



TD-219-Rev.00

PLANT PURCHASING SPECIFICATION

HY 10868

REV.No.01

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6/5/2/5/ HIGH SPEED TOOL STEEL BARS, ANNEALED**1.0 SCOPE:**

This specification governs the quality of 5% cobalt molybdenum base high speed tool steel bars, annealed.

2.0 APPLICATION:

For the manufacture of heavy duty profile, milling cutters, reamers, taps etc.

3.0 CONDITION OF DELIVERY:

Hot rolled and soft annealed. The bars shall be supplied with ends square and true. The bars shall be supplied in straight lengths.

4.0 COMPLIANCE WITH STANDARDS:

DIN: Material No. 1.3243

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes: The sizes shall be as specified in the enquiry/order.

5.2 Tolerances: The permissible deviation in size for hot rolled round, square and hexagonal bars shall be as per IS:7291, reproduced below:

Size, mm	Tolerance, mm	
	Permissible deviation	Out of Section
Below 20	+ 0.50 - 0.20	0.50
20 to 30 excluding	+ 0.70 - 0.30	0.70
30 & above	+ 2.5% of size - 1.0% of size	70% of range of permissible deviation.

5.3 Straightness: The permissible deviation shall not exceed 3.5 mm in any 1000 mm length. This applies also to bars under 1000 mm in length. Measurement is taken on the concave side of the bar with a straight edge.

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5.4 Length: Bars shall be supplied in 2 to 4 metre lengths with a maximum of 10 percent shorts down to 1 metre. When exact lengths are ordered, cutting and shearing tolerances shall not exceed ± 12 mm.

6.0 MANUFACTURE:

Material shall be manufactured from killed steel. Sufficient reduction and discard shall be made from each ingot to ensure freedom from piping, segregation and other defects.

The material shall be rough machined, chipped or ground to remove all surface imperfections which are likely to product defects in the finished product.

If the material is conditioned by grinding or chipping, depth of conditioning shall not exceed half the machining allowance per side and width of conditioning shall be atleast four times its greatest depth.

7.0 FREEDOM FROM DEFECTS:

The material shall be free from defects such as seams, laps, cracks, pipes, busts non-metallic inclusions and metallic segregates. Total decarburaization shall be kept at the minimum level and in no case shall exceed 80 percent of the machining allowance.

8.0 CHEMICAL COMPOSITION:

The analysis of the material shall be as follows:

<u>Element</u>	<u>Percent</u>	
	<u>min</u>	<u>max.</u>
Carbon	0.77	0.85
Silicon	0.15	0.40
Manganese	0.20	0.40
Chromium	3.75	4.50
Molybdenum	4.00	5.50
Vanadium	1.90	2.30
Tungsten	5.50	6.75
Cobalt	4.75	5.25
Sulpher	-	0.030
Phosphorous	-	0.030

9.0 MECHANICAL PROPERTIES: Hardness (Brinell)

When tested in accordance with IS:1500, the test pieces shall show a Brinell Hardness of 240-300 HB. Hardness test shall be carried out on a surface free from decarburization.



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10.0 RESPONSE TO HEAT TREATMENT:

Bars shall be capable of responding to heat treatment specified below and the material must achieve a Rockwell hardness of 64-67 HRC without showing any sign of over heating.

Warm up at 450-600°C

Preheat at two stages (1) 850°C
(2) 850-1050°C

Harden at 1200-1240°C

Quench in salt bath at 550°C.

Temper minimum two times at 550-570°C.

11.0 METALLOGRAPHIC TESTS:

11.1 Macrostructure: The macrostructure in the annealed condition shall be clean and exhibit a uniform and dense structure free from excess porosity, pipe, checks, cracks, non-metallic inclusions and other injurious defects. For guidance, it is recommended that 15-30 minutes etching time is necessary for revealing macrostructure in the annealed condition.

11.2 Surface decarburization: The depth of decarburization for hot rolled bars when measured in accordance with IS:6396, shall not exceed 80% of the minimum machining allowances given in the Annexure.

11.3 Carbide form and Distribution (Annealed Microstructure): Longitudinal specimen shall be taken at a location midway between the centre and the outer edge of the test specimen. The specimen shall be polished, suitably etched and examined microscopically. The material shall show well broken up evenly distributed carbide with segregation not greater than that shown in the photomicrographs referred to in Table 7 of IS:7291.

11.4 Grain Size: The grain size of the material shall conform to the following:

<u>Size, mm</u>	<u>Requirement</u>
Upto, & incld.25	11 or finer
Over 25 upto and incld.75	10 or finer
Over 75	9 or finer

12.0 ULTRASONIC TEST:

Each bar shall be tested ultrasonically. The following defects shall be unacceptable.

a) Cracks, flakes, seams & laps.

b) Defects giving indication larger than that from a 2mm diameter equivalent flaw.



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 70%.

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.

13.0 SELECTION OF TEST SAMPLES:

One sample product shall be taken from each heat for chemical analysis.

Samples for tests shall be selected from each size group, from each heat treatment batch and for the material of the same cast as follows:

<u>Test</u>	<u>Number of samples</u>
Hardness tests in the annealed and hardened and tempered conditions	5% of number of pieces in the charge upto a maximum of 10 and a minimum of 2 but all sizes shall be covered.
Microscopic examination	One each
Surface decarburization	One

14.0 TEST CERTIFICATE:

14.1 Three copies of a test certificate bearing the following information shall be supplied.

- a) BHEL Order No.
- b) BHEL Specification No: HY 10868
- c) Supplier's Name/Identification No.
- d) Heat No. and chemical analysis.
- e) Details of Heat treatment.
- f) Results of hardness test in soft annealed and hardened & tempered condition.
- g) Results of Metallographic tests and ultrasonic tests.

15.0 PACKING AND MARKING:

15.1 Marking: Bars above 25 mm size shall be stamped with specification No. HY 10868 and cast no. on the side near the end or on the end face.

Bars of same size and heat shall be bundled together.

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

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BHEL Order No.



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Consignment of Identification No.

Heat No.

Size & Weight

Supplier's Name

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