



## PLANT PURCHASING SPECIFICATION BHOPAL

BP 10590

Rev. No. 14

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SUPERSEDES  
BP 10590 Rev. 13

### NICKEL-CHROMIUM – MOLYBDENUM STEEL BARS H&T

#### 1. GENERAL:

This specification governs the quality of Nickel-Chromium Molybdenum Steel Bars having a tensile strength in the range of 1000-1150 N/mm<sup>2</sup>.

#### 2. APPLICATION:

For use in heavy duty railway motor shaft.

#### 3. CONDITION OF DELIVERY:

Hot Rolled or Forged bars in the hardened and tempered Condition to comply with the mechanical properties specified in Clause 11, of this specification.

The ends of bar shall be reasonably square and true.

The bars shall be supplied in straight lengths.

#### 4. COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply the requirements of the following National Standards and shall meet the mechanical properties of this specification:

##### 4.1. Indian Standard

IS : 5517 - 1993 Reaffirmed – 2019

{ Gr : 31 Ni 10 Cr 3 Mo 6 Type D – H & T } Steels for Hardening and Temperature.

##### 4.2. Any other comparable standard meeting requirement of this specification.

Note: Shaft forgings / rolled bars supplied by M/s steel Authority of India against their Gr. DA 125 is also acceptable provided its meet all the requirements of this specification.

#### 5. DIMENSIONS AND TOLERANCE:

##### 5.1. Sizes: Bars shall be supplied to be dimensional Specified on the order.

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### 5.2. Tolerances on hot rolled bars:

The tolerance on hot bars shall comply with those of Gr.2 of IS : 3739, reproduced blow :

#### 5.2.1. Round Bars:

The permissible deviation in size for hot rolled bars shall be as follows :

Nominal Size, mm		Tolerance Size, mm	
Over	Upto & incld.	Permissible Deviation	Out of round
-	25	$\pm 0.50$	0.50
25	50	$\pm 0.75$	0.75
50	80	$\pm 1.00$	1.00
80	100	$\pm 1.25$	1.25
100	125	$\pm 1.50$	1.50
125	200	$\pm 2.50$	2.50
150	200	$\pm 2.50$	2.50

#### 5.2.2. Forged Bars: + 1.5 %

#### 5.2.3. Straightness – Hot Rolled Bars

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

Upto & including 40 mm size of the bars : 6 mm  
Above 40 mm size of bars : 5 mm

### 5.3. Length :

Bars shall be supplied in specific lengths specified in the order / drawings or in multiple length thereon.

## 6 MANUFACTURE:

Raw material shall be manufactured from killed steel using AOD / VOD/ VAD process.

## 7 HEAT TREATMENT:

The bars shall be hardened from 830 - 850<sup>o</sup> C followed by tempering, at a suitable temperature up to 660<sup>o</sup>C max. Should the bars require straightening after oil hardening and tempering they shall subsequently be stabilized by re-tempering.

## 8 FREEDOM FROM DEFECTS:

The material shall be free from internal and surface defects such as seams, laps and injurious imperfection.





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### 9 CHEMICAL COMPOSITION:

The melt analysis of steel shall conform to any one of the following. The permissible variation in the composition of the material from the melt analysis shall be as follows:

#### A) National Standards as per Clauses 4

Element	% Min.	% Mix.	Permissible Deviation %
Carbon	0.27	0.35	$\pm 0.02$
Manganese	0.40	0.70	$\pm 0.04$
Silicon	0.10	0.35	$\pm 0.03$
Nickel	2.25	2.75	$\pm 0.07$
Chromium	0.50	0.80	$\pm 0.05$
Molybdenum	0.40	0.70	$\pm 0.04$
Sulphur	-	0.035	+ 0.005
Phosphorous	-	0.035	+ 0.005

#### B) As per Grade-DA 125 (M/s. SAIL).

Element	% Min.	% Max.	Permissible Deviation %
Carbon	0.25	0.35	$\pm 0.02$
Manganese	0.40	0.70	$\pm 0.04$
Silicon	0.10	0.35	$\pm 0.03$
Nickel	1.40	1.80	$\pm 0.07$
Chromium	1.20	1.60	$\pm 0.05$
Molybdenum	0.35	0.50	$\pm 0.04$
Sulphur	-	0.02	$\pm 0.005$
Phosphorous	-	0.02	$\pm 0.005$
Vanadium	-	0.12	$\pm 0.02$

### 10 SELECTION OF TEST SAMPLES:

#### 10.1 At Supplier's Work :

One sample shall be taken from each cast for chemical analysis.

