Tender No. F/F219/24/0530/K2

BHARAT HEAVY ELECTRICALS LIMITED
HEEP HARIDWAR INDIA-PIN 249403
FAX NO: 0091 1334 226462/223948
PHONE NO: 0091 1334 284144

Sub: Requirement of H/R Sheet (Alloy Steel)

The Heavy Electricals Equipment Plant (HEEP) located in Haridwar, India is one of the major manufacturing plants of Bharat Heavy Electricals Ltd. The core business of HEEP includes design and manufacture of large steam turbines, turbo generators and so on.

Bids are invited for following items through GeM Portal- https://gem.gov.in

Item Description	Mat. Code	Size (mm)	Qty. (Kg)	Delivery (Requirement)	Delivery Period (Days from PO Placement)
H/R Sheet/Plate Alloy Steel **Specification-** 0500.218 Rev 02 **Grade: ST-1X11MF-HR**	HW1061893014	**5 x 54 x (500-2000)**	1200	15/02/2025	90

Remarks-

1. Delivery period mentioned in enquiry is indicative, bidders to quote their best possible delivery.
2. Quantity tolerance ±10% is acceptable in view of dimensional tolerances.
3. **Sheets as per Specification HW10687 are also acceptable as an alternate to Specification 0500.218.**
4. **Vacuum Degassed steel is acceptable for specification HW10687 as well as 0500.218.**
5. **Sheets to be supplied in size 5 x 54 x (500-2000) mm.**
6. **Dimension tolerance shall be as per Specification 0500.218.**
7. Breach of Contract:

   In case of breach of contract, wherever the value of security instruments like performance bank guarantee available with BHEL against the said contract is atleast 10% of the contract value, the same be encashed. In case the value of the security instruments available is less than 10% of the contract value, the balance amount be recovered from other financial remedies (i.e. available bills of the contractor, retention amount, etc. with BHEL) or legal remedies be pursued. The balance scope shall be got done independently without Risk & Cost of the failed supplier/ contractor. Further, levy of liquidated damages, debarment, termination, de-scoping, short-closure, etc., shall be applied as per provisions of the contract. Accordingly, recovery of an amount equivalent to 10% of the contract value shall be made in case of breach of contract.
8. Payment terms shall be as follows:

Type of Bidder	Payment Terms (Number of days)
Micro & Small Enterprises (MSEs)	45 days
Medium Enterprises	60 days
Non MSME	90 days

Note: Benefits of MSE (such as EMD Waiver, Tender fee exemption, Price preference, Payment preference etc.) will be given only to those MSE Vendors who are manufacturers of offered items against the NIT. No MSE benefits shall be provided to Agents / Stockists / Dealers / Traders etc. for the items offered but not manufactured by themselves**.**

9. "A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices to the detriment of Procuring Entity's interests. **The bidder found to have a conflict of interest shall be disqualified.** A bidder may be considered to have a conflict of interest with one or more parties in the bidding process, if"

a. They have controlling partner (s) in common; **or**

b. They receive or have received any direct or indirect subsidy/financial state from any of them; **or**

c. They have the same legal representative/ agent for purposes of this bid; **or**

d. Thy have relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder; **or**

e. Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all bids in which the parties are involved. However, this does not limit the inclusion of the components / sub-assembly/ Assemblies from one bidding manufacturer in more than one bid; **or**

f. In cases of agents quoting in offshore procurements, on behalf of their principal manufacturers, one agent cannot represent two manufacturers or quote on their behalf in a particular tender enquiry. One manufacturer can also authorize only one agent / dealer. There can be only one bid from the following:
   1. The principal manufacturer directly or through one Indian agent on his behalf; and
   2. Indian/ foreign agent on behalf of only one principal;

   or

g. A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; **or**

h. In case of a holding company having more than one independently manufacturing units, or more than on unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidder must proactively declare such sister/ common business/ management units in same/ similar line of business."

