


दिनांक एवं स्टैंडार्ड सिग्न दिनांक एवं स्टैंडार्ड सिग्न		<b>संस्थान क्रय विनिर्देश (हीप - हरिद्वार)</b> <b>PLANT PURCHASE SPECIFICATION</b> (HEEP - HARIDWAR)	<b>HW 19391</b> मुख पृष्ठ PREFACE SHEET
सामग्री सूची संख्या को अधिकृतित करता है SUPERSEDES INVENTORY NO.	<p style="text-align: center;"><b>ALLOY STEEL FORGINGS FOR HIGH TEMPERATURE SERVICE- +AT+P (Gr : NiCr20TiAl (Nimonic 80A))</b></p> <p style="text-align: center;">केवल आंतरिक प्रयोग हेतु प्रदायक को देने से पूर्व इस मुखपृष्ठ को निकाल दें ।</p> <p style="text-align: center;">FOR INTERNAL USE ONLY REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS.</p> <p>समतुल्य मानक/सूची आदि COMPARABLE STANDARDS / CATALOGUES ETC. } :NIL</p> <p>सुझाए/सम्भावित प्रदायक एवं श्रेणी SUGGESTED / PROBABLE SUPPLIERS AND GRADES. } :AS PER PMD</p> <p>कोई अन्य जानकारी ANY OTHER INFORMATIONS } : BASED ON TLV 9520 04 11/2008</p>		
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	स्वत्वाधिकार एवं गोपनीय इस प्रवेश में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।		
दिनांक एवं स्टैंडार्ड सिग्न दिनांक एवं स्टैंडार्ड सिग्न	दिनांक एवं स्टैंडार्ड सिग्न दिनांक एवं स्टैंडार्ड सिग्न		
सामग्री सूची संख्या INVENTORY NO.	P-2007		
REV 02 4.10.2011	(SUPERSEDES)	स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE निमांण : PREPARED : MTE	जारी : मानक विभाग ISSUED : STANDARDS DIVISION दिनांक : DATE : 23.11.1996 Gp. No. 2.60

SUPERSEDES  
INVENTORY NO.  
TLV 9520/04 Dec'08

**ALLOY STEEL FORGINGS FOR HIGH TEMPERATURE SERVICE-  
+AT+P (Gr : NiCr20TiAl (Nimonic 80A))**

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**1.0 GENERAL:**  
This specification governs the quality requirements of Alloy Steel Forgings or rolling for High temperature Service (Gr: NiCr20TiAl; material no. 2.4952) in precipitation hardened condition.

**2.0 APPLICATION:**  
Used for turbine components such as Sealing ring  $D \leq 2000$  mm.

**3.0 CONDITION OF DELIVERY:**  
Solution annealed, stabilized and precipitation hardened.  
Unless otherwise specified in BHEL order / drawing, rough machining shall be carried out.

**4.0 DIMENSION AND TOLERANCES:**  
Component shall be supplied to the dimensions and tolerances as per the ordering drawing.

**5.0 MANUFACTURING:**  
Forgings shall be manufactured from steel produced by vacuum induction melting / electro-slag re-melting (VIM/ESR) or by vacuum induction melting / vacuum arc re-melting (VIM/VAR) process.  
The hot working shall be done in such a way that a uniform fine grained microstructure is achieved.  
**Note: Raw material like Ingots/Blooms/Billets required for forgings shall be procured from BHEL approved sources along with test certificate."**

स्वत्सधिकार एवं गोपनीय  
इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं अपरिष्कार रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।

**6.0 HEAT TREATMENT:**  
The forging shall be heat treated as per EN 10269 to get the mechanical properties specified as per Clause 11.0.  
Solution annealing temperature shall be between  $1050 - 1080^{\circ}\text{C}$  for 8 hours followed by air cooling.  
Stabilization treatment shall be carried out at  $850 \pm 10^{\circ}\text{C}$  for 24 hours (air cooling) followed by precipitation hardening at  $700 \pm 10^{\circ}\text{C}$  for 16 hours (air cooling).

**7.0 FINISH:**  
As mentioned in the drawing.

**8.0 FREEDOM FROM DEFECTS**  
The forgings shall be free from defects such as cracks, flakes, seams, segregation, non-metallic inclusions and other defects which may affect the utility of the forgings.

हस्ताक्षर एवं दिनांक  
SIGN & DATE  
21/10/11

	नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	
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सहमत विभाग AGREED DEPTT	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY GOPAL KRISHNAN

सामग्री सूची संख्या  
INVENTORY NO.  
P-2007

	स्वीकृति : संस्थान मानक समिति APPROVED : <b>PLANT STANDARDS COMMITTEE</b>	GP. NO 2.60
REV 02	<b>SUPERSEDES</b>	
4.10.2011	निर्माण : PREPARED : <b>MTE</b>	जारी : मानक विभाग ISSUED : STANDARDS DIVISION
		दिनांक : DATE : 23.11.1996

