

**HOT ROLLED / FORGED CARBON STEEL BARS - H & T****1.0 GENERAL**

This specification governs the quality requirements of Hot Rolled / Forged Carbon Steel Bars, Hardened and Tempered.

2.0 APPLICATION

For general engineering purposes.

3.0 CONDITION OF DELIVERY

Hot Rolled / Forged hardened and tempered.

Note: Sizes upto 100mm in hot rolled
>100 to 180mm in hot rolled or forged
above 180mm in forged

The ends of bars shall be reasonably square and true.
The bars shall be supplied in straight lengths without twists and bends.

4.0 COMPLIANCE WITH NATIONAL STANDARDS

The material shall comply with the requirements of the following National standard and also meet the requirements of this specification.

IS : 5517-1993 (Reaffirmed 1998)	Steel for
Gr:40 C 8	Hardening and Tempering
Hardened & Tempered	

5.0 DIMENSIONS AND TOLERANCES**5.1 Sizes**

The bars shall be supplied to the dimensions specified on BHEL order.

5.2 Tolerances:**5.2.1 For Forged bars:**

The tolerances shall be + 8 mm - 0mm.

5.2.2 Tolerances on hot rolled bars shall comply with those of Grade 2 of IS:3739: reproduced below:

Revisions :

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**Round and Square Bars :**

Nominal size. mm		Tolerance, mm	
Over	Upto & Including	Permissible deviation	Out of round/ square
---	25	± 0.50	0.50
25	50	± 0.75	0.75
50	80	± 1.00	1.00
80	100	± 1.25	1.25
100	125	± 1.50	1.50
125	160	± 2.00	2.00
160	200	± 2.50	2.50
200	250	± 3.00	3.00

5.2.3 On Straightness

Unless otherwise agreed to, the permissible deviation in straightness, shall not exceed the following limits in any 1000 mm length of the bar.

Upto & incl. 40 mm size of bars	-	6 mm
Above 40 mm size of bars	-	5 mm

5.3 Length

Bars shall be supplied in 3 to 6 metres length or in multiples with maximum of 10% shorts down to 1 metre.

Forged bars shall be supplied in length of 1.5 to 3 metres.

6.0 MANUFACTURE

Material shall be manufactured from fully killed steel.

7.0 HEAT TREATMENT

The recommended heat treatment is as follows:

Harden in oil / water from a temperature of 830-860°C.

Temper at a suitable temperature between 550-660°C.

8.0 FREEDOM FROM DEFECTS

The bars shall be sound, straight and free from internal and surface defects, such as seams, laps, cracks or any other defects which may impair the end use.



9.0 CHEMICAL COMPOSITION

The melt analysis of steel and the permissible variation in the composition of the finished product from the melt analysis shall be follows:

Element	Melt analysis, percent,		Permissible variation, percent, in product analysis
	Min.	Max.	
Carbon	0.35	0.45	± 0.02
Silicon	0.10	0.35	± 0.03
Manganese	0.60	0.90	± 0.04
Sulphur	---	0.035	+ 0.005
Phosphorus	---	0.035	+ 0.005

10.0 TEST SAMPLES :

10.1 One sample shall be taken from each melt for chemical analysis.

10.2 One sample shall be taken from each heat treatment batch for testing of mechanical properties. Test pieces for mechanical tests shall be taken in the longitudinal direction of the piece.

For ruling section up to & including 40mm, the test piece shall be machined coaxially from the test bars. For ruling section above 40mm the longitudinal axis shall be atleast 12.5 mm from surface of the test bars.

Test methods for determining mechanical properties shall be as per IS:1598 (For IZOD impact test)/IS:1757 (For impact test in ISO-V Charpy) and IS:1608 (For tensile test).

10.3 For ruling section above 200mm, tensile test sample can be taken in tangential or transverse direction.

11.0 MECHANICAL PROPERTIES (In Hardened and Tempered Condition)

Ruling section, mm	Tensile strength, N/mm ²	0.2%/PS/YS N/mm ² , min	Y.E 5.65√So min	* IZOD impact J, min
≤ 30	700 -850	480	17	35 (30)
>30	600-750	380	18	41 (35)

- Average of 3 samples applicable for sizes above 16 mm ruling section only. Values in bracket are in ISO - V Charpy.



12.0 ULTRASONIC TEST

12.1 Each bar above 100 mm 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.

12.2 Optional tests: If specified on order, each bar > 40 to 100mm shall be tested ultrasonically in accordance with BHEL standard AA 085 01 18 to ensure freedom from internal defects and the norms of acceptance shall be as per category 2.

13.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

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 :

BHEL References :

AA 102 18; (Rev. No. 07)

BHEL order No,

Supplier's References :

Name

Identification No.

Melt No.

Details of heat treatment.

Result of Tests:

Dimensional inspection.

Results of chemical analysis, mechanical and & Ultrasonic tests.

14.0 PACKING AND MARKING

The material shall be suitably packed in bundles hessian wrapped to prevent sagging, corrosion and damage during transit.

A suitable clear temperature rust preventive shall be applied on all the bars.

Each bar \geq 50 mm shall be stamped with 'AA 102 18'.

Bars below 50 mm shall be bundled together and tied with wire at 3 to 4 places along the length of the bars.

A metal label shall be securely attached to each bundle and shall bear the following information :

AA 102 18 : Hot Rolled / Forged Carbon Steel Bars - H & T.

BHEL Order No.

Consignment/Identification No.

Melt No.

Size and Weight.

Supplier's Name.

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS : 1598

2. IS : 1608

3. IS : 1757

4. IS : 3739

5. IS : 5517

6. AA 085 01 18