10. Rest terms & condition shall be as per latest GeM GTC.

11. Testing and certification as per ordering specification and documents.

Pre- Qualification Requirements

Specification: 0500.218

Item Details: Hot/Cold Rolled Steel Flats / Sheets

Clause		Pre-Qualification Requirement	Details to be submitted	Vendor's response
1		Vendor must have manufactured and supplied flats / sheets in material grade X22CrMoV121 / P91 / P92 or equivalent Cr-Mo-V Creep resistant steel against at least one purchase order in the last 10 years from enquiry issue date. Material supplied in hardened and tempered condition will only be considered for experience.	Vendor to submit at least one purchase order copy and its correlated test certificate	
2		Vendor to confirm that they have in house melting & refining, rolling and heat treatment facility to manufacture enquiry material and dimensions. In case of outsourcing of any manufacturing operation, vendor to inform operation outsourced with details of their sub supplier and its manufacturing facility and experience for the same.	Vendor's confirmation & in-house facilities for melting & refining, rolling and heat treatment are to be submitted.	
3	a	Vendor to confirm that they have inhouse testing facilities as per the requirement of enquiry specification.	Vendor's confirmation a testing facility details are to be submitted	
	b	In case of outsourcing of any test, vendor to agree to carry out testing at NABL / Govt. / any other lab accrediting agency like ILAC/APLAC etc. approved labs only.	Vendor's confirmation required	

Sl. No.	Quality Requirement	Vendor's confirmation (Y/N)
01	Testing and certification as per ordering specification and documents.	

Signature with stamp
Name:
Name of Firm:
Designation:
Date:

(Self-Certification for local content)

In line with Government Public Procurement Order 2017 dated 16.09.2020, we hereby certify that we

…… (supplier name) inform that local content is ……..……..% (indicate percentage of local content) and are

Class- I local supplier (meeting requirement of)-

Minimum Local content 50% ☐

or

Class- II local supplier (meeting requirement of)-

Minimum Local content 20% ☐

(mark wherever applicable)

defined by Nodal Ministries/ Departments as per above order for the material against Enquiry No.

……
Details of location at which local value addition will be made is as follows:

……

……

……

We also understand, false declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.

Seal and Signature of Supplier

(Specifications)

a. **0500.218 Rev 02**
b. **HW 10687 Rev 08**

540 N/mm^2 0.2% Proof stress 11% Cr-Mo-V Steel (For band segments of Steam Turbine)

1. GENERAL

This specification governs the quality of of creep-resistant Cr-Mo-V-Nb steel flat products (eg. sheet, strip plates).

2. APPLICATION

The flat products are required for machining and punching of band segements of rotor blades.

3. CONDITION OF DELIVERY

Hot rolled/cold rolled in heat-treated condition.

4. DIMENSIONS AND TOLERANCES

4.1 Sizes

Flat products shall be supplied to the dimensions as specified on the order.

4.2 Tolerances

Tolerances on the thickness of flat product shall be as per annexure-I.

5. MANUFACTURE

Steel shall be made by basic electric furnace, subsequently it should be remelted by electro-slag refined process or vacuum remelting. Any other process of manufacture is subjected to mutual agreement between BHEL & suppliers.

6. FREEDOM FROM DEFECTS

Surface of flat products shall be free from blisters, skin cavities, cracks, laps, laminations etc.

Flat products shall be completely free from laminations, cracks, hairline cracks, laps, scabs and inclusions etc.

7. FINISH

The surface of the flat products shall be smooth and even. Dent, roll marks, ripples, notches shall not be allowed. It can be dressed off with emery paper to a depth not exceeding the minimum tolerances on thickness.

REV.	DATE	REAFFIRMED
02	03.12.18	

TSX	S.KUMAR	Skumar 16.2.80
AGREED DEPTT.	NAME	SIGN & DATE

REVISION (a) SUBMITTED WITHOUT ANY CHANGE

DATE 16.2.80

ISSUED BY : STANDARDS DIVISION

PS 2.60

PREPARED	CHECKED	APPROVED	DATE
			12.10.77

FORM

INVENTORY No Sign & Date P-2052

8. CHEMICAL COMPOSITION

The chemical analysis of the steel shall conform to the following:

Element	Min(%)	Max.(%)
Carbon	0.12	0.19
Manganese	-	0.70
Silicon	-	0.60
Chromium	10.0	11.5
Nickel	-	0.6
Molybdenum	0.60	0.80
Vanadium	0.25	0.40
Sulphur	-	0.025
Phosphorus	-	0.03

9. HEAT TREATMENT

The recommended heat-treatment of the test sample shall be as follows:

Hardening in air or oil 1080-1100°C

Tempering 720-740°C

10 SELECTION OF TEST SAMPLES

Test samples for chemical analysis shall be taken from each heat. Two sample for mechanical testing shall be selected from each heat and each heat-treatment batch.

11. MECHANICAL PROPERTIES

11.1 The mechanical properties after heat-treatment shall show the following properties when tested in accordance with IS:1608.

