



TSD 6206 A

**PLANT PURCHASING SPECIFICATION**  
**BHOPAL**

BP 19381

Rev. No. 01

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**SUPERSEDES**  
**BP 19381 Rev.00**

NON-MAGNETIC CORROSION RESISTANT STEEL  
**FORGINGS** Gr.X 8 CrMn N18 18K

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1. **GENERAL:**

This **specification** governs the quality of forged and cold expanded, non magnetic, corrosion resistant, steel forgings of Gr:X8CrMn N18 18K variety.

2. **APPLICATION:**

For manufacture of cap ring forgings of AC Motors.

3. **CONDITION OF DELIVERY:**

Forged and Cold expanded to achieve mechanical properties mentioned in **C1.11**.

Forgings shall be supplied in the Rough Machined and Stress Relieved Condition, unless otherwise specified.

Our order shall specify the strength category (0.2% Rp Proof Stress) required.

4. **COMPLIANCE WITH NATIONAL STANDARDS:**

There is no Indian Standard covering this type of material.

5. **DIMENSIONS AND TOLERANCES:**

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 **µm** for the non-destructive test, clause 12.

6. **MANUFACTURE;**

Material shall be manufactured from killed **steel**.

Revision :

Reviewed and updated

Issued by :

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## 7. HEAT TREATMENT:

The material is to be forged and cold expanded within 300 deg.C. A hot cold deformation is not permissible. No age-hardening is permitted. The forgings are to be stress-relieved, at least 5 hours at 350 deg.C  $\pm$  20 deg.K after the cold expansion.

## 8. FREEDOM FROM DEFECTS:

The forgings shall be **sound**, clean and free from cracks, **flakes**, seams, **segregations**, harmful non-metallic inclusions other defects.

## 9. CHEMICAL COMPOSITION:

The chemical composition of the steel shall be as follows:

Element	Percent	
	Minimum	Maximum
Carbon	-	0.12
Silicon	-	0.80
Manganese	17.50	20.00
Phosphorus	-	0.05
Sulphur	-	0.015
Chromium	17.50	20.00
Nitrogen	0.40	-

## 10. TEST SAMPLES:

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 centre 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 in the table below:

11.2 Impact Value - **Charpy-ISO-V-Notch**- When tested in accordance with **IS:1498/DIN** 50115 the test pieces shall show the properties given in the table below, mean of three tests shall be taken.



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* 0.2% Proof Stress N/mm <sup>2</sup> , Min.	% Elongation 5.65 √S0 GL, Min.	Reduction in Area Percent Min.	Charpy Impact Value-ISO-V- Notch "J" Min.
550	37	61	130
600	35	60	125
650	32	59	120
700	30	58	110
750	28	57	105
800	26	55	100
850	24	54	95
900	22	53	90
950	20	52	80
1000	18	51	75

**\*NOTE:**

1. Strength category (0.2% Rp) shall be specified in the **order**.
2. The measured **0.2%** Proof Stress is permissible to exceed the required minimum value by 150 N/mm<sup>2</sup> maximum.
3. The Tensile Strength shall be mentioned for information in Test Certificate.

**12. NON DESTRUCTIVE EXAMINATION:****12.1 Ultrasonic Examination:**

The ultrasonic testing shall be performed on 100% of the external surface with a standard test probe in radial direction and with 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 μm**.

NOTE: With the calibrator 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.



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- c) Groups of defects with maximum indication less than that from a 2 mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back-echo is reduced to less than 70X.
- d) Defects giving indications of 1 to 2 mm diameter equivalent flaws separated by a distance less than four times the size of the larger of the adjacent flaws.

**12.2 Liquid Dye Penetration Examination**

Liquid dye penetrant 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 manufacturer's works. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the later, that the material is being furnished in accordance with this specification.

The manufacturer shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works the manufacturer shall make necessary arrangements for carrying out the prescribed tests elsewhere. The manufacturer shall notify BHEL in advance about readiness of the material for inspection and testing. BHEL reserves the right to test the material at BHEL's works 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 alongwith their despatch documents to facilitate quick clearance of material.



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## 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 19381 : Non-magnetic Corrosion Resistant Steel Forging  
Gr:X8CrMnN18 18K.

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 manufacturer 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.



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## Recommended Test Certificate Format For Forgings

## Annexure-1

## Supplier's Name and Address

1. Customer:	0. Reduction Ratio	1. Ingot to Bloom
2. TC No. & Date:	10. Batch No.:	/ Bloom to Blank
3. PO No.:	11. Heat/Melt No.	
4. Process of Melting Ingot:	12. Spec. No.	
5. Deoxidisation Process:	13. Test Bar Size & Nor	
6. Forging Method	14. Supplier of the ingot/billet/	
7. BHEL's Reference for Approval of Bloom	Bloom and TC reference.	
8. Discard Top _____ V 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										
As Per Specn	Min.	Max.	TS N/mm <sup>2</sup>	Y.S 0.5/0.2% Proof N/mm <sup>2</sup>	% Elongation 5.65√So GL	% R.A. Min.	Hardness BHN (Min 3 values)	Impact Value Joules	Bend Test	
									Angle of bend	Dia of mandrel
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.