



**PLANT PURCHASING
SPECIFICATION
HYDERABAD**

HY10565

REV. NO. 03

PAGE 1 OF 4

1% CHROMIUM CASE HARDENING STEEL BARS, ANNEALED

(GR : 16 Mn Cr 5)

1.0 GENERAL:

This specification governs the requirements of 1% chromium case hardening bars.

2.0 APPLICATION :

For the manufacture of case hardened components.

3.0 CONDITION OF DELIVERY :

The bars shall be supplied in the hot / cold rolled/ forged and Annealed condition

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

This specification complies with EN10084-1998 : Case hardening steels.

Gr : 16 Mn Cr5

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions : As specified in the order. Unless otherwise specified, the hot/cold rolled bars shall be supplied in random lengths of 3 to 6 meters. Forged bars shall be supplied in lengths of 1.5 to 3.0 metres.

5.2 Tolerance:

5.2.1 Rolled bars: The bars shall not vary from specified diameter or distance across flats by more than $\pm 2\frac{1}{2}$ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

Diameter, mm

Tolerance, mm

50 mm to 175 mm

+ 8.0 mm

Above 175 mm

+ 12.5 mm

Note: (Hot rolled & forged bars).

Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

Revisions:

Revised in line with EN10084 (latest version).

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HY10565	PLANT PURCHASING SPECIFICATION HYDERABAD	
REV. NO. 03		
PAGE 2 OF 4		

6.0 MANUFACTURE:

The method of steel manufacture is left to the discretion of the manufacturer. However, air or mixed air and oxygen bottom blown converter process is not acceptable. The steel shall be fully killed.

7.0 FREEDOM FROM DEFECTS:

The bars shall be free from surface and internal defects such as piping, segregation etc.

8.0 HEAT TREATMENT:

8.1 The bars shall be soft annealed at 650 - 700° C and furnace cooled.

8.2 The recommended heat treatment for sample test pieces shall be as follows:
Blank Carburize at 880 - 980° C, followed by air cooling.
Hardening : At 860 - 900° C followed by quench in oil or water.

The tempering temperature shall be 150 - 200 ° C. The actual heat treatment cycle followed shall be reported in the Test certificate.

9. SELECTION OF TEST SAMPLES:

9.1 Chemical Analysis: Each melt shall be analysed for chemical composition

9.2 Mechanical Properties : One sample per melt per size shall be tested for mechanical properties after heat treatment as per clause 8.2. For the bars beyond 250 mm diameter, the test samples shall be forged to dia 250 mm then tested for mechanical properties after heat treatment as per clause 8.2.

9.3 Metallography tests : One sample per melt per size shall be tested for metallography tests.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element		C	Si	Mn	Cr	P	S
Melt analysis	Min. %	0.14	--	1.00	0.80	--	-
	Max. %	0.19	0.40	1.30	1.10	0.035	0.035
Permissible variation in product analysis		± 0.02	+0.03	±0.05	±0.05	+0.005	+0.005



PLANT PURCHASING SPECIFICATION HYDERABAD

HY10565

REV. NO. 03

PAGE 3 OF 4

11.0 MECHANICAL PROPERTIES:

11.1 **Tensile:** The mechanical properties of the hardened and tempered test bars of ruling section 30 mm shall be as follows:

Tensile Strength N/mm ²	0.2% Proof Stress min. N/mm ²	% Elongation min. (l = 5 d)
780 - 1080	590	10

11.2 **Hardness:** 5 % of the bars or minimum 2 numbers, in annealed condition shall be tested for Brinell Hardness and the value shall be 207 BHN max.

12.0 METALLOGRAPHY TEST :

12.1 **Grain size :** Grain size shall be 5 or finer when tested in accordance with ASTM E 112.

12.2 **Cleanliness Rating :** Inclusion content shall be tested as per ASTM E 45 and inclusion rating for all types shall not be more than 2.0 (thin series) and 1.5 (thick series). The inclusion of all types i.e. A, B, C & D may exist simultaneously.

13.0 ULTRASONIC TESTING :

Each bar above 50 mm dia/size shall be tested ultrasonically in accordance with corporate standard AA0850118 to ensure freedom from internal defects. The norms of acceptance shall be as per category 2 of the above standard.

14.0 INSPECTION AT SUPPLIER'S WORKS:

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

BHEL representative/BHEL appointed Inspection Agency shall be given sufficient advance intimation to witness the various processes, tests, etc. punching and identification of test coupons and execution of various tests shall be done in presence of BHEL representative/BHEL appointed Inspection Agency.

HY10565	PLANT PURCHASING SPECIFICATION HYDERABAD	
REV. NO. 03		
PAGE 4 OF 4		

15.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied bearing the following details:

- BHEL Order No.
- BHEL Specification No: HY 10565 / Rev. 03
- Supplier's name:
- Identification No.
- Size:
- Cast No.
- Details of heat treatment carried out on material and test samples.
- Results of chemicals analysis and mechanical tests including hardness tests called for in this specification.
- Results of ultrasonic tests and metallography tests.

16.0 PACKING AND MARKING:

The bars shall be suitably packed in bundles to prevent corrosion and damage during transit.

Bars above 50mm in diameter or of equivalent cross-sectional area shall be stamped HY10565 and Cast No. on the side near the end or on the end face.

A metal lable shall be securely attached to each bundle and shall bear the following information for bars of diameters less than 50 mm.

HY 105 65/Rev. 03

BHEL Order No.

Consignment or Identification No:

Cast No.

Size & Weight.

Supplier's Name.

17.0 REJECTION AND REPLACEMENT:

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

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