Tender No. F/F219/24/2081/K1

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

Sub: Requirement of BOSS (manufactured from Forging)

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 Sl. No.	Item Description	Mat. Code	Drawing No.	Qty. (No)	Delivery
1	**BOSS as per DRG: 31350101441 Rev-00** Forging as per Spec no AA19331 **Testing as per HW0850192 Specification-AA19331 Rev:11**	W90413501175	31350101441	Lot 1- 64 No. Lot 2- 64 No.	Lot 1-15/03/2025 Lot 2-30/05/2025

Remarks-

1. Delivery period mentioned in enquiry is indicative, bidders to quote their best possible delivery.
2. Item to be supplied as per drawing & Specification/Testing standard (drawings, standard & Specification attached).
3. Please note that the testing norms mentioned in the Drawing TR will supersede the testing norms mention in the specification. Same is clearly mentioned in the TR. Hence testing of the item will be done as per **HW0850192.**

4. **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 may be made in case of breach of contract.
5. **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.*

6. "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."

7. Rest terms & conditions shall be as per latest GeM GTC.

8. Vendor should raise inspection call for BHEL / TPI inspection at least 4 days in advance to the planned date of inspection. If customer inspection is envisaged at vendor's works, vendor should give inspection call at least 7 days in advance to the planned date of inspection.

Pre- Qualification Requirements

<table>
<tr><th>PQR Clause</th><th colspan="2">PQR</th><th>Vendor's response</th></tr>
<tr><td>1</td><td colspan="2">Experience Requirement
Vendor must have experience of manufacturing and supplying forgings of carbon steel or alloy steel grades in heat treated condition. Vendor must have manufactured and supplied at least 3 forgings in above material grade in last seven years as on date of issue of enquiry.
In support of above, the vendor has to furnish details of 3 forging supplies in the following format.
<table>
<tr><th rowspan="2">PO number</th><th rowspan="2">Material Grade</th><th colspan="3">Dimension (in mm)</th><th rowspan="2">Date of Supply</th></tr>
<tr><th>OD</th><th>ID</th><th>Height</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
In support of experience, vendor to submit following document for at least one forging from the above table:
- Copy of purchase order and its correlated test certificates (duly signed by Third party inspection agency / Customer). Test certificates shall cover chemical composition, heat treatment, mechanical properties, dimensional report, non-destructive test report etc.
- Invoice / dispatch document.</td><td></td></tr>
<tr><td rowspan="3">2</td><td colspan="2">Manufacturing & Testing facility</td><td></td></tr>
<tr><td>a</td><td>Vendor should have in-house forging and heat treatment facility to manufacture forgings of above material grade and enquiry drawing dimension.
Outsourcing of forging and heat treatment is not acceptable. Vendor to confirm.
Details of in-house manufacturing facilities for forging and heat treatment are to be submitted with offer.</td><td></td></tr>
<tr><td>b</td><td><u>Raw material source:</u>
Vendor to submit confirmation and details as per Option 1 or Option 2, as applicable:
<u>Option 1:</u>
Raw material for forging shall be sourced from BHEL approved source listed below. Vendor to confirm (tick mark applicable).
<table>
<tr><td>CFFP, BHEL, Haridwar</td><td>☐</td><td>Mahindra Sanyo</td><td>☐</td><td>Arcvac Forge Cast Ltd.</td><td>☐</td><td>MIDHANI</td><td>☐</td><td>BGH GmbH</td><td>☐</td><td>Laxcon</td><td>☐</td><td>Goradia</td><td>☐</td><td>RMG Alloy</td><td>☐</td></tr>
<tr><td>Saarloha Special Steel</td><td>☐</td><td>Starwire India</td><td>☐</td><td>SAIL</td><td>☐</td><td>Metal Ravne</td><td>☐</td><td>BOHLER</td><td>☐</td><td>Sunflag Iron</td><td>☐</td><td>ISMT</td><td>☐</td><td>Saurabh Metal</td><td>☐</td></tr>
</table>
<u>Option 2:</u>
Raw material from other than above listed vendor can also be considered with following condition:
- Vendor to submit details of their source for carbon steel with details of their steel melting and refining facility.
- At least one mill test certificate of ingot/billet/bloom of carbon steel supplied by this source.</td><td></td></tr>
<tr><td>c</td><td>Vendor to confirm that they have all testing facility (in-house / outsourced) to carry out testing as per enquiry drawing and specification. In case of outsourcing of any test, vendor to agree for testing at NABL accredited labs only.</td><td></td></tr>
</table>

(Quality Requirements)

Sl. No.	Quality Requirement	Vendor's confirmation (Y/N)
1	Pre-dispatch Inspection by BHEL/ BHEL TPIA as per BHEL approved Quality Plan.	
2	Vendor to submit Quality Plan for BHEL approval (BHELQP format attached).	

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

(Quality Plan Format)

To be filled and signed by bidder for BHEL approval

MANUFACTURER'S NAME AND ADDRESS			QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME	ITEM		QP NO.			
				REV			
		DRG. NO.	AS PER PO				
		SPEC.	AS PER PO				
		REV		Page 1 of 1			

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11

Note: All page of inspection documents shall be numbered in chronology with the QAP clause , dully mentioning the corresponding QAP clause nos. at the top of each page. One index page containing the documents descriptions, their page no & QAP clause shall be attached upfront the inspection documents.

		LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	
MANUFACTURER/SUBCONTRACTOR				APPROVED BY

(Specification/Standards)

Spec: AA19331 Rev:11,
Standards: HW0400397, HW0850192

[redacted]

भेल BHEL	CORPORATE PURCHASE SPECIFICATION	AA 193 31
		Rev. No. 11
		PREFACE SHEET

CARBON STEEL FORGINGS, CLASS 2

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 2004 - 1991 Class 2 (20C8),

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : PS 10124, PS 10159206
2. HARDWAR : IS:2004, Class 2
3. HYDERABAD : HY19363, CSN 412020.1, CSN412020.3, SAE1020, IS:2004-Cl 2, CSN411373.0,
4. TIRUCHY : IS:2004, Class 2

REVISIONS : CL. 33. 1. 0, A.1 OF MRC (FCF+HTM)			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (FCF+HTM)		
Rev. No. 11	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt: 30.01.2008	Dt :	Year :	HARDWAR	Corp. R&D	JULY, 1980

03-05-08
CS-1087

[redacted]

CORPORATE PURCHASE SPECIFICATION	AA 193 31
	Rev. No. 11
	PAGE 1 OF 6

CARBON STEEL FORGINGS, CLASS 2 Î

1.0 GENERAL:

This specification governs the quality requirements of Carbon Steel Forgings, Class 2. Î

2.0 APPLICATION:

Suitable for general engineering purposes and for use in welded constructions.

3.0 CONDITION OF DELIVERY:

Normalised / Normalised and tempered..

Rough machining of the forgings shall be carried out, unless otherwise specified in the BHEL order/drawing.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the following National standards and also meet the requirements of this specification.