सामग्री सूची संख्या को SUPERSEDES INVENTORY NO. अधिकारित करता है

**9.0 CHEMICAL COMPOSITION**  
 Heat analysis in weight % shall be as per EN 10269 except for P, S and Ti+Al as follows:

<b>C</b>	0.04 - 0.10	<b>Si</b>	≤ 1.00	<b>Mn</b>	≤ 1.00
<b>P</b>	≤ 0.010	<b>S</b>	≤ 0.010	<b>Al</b>	1.00 – 1.80
<b>B</b>	≤ 0.008	<b>Cr</b>	18.00 – 21.00	<b>Ni</b>	≥65.00
<b>Cu</b>	≤ 0.20	<b>Co</b>	≤ 1.00	<b>Ti</b>	1.80 – 2.70
<b>Fe</b>	≤ 1.50	<b>Ti+Al</b>	≥3.50		

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Following values shall be aimed at: Si ≤ 0.25; P ≤ 0.005; S ≤ 0.005

**10.0 TEST SAMPLES:**  
 A hardness test shall be performed on all rings at two diametrically opposite positions. At least three hardness indents per position are to be made.  
 The mechanical properties are to be determined at one forging per melt and heat treatment batch. The specimens are to be taken out of a test sample that has undergone an analogous forming process as the ring. The test sample shall be placed by the rings during the whole heat treatment.

**11.0 MECHANICAL PROPERTIES:**  
 The following properties shall be achieved in delivery condition at room temperature:

**11.1 Tensile:**  
 When tested as per IS: 1608, the test pieces after being heat treated as per Cl: 6.0 shall show the following properties. Following values are for information only. Actual values are to be taken from the standard.

0.2% Proof Strength (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (l <sub>0</sub> = 5d) (%)	Reduction In area (%)	Impact Energy (J) <sup>1</sup>	Hardness HB30
≥ 600	1000 – 1300	≥ 12	≥ 12	≥ 20	305 - 405

<sup>1</sup> Average of 3 Charpy V-notch specimen

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 इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं आरक्षण रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।

**12.0 NONDESTRUCTIVE TESTING:**

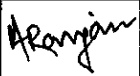

**12.1** Following NDE shall be performed in delivery condition:


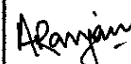
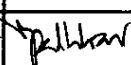
- Visual inspection
- Verification test
- 100% UT- inspection in simple shaped condition according to EN 10228-4 type 3b and 3c (table 2).
- 100% surface crack inspection in delivery condition according to EN 571-1 or to a similar procedure.

**12.2 Criteria for registration and decision:**  
Regarding the UT- inspection quality class 3 (table 4) according to EN10228-4 shall be applied. The decision limit for loss of back wall echo is 3 dB and for the real reflector length 10mm.  
 Defects that will be cut during final machining shall be evaluated individually.  
Surface crack inspection – All indications shall be recorded and evaluated individually.

**13.0 RECTIFICATION OF DEFECTS:**  
 Rectification of defects in forgings shall not be carried out by the supplier without the prior written permission of BHEL.

दिनांक एवं हस्ताक्षर SIGN & DATE  
 11/10/11

सामग्री सूची संख्या INVENTORY NO. <b>P-2007</b>	REV 02	निर्माणकर्ता WORKED BY Ashish Ranjan		4.10.11
<b>P-2007</b>		जांचकर्ता CHECKED BY Gopal Krishnan		4.10.11

दिनांक एवं हस्ताक्षर SIGN & DATE		<b>संस्थान क्रय विनिर्देश (हीप - हरिद्वार)</b> <b>PLANT PURCHASE SPECIFICATION</b> <b>(HEEP - HARIDWAR)</b>	<b>HW 19391</b> पृष्ठ का <b>Page 3 of 3</b>
सामग्री सूची संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.	<b>14.0 TEST CERTIFICATES:</b> 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. The following details shall be furnished in the test certificate: HW19391 : Alloy steel forgings for high temperature service-+AT+P, NiCr20TiAl BHEL order Heat No. , and melting type. Dimensional inspection Details of heat treatment cycle followed. Results of chemical analysis including tramp elements. Results of mechanical tests, including hardness test. All individual values shall be reported. Results of ultrasonic tests Results of surface crack examination 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	<b>15.0 DEVIATIONS</b> Any deviation from this delivery specification has to be reported to BHEL immediately using Performa PU-25 supplied with the order. Any deviation is generally accepted only if this has been approved by BHEL in a written form.		
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रस्ताव एवं अप्रस्ताव रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।	<b>16.0 CLEARANCE FOR DELIVERY:</b> 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.		
हस्ताक्षर एवं दिनांक SIGN & DATE	<b>17.0 PACKING AND MARKING:</b> Forgings shall be suitably packed to prevent corrosion and damage during transit. Machined surfaces shall be properly protected with anti-corrosive compounds. Each package or forging (when supplied separately) shall be legibly marked with the following information: HW19391 BHEL Order No. Drawing no. Batch No. Weight. Supplier's name		
सामग्री सूची संख्या INVENTORY NO. P-2007	REV 02	निर्माणकर्ता WORKED BY	Ashish Ranjan  04.10.11
		जांचकर्ता CHECKED BY	Gopal Krishnan  4.10.11