



CORPORATE PURCHASE SPECIFICATION

AA 193 21

Rev. No. 07

PREFACE SHEET

STAINLESS STEEL FORGINGS, Gr: X20Cr13 - H&T

FOR INTERNAL USE ONLY
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Comparable Standards:

1. GERMAN : DIN 17440 - 1996
Gr: X20Cr13 (1.4021)

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. HEEP, HARDWAR : --
2. HYDERABAD : --

Revisions :

Cl: 30.8.21 of MOM of FCF+HTM

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE-MRC (FCF+HTM)

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HARDWAR

Corp. R&D

JANUARY, 1980

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STAINLESS STEEL FORGINGS, Gr: X20Cr13 - HARDENED AND TEMPERED

1.0 GENERAL:

This specification governs the quality requirements of 13% Chromiun Stainless Steel Forgings having 0.2%, proof strength of 550 N/mm², minimum.

The raw material for these forgings is covered by BHEL specification AA 107 59: Stainless steel Billets and Blooms, Gr: X20Cr13 – Annealed.

2.0 APPLICATION:

Suitable for applications where resistance to corrosion against steam, water or air is required.

3.0 CONDITION OF DELIVERY:

Hardened and tempered.

Rough machining of the forgings shall be carried out unless otherwise specified in BHEL order/drawing.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply, in general, with the requirements of the following national standard and also meet the requirements of this specification.

DIN 17440-1996 : | SS:TDC for plates, HR strips and Bars for pressure
Gr: X 20Cr13(1.4021) H&T. | purpose, drawn wire and forgings.

5.0 DIMENSIONS AND TOLERANCES:

The dimensions and tolerances shall be as specified in BHEL order/drawing. Wherever these are not specified, forgings shall be supplied as per agreement between BHEL and manufacturer.

6.0 MANUFACTURE:

Forgings shall be manufactured from steel produced by an electric arc furnace or any process as may be agreed to between BHEL and the manufacturer.

Steel shall be fully killed.

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Sufficient discard shall be made from each ingot to ensure freedom from pipe, segregation and other defects. Sufficient reduction shall be given to each forging to ensure complete mechanical work throughout the section.

The amount of hot working and finishing temperature shall be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties after heat treatment. The forgings shall not be over heated.

The minimum reduction ratio when forgings are made out of ingots shall be 4:1.

For sizes above 250mm ruling section the minimum reduction ratio shall be as 3.5 : 1.

Note: Raw material like Ingots/Blooms/Billets required for forgings should be procured from BHEL approved sources along with test certificate."

7.0 HEAT TREATMENT:

Forgings shall be hardened and tempered to give the mechanical properties specified.

Test pieces shall also be heat treated along with the forgings they represent.

8.0 FINISH:

As mentioned in the drawing.

9.0 FREEDOM FROM DEFECTS;

Forgings shall be free from defects such as cracks, flakes, seams, segregation, harmful non-metallic inclusions and other defects which may affect the utility of the forgings.

10.0 CHEMICAL COMPOSITION:

The melt analysis of steel and permissible variation in the composition of the forgings from the melt analysis shall be as specified below :

Element	Melt analysis, percent		Permissible variation, percent, max.
	Min.	Max	
Carbon	0.16	0.25	± 0.01
Silicon	--	1.00	+ 0.05
Manganese	--	1.50	+ 0.04
Chromium	12.00	14.00	± 0.15
Nickel	--	0.75	+ 0.03
Sulphur	--	0.015	+ 0.005
Phosphorus	--	0.040	+ 0.005



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11.0 TEST SAMELES:

- 11.1 Unless otherwise specified in the order/drawing, test samples shall be taken from each melt and each heat treatment batch. Test samples should be cut from the heat treated forgings by cold process only and shall receive no further heat treatment.

Test samples shall be taken from locations indicated in the drawing, leaving enough material, if required, for testing at BHEL's end, integral with the forging.

Test samples shall be cylindrical or rectangular in shape and cut at a distance of 12.5 mm below the heat treated surface.

- 11.2 When integral test pieces are not called for and is not possible to destroy the forgings, separate test samples as mentioned on the order/drawing shall be provided from the blooms and billets from which the forgings are made. They shall be forged to the ruling section of the main forgings and shall be heat treated similarly and simultaneously with the forgings they represent. Test samples shall be taken at a distance of 12.5 mm below the heat treated surface.

12.0 MECHANICAL PROPERTIES:

The test pieces, after being heat treated as per clause 7.0 above, shall show the following properties, when tested in accordance with IS:1608:

Tensile test : 750 – 950 N/mm²

Yield strength : 550 N/mm², min.

% of elongation, min.	Ruling section	Longitudinal	Tangential
	60 mm	14	10
	> 60 mm to 160 mm	12	10
	> 160 to 400 mm	--	10

Impact Test:

Impact value shall be as given below:

	DVM test value (J, min.)	
	Longitudinal	Tangential
Upto 60 mm	30 (15)	20 (9)
> 60 upto 160 mm	30 (15)	--
> 160 upto 400 mm	Not applicable	

Note: Values under bracket are in ISO-V.

13.0 ULTRASONIC TEST:

Each forging shall be tested ultrasonically in accordance with BHEL standard AA 085 01 18 to ensure freedom from internal defects. The norms of acceptance shall be as per Category 2 of the above standard.

14.0 ADDITIONAL TESTS:

If specified in the drawing/order, the following tests shall be conducted:

- Magnetic particle test.
- Any other tests.

Norms and acceptance shall be as specified in the drawing/order.

**15.0 SCOPE OF THIRD PARTY INSPECTION:**

Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

1. Review of supplier's declared chemical composition.
2. Selection of test samples for mechanical tests and witness of mechanical tests.
3. Witness of Non-destructive tests as applicable.
4. Review of HT charts.
5. Dimensional inspection.

16.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied unless otherwise stated in the order, preferably in the test certificate format annexed to this specification (Annexure-1).

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following Information.

Dimensional Inspection.
 Details of heat treatment.
 Chemical composition
 Reduction ratio
 Results of mechanical tests.
 Results of ultrasonic test.
 Results of additional tests called for in the order/drawing.

17.0 PACKING AND MARKING:

Forgings shall be suitably packed to prevent corrosion and damage during transit. Machined surfaces shall be properly protected with anti-corrosive compounds. Each package or forging (when supplied separately) shall be legibly marked with the following Information:

AA 193 21 : Stainless Steel Forgings, Gr.:X20Cr13 - H&T
 BHEL Order No.
 Consignment/Identification No.
 Batch No.
 Weight.
 Supplier/s name

18.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. AA 085 01 18
2. DIN 17440
3. IS: 1608



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ANNEXURE - 1: RECOMMENDED TEST CERTIFICATE FORMAT 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√50 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/dwg.)									
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									
a) Details of all heat treatment processes carried out should be furnished sequentially in 17.									
b) Test certificates are to be furnished as per Purchase order and specification, in A4 size preferably in transparent paper.									
c) All the entries including signature should be in block colour ink.									
d) If testing is done by outside agencies, the original TCs 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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