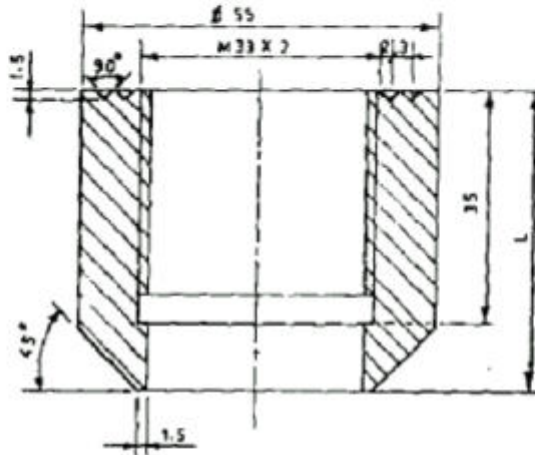


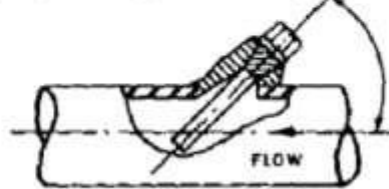
FIG. 2. TEMPERATURE STUB FOR
STRAIGHT IMMERSION

TABLE – 2 : TEMPERATURE STUB FOR STRAIGHT IMMERSION

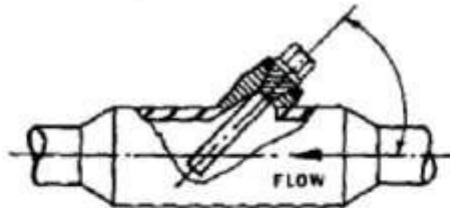
O.D. of Main pipe (mm)	Thermowell insertion Length (L1)	Length of The stub (1)	Material	Sub Code
168.3	150	64	ASTM A105	310
193.7	150	64	ASTM A105	310
219.1	150	45	ASTM A105	329
273.0	150	45	ASTM A105	329
323.9	175	45	ASTM A105	329
355.6	175	45	ASTM A105	329
406.4	250	45	ASTM A105	329
508.0	250	45	ASTM A105	329
Above 508.0	325	45	ASTM A105	329

- NOTE:** 1) These stubs are used for O.D of main pipe having 168.3 mm and above.
2) For 12 digit material code suffix sub code to the standard number
3) Specific requirements of the plant shall be covered by plant annexure to this standard.

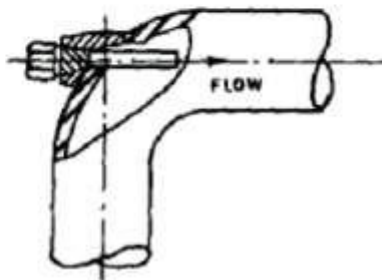
THERMOWELL INSTALLATION (ANNEXURE)

INSTALLATION TYPE-1

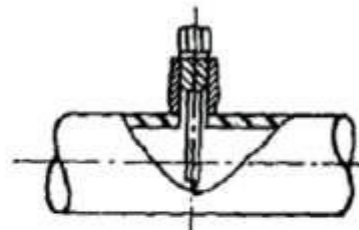
FOR MAIN PIPE OD'S 88.9mm to 159mm

INSTALLATION TYPE-2

FOR MAIN PIPE OD'S 88.9mm BELOW

INSTALLATION TYPE-3

FOR MAIN PIPE OD'S 88.9mm BELOW

INSTALLATION TYPE-4

MAIN PIPE OD 168.3 mm & ABOVE

Additional Technical Conditions for Purchase orders through GEM

Buyer Added Bid Specific Additional Terms & Conditions (ATC)

1.

PRE-QUALIFICATION CRITERIA:

1.1 TECHNICAL: As per GeM Tender and Technical Specifications

1.2 FINANCIAL: As per GeM Tender.

1.3 Submission of Integrity Pact duly signed: Not applicable

1.4 Bidder must not be admitted under Corporate Insolvency Resolution Process or Liquidation as on date, by NCLT or any adjudicating authority/authorities and shall submit undertaking (Annexure-4) to this effect.

1.5 Customer Approval: Applicable. Please refer to SCC (Annexure-19). Vendor should be approved by BHEL/End customer. Bids from approved vendors shall be qualified.

Explanatory Notes for the PQR:

- i. 'Supplied' in PQR – 1.1 means, bidder should have delivered the _____. Bidder shall submit the relevant documents against the above PQRs inclusive of Purchase order (wherein PO no., date, etc. is legible) along with proof of supply (i.e. - Completion Certificate/ Copy of Invoices / LR Copies/ Store Receipt Vouchers/ Payment Advice etc.) in the respective attachments in their offer in support of PQR. The "Contract" referred in Technical PQR may be Rate Contract/ Framework Agreement/ Purchase Order/ Work Order.
- ii. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against Financial Turnover PQR – 1.2 above along with all annexures.
- iii. In case of audited Financial Statements have not been submitted for all the three years as indicated against Financial Turnover PQR above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e. total divided by three.
- iv. If Financial Statements are not required to be audited statutorily, then instead of audited Financial Statements, Financial Statements are required to be certified by Chartered Accountant.
- v. Credentials furnished by the bidder against "PRE-QUALIFYING CRITERIA" shall be verified from the issuing authority for its authenticity. In case, any credential (s) is/are found to be spurious, offer of the bidder is liable to be rejected. BHEL reserves the right.
- vi. Price Bids of only those bidders shall be opened who stand qualified after compliance of QR – 1.1 to 1.5

2.	<u>SCOPE OF SUPPLY:</u> i) Supply of items as per tender Specification ii) <i>Supply of items (mentioned in tender) to project site on F.O.R. Destination Basis.</i> Unloading of materials at Destination/ Site shall be in BHEL's scope.
3.	<u>PRICE BASIS:</u> Price in INR should be quoted for F.O.R. DESTINATION basis. Delivery location shall be as per Tender specification
4.	<u>TAXES & DUTIES:</u> 4.1 The Supplier/Vendor shall pay all (save the specific exclusions as enumerated in this clause) taxes, fees, license, charges, deposits, duties, tools, royalty, commissions, other charges, etc. which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes/duties, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit along with the applicable overheads @5% and interest on the total value (i. e. amount paid by BHEL + overhead) However, provisions regarding GST on output supply (goods/service) and TDS/TCS as per Income Tax Act shall be as per following clauses. 4.2 GST (Goods and Services Tax) 4.2.1 GST as applicable on output supply (goods/services) are excluded from Supplier/Vendor's scope; therefore, contractor's price/rates shall be exclusive of GST. Reimbursement of GST is subject to compliance of following terms and conditions. BHEL shall have the right to deny payment of GST and to recover any loss to BHEL on account of tax, interest, penalty etc. for non-compliance of any of the following condition. 4.2.2 The admissibility of GST, taxes and duties referred in this chapter or elsewhere in the contract shall be limited to direct transactions between BHEL & its Supplier/Vendor. BHEL shall not consider GST on any transaction other than the direct transaction between BHEL & its Supplier/Vendor. 4.2.3 Supplier/Vendor shall obtain prior written consent of BHEL before billing the amount towards such taxes. Where the GST laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL shall have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Supplier/Vendor.

4.2.4 Supplier/Vendor has to submit GST registration certificate of the concerned state. Supplier/Vendor also needs to ensure that the submitted GST registration certificate should be in active status during the entire contract period.

4.2.5 Supplier/Vendor has to issue Invoice/Debit Note/Credit Note indicating HSN/SAC code, Description, Value, Rate, applicable tax and other particulars in compliance with the provisions of relevant GST Act and Rules made thereunder.