IS::2004 - 1991 } Carbon Steel Forgings For General Engineering
Gr: 2 (20C8), } Purposes. Î

5.0 DIMENSIONS AND TOLERANCES:

The dimensions and tolerances shall be as specified on the order/ drawing. Wherever these are not specified, specified, the machining allowances and tolerances shall be as specified below:

For finish machined drawings : 3 ± 1 mm

For rough machined drawings : ± 1 mm

03-05-08

CS 1087

REVISIONS : CL. 33. 1. 0, A.1 OF MRC (FCF+HTM)			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (FCF+HTM)		
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Dt. 30.01.2008	Dt :	Year :	HARDWAR	Corp. R&D	JULY, 1980

[redacted]

CORPORATE PURCHASE SPECIFICATION

6.0 MANUFACTURE:

Forgings shall be manufactured from steel produced by the open hearth, electric or such other process as may be agreed to between BHEL and the manufacturer.

Steel shall be fully killed.

Sufficient discard shall be made from each ingot to ensure freedom from pipe, segregation and other defects.

The amount of hot working and finishing temperature shall be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties after heat treatment. The forgings shall not be overheated.

The minimum reduction ratio when forgings are made out of ingots shall be 4:1.

For sizes above 250 mm ruling section, the minimum reduction ratio shall be 3.5:1

Note: Raw material like Ingots/Blooms/Billets required for forgings should be procured from BHEL approved sources along with test certificate."

7.0 FREEDOM FROM DEFECTS:

The forging shall be free from defects, such as cracks, fold, flakes, seams, segregation, nonmetallic inclusions and other injurious defects which may affect the utility of the forging.

8.0 HEAT TREATMENT:

Forgings shall be normalised / normalised and tempered at suitable temperature to achieve the mechanical properties specified.

Test pieces shall also be heat treated along with the forgings they represent.

9.0 FINISH:

As mentioned in the drawing.

10.0 CHEMICAL COMPOSITION:

The melt analysis of the steel and permissible variation in the composition of the forgings from the melt analysis shall be as follows:

Element	Percent		Permissible variation , percent
	min.	max.	
Carbon	0.15	0.25	± 0.02
Silicon	0.15	0.35	± 0.03
Manganese	0.60	0.90	± 0.04
Sulphur	---	0.040	+ 0.005
Phosphorus	---	0.040	+ 0.005

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[redacted]

NOTE:

1. Elements not quoted above shall not be added to the steel, other than for the purpose of finishing the heat and shall not exceed the following limits:

Element	Percent, max.
Nickel	0.30
Chromium	0.30
Copper	0.25
Molybdenum	0.05
Vanadium	0.05
Tin	0.05
Boron	0.0003

2. When steel is aluminium killed or killed with both aluminium and silicon, the requirements of minimum silicon content shall not apply. For aluminium killed steel the total aluminium content shall be with in 0.02 to 0.05 percent.
3. Percent Cu + 10 X (percent Tin) shall not exceed 0.5%.
4. Carbon equivalent (Melt analysis) value (C.E.) = 0.42%, max.

$$C.E. = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

5. Mo ≤ 0.15%, limiting to meeting conditions of Cr + Mo + Ni = 0.5%.

11.0 TEST SAMPLES:

11.1 Unless otherwise specified in the order/drawing, test samples shall be taken from each melt and heat treatment batch. Test samples should be cut from the heat treated forgings by cold process only and shall receive no further heat treatment.

Test samples shall be cylindrical or rectangular in shape and cut at a distance of 12.5 mm below the heat treated surface.

11.2 When integral test pieces are not called for, a test sample, having similar reduction ratio and heat treatment, as the forgings it represents, shall be provided per heat, per heat treatment batch, for check testing at BHEL, along with the forgings. The samples shall be properly identified and correlated with the Heat/Heat treatment batch No./Test certificate No. Test samples shall be taken, at a distance 12.5 mm below heat treatment surface.

11.3 Test samples shall generally be taken in the longitudinal direction. However, for economic reasons or where the size/configuration does not permit the same, test samples may be taken in the transverse or radial direction.

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12.0 **MECHANICAL PROPERTIES :**

The test pieces, after being heat treated as per clause 7.0 above, shall show the following properties upto a limiting ruling section of 800 mm. Properties for thicker sections shall be subject to agreement between BHEL and the manufacturer.

Test methods are specified below:

12.1 Tensile : IS: 1608

12.2 Hardness Test (Brinell) : IS:1500

12.3 Charpy Impact Value (2mm U-Notch) : IS:1499

The test is applicable for forgings of sizes above 16mm only.

Property	Sample (Cl 11.3)	Limiting ruling section, mm		
		Upto & incl.100	> 100 & upto 400	> 400 & upto 800
Tensile strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	430	390	370
Yield strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	230	195	185
Elongation on 5.65vSo gauge length percent, min.	Longitudinal Transverse/ Radial/ Tangential	24 12 16 18	23 11 15 17	21 9 13 15
* Hardness, Brinell, HB	----	120 – 167	111 – 156	111 - 156
Charpy Impact value (2mm U-Notch) min., joules	Longitudinal Transverse/ Radial/ Tangential	47 24 28 35	43 22 26 32	40 20 24 28

Note:

1. Unless otherwise stated on the order/drawing small forgings of non-critical nature weighing less than 300 kg shall be accepted on the basis of chemical composition and hardness.

*2. Hardness test can be conducted only when tensile test can not be performed.

13.0 ULTRASONIC TESTS:

13.1 For forgings ordered by BHEL, Hyderabad: Unless other wise specified on the drawing, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2.

.13.2 For forgings ordered by other units: If specified on the drawing/order, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2, unless otherwise specified.

[redacted]

14.0 ADDITIONAL TESTS: If specified in the drawing /order, the following tests shall be conducted:

14.1 Bend Test (Longitudinal):

The test pieces (230mm long and 32 mm square with edges rounded off, where the dimensions permit) shall be capable of being bent cold by direct pressure without fracture, until the sides are parallel, round a mandrel having a diameter of 44 mm when tested as per IS:1599.

14.2 Magnetic particle test:

14.3 Any other tests.

"Norms of acceptance shall be as specified on the drawing/order. "

15.0 SCOPE OF THIRD PARTY INSPECTION:

Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

1. Review of supplier's declared chemical composition.
2. Selection of test samples for mechanical tests and witness of mechanical tests.
3. Witness of Non-destructive tests as applicable.
4. Review of HT charts.
5. Dimensional inspection.

16.0 TEST CERTIFICATES:

Three copies of a test certificates shall be supplied, unless otherwise stated in the order, in the Test Certificate proforma annexed to this specification (Annexure -I).
In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The following details shall be furnished in the test certificate:

Dimensional inspection.
Details of heat treatment.
Reduction ratio
Chemical composition including trace elements.
Results of mechanical tests.
Results of Ultrasonic test
Results of ultrasonic examination.
Results of additional tests called for in the drawing/order.

17.0 PACKING & MARKING:

Forgings shall be suitably packed to prevent damage during transit.
Machined surfaces shall be properly protected with anticorrosive compounds.
Each package or forging (when supplied separately) shall be legibly marked with the following information:

AA 193 31 - Carbon Steel Forgings, Class 2 (20C8).
BHEL Order No.
Suppliers Name
Consignment/ Identification No.
Batch No.
Weight.

