



**PLANT PURCHASING
SPECIFICATION
HYDERABAD**

HY 19370

Rev. No.01

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ALLOY STEEL FORGINGS-H & T

GRADE: 40 Ni Cr Mo 65

1. GENERAL :

This specification governs the quality requirements of alloy steel forgings of grade 40 Ni Cr Mo 65.

2. APPLICATION :

Forgings are suitable for general engineering purposes.

3. CONDITION OF DELIVERY :

The forgings shall be supplied in hardened, tempered condition. Forgings shall be rough machined unless otherwise specified.

4. COMPLIANCE WITH NATIONAL STANDARD :

The forgings shall in general comply with the requirements of BS: 970 : Part 1 : 1983; Gr: 817 M40.

5. DIMENSIONS AND TOLERANCES :

The dimensions and tolerances shall be as follows.

- For finish machined component drawings the extra allowance of 3 mm/surface shall be provided for finish machining at BHEL.
- For rough machined Forging drawings necessary finish machining allowance is included in the dimensions. Extra allowance is not required.
- The tolerance on rough machined surface shall be ± 1 mm dimension, unless otherwise specified in the drawing.

Revisions: General revision.
As per BS 970; part1, 1983

Issued :
**STANDARDS SECTION
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Malts Engg.

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Malts Engg.

Approved:
GM (Engg)

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6. MANUFACTURE ::

The method of steel manufacture shall be at the discretion of the supplier. However, air or mixed air & oxygen bottom blown converter process is not permitted.

The Steel shall be fully killed, sufficient discard shall be made from the ingot, if used as forging stock, to ensure freedom from piping, segregation and other defects.

The amount of hot working shall be sufficient to ensure uniform working throughout the cross-section.

Reduction ratio shall be minimum 4:1 for ingots and 1.5:1 for rolled/forged stock.

7. HEAT TREATMENT :

The forgings shall be heat-treated to attain the mechanical properties specified.

The recommended heat-treatment shall be as given below. Hardening in Oil from a temperature of 820-850⁰ C.

Tempering at the temperature between 660⁰ C max, However, tempering between 280 and 500⁰ C shall be avoided, as it leads to temper embrittlement.

8. FINISH :

Surface finish of the forgings shall be 6.3 microns (r.m.s) to carry out ultrasonic test.

9. FREEDOM FROM DEFECTS :

Forgings shall be free-from cracks flakes, seams, segregation and other defects which may affect the utility of the forgings.



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10. CHEMICAL COMPOSITION :

The melt analysis of the steel shall be as follows :

Element		C	Si	Mn	Ni	Cr	Mo	S	P
Melt Analysis	% Min	0.36	0.10	0.45	1.30	1.00	0.20	-	-
	% Max	0.44	0.35	0.70	1.70	1.40	0.35	0.025	0.025
Permissible Variation In product analysis		±0.02	±0.03	±0.03	±0.05	-0.04 +0.05	±0.02	+0.003	+0.003

11. TEST SAMPLES :

- 11.1** Test coupons shall be taken from each melt and each heat-treatment batch/size unless integral test coupons are called for in the drawing/purchase order

The test coupons shall be heat treated along with the forgings. In case of integral test coupons, the test pieces shall be cut from the forgings only after heat treatment. However the remaining integral test coupon after testing at supplier's end shall be kept integral with the forging and sent to BHEL.

Sufficient test material shall be sent to BHEL for cross-check where necessary.

- 11.2** Test samples shall be cut at

- For Solid forgings: Distance of 1/3 radius or 1/6 diagonal from the outer surface.
- For hollow forgings: Midway between the inner and outer surface of the wall thickness.

Separately forged test pieces shall be forged to the ruling section of the actual forgings they represent.



12. MECHANICAL PROPERTIES :

Mechanical properties for the ruling section of 100mm shall be as given below.