4.2.6 Supplier/Vendor has to submit GST compliant invoice within the due date of invoice as per GST Law. In case of delay, BHEL reserves the right of denial of GST payment if there occurs any hardship to BHEL in claiming the input thereof. In case of goods, Supplier/Vendor has to provide scan copy of invoice & GR/LR/RR to BHEL before movement of goods starts to enable BHEL to meet its GST related compliances. Special care should be taken in case of month end transactions.

4.2.7 Supplier/Vendor has to ensure that invoice in respect of such services which have been provided/completed on or before end of the month should not bear the date later than last working day of the month in which services are performed.

4.2.8 Subject to other provisions of the contract, GST amount claimed in the invoice shall be released on fulfilment of all the following conditions by the Supplier/Vendor: -

- a) Supply of goods and/or services have been received by BHEL.
- b) Original Tax Invoice has been submitted to BHEL.
- c) Supplier/Vendor has submitted all the documents required for processing of bill as per contract/ purchase order/ work order.
- d) In cases where e-invoicing provision is applicable, Supplier/Vendor is required to submit invoice in compliance with e-invoicing provisions of GST Act and Rules made thereunder.
- e) Supplier/Vendor has filed all the relevant GST return (e.g. GSTR-1, GSTR-3B, etc.) pertaining to the invoice submitted and submit the proof of such return along with immediate subsequent invoice. In case of final invoice/ bill, contractor has to submit proof of such return within fifteen days from the due date of relevant return.
- f) Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice and in GSTR-2B of the month in which such invoices has been reported by the contractor along with status of ITC availability as "YES" in GSTR-2B. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the Supplier/Vendor.
- g) Supplier/Vendor has to submit an undertaking confirming the payment of all due GST in respect of invoices pertaining to BHEL.

4.2.9 Any financial loss arises to BHEL on account of failure or delay in submission of any document as per contract/purchase order/work order at the time of submission of Tax invoice to BHEL, shall be deducted from Supplier/Vendor's bill or otherwise as deemed fit.

4.2.10 TDS as applicable under GST law shall be deducted from Supplier/Vendor's bill.

4.2.11 Supplier/Vendor shall comply with the provisions of e-way bill wherever applicable. Further wherever provisions of GST Act permit, all the e-way bills, road permits etc. required for transportation of goods needs to be arranged by the contractor.

4.2.12 Supplier/Vendor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of Supplier/Vendor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder.

4.2.13 In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/alterd/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Supplier/Vendor's due payment.

4.2.14 Any denial of input credit to BHEL or arising of any tax liability on BHEL due to noncompliance of GST Law by the Supplier/Vendor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Supplier/Vendor.

4.2.15 In the event of any ambiguity in GST law with respect to availability of input credit of GST charged on the invoice raised by the contractor or with respect to any other matter having impact on BHEL, BHEL's decision shall be final and binding on the Supplier/Vendor.

4.2.16 Variation in Taxes & Duties:

Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability.

In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its Supplier/Vendor only and within the contractual delivery period only.

In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/ Supplier/Vendor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.

4.3 Income Tax:

TDS/TCS as applicable under Income Tax Act, 1961 or rules made thereunder shall be deducted/collected from Supplier/Vendor's bill.

5.	MATERIAL DISPATCH CLEARANCE CERTIFICATE (MDCC): MDCC shall be issued by BHEL. No material shall be dispatched by supplier unless and until Material Dispatch Clearance Certificate (MDCC) issued by BHEL Site. In case any material is dispatched without MDCC and any loss is incurred by Supplier/Vendor for any reason whatsoever, BHEL shall not be responsible in any manner to compensate the supplier in this regard.	Deviation is not acceptable
6.	<u>INSPECTION / INSPECTION & TESTING AT SUPPLIERS WORKS:</u> BHEL reserves the right to inspect the material during manufacturing and also to get tested the material under dispatch from third party. The test results of third-party test shall be final and binding on the Supplier/Vendor. BHEL will reserve the right to inspect/test the material during/after manufacturing at suppliers' works, and/or at BHEL Site. In case of rejection at any stage, Supplier/Vendor shall be liable to replace the materials at his own cost.	Refer to the "Annexure – 19: SPECIAL CONDITIONS OF CONTRACT & BOM"
7.	<u>DELIVERY:</u> a). If the delivery of supply as detailed above gets delayed beyond the delivery period, the Supplier/Vendor shall request for a delivery extension and BHEL at its discretion may extend the Contract. However, if any 'Delivery extension' is granted to the Supplier/Vendor for completion of supply, due to backlog attributable to the Supplier/Vendor, then it shall be without prejudice to the rights of BHEL to impose LD for the delays attributable to the Supplier/Vendor. b). In case BHEL increase the quantity during currency of the contract in line with quantity variation clause GeM bid, delivery extension on pro-rata basis shall be given for supply of these additional quantity.	Refer to the "Annexure – 19: SPECIAL CONDITIONS OF CONTRACT & BOM"
8.	<u>TRANSIT INSURANCE:</u> Transit Insurance of material is in Supplier/Vendor's scope. Supplier/Vendor shall insure the material at their cost for transportation.	Deviation is not acceptable
9.	<u>PAYMENT TERMS:</u> a). FOR NON MSE Bidders, 100% payment shall be released within 90 days from the date of acknowledged receipt & acceptance of material at site and submission of billing documents as mentioned in sl. no. 10 below. b) FOR MSE Bidders, 100% payment shall be released within 45 days from the date of acknowledged receipt & acceptance of material at site and submission of billing documents as mentioned in sl. no. 10 below. c) FOR MEDIUM ENTERPRISES Bidders, 100% payment shall be released within 60 days upon receipt & acceptance of material at site and submission of billing documents as mentioned in sl. no. 10 below.	Deviation is not acceptable