18.0 **REFERRED STANDARDS (Latest publications Including Amendments):**

1) IS:1499	2) IS:1500	3) IS:1599	4) IS:1608
5) IS:2004	6) AA 085 01 18		

[redacted]

AA 193 31	CORPORATE PURCHASE SPECIFICATION	बी एच ई एल BHEL
Rev. No. 11		
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ANNEXURE-I: RECOMMENDED TEST CERTIFICATE FORMAT FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS

TEST CERTIFICATE FOR FORGINGS

1. Customer:
2. TC No. & Date:
3. PO No.:
4. Process of Melting Ingot:
5. Deoxidisation Process:
6. Forging Method:
7. BHEL's Reference for Approval of Bloom
8. Discard: Top________%, Bottom________%
9. Reduction Ratio } Ingot to Bloom / Bloom to Blank
10. Batch No.:
11. Heat/Melt No.
12. Spec.No.
13. Test Bar Size & Nos.
14. Supplier of the ingot/billet/ Bloom and TC reference.

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element		C	Si	Mn	S	P										
As Per Specn.	Min.															
	Max.															
Actual Values																

17. HEAT TREATMENT
(To be accompanied by Recorder Chart, Whenever called for)

Condition	Heating Rate, °C/hr.	Temp.°C	Soaking Time, Hrs.	Cooling Rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

		T.S. N/mm^2	Y.S. 0.5/0.2% Proof N/mm^2	% Elongation $5.65\sqrt{So}$ GL	%R.A. Min.	Hardness BHN(Min.3 values)	Impact Value Joules	Bend Test: Angle of bend	Bend Test: Dia of mandrel	Bend Test: Result
As Per Specn.	Min.									
	Max.									
[illegible]										

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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CS-1087

03.05.08

संस्थान मानक (हीप – हरिद्वार)

PLANT STANDARD (HEEP - HARDWAR)

HW 0400397

पृष्ठ 6 का 1

Page 1 of 6

Based upon KUN 107.01

IDENTIFICATION OF WORK PIECES

1.0 PURPOSE OF STANDARD :

1.1 This standard shall be followed at HEEP for identification of work pieces.

1.2 To avoid mix-ups of parts of materials.

To avoid placing identification marking where they might cause functional interference, for example notch effect.

1.4 To minimize re-stampings during manufacture.

1.5 To place the identification marking in identical location on identical parts.

1.6 To place the identification marking in such a manner as to leave them legible when the parts are assembled.

1.7 To place the identification marking in such a manner that corrosion and erosion cannot destroy the marking.

2.0 IDENTIFICATION:

2.1 Extent of identification

Work order No.
Drawing No.
Q No.
IR No.
Heat No. in case of castings/ forgings

				नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
			अनुवादक TRANSLATED BY		
			निर्माणकर्ता WORKED BY	Lalit Kumar	Lalit Kumar
PED	R. PANJA		जांचकर्ता CHECKED BY	B. Choudhary	15/03/13
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	Rajiv Verma	23/3/13
(Supersedes)			स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE		GR.No. 1.10
REV - 04 Dt: 25.09.21	WORK BY CHECK BY	25/9/21	निर्माण : PREPARED : TSX	जारी : मानक विभाग ISSUED : TSX	दिनांक : DATE : 03.08.1984

C/A No: TSX(DPE)-21-311

हस्ताक्षर एवं दिनांक SIGN & DATE 25/3/13

सामग्री सूची संख्या INVENTORY 2-1709

Material colour codes for ferrous materials as per corporate standard number AA0400305.

Material colour codes or its abbreviation for aluminium & aluminium alloys as per corporate standard no. AA0400310.

Material colour codes or its abbreviation for copper and copper alloys as per corporate standard no. AA0400310.

Material test stamp as per quality assurance system no. SMI 301 (Material procurement control system)

Suppier's number/ manufacture's symbol (if specified in order documents).

Acceptance stamp of customer's representative (if agreed upon with customer).

"All rough machined casting and forgings received at our works must be identified by the casting/ forging nos. stamped by the supplier based on numbers giving by BHEL on the indent. These identification number must be retransferred suitably at works on the casting/ forging in case they are removed due to further machining"

2.2 Means of identification

The identification is stamped on the part with a marking punch, except for the following:

Sheet metal parts of ≤ 3mm thickness should be marked by electric engraver. Also wherever punching is not possible, admissible electric engraver can be used (see figure – 3)

Not yet machined castings and forgings are to be marked with oil paint on the surface which will remain unmachined even after final machining as far as possible. After machining this identification must be replaced by punch marking.

For identification marking example see pages 5.

Smaller items such as fasteners M16 and below, machined parts of nipple connectors/ nut nipple set where punching/ engraving of identification details is not possible , the following procedure to be adopted:

(i) For smaller items total weight less than 2Kg., these items may be put in plastic/ gunny bag suitably tied and bags may be tagged giving full details per clause 2.1.

(ii) If the number of parts is large i.e. weighting more than 2 kg., these are to be packed in a wooden box and identification detail to be clearly written on the box by paint.
(The requirements listed above to be mentioned in purchase order)

(iii) After the receipt of the boxes in store, the items are to be verified , steeloscope testing for chemistry of the components is to be done by quality control. The boxes are to be closed and sealed after satisfactory verification by quality control.

(iv) Shop planning/ shop store must be keep such boxes separately to avoid mixing with other similar items.

(v) Production to maintain and keep the records of these items plant order wise and Q. No. also to be mentioned in the records.

2.3 Process of identification

Ferrous material and its alloys should be marked with the material colour code as per corporate standard no. AA0400305. Aluminium and copper material and its alloys should be marked with the material colour code as per corporate standard AA0400310. If the colour code during manufacturing is removed than the work piece must be marked with abbreviation equivalent to colour code of the material as per AA0400310. It must be shown on the accompanying documents and compared with the work piece prior to the start of the first operation. Remaining identification should be affixed after the part is checked.

2.4 Identification of sub-contracted material

The identification of sub-contracted material/ semifinished parts, issued from stores shall be as per SMI- 623 (A) subcontracting

SYSTEMS WHICH READS AS UNDER:-

2.4.1 In case of issue of materials direct from stores,sub-contracting store will ensure that 'Q' mark and inspection seal are punched/ painted on total lengths/areas of plates by QCX before despatch of material to such contractor and these will be recorded on all the copies of SMIV by sub contracting store. (Ref. clause 9.6 of SMI 623-A)

2.4.2 In case of partly process materials shop planning will ensure that semifinished items are inspected and clear identification marks are punched/ painted by shop QCX before handing over to sub contracting store. (Ref. clause 10.5 of SMI 623 -A)

3 Drawing Notation:

The following shall be written in the vicinity of the title block of the blank drawing sheet:

Identification according to HW0400397
At the place indicated with IN →

The place of identification has to be indicated by an arrow and the letters in (IN) →

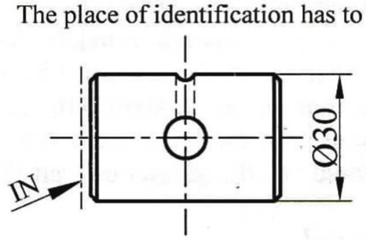


FIG.1

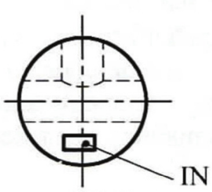
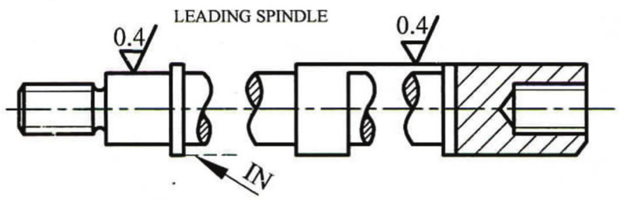


FIG.2

If it is not possible to allow to stamp the identification mark with a marking punch, one of the following remarks should be entered on the drawing.