Tensile strength in N/mm^2 (Kgf/mm^2)	705(72) Min.
0.2% Proof stress in N/mm^2(Kgf/mm^2)	540(55) Min.
Elongation on $5.65\sqrt{So}$	15% Min.
Reduction in Area	50% Min.

11.2 Hardness

When tested in accordance with IS:1500 shall show brinell hardness in the range of 217-255.

12. METALLOGRAPHIC TEST

12.1 The micro-structure of the steel shall be studied and photo-micrograph alongwith report shall be furnished to BHEL. The structure should be free from delta ferrite.

REV. 02 DATE 05.12.18

12.2 Non-metallic inclusions

The test sample shall be taken longitudinal plane midway between the centre and the surface of the material. The rating of the inclusion content shall be based upon the average length of the inclusions the longest inclusion and the general background when tested as per ASTM E45 plate III. The inclusion rating shall not exceed the following:

'A' sulphide type	Thin series -2
'B' or 'D' (Globular oxide or Alumina oxide type)	Thin series- 2
'C' Silicate type	Thin series- 2

12.3 Grain size

The average austenitic grain size of steel shall be between 5 & 8 when tested as per IS:2583/ASTM E 112.

13. ELEVATED TEMPERATURE PROPERTIES

The elevated temperature properties of of the steel after heat-treatment shall be guaranteed by the supplier as per annexure attached to this specification.

14. ULTRASONIC TEST

Each flat product shall be ultrasonically tested to determine its soundness and method of testing shall be mentioned during quotation.

15. INSPECTION AT SUPPLIER'S WORKS

BHEL representative shall have all reasonable facilities afforded to him to satisfy himself that the material is being furnished in accordance with this specification. Test shall be witnessed at supplier's works by BHEL or consultants representative and in such cases the supplier shall notify those concerned when the material is available for inspection and testing.

16. RETESTS

If any of the selected test specimen fails to meet the specified requirements, two test specimens may be selected for retest without reheat-treatment.

If any test specimen fails because of mechanical reasons such as testing equipment failure or improper specimen preparation, it may be described in the test certificate and another specimen taken for testing.

17. TEST CERTIFICATES

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

Test certificates shall bar the following information.

<u>BHEL reference</u>

Purchase order No.

Specification No.

<u>Supplier's reference</u>

Supplier's name

Identification No.

Heat No.

Size and weight of flat products

Heat-treatment details

Process of manufacture

Heat treatment batch No.

<u>Test results</u>

Chemical composition

Mechanical properties

Micro-structure report, grain size and non-metallic inclusions.

Ultrasonic reports.

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

18. PACKING AND MARKING

The melt number, specification number, grade of steel, indentification number, batch no. and inspecting authority stamp shall be stamped on the flat products along the rolling direction or on metallic tags attached to the flat product wherever not possible to stamp on flat products and bordered by white paint.

In addition to the above the supplier's name purchase order number, size and net weight of the flat product shall be painted on the top of all the plates and further protected by cost of transparent varnish.

The transportation of the plates shall be made in separate package each package containing the plates of the same heat, same batch or heat-treatment and size. The flate product shall be preserved against corrosion and damage during transportation.

ANNEXURE - I

TOLERANCE ON DIMENSION OF SHEETS

Thickness/ in mm.	Width in mm.	HOT ROLLED		COLD ROLLED
		Width less than 1000mm	Width 1000mm and over	All widths
0.2-04		± 0.07	± 0.07	± 0.03
0.50		± 0.08	± 0.08	± 0.04
1-1.1		± 0.12	± 0.12	± 0.07
1.5		± 0.15	± 0.15	± 0.11
2.8-3.0		+ 0.17 - 0.22	± 0.22	± 0.16
3.8-4.0		+ 0.20 - 0.10	+ 0.20 - 0.10	± 0.20
5.0-5.5		± 0.3	± 0.4	-
6.0-7.0		+ 0.3 - 0.6	+ 0.4 - 0.6	-

INVENTORY No Sign & Date

P-2052

REV. DATE

02 03-12-18

FORM

ANNEXURE - II

ELEVATED TEMPERATURE PROPERTIES

1. **Stress rupture**

Temperature °C	Stress rupture in N/mm^2 (Kgf/mm^2) in 100,000 hrs.
550	150 (15-13)

2. **Creep properties**

Temperature °C	1% creep in N/mm^2 (Kgf/mm^2) in 100,000 hrs.
550	90 (9)

REV.	DATE
02	03.12.18

भा एच ई एल BHEL

संस्थान क्रय विनिर्देश (हीप - हरिद्वार)

PLANT PURCHASE SPECIFICATION
(HEEP - HARIDWAR)

HW 10687
मुख्य पृष्ठ
PREFACE SHEET

हस्ताक्षर एवं दिनांक SIGN & DATE

सामग्री सूची संख्या को अधिक्रमित करता है SUPERSEDES INVENTORY NO.