However, GST amount shall be reimbursed in line with compliance to GeM Clauses of Taxes & Duties Note: A). Above due date is reckoned from the date of Receipt of material or 15 days from the date of submission of complete set of documents as per PO whichever is later. Objections, if any on the invoice, available on SUVIDHA portal need to be closed. In such instances, due date is reckoned from the closure of objections. Vendors are advised to get familiarized with the document exchange feature on SUVIDHA portal. Payment will be made for Material accepted value. B). MSEs (covered under MSME Act) need to register and renew periodically and update the same with BHEL C). The taxes that are reimbursed are limited to applicable taxes as on the Purchase Order delivery date or the amount actually paid whichever is less. D). Adherence to the above time schedule of payment is contingent upon Bidder complying with GST provisions and availment of Input Tax Credit by BHEL before the date of payment. E). In case of packaged items, 10% of supply value will be retained till completion of total supplies. F). Bidders to comply with respective Taxes and Duties clauses on GST requirements G). MSE benefits are not applicable to Traders/Wholesalers registered as MSEs H). In respect of procurement of goods or services from Micro, Small and Medium enterprises (MSMEs), the settlement of invoice shall be only through any of the TReDS platform ((i.e RXIL, Mlxchange, Invoicemart, KReDX), authorised by the Reserve Bank of India. Supplier will have the option to change the TReDS platform from the dropdown menu on Suvidha portal of BHEL, at the time of invoice submission. Wherever the Trade Receivable is accepted by BHEL, the same shall be validated by the Unit on the respective TReDS platform selected by the supplier. The routing of invoices through the TReDS platform shall not be construed as mandating discounting of such invoices and the MSMEs supplier shall have the option to avail or not avail financing or discounting of its receivables on the TReDS platform. In case discounting is not availed by the supplier on TReDS, the trade receivables will be paid through TReDS as per the payment timelines indicated in the contract." b) NO INTEREST PAYABLE TO CONTRACTOR No interest shall be payable on the security deposit or any other money due to the	
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	contractor".	
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10.	DOCUMENTS REQUIRED ALONG WITH DISPATCH OF MATERIAL/BILLING DOCUMENTS: The following documents are required to be sent immediately on dispatch of material to BHEL HPEP: • Two numbers of Original Tax Invoice/ e-invoice of GST Portal, if applicable. • Packing list -Clearly showing number of packages, gross weight and net weight. • Test/Warranty/Guarantee certificates, O&M Manual (if specified in ANNEXURE) • Insurance intimation/declaration certificate. • Pre-dispatch Inspection report/Third party Inspection certificates. • Consignee copy of LR signed and stamped by Customer/Site representative for DD items. • E-waybill • Any other documents as specified in SCC. Upload of Documents is mandatory for material Entry. Softcopies of the above documents shall be uploaded in SUVIDHA portal https://suvidha.bhel.in/suvidha/ or https://hpep.bhel.com/mm/main.jsp Vendor Bills tab. immediately after dispatch of the material. Upload of Documents is mandatory for material Entry.	Deviation is not acceptable
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11.	<u>BANK DETAILS FOR EMD & PERFORMANCE SECURITY SUBMISSION:</u> For Electronic Fund Transfer the details are as below: a) Name of the Beneficiary: Bharat Heavy Electricals Limited b) Bank Particulars (Details of Respectively executing region): Name of the Company - BHARAT HEAVY ELECTRICALS LTD. Address of the company - Name of the bank - Bank branch - BRANCH City Branch code - Account Number – Account type - IFSC code - MICR code –	Need to be submitted, if EMD/Performance Security is applicable
12.	EMD: Applicable / Not Applicable. 12.1 Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described herein. Wherever the quantity is to be split on two or more suppliers, amount of EMD may be based on the maximum quantity envisaged on one Supplier. i. EMD shall be furnished before tender opening / along with the offer in full as per the amount indicated in the NIT. ii. The EMD up to an amount of Rs. ...XXXXX..... is to be paid only in the following forms: a) Electronic Fund Transfer credited in BHEL account (before tender opening). b) Banker's cheque/ Pay order/ Demand draft, in favour of 'Bharat Heavy Electricals Limited' and payable at Regional HQ issuing the tender (along with offer). c) Fixed Deposit Receipt (FDR) issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL marking lien in favour of BHEL) (along with offer). The Fixed Deposit in such cases shall be valid for a period of 45 (forty-five) days beyond the final bid validity period. d) Bank Guarantee from any of the Scheduled Banks. In such cases shall be valid for a period of 45 (forty-five) days beyond the final bid validity period.	Not Applicable

e) Insurance Surety Bonds. In case the EMD is more than Rs. Two lakh and in case of foreign bidders, it may be in the form of a bank guarantee (in equivalent Foreign Exchange amount, in case of foreign bidders) issued/ confirmed from any of the scheduled commercial bank in India in the prescribed format. The EMD shall remain valid for a period of 45 (fortyfive) days beyond the final bid validity period. iii. No other form of EMD remittance shall be acceptable to BHEL. 12.2 EMD by the Bidder will be forfeited as per NIT conditions, if: i. The bidder withdraws or amends its/his tender or impairs or derogates from the tender in any respect within the period of validity of the tender or if the successful bidder fails to furnish the required performance security within the specified period mentioned in the Tender. ii. EMD by the Bidder shall be withheld in case any action on the tenderer is envisaged under the provisions of extant "Guidelines on Suspension of business dealings with suppliers/ contractors" and shall be forfeited in case of suspension 12.3 Subject to Clause 12.2 above, EMD of the unsuccessful bidders shall be returned at the earliest after expiry of the final bid validity period and latest by the 30th day after the award of the contract. However, in case of two packet or two stage bidding, EMD of unsuccessful bidders during first stage i.e., technical evaluation etc. shall be returned within 30 days of declaration of result of first stage i.e. technical evaluation etc. 12.4 EMD of successful Bidder shall be refunded on conclusion of the order/ receipt of a performance security as mentioned in NIT. 12.5 EMD shall not carry any interest. 12.6 Micro and Small Enterprises (MSEs) or Startups as recognized by Department for Promotion of Industry and Internal Trade (DPIIT) shall be exempted from payment of EMD.	
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13	PERFORMANCE SECURITY: Applicable / Not Applicable. 13.1 Successful bidder awarded the contract should deposit 5% of the contract value as performance security towards fulfilment of all contractual obligations, including warranty obligations. 13.2 Performance Security is to be furnished within 14 days after issuance of Contract/PO and should remain valid for a period of 60 (sixty) days beyond the date of completion of all contractual obligations of the Supplier/Vendor, including warranty obligations. 13.3 Modes of deposit: a) Performance security may be furnished in the following forms: i. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/Demand Draft/ Electronic Fund Transfer in favour of 'Bharat Heavy Electricals Limited' and payable at Regional HQ ii. Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee should be in the prescribed format of BHEL. iii. Fixed Deposit Receipt (FDR) issued by Scheduled Banks / Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL). iv. Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL). v. Insurance Surety Bond. Note: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith. b) In case of GTE tenders, the performance security should be in the same currency as the contract and must conform to Uniform Rules for Demand Guarantees (URDG 758) - an international convention regulating international securities. 13.4 The performance security will be forfeited and credited to BHEL's account in the event of a breach of contract by the Supplier/Vendor as provided herein or elsewhere in the Contract/PO. 13.5 Performance Security shall be refunded to the Supplier/Vendor without interest, after the	Not Applicable

	Supplier/Vendor duly performs and completes the contract in all respects but not later than 60(sixty) days of completion of all such obligations including the warranty under the contract. 13.6 The Performance Security shall not carry any interest. 13.7 There is no exemption of Performance security deposit submission for MSE Vendors.	
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14. **BREACH OF CONTRACT, REMEDIES AND TERMINATION:**

14.1 The following shall amount to breach of contract:

- I. Non-supply of material/ non-completion of work by the Supplier/Vendor within scheduled delivery/ completion period as per contract or as extended from time to time.
- II. The Supplier/Vendor fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery/ completion period to justify that supplies shall be inordinately delayed beyond contractual delivery/ completion period.
- III. The Supplier/Vendor delivers equipment/ material not of the contracted quality.
- IV. The Supplier/Vendor fails to replace the defective equipment/ material/ component as per guarantee clause.
- V. Withdrawal from or abandonment of the work by the Supplier/Vendor before completion as per contract.
- VI. Assignment, transfer, subletting of Contract by the Supplier/Vendor without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.
- VII. Non-compliance to any contractual condition or any other default attributable to Supplier/Vendor.
- VIII. Any other reason(s) attributable to Vendor towards failure of performance of contract.
In case of breach of contract, BHEL shall have the right to terminate the Purchase Order/ Contract either in whole or in part thereof without any compensation to the Supplier/Vendor.
- IX. Any of the declarations furnished by the contractor at the time of bidding and/ or entering into the contract for supply are found untruthful and such declarations were of a nature that could have resulted in non-award of contract to the contractor or could expose BHEL and/ or Owner to adverse consequences, financial or otherwise.
- X. Supplier/Vendor is convicted of any offence involving corrupt business practices, antinational activities or any such offence that compromises the business ethics of BHEL, in violation of the Integrity Pact entered into with BHEL has the potential to harm the overall business of BHEL/ Owner.

Note-Once BHEL considers that a breach of contract has occurred on the part of Supplier/Vendor, BHEL shall notify the Supplier/Vendor by way of notice in this regard. Contractor shall be given an opportunity to rectify the reasons causing the breach of contract within a period of 14 days.