One sample product shall be taken from each size grouping of each heat treatment batch for testing of tensile and impact properties. Test pieces for mechanical tests shall be taken in the longitudinal direction of the products in accordance with Figure 1 of IS; 5517.





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Each bar shall be hardness tested at either end when supplied in specific lengths. When supplied in multiple lengths the bars shall be tested in the middle and at either ends. Each bar shall be allotted a sequential series number which identifies with the heat treatment batch number.

General conditions for selection and preparation of samples and test pieces shall be in accordance with IS: 3711.

### 10.2 At BHEL'S Works

One shaft for every heat to be supplied in length 300 mm excess of specified length for mechanical test in BHEL Bhopal. This shaft / bar shall be properly identified and correlated with the heat treatment batch No. / Test certificate No.

Alternatively, BHEL Bhopal may at their discretion and cost can destroy one shaft taken randomly per heat for testing.

## 11 MECHANICAL PROPERTIES:

### 11.1 Tensile:

When tested in accordance with IS: 1608, the test pieces shall show the following properties.

Tensile strength	1000-1150 N / mm <sup>2</sup>
0.2% Proof Stress	800 N / mm <sup>2</sup> Min.
Elongation on 5.65√S <sub>0</sub> gauge length	12 % Min.

### 11.2 Impact value at room temperature (for bars of sizes above 16 mm only).

#### CHARPY IMPACT VALUE (ISO-V):-

When tested in accordance with IS: 1757, the test pieces shall show an average charpy impact value of 42 joules min. over 3 test values while the lowest value of the 3 values being not less than two-thirds the average value obtained. All the 3 values shall be reported.

OR

#### IZOD IMPACT VALUE: -

When tested in accordance with IS: 1598, the test pieces shall show a minimum Izod impact value of 48 Joules.





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### 11.3 Hardness (Brinell):

The bars when tested to IS: 1500 shall show a Brinell Hardness in the range of 293-341 (HB).

Notes: 1. Departure from specified hardness value is acceptable provided the mechanical properties mentioned in Cl.11.1 & 11.2 (above) are complied with.

2. Hardness variation in each bar should not exceed 20 Brinell.

### 12 ULTRASONIC TESTING:

The bars shall be ultrasonically tested to BHEL corporate standard AA 085 01 18. The acceptance standards shall comply with "category-2" of AA 085 01 18.

### 13 TEST CERTIFICATES:

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

In addition, the supplier shall ensure to include one copy of the test certificate along with their dispatch documents to facilities quick clearance of the material.

The test certificate shall bear the following information.

BHEL References:

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Our Order No.

Supplier's Reference:

Name.

Consignment / Identification No.

Cast No. / Melt No.

Heat treatment Batch number and Serial No.

Details of Heat treatment

Size and No. of Bars.





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### Results of Tests:

Chemical composition	Per Cast
Tensile & Izod impact	Per heat Treatment Batch
Hardness – Brinell	Hardness on the individual bars along with their serial numbers & there heat treatment batch number.
Ultrasonic Examination	All the bars supplied along with their identification number.

### 14. PACKING AND MARKING:

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

Bars above 25 mm in diameter or of equivalent cross sectional area shall be stamped BP 10590 and the cast number on the side near the end face.

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

BP 10590: Nickel Chromium Molybdenum Steel Bars – hardened And Tempered.

Our Order No.

Consignment / Identification Nos.

Cast No. / Melt No.

Heat Treatment Batch No.

Size & Weight.

Supplier's & Name.