हस्ताक्षर एवं दिनांक SIGN & DATE

सामग्री सूची संख्या INVENTORY NO. P-2021

HEAT RESISTANT STEEL BARS FOR TURBINE BLADES
GRADE: X22CrMoV121 +QT2

केवल आंतरिक प्रयोग हेतु
प्रदायक को देने से पूर्व मुख्य पृष्ठ को निकाल दें
FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS.

समतुल्य मानक सूची आदि /
COMPARABLE STANDARDS / CATALOGUES ETC.

सुझाए संम्भावित प्रदायक एवं श्रेणी /
SUGGESTED / PROBABLE SUPPLIERS AND GRADES. : As Per PMD

कोई अन्य जानकारी
ANY OTHER INFORMATIONS : Based on TLV9248, 06, Dec'2013

			स्वीकृति : संस्थान मानक समिति. APPROVED : PLANT STANDARDS COMMITTEE		Gr. No. 2.60
REV: 08 Dt. 14.5.17			निर्माण PREPARED : MTE	जारी : मानक विभाग ISSUED : STANDARDS DIVISION	दिनांक DATE 31.12.1985

दिनांक एवं हस्ताक्षर SIGN & DATE	संस्थान क्रय विनिर्देश (हीप : हरिद्वार) **PLANT PURCHASE SPECIFICATION** **(HEEP: HARIDWAR)**	**HW10687** पृष्ट का Page 1 of 8

सामग्री सूची संख्या को अधिक्रमित करता है: TLV9248/06, Dec'13
SUPERSEDES INVENTORY NO.

HEAT RESISTANT STEEL BARS FOR TURBINE BLADES
GRADE: X22CrMoV121 +QT2

1.0 General:

This specification governs the quality of Steel rectangular bars in steel grade X22CrMoV121, material no. 1.4923 EN10269.

2.0 Application:

For machining of blades for Steam Turbine.

3.0 Condition of Delivery:

Rolled or Forged and Heat Treated.

4.0 Dimension and Tolerances:

Dimensional tolerance, straightness, twisting and bulging limits shall be as per HW0993008.

5.0 Manufacture:

Degassed steel (e.g. vacuum degassed) shall be used. Cast ingot is to be used as initial material for production of the bars.

The manufacturing process must ensure a homogenous grain structure over the entire length of the bar and the bar cross section.

6.0 General Requirements:

- Prerequisite requirement for approval of a new vendor is a successful Process qualification. Manufacturing process established during this shall be the basis for future manufacture. Manufacturing plan shall be prepared and submitted after successful process qualification. Manufacturing plan shall include specific information on manufacturing like rolling temperature, reduction ratio, heat treatment temperature, hardening method and soaking time, rate of heating and cooling etc. Test instructions for nondestructive and destructive testing are to be provided in the manufacturing and testing plan.
- Product and process qualification is mandatory for each of the supplier's manufacturing plants.
- For new supplier, process qualification shall be required for three purchase orders.
- If necessary, BHEL may ask for process qualification for verification of manufacturing reliability from regular suppliers also.
- Any change in the agreed manufacturing plan shall be informed to BHEL. BHEL will review the requirement of renewed process qualification.

				नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
TSX	V.Srivastava				
PSC	G.KRISHNAN		अनुवादक TRANSLATED BY		
QAX	U. K. PANDA		निर्मितकर्ता WORKED BY	ASHISH RANJAN	
STE	P. K. BANSAL		जांचकर्ता CHECKED BY	ASHISH RANJAN	
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	GOPAL KRISHNAN	

REV.NO.	08	स्वीकृति APPROVED : संस्थान मानकीकरण समिति PLANT STANDARDIZATION COMMITTEE		Gr. NO. 2.60
Dt.	4.6.17	निर्माण PREPARED : MTE	जारी ISSUED : TSX	दिनांक DATE : 31.12.1985
CHANGE ADVICE NO.	TSX(MTE)-17-38			

दिनांक एवं हस्ताक्षर SIGN & DATE 4/5/17

सामग्री सूची संख्या INVENTORY NO. P-2006

7.0 Heat Treatment:

Hardening has to be done in accordance with EN 10269 + QT2 in line with Table B .1 (1020 - 1070°C /air or liquid quenching).