In case the contractor fails to remedy the breach, as mentioned in the notice, to the satisfaction of BHEL, BHEL shall have the right to take recourse to any of the remedial actions available to it under the relevant provisions of contract.

14.2 Remedies in case of Breach of Contract

- i. Wherein the period as stipulated in the notice issued under clause 14.1 has expired and Supplier/Vendor has failed to remedy the breach, BHEL will have the right to terminate the contract on the ground of "Breach of Contract" without any further notice to contractor.
- ii. Upon termination of contract, BHEL shall be entitled to recover an amount equivalent to 10% of the Contract Value for the damages on account of breach of contract committed by the Supplier/Vendor. This amount shall be recovered by way of encashing the security instruments like performance bank guarantee etc available with BHEL against the said contract. In case the value of the security instruments available is less than 10% of the contract value, the balance amount shall be recovered from other financial remedies (i.e. available bills of the Supplier/Vendor, retention amount, from the money due to the Supplier/Vendor etc. with BHEL) or the other legal remedies shall be pursued.
- iii. wherever the value of security instruments like performance bank guarantee available with BHEL against the said contract is 10% of the contract value or more, such security instruments to the extent of 10% contract value will be encashed. In case no security instruments are available or the value of the security instruments available is less than 10% of the contract value, the 10% of the contract value or the balance amount, as the case may be, will be recovered in all or any of the following manners:
- iv. In case the amount recovered under sub clause (a) above is not sufficient to fulfil the amount recoverable then; a demand notice to deposit the balance amount within 30 days shall be issued to Supplier/Vendor.
- v. If Supplier/Vendor fails to deposit the balance amount within the period as prescribed in demand notice, following action shall be taken for recovery of the balance amount:
 - a. from dues available in the form of Bills payable to defaulted Supplier/Vendor against the same contract.
 - b. If it is not possible to recover the dues available from the same contract or dues are insufficient to meet the recoverable amount, balance amount shall be recovered from any money(s) payable to Supplier/Vendor under any contract with other Units of BHEL including recovery from security deposits or any other deposit available in the form of security instruments of any kind against Security deposit or EMD.

- vi. In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against defaulted supplier/Vendor.
- vii. It is an agreed term of contract that this amount shall be a genuine pre-estimate of damages that BHEL would incur in completion of balance contractual obligation of the contract through any other agency and BHEL will not be required to furnish any other evidence to the Supplier/Vendor for the purpose of estimation of damages.
- viii. In addition to the above, imposition of liquidated damages, debarment, termination, de-scoping, short-closure, etc., shall be applied as per provisions of the contract.

Note:

1) The defaulting Supplier/Vendor shall not be eligible for participation in any of the future enquiries floated by BHEL to complete the balance work. The defaulting contractor shall mean and include:

- a. In case defaulted Supplier/Vendor is the Sole Proprietorship Firm, any Sole Proprietorship Firm owned by same Sole Proprietor.
- b. In case defaulted Supplier/Vendor is The Partnership Firm, any firm comprising of same partners/ some of the same partners; or sole proprietorship firm owned by any partner(s) as a sole proprietor.

15.	BILL TO/ SHIP TO ADDRESS:	For delivery location Refer to SCC (Annexure-19). Other details will be provided during dispatch clearance
16.	GUARANTEE/WARRANTY:	Annexure – 19: SPECIAL CONDITIONS OF CONTRACT & BOM

17.	<u>MICRO AND SMALL ENTERPRISES (MSE):</u> Any Bidder falling under MSE category shall furnish the following details & submit documentary evidence/ Govt. Certificate etc. in support of the same along with their techno-commercial offer. <table border="1"> <thead> <tr> <th>Type under MSE</th><th>SC/ST owned</th><th>Women owned</th><th>Others (excluding SC/ ST & Women Owned)</th></tr> </thead> <tbody> <tr> <td>Micro</td><td></td><td></td><td></td></tr> <tr> <td>Small</td><td></td><td></td><td></td></tr> </tbody> </table> Note: If the bidder does not furnish the above, offer shall be processed construing that the bidder is not falling under MSE category. a) MSE suppliers can avail the intended benefits in respect of the procurements related to the Goods and Services only (Definition of Goods and Services as enumerated by Govt. of India vide Office Memorandum F. No. 21(8)/2011-MA dtd. 09/11/2016 office of AS & DC, MSME) and subsequent amendments & clarifications only if they submit along with the offer, attested copies of Udyam Registration. Date to be reckoned for determining the deemed validity will be the last date of Technical Bid submission. Non-submission of supporting document in GeM portal will lead to consideration of their bids at par with other bidders. No benefits shall be applicable for this enquiry if the above required documents are not uploaded at the time of bid submission. Documents submitted by the bidder shall be verified by BHEL for rendering the applicable benefits.			Type under MSE	SC/ST owned	Women owned	Others (excluding SC/ ST & Women Owned)	Micro				Small			
Type under MSE	SC/ST owned	Women owned	Others (excluding SC/ ST & Women Owned)												
Micro															
Small															
18.	<u>18. LIQUIDATED DAMAGE/ PENALTY:</u> In the event of delay in supply /part-supply of goods, Penalty as detailed below is leviable - Penalty of 0.5% per week or part there of shall be levied, limited to a max of 10% (ten percent) of delayed portion value / order value as per PR. - Penalty applicable for delay in documentation is as per PR. - Date Reckoned for Penalty - Indigenous Orders with delivery terms FOR HPEP: C Note date. - Indigenous Orders (Others): Date of e-waybill. - Timelines as mentioned in the Annexure 20 will be considered for reckoning delivery.														

19.	INTEGRITY PACT (IP): Applicable / Not Applicable a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Supplier/Vendor are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL. <table border="1"> <thead> <tr> <th>Sl. No.</th><th>IEM</th><th>Email</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Dr Sharath Kumar Acharya</td><td>iem1@bhel.in</td></tr> <tr> <td>2.</td><td>Mr R Mukundan</td><td>iem2@bhel.in</td></tr> <tr> <td>3.</td><td>Mr Madan Lal Meena</td><td>iem3@bhel.in</td></tr> </tbody> </table> b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification. c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only. Note: <i>No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are as per Clause no. 21 below.</i>	Sl. No.	IEM	Email	1.	Dr Sharath Kumar Acharya	iem1@bhel.in	2.	Mr R Mukundan	iem2@bhel.in	3.	Mr Madan Lal Meena	iem3@bhel.in	Not Applicable
Sl. No.	IEM	Email												
1.	Dr Sharath Kumar Acharya	iem1@bhel.in												
2.	Mr R Mukundan	iem2@bhel.in												
3.	Mr Madan Lal Meena	iem3@bhel.in												
20.	PREFERENCE TO MAKE IN INDIA: For this procurement, the local content to categorize a Supplier/Vendor as a Class I local supplier/ Class II local Supplier/Non-Local Supplier and purchase preferences to	Not Applicable												

	Class I local supplier, is as defined in Public Procurement (Preference to Make in India), Order 2017 dated 04.06.2020 issued by DPIIT. In case of subsequent orders issued by the nodal ministry, changing the definition of local content for the items of the GeM Bid, the same shall be applicable even if issued after issue of this GeM Bid, but before opening of Part-II bids against this GeM Bid.	
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20.1 Compliance to Restrictions under Rule 144 (xi) of GFR 2017:

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority. The Competent Authority for the purpose of this Clause shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT).
- II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.
- III. "Bidder from a country which shares a land border with India" for the purpose of this Clause means: -
 - a. An entity incorporated established or registered in such a country; or
 - b. A subsidiary of an entity incorporated established or registered in such a country; or
 - c. An entity substantially controlled through entities incorporated, established or registered in such a country; or
 - d. An entity whose beneficial owner is situated in such a country; or
 - e. An Indian (or other) agent of such an entity; or
 - f. A natural person who is a citizen of such a country; or
 - g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.
- IV. The beneficial owner for the purpose of (III) above will be as under:
 1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation

- a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company.

"Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholder's agreements or voting agreements.

	2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership. 3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person has ownership of or entitlement to more than fifteen percent of the property or capital or profits of the such association or body of individuals. 4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official; 5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership. V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person. Note: (i) The bidder shall provide undertaking for their compliance to this Clause, in the format provided in Annexure-13. (ii) Registration of the bidder with Competent Authority should be valid at the time of submission of bids and at the time of acceptance of the bids.	
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21	Settlement of Dispute If any dispute or difference of any kind whatsoever shall arise between BHEL and the Supplier/Vendor, arising out of the contract for the performance of the work whether during the progress of contract termination, abandonment or breach of the contract, it shall in the first place referred to Designated Engineer for amicable resolution by the parties. Designated Engineer (to be nominated by BHEL for settlement of disputes arising out of the contract) who within 60 days after being requested shall give written notice of his decision to the contractor. Save as hereinafter provided, such decision in respect of every matter so referred shall forthwith be given effect to by the Supplier/Vendor who shall proceed with the work with all due diligence, whether he or BHEL desires to resolve the dispute as hereinafter provided or not. If after the Designated Engineer has given written notice of this decision to the party and no intention to pursue the dispute has been communicated to him by the affected party within 30 days from the receipt of such notice, the said decision shall become final and binding on the parties. In the event the Supplier/Vendor being dissatisfied with any such decision or if amicable settlement cannot be reached then all such disputed issues shall be resolved through conciliation in terms of the BHEL Conciliation Scheme 2018 as per Clause 21.1
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	21.1 Conciliation: Any dispute, difference or controversy of whatever nature howsoever arising under or out of or in relation to this Agreement (including its interpretation) between the Parties, and so notified in writing by either Party to the other Party (the "Dispute") shall, in the first instance, be attempted to be resolved amicably in accordance with the conciliation procedure as per BHEL Conciliation Scheme 2018. The proceedings of Conciliation shall broadly be governed by PartIII of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in - "Procedure for conduct of conciliation proceedings" (as available in www.bhel.com)). Note: Ministry of Finance has issued OM reference No. 1/2/24 dated 03.06.2024 regarding "Guidelines for Arbitration and Mediation in Contracts of Domestic Public Procurement. In the said OM it has been recommended that Government departments/ Entities/agencies are to encourage mediation under the Mediation Act. 2023. The said Act has not yet been notified by the Government. Therefore, the clause "Settlement of Disputes" shall be modified accordingly as and when the Mediation Act 2023 gets notified. 21.2 ARBITRATION: 21.2.1 Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause 21.1 herein above or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or. in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, refer the disputes to Arbitral Institution (to be identified by the contract issuing agency (e.g. "IIAC" (India International Arbitration Centre) for

Delhi/NCR offices) and such dispute to be adjudicated by Sole Arbitrator appointed in accordance with the Rules of said Arbitral Institution.

21.2.2 A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving notice to the other party in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice') before referring the matter to arbitral institution. The Notice shall be addressed to the Head of the Region, Power Sector/ Unit, BHEL, executing the Contract and shall contain the particulars of all claims to be referred to arbitration with sufficient detail and shall also indicate the monetary amount of such claim including interest, if any.

21.2.3 After expiry of 30 days from the date of receipt of aforesaid notice, the party invoking the Arbitration shall submit that dispute to the Arbitral Institutions..... (to be identified by the contract issuing agency) and that dispute shall be adjudicated in accordance with their respective Arbitration Rules. The matter shall be adjudicated by a Sole Arbitrator who shall necessarily be a Retd Judge having considerable experience in commercial matters to be appointed/nominated by the respective institution.

The cost/expenses pertaining to the said Arbitration shall also be governed in accordance with the Rules of the respective Arbitral Institution. The decision of the party invoking the Arbitration for reference of dispute to a specific Arbitral institution for adjudication of that dispute shall be final and binding on both the parties and shall not be subject to any change thereafter. The institution once selected at the time of invocation of dispute shall remain unchanged.

21.2.4 The fee and expenses shall be borne by the parties as per the Arbitral Institutional rules.

21.2.5 The Arbitration proceedings shall be in English language and the seat and venue of Arbitration shall be (to be identified by the contract issuing agency)(i.e. New Delhi for Delhi/NCR based Units).

21.2.6 Subject to the above, the provisions of Arbitration & Conciliation Act 1996 and any amendment thereof shall be applicable. All matters relating to this Contract and arising out of invocation of Arbitration clause are subject to the exclusive jurisdiction of the Court(s) situated at.....(i. e. New Delhi for Delhi/NCR based Units).

21.02.7 Notwithstanding any reference to the Designated Engineer or Conciliation or Arbitration herein, a. the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree. Settlement of Dispute clause cannot be invoked by the Contractor, if the Contract has been mutually closed or 'No Demand Certificate' has been furnished by the Contractor or any Settlement Agreement has been signed between the Employer and the Contractor.

21.2.8 It is agreed that Mechanism of resolution of disputes through arbitration shall be available only in the cases where the value of the dispute is less than Rs. 10 Crores.

21.2.9 In case the disputed amount (Claim, Counter claim including. interest is Rs. 10 crores and above, the parties shall be within their rights to take recourse to remedies other than Arbitration, as may be available to them under the applicable laws after prior intimation to the other party. Subject to the aforesaid conditions, provisions of the Arbitration and Conciliation Act, 1996 and any statutory modifications or re-enactment thereof as amended from time to time, shall apply to the arbitration proceedings under this clause.

21.2.10 In case, multiple arbitrations are invoked (whether sub-judice or arbitral award passed) by any party to under this contract, then the cumulative value of claims (including interest claimed or awarded) in all such arbitrations shall be taken in account while arriving at the total claim in dispute for the subject contract for the purpose of clause 21.2.9. Disputes having cumulative value of less than 10 crores shall be resolved through arbitration and any additional dispute shall be adjudicated by the court of competent jurisdiction.

21.3 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution of CPSEs Disputes) as mentioned in DPE OM No. 05/0003/2019-FTS-10937 dated 14-12-2022 as amended from time to time.

22 JURISDICTION

Subject to clause 21 of this contract, the Civil Court having original Civil Jurisdiction at Hyderabad shall alone have exclusive jurisdiction in regard to all matters in respect of the Contract.

GOVERNING LAWS

The contract shall be governed by the Law for the time being in force in the Republic of India.

23 Force Majeure

23.1 "Force Majeure" shall mean circumstance which is:

- a. beyond control of either of the parties to contract,
- b. either of the parties could not reasonably have provided against the event before entering into the contract,
- c. having arisen, either of the parties could not reasonably have avoided or overcome, and
- d. is not substantially attributable to either of the parties And

Prevents the performance of the contract,

Such circumstances include but shall not be limited to:

- i. War, hostilities, invasion, act of foreign enemies.
- ii. Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war.
- iii. Riot, commotion or disorder by persons other than the contractor's personnel and other employees of the contractor and sub-contractors.
- iv. Strike or lockout not solely involving the contractor's personnel and other employees of the contractor and sub-contractors.
- v. Encountering munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio- activity.
- vi. Natural catastrophes such as earthquake, tsunami, volcanic activity, hurricane or typhoon, flood, fire, cyclones etc.
- vii. Epidemic, pandemic etc.