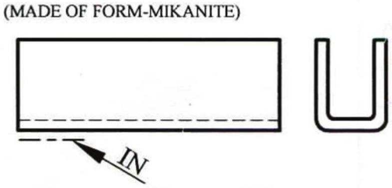
LEADING SPINDLE



WITH ELECTRIC ENGRAVER

FIG.3

INSULATING CAP
(MADE OF FORM-MIKANITE)



WITH FELT PEN/ SKETCH PEN

FIG.4

Rev.No. 04	निर्माणकर्ता WORKED BY	Lalit Kumar	[signature]	18.3.13
	जांचकर्ता CHECKED BY	B.Chodhary	[signature]	18.3.13

हस्ताक्षर एवं दिनांक SIGN & DATE

सामग्री सूची संख्या INVENTORY

R-1709

In case of the mass produced parts eg. cores, spacers, conductors (hollow conductors and solid strands) and cooling pipes (generator construction) respectively condenser cooling pipes, the identification spot does not need to be indicated on the drawing, identification according to HW0400397 is sufficient.

Guidelines for the selection of the place of identification is contained in plant standard no. HW0400398.

4.0 SPACE REQUIREMENT:

The size of the letter used for marking of casting and forgings with oil paint, as well as other parts with a marking punch is left to the individual operator .It should be choosen according to the space available for marking purposes as well as size of the part.

The standardized letter and number of punch sizes at corporate level are 3, 5, 8 & 10 millimeter.

See section 2.2 for means of identification if sufficient space is not available for stamping all the required information on the part.

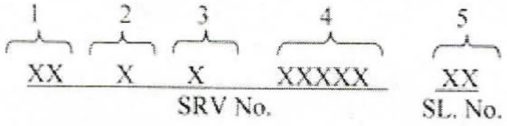
5.0 EXAMPLES OF IDENTIFICATION MARKINGS:

TURBINE L.P. SHAFT	IDENTIFICATION
WORK ORDER NUMBER	10049-A-107-01
DRAWING NUMBER	9 103 01 01000
IDENTIFICATION NUMBER FOR ATTESTED/ CONTROLLED MATERIAL	XX-X-X-XXXXX-XX (As per AA4915)

MOVING BLADE	IDENTIFICATION
WORK ORDER NUMBER	10049-A-107-01
DRAWING NUMBER	21 0 1 02010 01
MATERIAL CODE COLOUR	ORANGE-VOILET-ORANGE

6.0 IDENTIFICATION NUMBER FOR ATTESTED/ CONTROLLED MATERIALS:

The identification scheme for system for attested/ controlled material is as follows:



Barrel 1 will be two digits code representing the receipt cell concerned.

Barrel 2 will be single digit indicating whether the material required is imported or indigenous. '0' will be used for imported and '1' for indigenous materials.

Barrel 3 will be a single digit representing the last digit of the financial year. (for example '4' will be written for 1984-85)

Barrel 4 will be a five digit serial numbers within Barrel 1 & 3

Barrel 5 will be serial number of the entry on store receipt voucher.

7.0 IDENTIFICATION FOR DABG-DEFENCE ITEMS:

Only applicable for DABG-Defence items where specifically 'IN' is marked on the drawings.

Identification for Items shall be either punched/engraved/Laser marked or any equivalent method by shop/vendor (as case may be) prior to protective surface treatment/coating, if any, in following format:

a) **D YY XXXX Z – N:** (**D** indicates BOI, **YY** indicates Year, **XXXX** indicates last 4 digits of PO, **Z** item sl. number in PO, **N** item's own running sl. no.).

b) **X YY XXXX Z – N**: (**X** indicates Sub-contracting, **YY** indicates Year, **XXXX** indicates last 4 digits of SCO, **Z** item sl. number in SCO, N item's own running sl. no.).

c) **S YY XXXXX Z -N**: (**S** indicates Shop manufactured, **YY** indicates Year, **XXXXX** indicates last 5 digits of docket, **Z** item sl. number in docket, **N** item's own running sl. no.).

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		जांचकर्ता CHECKED BY	RAHUL (DPE)	25/9/21	25.09.21

FORM DG 52

PLANT STANDARD
HEEP--HARDWAR

HW 0850192

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BASED ON STANDARD SEP 1923, DEC 1990

ULTRASONIC TEST OF FORGING

1. PURPOSE : This test specification applies to the ultrasonic testing of forgings with high requirements, particularly components for turbine and generator plant, mainly to determine internal defects by the pulse-echo technique.

The ultrasonic test facilitates an assessment of reflection points in relation to their position, their size, extent and frequency. The test specification incorporates (d) GUIDELINES FOR SELECTING SCANNING SCHEME AND QUALITY LEVEL WITH RESPECTIVE ~~requirements to determine test ranges and classification and their relevant~~ assessment criteria, and outlines the conditions which must be observed.

2. SCOPE : The specification applies for the test of appropriately shaped forgings (d) MADE FROM FERRITIC/MARTENSITIC (L) ~~from re-meltable~~ steels. If the test specification is to be applied to ~~non-remeltable~~ AUSTENITIC (d) steels, compliance with the relevant assessment criteria must first be agreed between Manufacturer and Orderer.

3. PREPARATION OF FORGINGS : Forgings in the form of blanks shall for test purposes be simple in shape (note DIN 54 126 part 1, section 6). Test areas and all reflection surfaces must ensure that the test results are in no way restricted.

(c) Supercedes the old ~~Drg~~ / Sheet under the same number.
Change Advice No. TSX(MTE)_93-424
Name A.K. SARKAR Sign ... Date ...

A smooth surface, free from loose scale is adequate for the test, providing the coupling is adequate. The recommendation for the surface condition of machined, bright components is an average roughness value of Ra < 20 µm to DIN 4762 .

4. TIMING OF TEST : Preliminary test should be carried out as soon as possible to determine the forging's ability and suitability for testing. Delivery test are generally carried out before the forging has too many

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TSX	A.K. TRIPATHI	Akripa 28.10.1993	DRAWN		
QAX	T. S. Kauth		WORKED	A.K. SARKAR	5.10.93
STE	P. AGARWAL	Pagarwal 26/XI/93	CHECKED	J. P. MEENA	11.10.93
AGREED DEPTT	NAME	SIGN & DATE	SUPERVISED	V. B. ARORA	12.X.93

REVISION: 01 (REAFFIRMED) YEAR 2022 — Work by: S. Rana 15.3.22; Check by: Sujeet Kumar 15/3/22

APPROVED: PLANT STANDARDIZATION COMMITTEE 6.47

PREPARED: MTE — ISSUED: STANDARDS DIVISION — DATE:

10.3.09

C/A No: TSX(MTE)-22-103

SIGN & DATE: 28-7-94

INVENTORY No. P-3105

SUPERSEDES INVENTORY No. SEP 1923 DEC 1990

SIGN & DATE

contures, but after the required quality heat treatment or otherwise during the preliminary stages, which will be agreed in advance.

