

	CORPORATE PURCHASING SPECIFICATION	AA10622 Rev No.10 PREFACE SHEET																		
ALLOY STEEL BARS FOR HIGH TEMPERATURE BOLTS UPTO 565° C – H&T (20CrMoVTiB4 – 10) FOR INTERNAL USE ONLY REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS Equivalent/Comparable Standards: 1) EUROPEAN : EN 10269 – 2013 (Gr: 20CrMoVTiB4 – 10) Suggested / Probable Suppliers and Grades: Refer Plant vendor's list. User Plants and Replaced Plant Specifications/References: 1) HEP, BHOPAL : 2) HEEP, HARDWAR : 3) HPEP, HYDERABAD :																				
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ALLOY STEEL BARS FOR HIGH TEMPERATURE BOLTS UPTO 565° C – H&T (20CrMoVTiB4 – 10)																				
1.0 GENERAL: This specification governs the quality requirements of alloy steel bars suitable for machining. 2.0 APPLICATION: Used mainly for bolts, nuts and studs etc. 3.0 CONDITION OF DELIVERY: Hot rolled/forged bars shall be supplied in the hardened and tempered condition according to EN10269 to comply with the mechanical properties specified in the specification. 4.0 COMPLIANCE WITH NATIONAL STANDARDS: There is no Indian standard covering this material. However, assistance has been derived from EN 10269 material grade 20CrMoVTiB4 – 10 “Steels and Nickel alloys for fasteners with specified elevated and / or low temperature properties”. 5.0 DIMENSIONS AND TOLERANCES: 5.1 Sizes: Bars shall be supplied to the dimensions specified in BHEL order. 5.1.1 Length: Unless otherwise specified, hot rolled bars shall be supplied in 3 to 6 meters length or in multiples with maximum of 10 per cent, shorts down to 1 meter. Forged bars shall be supplied in lengths of 1.5 to 6 meters 5.2 Tolerances: 5.2.1 Hot 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: <table style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="text-align: left;"><u>Diameter, mm</u></th> <th style="text-align: left;"><u>Tolerance, mm</u></th> </tr> </thead> <tbody> <tr> <td>> 50 to 125</td> <td>+ 6.0</td> </tr> <tr> <td>>125 to 175</td> <td>+ 8.0</td> </tr> <tr> <td>>175</td> <td>+ 12.5</td> </tr> </tbody> </table>			<u>Diameter, mm</u>	<u>Tolerance, mm</u>	> 50 to 125	+ 6.0	>125 to 175	+ 8.0	>175	+ 12.5										
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Note: (FOR 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 tolerances on each size.

6.0 MANUFACTURE

The steel shall be made by electric furnace process and degassed (e.g. vacuum degassed). Any other process shall be subjected to the mutual agreement between BHEL and the manufacturers.

Note: The material as per this specification shall be supplied by the manufacturers who are having complete in-house steel melting, refining, hot rolling/forging/blooming/etc., heat treatment and testing facilities.

7.0 HEAT TREATMENT

Following heat treatment parameters are suggested to achieve the mechanical properties specified in Clause 11.0 of this specification.

Bars shall be annealed at 660 – 700°C followed by air cooling, hardened by heating uniformly to 970 – 990°C and quenching in air / water / oil. They shall be tempered at temperatures between 680 – 720°C.

If bars need to be straightened after heat treatment, stress relieving is mandatory after completion of the entire straightening process. Stress relieving shall be carried out at 30°C below the actual tempering temperature with a subsequent slow cooling rate.

8.0 FREEDOM FROM DEFECTS

The bars shall be straight, sound and free from internal defects. Cracks, other material separations or more severe linear inclusion lines are only acceptable when located in the dimensional tolerance areas.

9.0 CHEMICAL COMPOSITION:

The analysis of the material shall be as follows:

Element (wt%)	C	Si	Mn	Cr	Mo	V	Ti	B	S	P*	Al**
Minimum	0.17	–	0.35	0.90	0.90	0.60	0.07	0.001	–	–	0.015
Maximum	0.23	0.4	0.75	1.20	1.10	0.80	0.15	0.010	0.020	0.020	0.080

The following trace elements shall be restricted to the following maximum limits:

Copper	--	0.20
Tin	--	0.020*
Arsenic	--	0.020
Ni	--	0.20

* The elements P and Sn shall be controlled according to the formula $P+3.6XSn \leq 0.055\%$

** A maximum Al-value of 0.03% is to be aimed.

10.0 TEST SAMPLES

10.1 CHEMICAL ANALYSIS:

Each melt shall be analysed for chemical composition.