	23.2 The following events are explicitly excluded from Force Majeure and are solely the responsibilities of the non-performing party: a) any strike, work-to-rule action, go-slow or similar labour difficulty (b) late delivery of equipment or material (unless caused by Force Majeure event) and (c) economic hardship. 23.3 If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 15 (fifteen) days after the occurrence of such event. 23.4 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended by a period of time equal to period of delay caused due to such Force Majeure event. 23.5 Delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall not v) Constitute a default or breach of the Contract. vi) Give rise to any claim for damages or additional cost expense occasioned thereby, if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure. 23.6 BHEL at its discretion may consider short closure of contract after 1 year of imposition of Force Majeure in line with extant guidelines. In any case, Supplier/Vendor cannot consider deemed short-closure after 1 year of imposition of Force Majeure.
24	Non-Disclosure Agreement: The bidders shall enter into the Non-disclosure agreement separately. (Format attached).
25	Cartel Formation The Bidder declares that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. In case, the Bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/ guidelines.
26	Fraud Prevention Policy Bidder along with its associate /collaborators /sub-contractors /sub-vendors / consultants / service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.

27 Suspension of Business Dealings with Suppliers / Contractors:

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms / principal / agents, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

If any bidder / supplier / contractor during pre-tendering / tendering / post tendering / award / execution / post-execution stage indulges in any act, including but not limited to, malpractices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or tampers the tendering process or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860(Bhartiya Nyaya Samhita 2023) or any other law in force in India, or does anything which is actionable under the Guidelines for Suspension of Business dealings, action may be taken against such bidder / supplier / contractor as per extant guidelines of the company available on www.bhel.com and / or under applicable legal provisions. Guidelines for suspension of business dealings is available in the webpage: http://www.bhel.com/vender_registration/vender.php.

28 Bid should be free from correction, overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection. In the event of any Technical or Commercial queries, the same may please be addressed to the following BHEL concerned before Part I opening-

For Commercial Related Points (Procurement team)	For Technical related Points (Technical Team)
Sh. Sumit Das Sarkar Manager/TC Purchase 040-23182155/9007104572 sdsarkar@bhel.in	Sh. B Uma Chandrasekhar Sr. Manager/ Compressor Engineering 040-2318 4236/9966501934 _chandus336@bhel.in Sh. Pankaj Kumar Sr. Manager/ Engineering Indl Turbines 040-2318 3551/ 9912973636 _pankajkumar29@bhel.in Ms. Ramyakrishna T Manager/ Compressor Engineering 040-2318 2807/..... _ramyakrishnat@bhel.in

29	Order of Precedence: In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be in the order below: - Amendments/Clarifications/Corrigenda/Errata etc. issued in respect of the tender documents by BHEL. - Buyer Added Bid Specific ATC - GeM Bid Technical Conditions of Contract (TCC) e GeM GTC
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30	Notes: - GENERAL INSTRUCTIONS: - The quotation should be neatly typed and free from over writing/ erasures. Any correction or addition must be authenticated. The offer including annexures and brochures should be submitted in English. All Pages of Techno Commercial Bids (Main Pages), ATC should be signed and Stamped. Prices shall be quoted both in figures and words. In case of any discrepancy in value, the prices quoted in words shall be considered for evaluation and establishing L1 Status. - Bidders to please note that the Terms & conditions contained in this document and ATC are to be read fully before submission of quotations. - Bidders are advised to comply with ATC, should there be any deviations (where deviations are permitted), it shall be entered in the deviation column. BHEL reserves the right to reject such offers. - Excess materials supplied beyond tolerance limit as specified in PO will not be paid and bidder may raise credit note for the excess/unaccepted material as per GST law. - Rejected materials, if any, shall be collected by the bidder within 90 days of such communication to the bidder. Beyond this period the bidder forfeits their right to the materials. - Procurement directly from the manufacturers/ suppliers shall be preferred. However, no agent shall be allowed to represent more than one manufacturer/ supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer / supplier could bid directly but not both. In case bids are received from both from the manufacturer/ supplier and the agent, bid received from the agent shall be ignored. - RIGHT OF REJECTION /NON- PLACEMENT OF PO: BHEL reserves the right to accept or reject any or all bid/s in full or part without assigning any reason whatsoever. - Inspection Measuring and Test Equipment (IMTE) used by the Bidder/ Contractor or sub-contractor shall be calibrated, maintained and controlled. Calibration shall be valid and IMTE maintained in sound condition during usage. - ISO-9001, ISO14001 and OHSAS 18001 shall be complied - Any other terms and conditions of the bidder attached/referred against the tender enquiry will not be considered. - All drawings, patterns and tools supplied by BHEL or made at BHEL's expense are BHEL's property. These cannot be used or referred to any other party and must be used only in the execution of BHEL's orders.
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	10. Any amount payable by the bidder under any of the conditions of this contract shall be liable to be adjusted against any amount payable to the bidder under any other work / contract awarded by BHEL HPEP or any other BHEL Units. This is without prejudice to any other action as may be deemed fit by BHEL. 11. Execution: The whole contract is to be executed in the most workman like manner, substantial and approved as per the contracted terms.
	12. Progress Report: The bidder shall render such report as to the progress of work and in such form as may be called for by the Buyer from time to time. The submission and acceptance of such reports shall not prejudice the rights of the buyer in any manner. Bidder shall communicate to BHEL immediately, the change of address, ownership, contact person(s), the mobile numbers and e-mail of the dealing person concerned. Milestones shall be periodically updated by bidder through PRADAN Portal (https://web.bhelhyd.co.in/mm/). Non updation will adversely affect service rating of bidder performance. 13. Quality and Condition of the Deliverables: The bidder shall be responsible for compliance with applicable technical, safety, quality, environmental requirements and other regulations in relation to products, packaging and raw and ancillary materials. 14. Packaging and Dispatch The bidder shall package the deliverables safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by sea/air/rail/road to its destination suitably protected against loss, damage, corrosion in transit and the effect or tropical salt laden atmosphere. The packages shall be provided with fixtures/hooks and sling marks as may be required for easy and safe handling by mechanical means. Special packaging conditions/ environmental conditions as defined in the NIT shall be fully complied. Each package must be marked with consignee name, address, P.O. number, Package Number, gross weight & net weight, dimensions (Lx B x H) and bidder's name. The packing shall allow for easy removal and checking of goods on receipt and comply with carrier's conditions of packing or established trade practices. Packing list for goods inside each package with P.O. item No. & quantity must also be fixed securely outside the box to indicate the contents. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols/instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations.

15. In the event of our customer order covering this tender being cancelled /placed on hold /otherwise modified, BHEL would be constrained to accordingly cancel / hold / modify the tender at any stage of execution.
16. BHEL may negotiate the L1 rate, if not meeting our budget / estimated cost. BHEL may re-float the tender opened, if L1 price is not acceptable to BHEL even after negotiation. Any deviation from the conditions specified in TECHNO-COMMERCIAL TERMS AND CONDITIONS - Annexure-A, will lead to rejection of offer.
17. Any change in applicable rates of Tax or any other statutory levies (Direct / Indirect) or any new introduction of any levy by means of statute and its corresponding liability for the deliveries beyond the agreed delivery date for reasons not attributable to BHEL will be to vendors account. BHEL will not reimburse the same and any subsequent claim in this respect will be summarily rejected.
18. BHEL reserves its right to reject an offer due to unsatisfactory past performance by the respective Vendor in the execution of any contract to any BHEL project / Unit.
19. The offers of the bidders who are under suspension and also the offers of the bidders, who engage the services of the banned firms /principal/agents, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.
20. Recovery / deduction as applicable as per Direct and Indirect taxes as notified by Govt. Of India from time to time will be made and information/certificate for such deduction/recoveries shall be provided by BHEL to the vendor.