5. TEST SYSTEM :

5.1 Test Apparatus :Ultrasonic test device must comply with the requirements of DIN 54 126 part 1.

5.2 Probes :The selection of the probe in regard to the nominal frequency and the crystal diameter is dependent on the desired detectability in terms of circular disk-shaped reflector (CDR), the length of the sound path and the sound attenuation of the forging to be tested. Generally the probes which are used have a nominal frequency of 2 or 4 MHz. Probes with other frequencies can also be used.

In normal procedures single-crystal normal probes are used. Other types of probes, such as transmitter-receiver (TxRx) or angle probes may also be used, e.g. for the detection of reflection points below the surface, for a better resolution of the indications, in parts which are difficult to access, and for hollow bodies or special defect orientations.

To assess indications in terms of circular disk reflector(CDR), mm Ø a distance gain size(DGS) diagram appropriate to the type of probe should be used or universal DGS diagram (note DIN 54127 part 1) should be used.

5.3 Checking the test system: The check is based on DIN 54 126 part 1 .Reference block 1 to DIN54 120 must be available for calibrating the equipment and monitoring the correct functioning of device and probe.

Reference Block 2 to DIN 54 122 or other compatible devices with reference may also be used to monitor the test system.

5.4 Coupling agents: The coupling agents(note also DIN 54 126 part 1, section 5.6. must sufficiently moisten the workpiece surface. Particularly suitable are water (preferably containing additives which increase the viscosity),

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INVENTORY NO. P-3105
SIGN & DATE 26/1/94

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WORKED BY	A.K.SARKAR		28.10.94
CHECKED BY	J.P.MEENA		28.10.94

oil and pastes. The coupling agents used for setting the system and for subsequent tests must be the same. If forgings have to be tested after machining, the coupling agents must not cause corrosive damage.

6. TEST PERSONNEL : The Manufacturer must ensure that all test are carried out by suitable qualified personnel, which are able to carry out proper test procedure in accordance with this specification.

7. TEST RANGE : Depending on the varying requirements of individual forgings, the test range is selected by the Orderer from table 1 according to product group

A Shafts
B Discs, plates
C Rings, tubes, hollow shafts, boxes
D steel bars

and specified by test numbers.

8. TESTING

8.1 Calibration of sensitivity: The calibration of the ultrasonic test system is carried out according to DIN 54 127 part 1 .

: 8.2 Test Procedure: The test is carried out to DIN 54 126 part 2). According to the test numbers specified in table 1, the relevant areas of the forging are scanned by the probe.

In manual testing, the test speed should not exceed 100 mm s– . In automatic testing, the test speed and pulse cycle frequency must be adjusted to ensure that all recording thresholds are safely detected.

In continuous testing, the test orbits must overlap each other by approx 15%.

9. ECHO (INDICATION)

DESCRIPTION:

9.1 Description of recordable indications:
Echo indications are characterised by echo amplitude, form, extended length & possibly their dynamic behaviour and frequency dependence. Further backwall echo drop & detectability limit, must also be furnished.

9.1.1 Echo Amplitude: Echo amplitudes are

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evaluated by their echo height in accordance with the DGS-method to DIN 54 127 part 1 , whereby equivalent reflector size must be stated in mm as a diameter of the equivalent circular disk reflector (CDR). The quantities(effective diameter,test frequency,Near field length etc), which characterize the crystal must however be known, or be taken from the test probe data sheet.

In normal circumstances the indications are assessed with 2 or 4 MHz probes. When recording thresholds are detected, introduce additional probes to obtain a better assessment of the reflection points.

In exceptional cases and after consultation with the Orderer comparisons with reference reflectors may be admissible to assess the echo amplitude.In these cases the echo height of the reflection points are stated in dB in relation to the corresponding echo height of the reference reflector.

9.1.2 Echo form indications are distinguished by echo form shown in Table 2. Also summarized there are the screen images of the corresponding echo form.

9.1.3 : Dynamic behaviour measured extended length: Unless agreed otherwise,individual indications lengths are measured by the half-value method. However, the beam divergence characteristics of the probe must be taken into account.

Two single indications are considered as adhering together and are thus classed as a single defect, if when moving the probe between the two points of 2 echo maxima at approx, equal sound distance(tol. +/- 2 mm), the echo level drops by less than 12 dB below the echo maximum of the larger indication.

When indications with extended length do appear, then the measured extended length smaller than the thresholds of Table 3 need not be recorded.

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PLANT STANDARD
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In suspected transverse defects, the echo level must be determined by optimising the beaming angle.

9.1.4 : Backwall echo drop: In recordable indications, the amplitude of the back-wall echo in the indication area must be checked and compared with the immediately adjoining indication free zone. Back-wall echo drops of > 4dB must be recorded and specified in dB.

A backwall echo drop must be assessed by taking into account the diameter of the crystal, the test frequency and the ratio of the sound paths to the reflector as well as to the backwall.

9.1.5 Detectability limit: The detect-ability limit is the value of the small-est, with a signal-to-noise-ratio of 6 dB recognisable circular disk reflector, at the largest sound path. If the signal -to-noise-ratio in relation to the re-cording threshold is < 6 dB, then the detection threshold for the corresponding beaming directions and probes must be determined and recorded in CDR mm togeth-er with their relevant details e.g. probe, beaming direction, sound path etc. In this case further action would only be taken after consultation with the Order-er.

9.1.6 Test sensitivity: The selected test sensitivity must ensure, that thresholds of group echo readings cover at least 2/5 of the screen. The signal-to-noise ratio must be min 6 dB. Otherwise further action would be taken after consultation with the Orderer.

9.2 Recordable,decisive and acceptance criteria: Table 3 shows the recording thresholds and decisive limits in regard to echo height ,backwall echo drop and measured reflector length depending on quality level.On reaching a decisive limit, the Orderer must decide whether it is acceptable, or if further action is to be taken. When the decisive limit is the same as the final acceptance, must be specified by the Orderer.

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CHANGE AL VIDE TSK.MTE.94-13/
NAME AKS. - DATE 28.10.94

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INVENTORY NO. P-3905
SIGN & DATE 26/1/94

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PLANT STANDARD
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9.3 Sound attenuation : Sound attenuations which have to be measured after completed heat treatment must be measured in accordance with table 1. The values are recorded in dB/m. Depending on the frequency, decision limits are reached at

2 MHz : 2 dB/m
4 MHz : 6 dB/m

5 MHz : 10 dB/m

10. TEST REPORT : The test report must contain the following details:

a) Reference data of the test piece
b) test specification data
c) Testing stage (Timing of test)
d) Test apparatus and type of probe
e) Finish of areas to be tested
f) Coupling agent
g) Type of calibration
h) Scanning scheme (test numbers acc. to table (A,B,C,D)
i) Recording thresholds and decisive acceptance limit.
j) Results
k) Date, tester and test supervisor

Recording thresholds must be described acc. to point 9 by specifying their coordinates within the workpiece, and/or entered on a true-to-scale sketch of the forging, the cross section or the surface development.