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10.2 MECHANICAL TESTS

A hardness test is to be carried out to verify the uniformity of the strength within the delivery lot (per melt and heat treatment batch). Hardness check shall be conducted on 10% of the bars or a minimum 10 numbers of bars whichever is higher. In case the lot consist of less than or equal 10 bars, then all the bars need to be checked for hardness. Mechanical properties shall be tested on hardest and softest bar.

Specimens are to be taken in longitudinal direction according to EN 10083-1. For bars with diameter (d) respectively side lengths (a, b) > 100mm, the specimens shall be taken at a distance d/3 respectively a/3 and b/3 from the respective surfaces. In this case transverse specimens are also allowed.

11.0 MECHANICAL PROPERTIES

11.1 When tested in accordance with IS:1608, the test pieces shall show the following properties tensile properties at room temperature (EN 10269):

Properties	$d \leq 100$	$100 < d \leq 250$
Ultimate tensile strength	820–1000 N/mm ²	820–1000 N/mm ²
0.2% proof stress	660 N/mm ² (min.)	660 N/mm ² (min.)
Elongation on $5.65\sqrt{s_0}$ gauge length	15 % (min.)	15 % (min.)
Reduction in area	50% (min.)	50% (min.)
Charpy 2mm V notch (J)	40 (min.)	27 (min.)

11.2 Charpy Impact Value (V notch)

When tested in accordance with IS:1757, using a test specimen of 10 mm x 10 mm x 55 mm and having a 2 mm V notch, the materials shall show a minimum Charpy impact value (in Joules) at room temperature as mentioned in the above table. This test is applicable for Bars of sizes above 16mm only.

11.3 Hardness (Brinell) - for information only

When tested in accordance with IS: 1500, the material shall have a Brinell hardness in the range of 245 – 310 BHN.

Note: In lieu of IS:1608, IS:1757 & IS:1500, any other National or International may be used.

12.0 NON-DESTRUCTIVE TEST

12.1 Verification test of all bars.

12.2 100% Ultrasonic inspection of all bars according to EN 10308 type 1a-1c (table 1). Acceptance criteria shall be quality class 4 according to EN 10308 (table 2). In general, the decision limits for loss of back wall echo is 4 dB for all bar dimensions. Every linear or surface-like in-homogeneity larger than 10mm in any direction is not acceptable.

13.0 RETESTS

As per EN10021.

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14.0 TEST CERTIFICATE:

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

In addition the supplier shall ensure to enclose one copy of test certificate alongwith their dispatch documents to facilitate quick clearance of material.

The test certificate shall bear the following information:

BHEL references:

BHEL order No.

AA10622 (Rev.No.10):ALLOY STEEL BARS FOR HIGH TEMPERATURE BOLTS UPTO 565° C – H&T (20CrMoVTiB4 – 10)

Supplier References:

Supplier's Name

Heat or Cast No.

Process of manufacture

Identification No.

Particulars of heat treatment and Batch No.

Results of Tests:

Chemical analysis

Non-destructive tests

Mechanical properties

Results of dimensional inspection

The certificate must be signed by the Chief, Inspection Department / Chief Metallurgist of the supplier's plant.

15.0 PACKING AND MARKING

Bars shall be suitably packed to prevent corrosion and damage during transportation.

Bars over 63 mm diameter shall be individually stamped / painted on one end face with cast number and AA10622.

Bars of 63 mm diameter and less shall be bundled together and identified by means of a metal label stating the cast number and specification No. AA10622 attached to the bundle.

Each package shall, in addition bear the following information:

AA10622:Alloy steel bars for high temperature bolts up to 565 °C-H&T(20CrMoVTiB4 – 10)

BHEL Order No.

Cast / Batch No.

Identification No.

Weight.

Supplier's Name.

16.0 REFERRED STANDARD (Latest publications including amendments)

1) IS:1500

2) IS:1608

3) EN10021

4) EN 10204

5) EN 10308

6) EN10083-1

7) IS 1757