21. Escalation Matrix

Details	Name	Contact Number	Authorised representative
Technical In-charge			
Finance & Taxation			
Escalation for above			

Changes may be communicated to BHEL.

31	Treatment of cases regarding conflict of interest: The bidder notes that a conflict of interest would said to have occurred in the tender process and execution of the resultant contract, in case of any of the following situations: i) If its personnel have a close personal, financial, or business relationship with any personnel of BHEL who are directly or indirectly related to the procurement or execution process of the contract, which can affect the decision of BHEL directly or indirectly; ii) The bidder (or his allied firm) provided services for the need assessment/ procurement planning of the Tender process in which it is participating; iii) Procurement of goods directly from the manufacturers/ suppliers shall be preferred. However, if the OEM/ Principal insists on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer / supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer/ supplier could bid directly but not both. In case bids are received from both the manufacturer/ supplier and the agent, bid received from the agent shall be ignored. However, this shall not debar more than one Authorised distributor (with/ or without the OEM) from quoting equipment manufactured by an Original Equipment Manufacturer (OEM) in procurements under a Proprietary Article Certificate. iv) A bidder participates in more than one bid in this tender process. Participation in any capacity by a Bidder (including the participation of a Bidder as a partner/ JV member or sub-contractor in another bid or vice-versa) in more than one bid shall result in the disqualification of all bids in which he is a party. However, this does not limit the participation of an entity as a sub-contractor in more than one bid if he is not bidding independently in his own name or as a member of a JV.
	<u>The Bidder declares that they have read and understood the above aspects, and the bidder confirms that such conflict of interest does not exist and undertakes that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s), in this regard. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.</u> <i>In case, the Bidder is found having indulged in above activities, the same will be considered as a violation of the tender conditions, and suitable action shall be taken by BHEL as per extant policies/ guidelines.</i>
32	Grievance Redressal Mechanism To promote transparency and ensure fair treatment of all bidders, a structured Grievance Redressal Mechanism is in place to address any concerns or issues arising during the tendering process or in subsequent business dealings with the company. Suppliers/Contractors are requested to follow the below escalation process for grievance resolution: 1. First Level: Any grievance should initially be addressed to the designated Dealing Officer, whose contact details are provided in the Notice Inviting Tender (NIT)/Contract. 2. Second Level: If the issue remains unresolved, it may be escalated by lodging a formal grievance through the SUVIDHA Portal:

<https://suvidha.bhel.in/suvidha/>. Responses will be provided in accordance with the defined escalation matrix."

Enclosure:

Annexure-1: Check List.

Annexure-3: No Deviation Certificate

Annexure-4: Declaration regarding Insolvency/ Liquidation/ Bankruptcy Proceedings

Annexure-6: Declaration by Authorized Signatory regarding Authenticity of submitted Documents

Annexure-7: Non-Disclosure Certificate

Annexure-8: Integrity Pact

Annexure-9: Declaration confirming knowledge about Site Conditions

Annexure-10: Declaration reg. Related Firms & their areas of Activities

Annexure-11: Declaration for relation in BHEL

Annexure- 12: Declaration reg. minimum local content in line with revised public procurement

Annexure- 13: Declaration regarding compliance to Restrictions under Rule 144 (xi) of GFR 2017

Annexure-14: Bank Account Details for E-Payment

Annexure-16: Proforma of Bank Guarantee for Earnest Money.

Annexure-17: Proforma of Bank Guarantee for Performance Security.

Annexure-18: List of Consortium Bank.

Annexure – 19 : Special Conditions to the Contract(SCC) for GeM

Annexure – 20 : Major Activity timelines

CHECK LIST

NOTE: - Suppliers are required to fill in the following details in their Letterhead and no column should be left blank

A	Name and Address of the Supplier		
B	GSTN No. the Supplier (Place of Execution of Contract / Purchase Order)		
C	Details of Contact person for this Tender	Name: Mr./ Ms.	
		Designation:	
		Telephone No:	
		Mobile No:	
		Email ID:	
D	EMD DETAILS	Not Applicable	
E	DESCRIPTION	APPLICABILITY (BY BHEL)	ENCLOSED BY BIDDER
i	Whether Pre - Qualification Criteria is understood and provided proper supporting documents.	Applicable	YES / NO
ii	Whether all pages of the Tender documents including annexures, appendices etc are read and understood	Applicable	YES / NO
iii	Audited Balance Sheet and profit & Loss Account for the last three years	Applicable	YES / NO
iv	Copy of PAN Card & GST registration	Applicable	YES / NO
v	Submission of MSE certificate as specified in Tender	Applicable	YES / NO
vi	Submission of Certificate of No Deviation as per Annexure – 3	Applicable	YES / NO
vii	Declaration regarding Insolvency/ Liquidation/ Bankruptcy Proceedings as per Annexure – 4	Applicable	YES / NO
viii	Declaration by Authorized Signatory regarding Authenticity of submitted Documents Annexure – 6	Applicable	YES / NO
ix	Submission of Non-Disclosure Certificate as per Annexure - 7	Applicable	YES / NO
x	Submission of Integrity Pact as specified in Tender as per Annexure – 8	Not Applicable	YES / NO
xi	Declaration confirming knowledge about Site Conditions as per Annexure – 9	Not Applicable	YES / NO
xii	Declaration reg. Related Firms & their areas of Activities as per Annexure – 10	Not Applicable	YES / NO
xiii	Declaration for relation in BHEL as per Annexure – 11	Applicable	YES / NO
xiv	Declaration reg. minimum local content in line with revised public procurement as per Annexure – 12	Applicable	YES / NO
xv	Declaration regarding compliance to Restrictions under Rule 144 (xi) of GFR 2017 as per Annexure – 13	Applicable	YES / NO
xvi	Bank Account Details for E-Payment as per Annexure – 14	Applicable	YES / NO
xvii	Proforma of Bank Guarantee for Earnest Money as per Annexure – 16	Not Applicable	YES / NO

NOTE: Strike off 'YES' or 'NO', as applicable. Tender not accompanied by the prescribed above applicable documents
DATE :

Sign. of the AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

Annexure-20

Major Activity timelines shall be considered for indigenous purchases

S No	Activity	Agency	Timeline
1	PO acknowledgement	Vendor	03 days from the date of receipt of PO
2	First submission of Drawings, Data sheets and QP Rev-00	Vendor	15 days from receipt of PO
3	commented / approved drawings / data sheets and QP to vendor	BHEL/Customer	07 days from the receipt of Rev-00 submission.
4	Subsequent submission of revised drawings / data sheets and QP	Vendor	07 days from the receipt of commented drawings / data sheets and QP
5	Subsequent Approved /commented Drawings and QP to vendor	BHEL/Customer	07 days from the date of receipt of revised drawings / data sheets and QAP.
6	Raising of Inspection Call	Vendor	07 days before the proposing inspection date. (BHEL will provide approved QP before raising inspection call)
7	Inspection completion	BHEL Third party inspection agency / Customer	07 days from inspection call date.
8	Despatch Instructions	BHEL	07 days from the date of receipt of final approved inspection report to BHEL.
9	Receipt of Material at BHEL stores/ site	Vendor	15 days from Despatch instructions.
Absence of this annexure in NIT will entail non processing of delivery extension cases in case of delay in supplies of goods owing to reason attributable to BHEL. Vendor Signature			

ANNEXURE- 3

CERTIFICATE OF NO DEVIATION

(To be Typed & submitted in the Letter Head of the Company/Firm of Bidder)

----- To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Subject: **No Deviation Certificate**

Ref: 1) GeM Bid No:
2) All other pertinent issues till date

We hereby confirm that we have not changed/ modified/materially altered any of the tender documents as downloaded from the website/ issued by BHEL and in case of such observance at any stage, it shall be treated as null and void.