Tempering must be done at a temperature ≥ 650°C.

A fully transformed and tempered martensitic microstructure must be present over the entire cross section.

Hardening and tempering in bundles are not allowed. Suitable gaps between two bars are to be ensured during heat treatment for uniformity of properties.

If bars need to be straightened after the heat treatment, a stress relieving heat treatment shall be performed after completion of entire straightening process. Stress relieving is to be carried out at 20 - 30°C below the tempering temperature with a subsequent slow cooling.

The lowest possible residual stresses shall be targeted. Distortion of the finish machined part due to residual stresses from the manufacturing process or heat treatment process shall not occur.

8.0 Properties and their verification:

8.1 Chemical Composition:

Heat analysis in weight %

C	Si	Mn	P	S	Cr	Mo
0.18 - 0.24	0.10 - 0.50	0.30 - 0.80	≤ 0.020	≤ 0.020	11.0 - 12.5	0.80 - 1.20

Ni	V
0.30 - 0.80	0.25 - 0.35

8.2 Properties and Microstructure:

The specimens shall be taken in the longitudinal direction in accordance with Attachment 1. The properties described below shall be determined at room temperature in the delivery condition, i. e. after the last heat treatment including any stress relieving heat treatment.

The metallographic investigations shall be performed on the hardest and softest bar with an area of at least 320mm² each. The areas to be investigated must be in the longitudinal direction. The longitudinal direction must be indicated in the documentation.

8.2.1 Mechanical Properties:

Hardness of the bars in a test unit shall be verified by Brinell hardness testing in accordance with ISO 6506 -1, HBW10/3000 or HBW 5/750 may be used.

The surface of the bar shall be prepared in the area of the hardness measurement so that the result is not affected by the surface condition

Hardness testing shall be performed on 10% of each test unit but at least on 10 bars or on each bar if test unit is less than 10 bars. The greatest resulting difference in hardness shall not exceed 35HBW.

Mechanical properties shall be determined on the hardest and softest bar determined in a test unit.

Tensile testing shall be performed in accordance with ISO 6892 -1 or ASTM E8M (round specimen with L_0 = 50mm and d_0 = 10mm) or ASTM E8M (standard specimen in accordance with figure 8).

Standard specimens Charpy (V-notch) in accordance with ISO 148 -1 shall be used for determining the absorbed impact energy.

The following properties must be achieved at room temperature:

0.2 % Proof Stress (N/mm^2)	Tensile Strength (N/mm^2)	Elongation After Fracture (%)	Reduction in area %	Impact Energy (J)[1]	Hardness HBW
≥ 700	900 - 1050	≥ 11	≥ 35	≥ 20	265 - 310

[1] Average of 3 specimens and minimum value for two specimens in accordance with EN10021, where the lowest value shall be at least 14 Joule.

8.2.2 Microstructure:

Microstructure must be uniform, without porosity, excessive segregation or other inhomogeneities.

8.2.2.1 Cleanliness:

The cleanliness shall be determined as per ASTM E45 method A. Acceptance criteria:

Inclusion: Thin Series

Type A, B, C: 2 max Type D: 2.5max

Inclusions: Heavy Series

Type A, B, C, D: 1.5max

Maximum Number and dimension of globular inclusions (type D)

IR (D) = n1 + 2.5n2, IR (D) is converted to an area of $160mm^2$

IR (D) ≤ 10

n = number of globular inclusions

n1 (25-50 µm); n2 (51-75 µm)

Any material discontinuities present at the inclusion must also be accounted for in determining the size of the globular inclusion.

Inclusions > 75 µm, inclusing any material discontinuities are not allowable.

8.2.2.2 Delta Ferrite content and grain size:

- **Delta ferrite content shall be < 5%.** The determination of delta ferrite content shall be performed based on analysis methods in accordance with ASTM E45 Method A, "Worst field method" with V=100:1.
- **An average grain size of 4 or finer** has to be achieved. Grain size shall be determined on the martensitic secondary grain structure in accordance with ASTM E112 or ISO643. A deviation of more than 2 grain sizes in size of individual's grains from the average grain size is not allowable.

SUPERSEDES INVENTORY NO.

सामग्री सूची संख्या को अधिक्रमित करता है

8.3 Non-destructive Testing:

8.3.1 Test Scope:

The following Non-destructive inspection shall be performed in the as delivered condition:

- Visual inspection of all bars
- Ultrasonic examination of all bars in accordance with TWP1204. 100% of the volume must be tested in accordance with the recording level.

