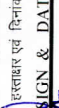


दिनांक एवं हस्ताक्षर SIGN & DATE 		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)	HW 19386 मुख पृष्ठ PREFACE SHEET
सामग्री सूची संख्या को INVENTORY NO अधिकृत करता है	SUPERSEDES INVENTORY NO	ALLOY STEEL FORGINGS FOR HIGH TEMPERATURE SERVICE- H & T (Gr : 21CrMoNiV4-7)	
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company.	केवल आंतरिक प्रयोग हेतु प्रदायक को देने से पूर्व इस मुखपृष्ठ को निकाल दें । FOR INTERNAL USE ONLY REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS. समतुल्य मानक/सूची आदि COMPARABLE STANDARDS / CATALOGUES ETC. } : NIL		
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सामग्री सूची संख्या INVENTORY NO P-1044	दिनांक एवं हस्ताक्षर SIGN & DATE 	कोई अन्य जानकारी ANY OTHER INFORMATION } : BASED ON TLV 9187 02 04/2011	
सामग्री सूची संख्या INVENTORY NO P-1044	REV : 03 17.03.18	स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE निर्माण : PREPARED : MTE	जारी : मानक विभाग ISSUED : STANDARDS DIVISION दिनांक : DATE : 07.01.1984

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		HW 19386 पृष्ठ का Page 1 of 4																															
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	2.0 APPLICATION: Used for steam turbine components such as discs, rings, bushings, bars etc.																																		
	3.0 CONDITION OF DELIVERY: Forged or rolled. Hardened and Tempered. Unless otherwise specified in BHEL order / drawing, rough machining of the forgings shall be carried out.																																		
	4.0 DIMENSION AND TOLERANCES: Forging shall be supplied to the dimensions and tolerances as per the ordering drawing.																																		
	5.0 MANUFACTURING: Degassed steel shall be used. Note: Raw material like Ingots/Blooms/Billets required for forgings shall be procured from BHEL approved sources along with test certificate."																																		
	6.0 HEAT TREATMENT: Hardening: 900 - 950°C / air, oil, polymer * or water dipping* * With center cooling rate comparable to oil quenching Tempering: 680 – 720 °C (Min. 2 hours) The duration of tempering as well as the controlled cooling rate are to be chosen to achieve minimum residual stress.																																		
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	<table border="1"> <tr> <td>C</td> <td>0.17 - 0.25</td> <td>Si</td> <td>0.15 – 0.35</td> <td>Mn</td> <td>0.35 - 0.85</td> </tr> <tr> <td>P</td> <td>≤ 0.020</td> <td>S</td> <td>≤ 0.020</td> <td>Cr</td> <td>0.90 - 1.20</td> </tr> <tr> <td>Mo</td> <td>0.65 - 0.80</td> <td>Ni</td> <td>0.50 – 0.80</td> <td>V</td> <td>0.25 - 0.35</td> </tr> <tr> <td>Al_{tot.}</td> <td>≤ 0.015</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>					C	0.17 - 0.25	Si	0.15 – 0.35	Mn	0.35 - 0.85	P	≤ 0.020	S	≤ 0.020	Cr	0.90 - 1.20	Mo	0.65 - 0.80	Ni	0.50 – 0.80	V	0.25 - 0.35	Al _{tot.}	≤ 0.015										
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			पृष्ठ का Page 2 of 4													
सामग्री सूची संख्या INVENTORY NO.	SUPERSEDES INVENTORY NO.	8.0 TEST SAMPLES: A hardness test shall be performed on all forgings. The mechanical properties are to be determined at one forging per melt and heat treatment batch. In case of rings, the specimens (1 tensile specimen, 3 impact specimens) are to be taken out from tangential ring. In case of discs and solid material, the specimens have to be taken at a distance d/3 or a/3 and b/3 from the respective surfaces. In this case, transverse specimens are also allowed. In case of other geometries the specimens are to be taken out from prolongations of the forging. When different dimensions are produced within the same heat and heat treatment batch, the heaviest one shall be used for the determination of the mechanical properties. The tangential test ring or the sample for determination of the mechanical properties shall be cut from the forging after all heat treatment operations. If re- tempering is necessary, the test ring shall be placed by the forging.														
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		9.0 MECHANICAL PROPERTIES: Following properties must be achieved at room temperature:														
		<table border="1"> <thead> <tr> <th>0.2% Proof Stress (N/mm²)</th> <th>Tensile Strength (N/mm²)</th> <th>Elongation (%)</th> <th>Red. in area (%)</th> <th>Impact¹ Joule</th> <th>Hardness HB30</th> </tr> </thead> <tbody> <tr> <td>550 - 700</td> <td>≥ 700</td> <td>≥ 15</td> <td>≥ 40</td> <td>≥ 24</td> <td>≥ 215</td> </tr> </tbody> </table>			0.2% Proof Stress (N/mm ²)	Tensile Strength (N/mm ²)	Elongation (%)	Red. in area (%)	Impact ¹ Joule	Hardness HB30	550 - 700	≥ 700	≥ 15	≥ 40	≥ 24	≥ 215
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550 - 700	≥ 700	≥ 15	≥ 40	≥ 24	≥ 215											
		¹ Average of 3 Charpy V-notch specimens, longitudinal or transverse minimum value = 17 J														
		10.0 NONDESTRUCTIVE TESTING:														
		10.1 Following NDE shall be performed in delivery condition: - Visual inspection - Material verification test - 100% UT- inspection according to EN 10228-3 (table 3). Depending on the forging geometry, following inspection types are applicable: - for bar shape components; type 1 (inspection may also be carried out as per EN10308 for type 1) - for discs and plate- like components: type 2 - for ring or bushing- like components: type 3b and 3c														
		10.2 Criteria for registration and decision: Regarding the UT- inspection quality class 3 (table 5) according to EN10228-3 shall be applied. The decision limit for loss of back wall echo is 4 dB and for the real reflector length 10 mm.														
		11.0 PRODUCT AND PROCESS QUALIFICATION:														
		11.1 General Product and process qualification procedures must be conducted for first order. Such product and process qualification is required for each of the manufacturer's fabrication sites and for every raw material source.														
निर्माक एवं हस्ताक्षर SIGN & DATE	सामग्री सूची संख्या INVENTORY NO.	REV 03	निर्माणकर्ता WORKED BY	A. Ranjan	06.01.12											
	8-1044		जांचकर्ता CHECKED BY	Gopal Krishnan	06.01.12											

