



PLANT PURCHASING SPECIFICATION HYDERABAD

HY10765

REV. NO: 03

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VACUUM DEGASSED STAINLESS STEEL BARS FOR STEAM TURBINE SHROUDING, HARDENED AND TEMPERED (GRADE : X20 Cr 13V)

1.0 GENERAL:

This specification governs the requirements of vacuum degassed, hot rolled/cold rolled, hardened & tempered, stainless steel bars of grade X20 Cr 13 for steam turbine shrouding.

2.0 APPLICATION:

For steam turbine shrouding.

3.0 CONDITION OF DELIVERY:

Hot rolled/cold rolled, hardened & tempered.

4.0 COMPLIANCE WITH STANDARDS

This specification complies in general with TLV:9238 01/07 Sep. 90 of M/s. Siemens, Germany.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Dimensions: As specified in the order. Unless otherwise specified in the order, the bars shall be supplied in random lengths of 3 to 6 metres with a maximum of 10% shorts down to 1 metre.

5.2 Tolerances: The tolerances on width and thickness of the flat bars shall be as follows:

For cold rolled bars:

<u>Size</u>	<u>Tolerance on width</u>	<u>Tolerance on thickness</u>
All sizes	+ 0.2 0	+ 0.1 0

Revisions:
Modified clause 3.0 and 5.0

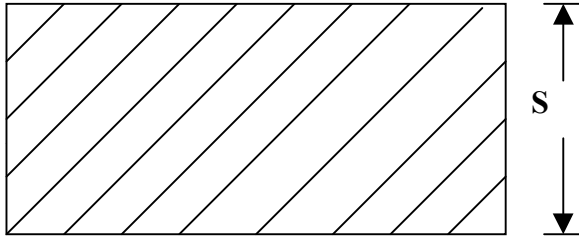
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For hot rolled bars:



b

'b' width across flats, mm	Allowable Deviation On 'b' mm	'S' thickness mm	Allowable deviation on 'S' mm
Upto 35	+ 1.5	Upto 20	+ 1.0
Over 35 and upto 75	+ 2.0	Over 20 and upto 40	+ 2.0
Over 75	+ 3.0	Over 40	+ 3.0

6.0 MANUFACTURE:

The steel shall be manufactured by basic electric furnace process and subsequently vacuum degassed.

7.0 HEAT TREATMENT:

The recommended heat treatment cycle shall be as follows:

Harden in air or oil at 980-1030° C

Temper at not less than 650° C

Soak for a minimum of 2 hours –cool in air.

The details of the actual heat treatment cycle followed shall be furnished in the test certificate.

8.0 FREEDOM FROM DEFECTS:

The bars shall be free from cracks, scabs, seams and other harmful defects.

9.0 FINISH:

The surface of the bars shall be smooth without any laps, rolled in scales etc. Dents, roll marks and scratches are permitted provided their depth does not exceed half the tolerance limits in clause 5



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The edges of bars shall be cut square by sawing or shearing and no crop ends shall be permissible.

10.0 TEST SAMPLES:

10.1 For Chemical Analysis: One test sample for chemical analysis shall be taken from each melt.

10.2 For Mechanical Tests:

10.2.1 One sample per size belonging to the same melt and heat treatment batch shall be taken for mechanical testing.

10.2.2 The test specimen shall be concentric with the bars for sectional dimension upto 40 mm. For sectional dimension exceeding 40 mm, the specimen location shall be $1/3^{\text{rd}}$ the radius below the bar surface.

11.0 CHEMICAL COMPOSITION:

The melt analysis of the material shall be as follows:

Element	C	Si	Mn	Cr	Ni	P	S
%min.	0.17	0.10	0.30	12.50	0.30	-	-
%max.	0.22	0.50	0.80	14.00	0.80	0.030	0.020
Permissible variation in product Analysis	±0.02	±0.05	±0.04	±0.15	±0.03	+0.005	+0.005

12.0 MECHANICAL PROPERTIES:

The material shall comply with the following mechanical properties.

Tensile Strength N/mm ²	0.2% Proof Stress N/mm ² Min.	%Elongation (L=5d) Min.	% Reduction in area of Cross section Min.
800 - 950	600	15	50

NOTE: 1) The tensile test shall be carried out in accordance with IS:1608 or any reputed national standard.

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13.0 RETESTS:

- 13.1** If any of the test specimen fails to meet the requirements specified in cl. 12, the sample bar from which the test specimen was cut shall be rejected and two further sample bars from the same lot shall be taken for retest.
- 13.2** If the retests also fail, manufacturer is at liberty to reheat-treat the bars in question. Not more than two reheat treatments are allowed. However, retempering is not considered as reheat treatment.
- 13.3** If after re-heat treatment, the mechanical properties are not complied with, the entire lot shall be rejected.

14.0 METALLOGRAPHIC TEST:

- 14.1 Microstructure:** The micro structure shall be studied on the fractured tensile or impact specimens and the photomicrographs shall be furnished to B.H.E.L. The microstructure shall show predominantly tempered martensite. The average austenitic grain size of the steel shall be five or finer when tested as per ASTM: E112.
- 14.2 Non-metallic Inclusions:** The sample for testing shall be taken in longitudinal direction. When tested as per ASTM: E45, part III, the inclusion rating should not exceed the following norms:

‘A’ Sulphide type : Thin series 2

‘B’ or ‘D’ Globular type oxide : Thin series 2

‘C’ Silicate type: Thin series 2

However, any one of the above can be allowed upto 2.5, provided the other two do not exceed 2.

15.0 ULTRASONIC TEST:

All the bars shall be ultrasonically tested to ensure freedom from defects. The following defects shall be unacceptable.

- i) Cracks, flacks, seams and laps.
- ii) Defects giving indications larger than that from a 4 mm diameter equivalent flaw.
- iii) Groups of defects with maximum indication less than that from a 4 mm diameter equivalent flaw which can not be separated at testing sensitivity if the back echo is reduced to less than 50%.
- iv) Defects giving indications of 2 to 4 mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.



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16.0 INSPECTION AT SUPPLIER'S WORKS:

The representative of BHEL shall have free access to the supplier's works at all times during the execution of the order, to satisfy himself that the material is produced as per the quality requirements of this specification. All reasonable facilities shall be extended to him, free of charge. He may also witness the sampling, testing and marking called for in this specification.

17.0 TEST CERTIFICATE:

Five copies of the test certificate shall be furnished giving the following details:

- Specification No. HY10765 Rev.03
- BHEL Order No.
- Name of the supplier
- Melt No.
- Heat treatment batch no.
- Process of Manufacture
- Results of chemical analysis and mechanical tests
- Results of Metallographic and Ultrasonic tests with representative photomicrographs.

18.0 PACKING AND MARKING:

18.1 Marking: All bars with cross-sectional size greater than 50 mm shall be stamped with the melt number, specification number and supplier's trade mark on both the end faces of the bars.

Bars of sectional size 50 mm and below shall be bundled as per each size and a metal label bearing the following information shall be securely attached to each bundle.

- BHEL Order No.
- BHEL Specification No. HY10765 Rev.03
- Melt No. & Heat treatment batch no.
- Size & Weight
- Supplier's trade mark.

18.2 Packing: The bars shall be suitably packed to prevent corrosion and damage during transit.

19.0 REJECTION:

In the event of any material proving defective during the course of further processing or testing, such material shall be rejected and the supplier shall make immediate arrangements to replace the same free of cost.