8.3.2 Recording level and acceptance criteria:

- Indications of surface defects such as rolled marks shall be ground out to investigate their depth at least at both ends, in the middle of the indication and at an interval of approx. 250mm.
- Surface defects with a depth extension of ≥ 1mm are not allowable, and these areas shall be cut out of the bar.
- Ultrasonic examination of all bars in accordance with TWP 1204.
- Defects above the recording level are not acceptable.
- It shall be confirmed in writing to the BHEL that bar sections containing defects above the recording level have been cut out of the bar.
- The acceptance of material at vendor's works does not relieve the supplier of his responsibility for defects discovered at later stages.

8.3.3 Material Identity Test:

An identity test must be conducted in the as – delivered condition on all bars.

9.0 Process Qualification:

In addition to testing as per clause 8.0 of this specification, following additional testing shall be performed in process qualification (see Attachment 2). **All test results carried out during process qualification shall be submitted to BHEL for approval.**

- **Tensile tests[1]:**
  The strength values (0.2% Proof Stress and Tensile Strength) in the transverse direction (specimen orientation ZQ) shall not differ by more than 10% from the corresponding longitudinal values.
- The absorbed impact energy in the transverse direction (KQ 1 -3) should not differ by more than 25% from the values in the longitudinal direction (Kl at room temperature).
- **FATT:** Determination of FATT (fracture appearance transition temperature) in accordance with ASTM A370. The FATT should be preferably evaluated based on SEP 1670 (software) method. The test scope must include at least 10 specimens. FATT < 25°C is to be achieved.

In accordance with ISO 6892 -2, a tensile test (in longitudinal direction) has to be performed at 600°C. The following properties must be achieved:

0.2 % Proof Stress (N/mm^2)	Tensile Strength (N/mm^2)	Elongation After Fracture (%)	Reduction in area (%)
≥ 285	≥ 380	≥ 18	≥ 60

[1] **For case where standard specimens in transverse direction cannot be made: -**

- For tensile test specimens, a round specimen with L_0 = 5 d_0 or a flat specimen with a proportionality factor of k= 5.65. Proportional specimens in accordance with Fig 8 shall be used if ASTM E8 is applied.
- An undersized specimen in accordance with ISO 148 -1 for impact test specimen. Undersize dimension to be reported.
- If dimension do not allow testing in the transverse direction, even with special specimen, testing will be carried out in the longitudinal direction only.

हस्ताक्षर एवं दिनांक SIGN & DATE 15/6/17

सामग्री सूची संख्या INVENTORY P-2086

Intergranular Fracture:

The fraction of Intergranular fracture shall be determined over the entire brittle fracture portion of the fracture surface of the impact test specimens tested at room temperature. The fraction of Intergranular fracture shall not exceed 10%. This test is not required for materials which indicate ≥90% ductile fracture at room temperature.

Magnetic Particle Test:

Performance of MT testing by the magnetic flux leakage method, alternating current phase shifted and a field strength of 20 – 65A/cm.

Distribution, type and size of grain structure in-homogeneities (e.g. segregation or delta ferrite) shall not result in MT indications.

10.0 Identification Marking:

All bars are to be marked with following information:

- Purchase Order Number
- Size
- Material Grade
- Supplier Identification

The details are to be clearly stamped and encircled by oil paint. Each bar shall be painted with gold colour on both ends. All the bars shall be suitably packed to protect them against corrosion and damage during transportation.

Bars having maximum and minimum hardness (from which test samples are taken) shall be clearly marked by oil paint for easy identification. Their respective hardness values shall also be punched on these bars.

11.0 Documentation:

Prior to, but in no case later than the delivery of the material, an inspection certificate as per EN 10204 shall be provided to BHEL in duplicate; this certificate must contain the following data:

(a) Material code no and P.O. number
(b) Material designation
(c) Heat no., heat analysis and melting methods
(d) Complete information on all heat treatments performed
(d) Mechanical test results including hardness range and the metallurgical examination.
(e) Results of non-destructive tests, UT inspection report
(f) Confirmation of the material identity check
(g) Confirmation of the dimensions and visual inspection