Tensile Strength N/mm ²	0.2% Proof Stress N/mm ² Min	% Elongation (L=5d) min		Charpy Impact Strength (ISO-v) J, Min	
		L	T	L	T
925-1075	755	12	10	42	30

- NOTE:**
- Mechanical tests shall be performed preferably on tangential test samples. If the forging configuration does not allow for taking tangential test samples, longitudinal ones shall be used. L&T in the above table indicate values for longitudinal and transverse samples.
 - Tensile test shall be performed as per IS : 1608 or any reputed National Standard.
 - The charpy impact test shall be performed on 2 mm ISO V-Notch, as per IS: 1757 or any reputed National Standard.

The impact values indicated above are average of 3 values. All the 3 values shall be reported. Only one value can be lower than the minimum specified value but not less than 2/3 of the same.

13. NON-DESTRUCTIVE TESTS :

The following tests shall be conducted on the forgings.

- 13.1 Ultrasonic test:** Ultrasonic test shall be carried out performed as per ASTM :A388 (BHEL Standard AA 0850118) and following shall be unacceptable defects. (Category 2, AA 0850118).

- Cracks, flakes, seams and laps.
- Defects giving indications larger than that from a 4mm diameter equivalent flaw.
- Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%.
- Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.



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13.2 Magnetic particle test: MPI shall conducted as per ASTM-A275.

Cracks and laps are not acceptable.

14. RETESTS :

If any of the selected test specimens fail to meet the specified requirement due to some mechanical reasons, another specimen may be taken for testing.

In the event of failure due to material heat-treatment only two more reheat-treatments shall be permitted. However retempering is not considered as reheat-treatment.

15. INSPECTION AT SUPPLIER'S WORKS :

BHEL representative shall have free entry and access to all areas where the manufacture of the forging is carried out. All reasonable facilities shall be extended to him including labour where necessary.

BHEL representative shall be given sufficient advance intimation to witness the various processes, tests etc. Punching and identification of test coupons & forgings and execution of various tests shall be done in his presence of BHEL representative.

16.0 TEST CERTIFICATE :

16.1 The suppliers shall furnish five copies of the test certificate (English) with one transparent copy containing the following details.

- 1) HY 19370. Rev.01
- 2) BHEL Order No:
- 3) Item Description.
- 4) Drawing No:
- 5) Supplier's NameMolt No:
- 6) Melt No.
- 7) Serial No. of forging
- 8) Heat Treatment details.
- 9) Results of all tests stipulated in this Specification.

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16.2 The test certificate shall be attested by the Chief of Inspection/Chief Metallurgist of the supplier and also by BHEL representative.

17. MARKING AND PACKING :

17.1 The following details shall be punched clearly on each forging and the same shall be encircled by paint:

- 1) HY19370/ Rev No. 01
- 2) BHEL Order No.
- 3) Melt No.
- 4) Serial No. of the forging
- 5) Drawing No.
- 6) BHEL Inspectors Stamp.
- 7) Supplier's Name.

The forgings shall be suitably packed & prevented from damage and corrosion during transit. In the case of imported forgings, the packing shall be seaworthy.

18. REJECTION AND REPLACEMENT :

In the event of the forging proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance.

The supplier shall replace the rejected forging at his own cost and the rejected forging shall be returned after all the commercial conditions are satisfied.



AMENDMENT-NOTIFICATION

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1. Clause 4.0: Compliance with National Standards
The existing clause should be replaced with the following:
“The forgings shall be in general comply with the requirement of BS970 – Part 3 – 1991, Gr.817 M40”.
2. Clause 10.0: Chemical Composition
Si – content shall be read as 0.10 to 0.40%

S – content shall be read as 0.040% max.

P - content shall be read as 0.035% max.

REF:	Amd.No.	APPROVED AGM(E&CC)	ISSUED MANAGER, (STDS.ENG)	DATE	CUM.Sr.No
	01			FEB.93	0029

RESTRICTED USE