SUPERCEDES THE OLD DRG/SHEET
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(d)

11. ORDER INSTRUCTION: Orders to this specification require to the test numbers and quality levels to be stated by the Orderer.

12.0 ACCEPTANCE FOR ROTORS :

12.1 HP,IP & LP ROTORS AND TG ROTORS:

a) Testing/Scanning Scheme:
A3,A4,A5:- The axial distance between two measuring positions must be shorter than 1000 mm.
A7 :- The incidence angle α has to be adopted to the beam spread of ultrasonic probes used, so that the center of the rotor of about 40 % of the outer diameter is ultrasonically tested in tangential direction e.g. for a probe with 24 mm dia. of the crystal, 2 MHz frequency and

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INVENTORY NO 12-3105
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CHECKED BY	J.P.MEENA		28/10/94

about 7 ° beam spread to the incidence angles are α = 7°, 14°, 21°.
– in addition α= 45° and for TG rotor also with α = 60 °
A8:– Rotor body with α = 45° and for TG rotor also with α = 70 °
– transition of cross-section with α = 45°; 70°.
A9: only for the TG rotor body.

b.) Quality Class: 4a

Within a radial distance of 50 mm starting at any bore surface and the rotor body (blading area) surface : 1a
The decision limits for backwall attenuation are 3dB and for the length of indication 10mm. Defects which can be eliminated during machining can be recorded separately for permission .

12.2 The testing scheme & quality levels for other components are indicated in the respective specification.

(e)

13. ~~REFERENCES:~~ CROSS REFERRED STANDARDS :

1) DIN 54 126 part 1 – Codes of practice for ultrasonic test requirement for systems and test objects.

2) DIN 4762 – Surface roughness; Defin definition, surface and its reference values.

3) DIN 54 127 part 1 – Calibration of ultrasonic test systems and echo assessment .

4) DIN 54 120 – Control gauge 1 and its use in calibrating and monitoring ultrasonic pulse-echo devices.

5) DIN 54 122 – control gauge 2 and its use in lubricating and monitoring ultrasonic pulse-echo devices.

6) DIN 54126 part 2 – Codes of practice for ultrasonic tests, test execution.

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NAME ARS DATE 28/10/94

DOC REV NO.: 3

TABLE ~~2~~ 1A (c) : Product Group 'A' : SHAFTS
(e.g) Turbine/Generator Shafts, Spindle, Tie Rod

Single Crystal-Normal Probe

No	Test Surface	Test Dirn.	Volume to be Scanned	Symbol
A 1	Axial Direction testing, 2 probes at 90°, whole length	Radial	Volume covered by 1) Sound Beam in important core region.	
A 2	Half circumfrence whole length	-do-	1) Total Volume	
A 3	100% Outer Surface (crust)	-do-	Total volume 1)	
A 4	100% End planes	Axial	Total Volume 1) limited by test technique	
A 5	Min. five locations spread over length or as agreed mutually.	Radial	Measurement of sound attenuation	

Single Crystal - Angular Probe 2)

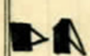
No	Test Surface	Test Dirn.	Volume to be scanned	Symbol
A 6	100% outer surface (crust)	Clockwise circumfrential	Ring zone determined by incident & reflected beam.	
A 7	100% Outer surface (crust)	Clock/Anti-clockwise circumferential	Ring zone determined by incident & reflected beam	
A 8	100% Outer surface (Crust)	2-Axial Direction	Total Volume	

Twin Crystal - Normal Probe

No	Test Surface	Test Dirn.	Volume to be scanned	Symbol
A 9	100% Outer surface (Crust)	Radial	Zone near outer Surface	

Twin Crystal - ~~Normal~~ Angular (d) Probe

No	Test surface	Test Dirn.	Total volume scanned	Symbol
A 10	100% outer surface (crust)	1-Circumfrential Direction	Zone near the outer surface	
A 11	100% Outer surface (Crust)	2-Circumfrential directions	Zone near the outer surface	
A 12	100% outer surface (crust)	2-axial directions	Zone near outer surface	


Twin crystal Normal Probe
Twin crystal Angular Probe


Normal Probe
Angular Probe
Region to be scanned.

1) Zone near outer surface is exception, and depends on type of probe used.
2) Beam Angle shall be mutually agreed between supplier and BHEL.

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INVENTORY No. P-3105

REVISION 01

WORKED BY	S. K. GHOSHAL	[signature]	26.10.89
CHECKED BY	VB ARORA	[signature]	26.X.89

FORM DG 50

PLANT PURCHASING SPECIFICATION

HEEP–HARDWAR

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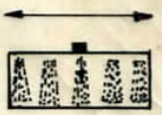
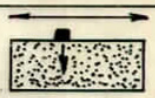
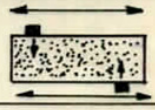
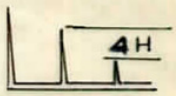
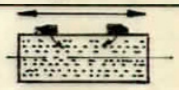
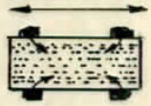
TABLE 3: PRODUCT GROUP 'B' DISCS, PLATES

e.g. Turbine Discs, Compressor Discs, Flywheel

Single Crystal–Normal probe.

No.	Test Surface	Test Dirn	volume to be scanned	Symbol
B 1	Normal probing at interval of 200 mm On one plain surface so that by double normal probing the disc centre is scanned.	Thickness e.g. Axial direction	With sound beam detect volume.	
B 2	Same as B1, in Special Cases at 100 mm interval	–do–	–do–	
B 3	100% One Plain Surface	–do–	Total Volume	
B 4	100% both plain surfaces	–do–	–do–	
B 5	100% Circumferential surface	Radial e.g. normal to circumferential surface	–do–	
B 6	Min. 2 Places on One Plain surface & Min. 2 Places on the outer surface (crust) 90° apart on circumference	Thickness e.g. Axial & Radial direction, e.g. Normal to cicumferential dirn.	Measurement of sound Attenuation	

Single Crystal angular probe.