12.0 Cross Referred Standards:

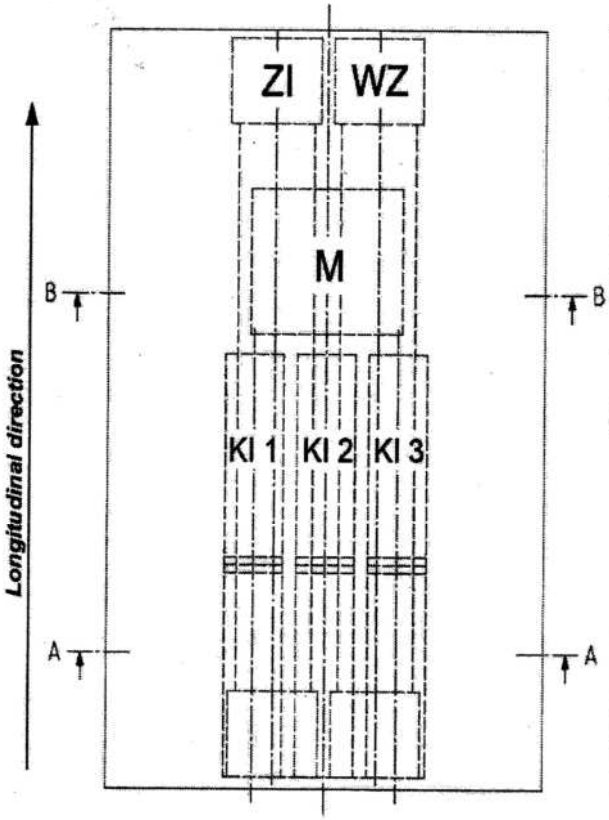
EN10269, HW0993008, ISO 6506-1, ISO 6892, ISO 148-1, ASTM E8M, EN10021, ASTM E45, ASTM E112, ISO 643, TWP1204, ASTM A370, SEP1670, EN10204

13.0 Modification with respect to last revision:

- Clause 8.3 modified.

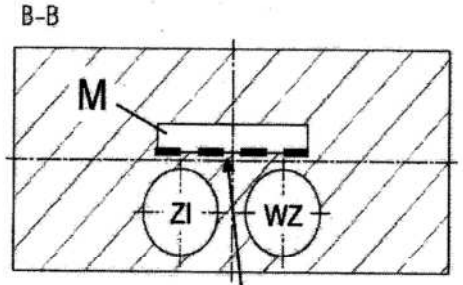
Attachment 1

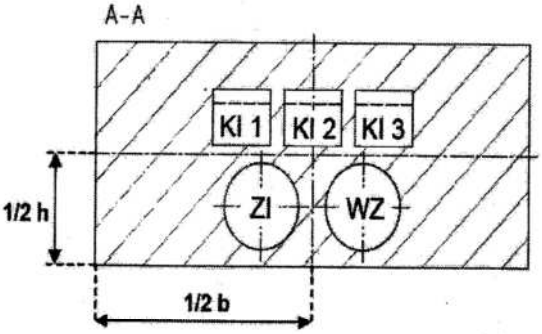
Standard Testing



Label	Specimen
ZI	Tensile Specimen Centre
WZ*	Hot Tensile Specimen
KI 1 - KI 3	Notched Impact Specimen Centre
M	Metallographic Specimen