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		SUPERSEDES INVENTORY NO. सामग्री सूची संख्या को अधिकृत करता है			
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REV 03					
निर्माणकर्ता WORKED BY					
जांचकर्ता CHECKED BY					
निर्माणक A. Ranjan					
जांचकर्ता Gopal Krishnan					
दिनांक 06.01.12					
दिनांक 06.01.12					

Depending on the complexity of the product and/or process and the experience from the first order, additional product and process qualification procedures may have to be implemented for subsequent orders.

Prior to the start of manufacture, the manufacturer has to submit a manufacturing and testing plan to BHEL in which the quality assured process workflow, i.e. the sequence of process activities (manufacturing, testing and inspection steps) are specified in chronological order. The internal and external codes, standards, drawings, specifications and records applied to each sub process step must be noted along with the information about the equipment and test and inspection scopes used and, where related, any related subcontracting.

BHEL may inspect/review supplier internal documents also.

If any change in the manufacturing and testing process is required, prior approval from BHEL is to be taken. Depending on the type and scope and thus the significance of any given change, BHEL will decide whether it is necessary to requalify the product and/or process.

11.2 The following additional tests have to be performed during qualification:

11.2.1 Tensile tests at elevated temperature:

In accordance with EN 10002-5 a tensile test (in the same direction as at room temperature) has to be performed at 560°C.

The following properties must be achieved:

0.2% Proof Stress $\geq$ 290 Mpa, Tensile Strength $\geq$ 400 MPa, Elongation $\geq$ 18 %

Reduction in area $\geq$ 68%

11.2.2 Microstructure Examination:

The homogeneity of the microstructure has to be checked and documented by micro section. The microstructure must be uniform and free from porosity, excessive segregation and other inhomogeneities.

The inclusion content has to be determined in accordance with ASTM E 45.

The grain size must be measured after all heat treatments have been performed in accordance with ASTM E 112 or ISO 643. Grain size 4 or finer must be achieved.

A deviation from the average grain size of more than 2 grain sizes is not permissible.

12.0 RECTIFICATION OF DEFECTS:

Rectification of defects in forgings shall not be carried out by the supplier without the prior written permission of BHEL.

13.0 TEST CERTIFICATES:

Unless otherwise stated in the order, three copies of test certificates shall be supplied as per 3.1 of EN10204.

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.

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सामग्री सूची संख्या को SUPERSEDES INVENTORY NO.	Following details shall be furnished in the test certificate: HW19386 : Alloy Steel Forgings for high temperature service- H & T (Gr : 21CrMoNiV4-7) BHEL order Heat No. , and melting type. Dimensional inspection Details of all heat treatment cycle followed. Results of chemical analysis including trace elements. Results of mechanical tests, including hardness test. All individual values shall be reported. Results of ultrasonic tests Confirmation of the visual inspection Confirmation of the verification inspection Results of additional tests called for in the drawing/order Mill test certificate				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		14.0 DEVIATIONS: Any deviation from this delivery specification has to be reported to BHEL immediately using Proforma PU-25 supplied with the order. Any deviation is generally accepted only if this has been approved by BHEL in a written form.			
		15.0 CLEARANCE FOR DELIVERY: The clearance for dispatch is based on the total results of all tests performed considering the service stresses of the component. BHEL has the right to accept deviations of the specified values, if it is shown by individual judgment that the service properties are not reduced. The clearance does not release the manufacturer from the responsibility for hidden defects that are detected at later stage of manufacturing.			
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दिनांक एवं हस्ताक्षर SIGN & DATE 9/11/12		17.0 REFERRED STANDARDS (Latest Publications Including Amendments): 1. EN 10228-3. 2. EN10308 3. ASTM E45 4. ASTM E 112 5. ISO 643 6. EN 10002, Part 5 7. EN10204			
सामग्री सूची संख्या INVENTORY NO. P-1044	REV 03		निर्माणकर्ता WORKED BY	A. Ranjan	06.01.12
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