



# PLANT PURCHASING SPECIFICATION BHOPAL

BP 19383

Rev No. 02

PAGE 1 OF 5

## STAINLESS STEEL FORGINGS Gr. X 4 CrNiMnMo N 19138

SUPERSEDES  
BP 19383 Rev.01

### 1 GENERAL :

This Specification governs the quality of stainless steel forgings of Gr: X4CrNiMnMo N 19138 variety.

### 2 APPLICATION :

For manufacture of retaining ring for 2 pole squirrel Cage Motors.

### 3 CONDITION OF DELIVERY :

Forged, and heat treated to achieve mechanical properties mentioned in Cl.11.

Forgings shall be supplied in the rough machined and Stress Relieved Condition, unless otherwise specified.

### 4 COMPLIANCE WITH NATIONAL STANDARDS :

There is no Indian Standard covering this type of material.

### 5 DIMENSIONAL AND TOLERANCE :

The dimensions of the forgings shall be as stated on the drawing or order. If the order / drawing calls for finished dimensions, the forgings are to be delivered with all side machining allowances of 3 to 4 mm to this finished dimensions after rough machining. The surface roughness shall be maximum  $Ra=6 \mu m$  for the non-destructive, clause 12.

### 6 MANUFACTURE :

Material shall be manufacture by an electric process or any other approved process.

Revision :

Reviewed &amp; No Tech. Change

Issued by :

STANDARDS AND MATERIALS GROUP  
TECHNICAL SERVICES DEPARTMENT

Rev.02

Date: 25.01.2020

Date of first Issue : Feb 1986



TSD 6206

## PLANT PURCHASING SPECIFICATION BHOPAL

BP 19383

Rev. No. 02

PAGE 2 OF 5

### 7. HEAT TREATMENT :

The material shall be heat treated to achieve the mechanical properties specified in clause 11.

### 8. FREEDOM FROM DEFECTS :

The forging shall be sound, clean and free from cracks, flakes, seams, segregation harmful non-metallic inclusion or other defects.

### 9. CHEMICAL COMPOSITION :

The chemical composition of the steel shall be follows :

Element	Percent	
	Minimum	Maximum
Carbon	-	0.15
Silicon	-	1.00
Manganese	7.00	10.00
Phosphorus	-	0.030
Sulphur	-	0.020
Chromium	17.50	20.00
Nitrogen	0.20	0.40
Molybdenum	2.50	3.50
Nickel	12.00	15.00

### 10. TEST SAMPLE :

One tangential test sample shall be selected per heat per heat treatment batch, per consignment for mechanical properties. Tangential samples are to be taken from the forged specimen from the center of the wall thickness after the last heat treatment.

### 11. MECHANICAL PROPERTIES :

#### 11.1 Tensile :

When tested in accordance with IS:1608/DIN 50145 & 50125 the test pieces shall show, the properties given below :

Tensile Strength	-	700 – 900 N/mm <sup>2</sup>
0.2% Proof Stress	-	410 N/mm <sup>2</sup> Min.
Elongation on 5.65√So Gauge length	-	35 Percent Minimum

### 12. NON DESTRUCTIVE EXAMINATION :



TSD 6206

## PLANT PURCHASING SPECIFICATION BHOPAL

BP 19383

Rev. No. 02

PAGE 3 OF 5

### 13. Ultrasonic Examination :

The ultrasonic testing shall be performed on 100% of the external surface with a standard test probe in radial direction and width 45 deg. Angular probe, twice in periphery direction and twice in axial direction. Test frequency shall be 1 or 2 MHz. The desired surface finish shall be less than or equal to 6  $\mu$ m.

Note : With the calibration attenuator, the back wall or edge echo is adjusted to 100% screen height and then increase the gain by 12 dB. Any texture noise / grass echoes appearing should not exceed 20% of screen height.

The ultrasonic testing shall be performed as per BHEL corporate standard AA 085 01 18 and the following shall be the unacceptable defects (category I of AA 085 01 18).

- a) Cracks, flakes, seams and laps.
- b) Defects giving indication larger than that from a 2 mm diameter equivalent flaw.
- c) Groups of defects with maximum indication less than that from a 2 mm diameter equivalent flaw with cannot be separated at testing sensitivity if the back – eco is reduced to less than 70%.
- d) Defects giving indications of 1 to 2 mm diameter equivalent flaws separated by distance less than four times the size of the larger of the adjacent flaws.

### 12.1 Liquid Dye Penetration Examination

Liquid dye penetration test is to be carried out in 100% surface of the forgings to examine freedom from cracks as per DIN 54152 Part I and the indications are to be recorded and marked on the forging.

### 13 INSPECTION AT SUPPLIER'S WORKS :

Whenever specified tests and inspection are to be conducted in the presence of BHEL's representative.

BHEL representative shall have free access at all times while the work on the contract is being performed to all parts of the manufacture's works. The manufacture shall offer BHEL's representative all responsible facilities, without charge, to satisfy the letter, that the material is being furnished in accordance with this specification.

The manufacturer shall prepare and provide necessary test specimen for testing to be carried out at his premises. If facilities are not available at his work manufacture shall make necessary arrangements for carrying out the prescribed tests elsewhere.



TSD 6206 A

## PLANT PURCHASING SPECIFICATION BHOPAL

BP 19383

Rev. No. 02

PAGE 4 OF 5

The manufacture shall notify BHEL in advance about readiness of the material for inspection and testing. BHEL reserve the right to test the material at BHEL's work and the final acceptance of the material shall be based on these test results.

### 14. REWORK :

Repair or elimination of insignificant defects shall not be carried out without the prior permission of BHEL.

### 15. TEST CERTIFICATE :

Three copies of test certificates shall be supplied, unless otherwise stated on the order in the 'Test Certificate' proforma annexed to this specification, (Annexure – I).

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

### 16. PACKING AND MARKING :

Forgings shall be suitably packed to prevent corrosion & 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 paint with the following information.

BP 19383: Stainless Steel Forging Gr : X4CrNiMnMo N 19138.

BHEL Order No.

Drawing No. (on the inner surface)

Consignment or Identification No.

Batch No.

Weight

Supplier's Name.

### 17. REJECTION AND REPLACEMENT :

If the forging does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during the course of preparation, machining, testing or erection such forging shall be rejected notwithstanding any previous certification of satisfactory testing and / or inspection.

The manufacture shall undertake to replace the rejected forgings at his own cost and the rejected forgings shall be taken back by the supplier after fulfilling the commercial terms and conditions.



TSD 6206 A

# PLANT PURCHASING SPECIFICATION BHOPAL

BP 19383

Rev. No. 02

PAGE 5 OF 5

## Recommended Test Certificate Format For Forgings

### Annexure-1

#### Supplier's Name and Address

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. Decarburisation 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. Decarbur: 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									
	Y.S. N/mm <sup>2</sup>	Y.S. 0.5% Proof N/mm <sup>2</sup>	% Elongation 5.65√S <sub>0</sub> 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**

- 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 filing up of details.