* if required in material specification

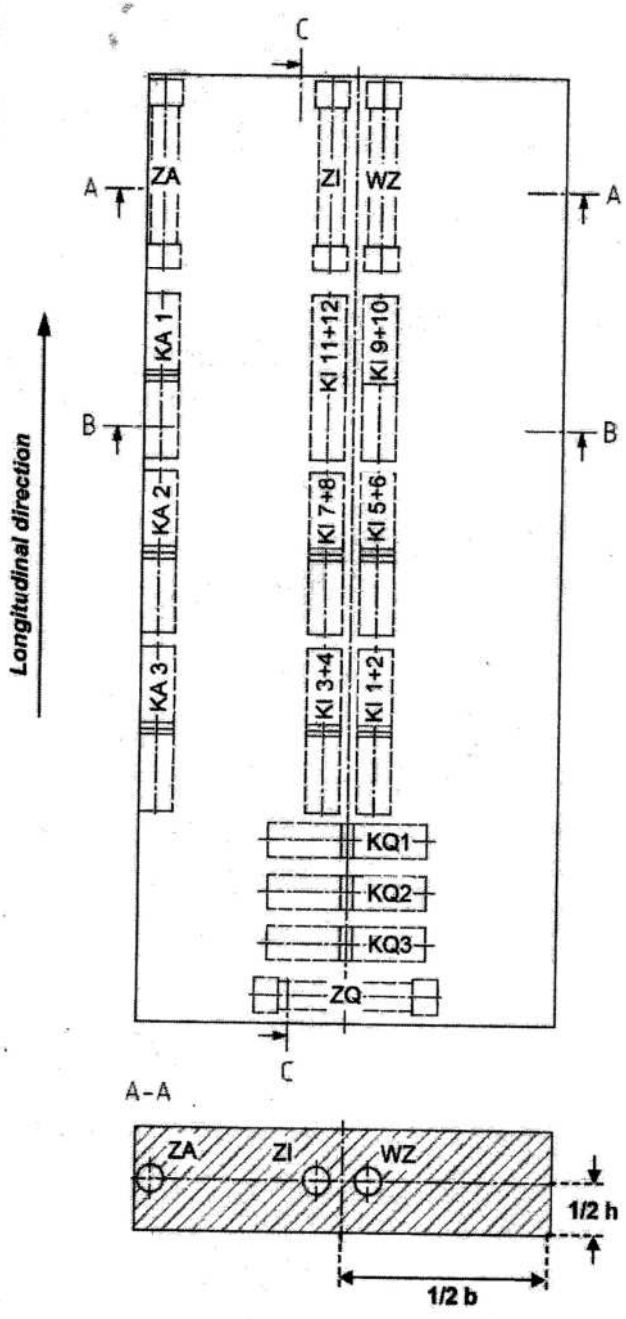




***Lower Surface** of the Metallographic Specimen has to be examined. Longitudinal direction must be indicated in the documentation. A ≥ 320 mm²*

Attachment 2, Page 1/2

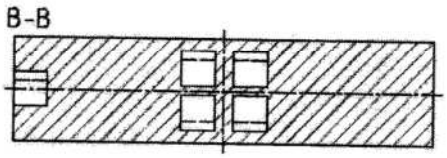
Process Qualification

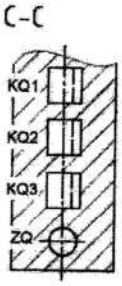


Label	Specimen
ZI	Tensile Specimen Centre
ZA	Tensile Specimen Rim
ZQ	Tensile Specimen Transverse
WZ*	Hot Tensile Specimen
KI 1 - KI 12	Notched Impact Specimen Centre (FATT)
KA 1 - KA 3	Notched Impact Specimen Rim
KQ 1 - KQ 3	Notched Impact Specimen Transverse

* if required in material specification

Note the notch positions of the notch impact specimens (see B - B and C - C).

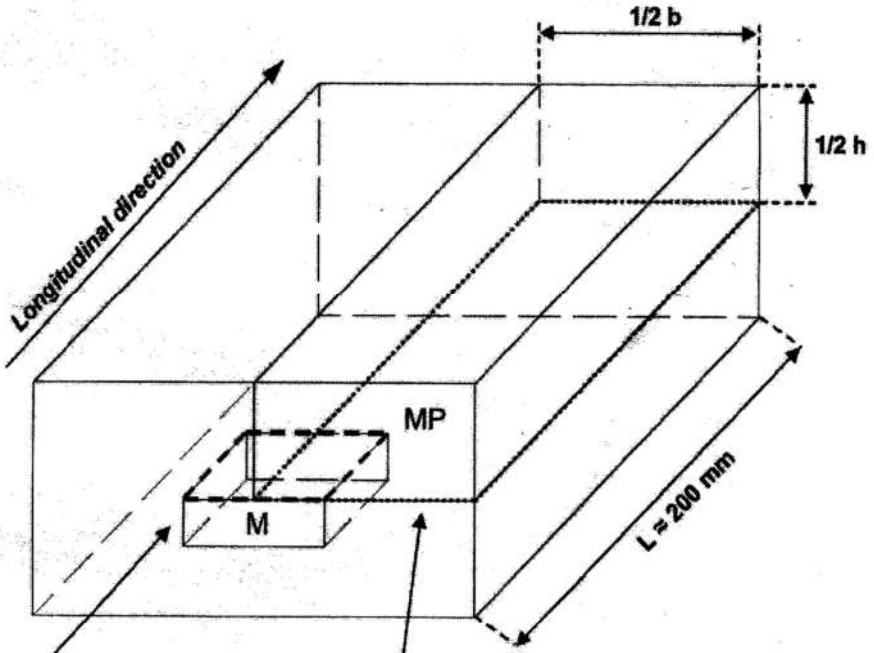




Attachment 2, Page 2/2

Process Qualification

Label	Specimen
M	Metallographic Specimen
MP	Specimen for Magnetic Particle Test



Upper Surface of the Metallographic Specimen has to be examined. Longitudinal direction must be indicated in the documentation. A ≥ 320 mm²

Lower Surface of the specimen has to be examined in Magnetic Particle Test .