NO.	Test Surface	Test Dirn.	Volume to be scanned	symbol
B 7	100% one Plain Surfaces	4-Testing directions each turned 90°	Total volume	
B 8	100% both Plain Surfaces	4-Testing directions on each plain surface turned 90°	–do–	
B 9	100% Outer Surface (Crust)	1-Circumferential direction	Ring Zone determined by incident & reflected beam.	
B 10	–do–	2-Circumferential direction	–do–	

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WORKED BY	VBARUA	VBarua	11.7.91
CHECKED BY	VBARUA	VBarua	11.7.91

INVENTORY No. P-3105

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SIGN & DATE

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PLANT PURCHASING SPECIFICATION

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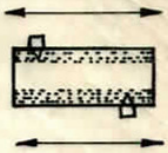
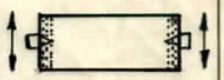
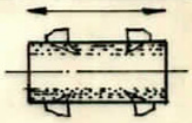
TABLE – 1B Contd. (c)

SE_ TWIN CRYSTAL_ NORMAL PROBE

No.	Test Surface	Test Dirn.	Volume to be scanned	Symbol
B 11	100% both plain surfaces	Thikness e.g. Axial direction	Zone near the Outer surface.	
B 12	100% circumfe - rential surfaces	Radial e.g. normal to circumfer - ential surface	–do–	

SE_ TWIN CRYSTAL ANGULAR PROBE

No.	Test Surface	Test Dirn	Volume to be scanned	Symbol
B 13	100% Circumf- erential surface	1-Circumf- erential direction	Zone near the Outer surface	
B 14	–do–	2-Circumf- erential direction.	–do–	
B 15	–do–	4-Testing directions on each plane surface turned 90°	–do–	

SIGN & DATE | SUPERSEDES INVENTORY No.

SIGN & DATE | INVENTORY No. P. 3105

REVISION: 01

WORKED BY	V. B. ARORA	CBA	11.7.91
CHECKED BY	CBARORA	CBA	11.7.91

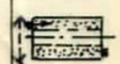
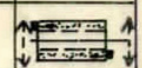
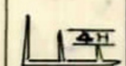
PLANT PURCHASING SPECIFICATION

HEEP—HARDWAR

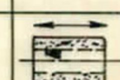
HW 085092

TABLE ~~4~~ 1C — (6): PRODUCT GROUP 'C': RINGS, PIPES, HOLLOW SHAFTS, BUSHES, FLANGE & SIMILAR PARTS.

Single crystal Normal Probe.

No.	Test Surface	Test Dirn.	Volume to be Scanned	Symbol
C 1	Axial Probing at an interval of 200 mm over the entire length but min. 3 location.	Radial	With sound beam detect volume	
C 2	100% Crust surface Outer	-do-	Total Volume	
C 3	100% Crust surface inner	-do-	-do-	
C 4	100% On front flange	Axial	Total Volume what ever can be scanned	
C 5	100% On both front flange	-do-	-do-	
C 6	Min. 5 Places over the length & periphery. The exact no. to be fixed by manufacturer	Radial	Measurement of sound attenuation	

Single Crystal Angular Probe.

No.	Test Surface	Test Dirn.	Volume to be Scanned	Symbol
C 7	100% Crust Surface Outer.	1-circumferential direction	With normal & angular probe total ring zone	
C 8	100% Crust Surface (Inner)	-do-	Total Volume Whatever can be scanned	
C 9	100% Crust Surface (Outer)	2-Cicumferential. direction	With normal & angular probe total ring zone.	
C 10	100% Crust surface (Inner)	2. Circumferential direction	Total Volume What ever can be scanned	
C 11	100% Crust surface (Outer)	1- Axial direction	Pass along total volume.	
C 12	100% Crust surface (Inner)	1- Axial direction	Pass along total volume	
C 13	100% Crust surface (Outer)	2- Axial direction	Total Volume	
C 14	100% Crust surface (Inner)	2- Axial direction	Total volume	

REVISION: 01

WORKED BY	V. B. ARORA	CBAC	11/7/91
CHECKED BY	V. B. ARORA	CBAC	11/7/91

INVENTORY No. P-3105

SIGN & DATE

SUPERSEDES INVENTORY No.

PLANT PURCHASING SPECIFICATION

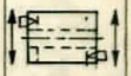
HEEP–HARDWAR

HW 085 01 92 15

PAGE 12 11 OF 15 (b)

TABLE - 1c (Contd.) (c)

Twin Crystal Normal Probe.

No.	Test Surface	Test Dirn.	Volume to be Scanned	Symbol
C 15	100% Crust Surface(Outer)	Radial	Outer Zone	
C 16	100% Crust Surface (Inner)	-do-	Outer Zone	
C 17	100% Both Front flanges	Axial	Outer Zone	

Twin Crystal Angular Probe

C 18	100% Crust Surface (Outer)	1-Circumferential direction	Outer Zone	
C 19	100% Crust Surface(Inner)	-do-	-do-	
C 20	100% Crust Surface (Outer)	2-Circumferential direction	-do-	
C 21	100% Crust Surface (Inner)	-do-	-do-	
C 22	100% Crust Surface (Outer)	1-Axial direction	-do-	
C 23	100% Crust Surface (Inner)	-do-	-do-	
C 24	100% Crust Surface (Outer)	2-Axial direction	-do-	
C 25	100% Crust Surface (Inner)	-do-	-do-	

SIGN & DATE | SUPERSEDES INVENTORY No.

SIGN & DATE | INVENTORY No. P-3105

REVISION : 01

WORKED BY	V.B.ARORA	VBARORA	11.7.91
CHECKED BY	V.B.ARORA	VBARORA	11.7.91.

FORM DG 50

PLANT PURCHASING SPECIFICATION

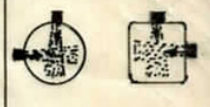
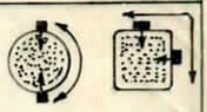
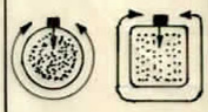
HEEP–HARDWAR

HW 0850192 15

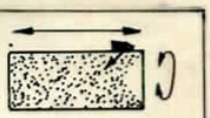
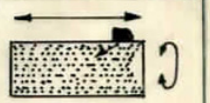
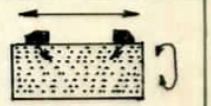
PAGE 13 OF 16

TABLE-5 (1D) PRODUCT GROUP 'D' : STEEL BARS

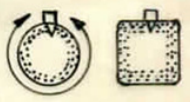
Single Crystal Normal Probe

No.	Test Surface	Test Dirn.	Volume to be Scanned	Symbol
D 1	Axial Direction testing, 2 probes at 90°, whole length.	Radial e.g. Normal to Circumferential Surface.	With sound Beam Defect Volume essentially in core region.	
D 2	Half circumference Total length	-do-	Total Volume	
D 3	100% Circumferential surface	-do-	-do-	

Single Crystal Angular Probe.

D 4	Half Circumference Total length	1- Axial direction 1-Longitudinal direction	Pass along total Volume.	
D 5	-do-	2- Axial direction 2- Longitudinal direction	-do-	
D 6	100% Circumference	1- Axial direction 1- Longitudinal direction	-do-	
D 7	-do-	2- Axial direction 2-Longitudinal direction	Total volume	

Twin crystal Normal probe

No.	Test Surface	Test Dirn.	Volume to be scanned	Symbol
D 8	100% Circumference	Radial e.g. normal to circumference	Outer surface zone	

- Normal Probe
- Angular Probe
- Twin crystal Normal Probe
- Twin crystal angular probe
- Region to be scanned

1. Zone near the outer surface is exception & depends on the type of probe used.
2. Beam Angle shall be mutually agreed between supplier & BHEL.

