	संस्थान क्रय विनिर्देश (हीप – हरिद्वार) **PLANT PURCHASE SPECIFICATION** (HEEP - HARIDWAR)	**HW 19391** मुख पृष्ठ **PREFACE SHEET**

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

केवल आंतरिक प्रयोग हेतु
प्रदायक को देने से पूर्व इस मुखपृष्ठ को निकाल दें ।

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समतुल्य मानक/सूची आदि
COMPARABLE STANDARDS / CATALOGUES ETC. : **NIL**

सुझाए/सम्भावित प्रदायक एवं श्रेणी
SUGGESTED / PROBABLE SUPPLIERS AND GRADES. : AS PER PMD

कोई अन्य जानकारी
ANY OTHER INFORMATIONS : BASED ON TLV 9520 04 11/2008

हस्ताक्षर एवं दिनांक SIGN & DATE 4/11/11

सामग्री सूची संख्या INVENTORY NO. P-2007

REV 02 4.10.2011	(SUPERSEDES)		स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE		GP. No. 2.60
			निर्माण : PREPARED : MTE	जारी : मानक विभाग ISSUED : STANDARDS DIVISION	दिनांक : DATE : 23.11.1996

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

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 ≤ 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."

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^{0}C for 8 hours followed by air cooling. Stabilization treatment shall be carried out at 850 ± 10^{0}C for 24 hours (air cooling) followed by precipitation hardening at 700 ± 10^{0}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.

				नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
TSX	B. CHOUDHARY	05/10/11			
PSC	V. K. CHAUHAN		अनुवादक TRANSLATED BY		
STE	NEERAJ VERMA	5.10.11	निर्माणकर्ता WORKED BY	PANKAJ AGARWAL	4.10.11
QAX	SUGANDH AGARWAL	5.10.11	जांचकर्ता CHECKED BY	ASHISH RANJAN	4.10.11
सहमत विभाग AGREED DEPTT	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	GOPAL KRISHNAN	4.10.11

स्वीकृति : संस्थान मानक समिति
APPROVED : PLANT STANDARDS COMMITTEE

GP. NO 2.60

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हस्ताक्षर एवं दिनांक SIGN & DATE 5/10/11

सामग्री सूची संख्या INVENTORY NO Q-2007

9.0 CHEMICAL COMPOSITION

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

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

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^2)	Tensile Strength (N/mm^2)	Elongation (l_0= 5d) (%)	Reduction In area (%)	Impact Energy (J)[1]	Hardness HB30
≥ 600	1000 – 1300	≥ 12	≥ 12	≥ 20	305 - 405

[1] **Average of 3 Charpy V-notch specimen**

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.

14.0 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.

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

15.0 DEVIATIONS

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.

16.0 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.

17.0 PACKING AND MARKING:

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

18.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1608 2. EN 10228-4. 3. EN10204 4. EN10269 5. EN 571-1