We also hereby confirm that we have neither set any Terms and Conditions and nor have we taken any deviation from the Tender conditions together with other references applicable for the above referred GeM Bid.

We further confirm our unqualified acceptance to all Terms and Conditions, unqualified compliance to Tender Conditions.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

**(Signature, date & seal of authorized
representative of the bidder)**

Date:

Place:

ANNEXURE- 4

UNDERTAKING

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir/Madam,

Sub: DECLARATION REGARDING INSOLVENCY/ LIQUIDATION/ BANKRUPTCY PROCEEDINGS

Ref: GeM Bid Specification No:

I/We, _____ declare that,

I/We am/are not admitted under insolvency resolution process or liquidation under Insolvency and Bankruptcy Code, 2016, as amended from time to time or under any other law as on date, by NCLT or any adjudicating authority/authorities.

**Sign. of the AUTHORISED SIGNATORY
(With Name, Designation and Company seal)**

Place:

Date:

ANNEXURE – 6

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **Declaration by Authorised Signatory regarding Authenticity of submitted documents.**

Ref : 1) GeM Bid No. & Date:

2) All other pertinent issues till date

I/We, hereby certify that all the documents submitted by us in support of possession of "Qualifying Requirements" are true copies of the original and are fully compliant required for qualifying / applying in the bid and shall produce the original of same as and when required by Bharat Heavy Electricals Limited.

I / We hereby further confirm that no tampering is done with documents submitted in support of our qualification as bidder. I / We understand that at any stage (during bidding process or while executing the awarded contract) if it is found that fake / false / forged bid qualifying / supporting documents / certificates were submitted, it would lead to summarily rejection of our bid / termination of contract. BHEL shall be at liberty to initiate other appropriate actions as per the terms of the Bid / Contract and other extant policies of Bharat Heavy Electricals Limited.

Yours faithfully,

**(Signature, Date & Seal of Authorized
Signatory of the Bidder)**

Date:

ANNEXURE- 7

NON-DISCLOSURE CERTIFICATE

(To be Typed & submitted in the Letter Head of the Company/Firm of Bidder)

I/We understand that BHEL <PS- Region> is committed to Information Security Management System as per their Information Security Policy.

Hence, I/We M/s

.....
who are submitting offer for providing services to BHEL <PS- Region> against GeM Bid No..... hereby undertake to comply with the following in line with Information Security Policy of <PS- Region>.

- To maintain confidentiality of documents & information which shall be used during the execution of the Contract.
- The documents & information shall not be revealed to or shared with third party which shall not be in the business interest of BHEL <PS- Region>.

**(Signature, date & seal of Authorized
Signatory of the bidder)**

Date:

ANNEXURE – 10**DECLARATION**

Date: _____

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir/ Madam,

Sub: **Details of related firms and their area of activities**

Please find below details of firms owned by our family members that are doing business/ registered for same item with BHEL, _____ (NA, if not applicable)

1	Material Category/ Work Description	
	Name of Firm	
	Address of Firm	
	Nature of Business	
	Name of Family Member	
	Relationship	
2	Material Category/ Work Description	
	Name of Firm	
	Address of Firm	
	Nature of Business	
	Name of Family Member	
	Relationship	
...		

Note: I certify that the above information is true and I agree for penal action from BHEL in case any of the above information furnished is found to be false.

Regards,

(_____)

From: M/s _____

Supplier Code: _____

Address: _____

ANNEXURE – 11

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

----- To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub: Declaration for relation in BHEL

Ref: 1) GeM Bid Specification No:

I/We hereby submit the following information pertaining to relation/relatives of Proprieter/Partner(s)/ Director(s) employed in BHEL

Tick (√) any one as applicable:

1. The Proprieter, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprieter, Partner(s), or Director(s) of our Company/Firm HAVE relation/relatives employed in BHEL and their particulars are as below:

i.

ii

.

**(Signature, Date & Seal of Authorized
Signatory of the Bidder)**

Note:

1. Attach separate sheet, if necessary.
2. If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable against the Bidder/Contractor.

ANNEXURE – 12

**DECLARATION REGARDING MINIMUM LOCAL CONTENT IN LINE WITH
REVISED PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA), ORDER 2017 DATED 04TH
JUNE, 2020 AND SUBSEQUENT ORDER(S)**

(To be typed and submitted in the Letter Head of the Entity/Firm providing certificate as applicable)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub: Declaration reg. minimum local content in line with Public Procurement (Preference to Make in India), Order 2017-Revision, dated 04th June, 2020 and subsequent order(s).

Ref: 1) GeM Bid Specification No:
2) All other pertinent issues till date

We hereby certify that the items/works/services offered by..... (*specify the name of the organization here*) has a local content of _____ % and this meets the local content requirement for '**Class-I local supplier**' / '**Class II local supplier**' ** as defined in Public Procurement (Preference to Make in India), Order 2017-Revision dated 04.06.2020 issued by DPIIT and subsequent order(s).

The details of the location(s) at which the local value addition is made are as follows:

- | | |
|----------|----------|
| 1. _____ | 2. _____ |
| 3. _____ | 4. _____ |
| ... | |

Thanking you,
Yours faithfully,

**(Signature, Date & Seal of
Authorized Signatory of the Bidder)**

**** - Strike out whichever is not applicable.**

Note:

1. Bidders to note that above format, duly filled & signed by authorized signatory, shall be submitted along with the techno-commercial offer.

2. In case the bidder's quoted value is in excess of Rs. 10 crores, the authorized signatory for this declaration shall necessarily be the statutory auditor or cost auditor of the company (in the case of companies) or a practising cost accountant or practicing chartered accountant (in respect of suppliers other than companies).
3. In the event of false declaration, actions as per the above order and as per BHEL Guidelines shall be initiated against the bidder.

ANNEXURE – 13

DECLARATION REGARDING COMPLIANCE TO RESTRICTIONS UNDER RULE 144 (xi) OF GFR 2017

(To be typed and submitted in the Letter Head of the Entity/ Firm providing certificate as applicable)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub: Declaration regarding compliance to Restrictions under Rule 144 (xi) of GFR 2017

Ref: 1) GeM Bid Specification No:
2) All other pertinent issues till date

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India. I certify that _____ (**SPECIFY THE NAME OF THE ORGANIZATION HERE**), is not from such a country/ has been registered with the Competent Authority (*attach valid registration by the Competent Authority, i.e., the Registration Committee constituted by the Dept. for Promotion of Industry and Internal Trade (DPIIT).*)

I hereby certify that we fulfil all requirements in this regard and is eligible to be considered.

Thanking you,
Yours faithfully,

**(Signature, Date & Seal of
Authorized Signatory of the Bidder)**

Note: Bidders to note that in case above certification given by a bidder, whose bid is accepted, is found to be false, then this would be a ground for immediate termination and for taking further action in accordance with law and as per BHEL guidelines.

ANNEXURE – 14

BANK ACCOUNT DETAILS FOR E-PAYMENT

(To be given on Letter head of the Company /Firm of Bidder, and **ENDORSED (SIGNED & STAMPED)**
BY THE BANK to enable BHEL release payments through Electronic Fund Transfer (EFT/RTGS)

1. Beneficiary Name :

2. Beneficiary Account No. :

3. Bank Name & Branch :

4. City/Place :

5. 9 digit M ICR Code of Bank Branch :

6. IFSC Code of Bank Branch :

7. Beneficiary E-mail ID :
(for payment confirmation)

NOTE: In case Bank endorsed certificate regarding above has already been submitted earlier, kindly submit photocopy of the same