REVISION : 01			
WORKED BY	V B ARORA	VBARORA	11.7.91
CHECKED BY	VBARORA	VBARORA	11.7.91

INVENTORY No. P-3105 SIGN & DATE

SUPERSEDES INVENTORY No. SIGN & DATE

BHEL

PLANT STANDARD.
HEEP - HARDWAR

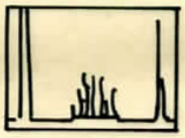
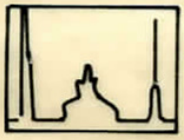
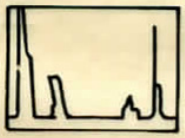
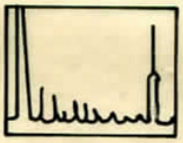
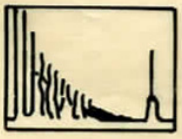
HW 0850192
PAGE ~~8~~ 9 OF ~~9~~ 17

SIGN & DATE | SUPERSEDES INVENTORY No.

INVENTORY No. P- 3105 | SIGN & DATE

TABLE - ~~1~~ 2.

ECHOFORMS (ECHOSHAPE) DURING UT ~~OF ROTORS~~

SCREEN	ECHOFORM	SYMBOL
	INDIVIDUAL-ECHO	EE
	GROUPECHO RESOLVABLE	GA
	GROUPECHO Non-resolvable	GN
	RINGZONE	RZ
	MANY INDIVIDUALECHOS	VE
	GRASS (Structural Noise)	GR

REVISION -01

WORKED BY	P. SINGH		10/9/1986
CHECKED BY	VB ARORA		18/9/88

REVISION 01

WORKED BY: SK GHOSHAL — 27.10.87
CHECKED BY: VB ARORA — 28.X.87

TABLE - 3 QUALITY LEVELS (Explanation of abriviations as in Table-1) (ECHO LEVEL) — 2 — (c)

Quality Level	ECHOFORM / ECHO HEIGHT					Max. Defect Length (EE, VE). Acceptance Limit (mm)
	EE+VE WITHOUT EXTENSION		EE+VE WITH EXTENSION (GA GN RZ)		Back wall echo loss Acceptance Limit (db)	
	Record-able limit mm EFH	Acceptance limit mm EFH	Recordable limit mm EFH	Acceptance Limit mm EFH		
1 a 1 b	1 2	2 2	All indica-tions	All indica-tions	4 4	10 10
2 a 2 b	1 3	3 3	-do- 1	1 1	4 4	10 10
3 a 3 b	2 4	4 4	1 2	2 2	4 4	20 20
4 a 4 b	2 5	5 5	1 3	3 3	4 4	20 20
5 a 5 b	3 6	6 6	2 4	4 4	6 6	50 50
6 a 6 b	3 8	8 8	2 5	5 5	6 6	50 50
7 a 7 b	5 10	10 10	3 6	6 6	12 12	100 100
8 a 8 b	5 15	15 15	3 8	8 8	12 12	100 100

(b)

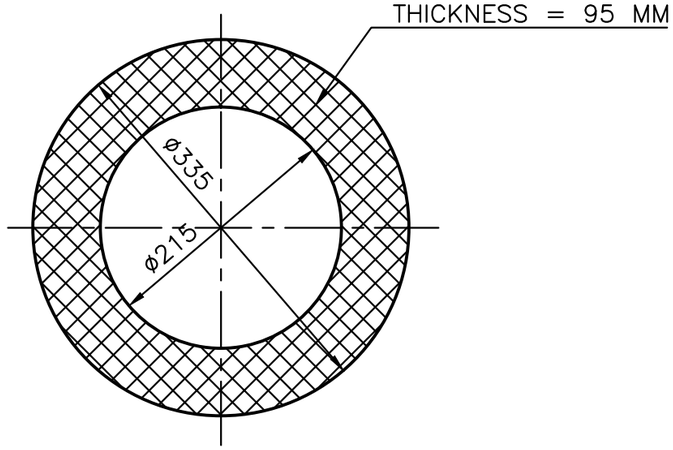
(Drawing)

(31350101441 Rev 00)

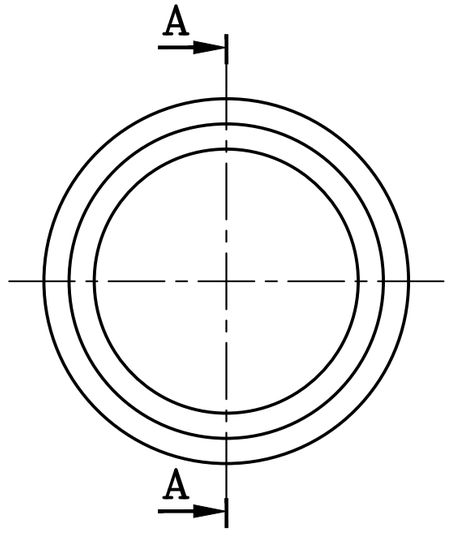
FIRST ANGLE PROJECTION | (ALL DIMENSIONS ARE IN mm) | FORM: DG-38(B)

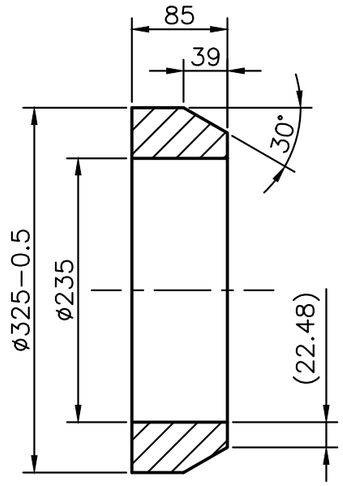
DRAWING NO. 31350101441

12.5 ALL OVER



BLANK FORGING





SECTION AA

TECHNICAL REQUIREMENTS

1. IDENTIFICATION ACCORDING TO HW0400397
2. ITEM IS TO BE MANUFACTURED FROM FORGING.
3. FORGING IS TO BE ULTRASONICALLY TESTED AS PER HW0850192 CHECK NUMBER – C2, C3 AND C5. QUALITY GRADE TO BE 1a.

REF. DRG NO. KWU	24-0193-140112/060
SIGN & DATE	
INVENTORY NO.	

CBOM NO. 01350101064			STATUS OF DRG.
AGREED DEPT.	NAME	SIGN	DATE
WTX	AWTXTSC	AWTXTSC	27/11/2007

GRADE OF UNTOL. DIM.:-
M/CG- ~~V/C~~/M/~~F~~ AA 0230208
~~WELDING A/B/C/D AA621104~~
GAS CUTTING-'T3'AA0621101

REV.	DATE	ALTERED / CHECKED

TYPE OF PRODUCT OR NAME OF CUSTOMER/ PROJECT: THDF 125/67

BHARAT HEAVY ELECTRICALS LTD. HARDWAR

	NAME	SIGN	DATE	NO.OF VAR.
DRN	STGEPK	STGEPK	26/11/2007	
CHD	STGEAM	STGEAM	27/11/2007	
APD	ATGERK	ATGERK	28/11/2007	73 , 74

DEPT.	SCALE	WEIGHT(Kg.)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TGE	1:2	22.8	3-13501-01445	002	75 , 77
CODE 4133					

TITLE: BOSS

DRAWING NO. 31350101441

SHEET NO. 1 | NO.OF SHEETS 1

31350101441

SIZE A3