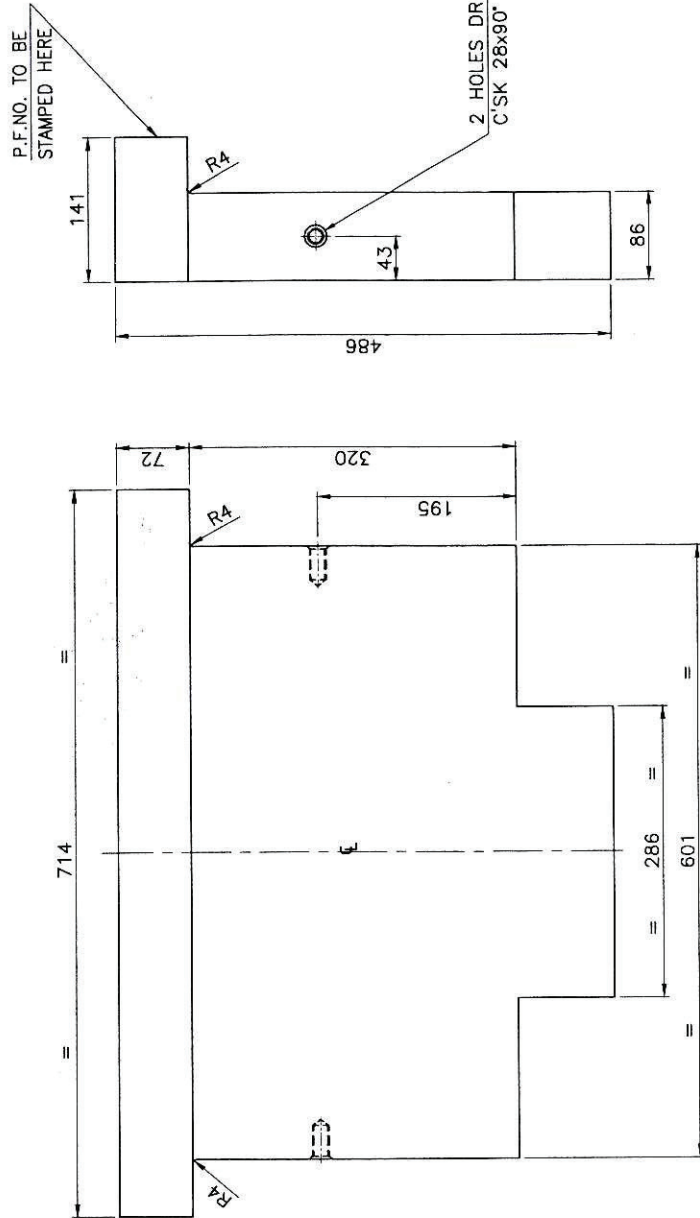


DRG. NO. 3 253 02

(ALL DIMENSIONS ARE IN mm)

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY**TECHNICAL REQUIREMENTS:-**

- FORGINGS SHALL BE SUPPLIED IN ACCORDANCE WITH CONDITION LAID DOWN IN DRG. NO. 3 253 02 01400.
- THE END PLATES ARE TO BE ROUGH MACHINED TO DIMENSION SHOWN MACHINING TOLERANCE ± 0.15
- MAX. ROUGHNESS OF MACHINED SURFACE SHALL NOT BE WORSE THAN 6.3 MICRONS EXCEPT WHERE OTHERWISE STATED.
- P.F. NOS TO BE STAMPED IN 6 MM SIZE AS BELOW
 - FOR 48 NOS. (UNIT-1) USE P.F. NO. 310240 TO 310287
 - FOR 48 NOS. (UNIT-2) USE P.F. NO. 310288 TO 310335
 - FOR 48 NOS. (UNIT-3) USE P.F. NO. 310336 TO 310383
 - FOR 48 NOS. (UNIT-4) USE P.F. NO. 310384 TO 310431
 - FOR 04 NOS. (SPARE) USE P.F. NO. 310432 TO 310435
- EACH FORGING SHALL BE TESTED ULTRASONICALLY IN ACCORDANCE WITH CORPORATE STANDARD AA 0850118 TO ENSURE FREEDOM FROM INTERNAL DEFECTS. THE NORMS OF ACCEPTANCE SHALL BE AS PER CATEGORY-2 OF THE ABOVE STANDARD.
- ALL SURFACES SHALL BE PARALLEL & SQUARE.

EXPORT

1

REF. DRG. NO.		SIGN. & DATE		INVENTORY NO.	
HGS 860/210-24D		HGS 860/210-24D		HGS 860/210-24D	
ARUN-III HEP/SAPDC_NEPAL		ARUN-III HEP/SAPDC_NEPAL		ARUN-III HEP/SAPDC_NEPAL	
NAME OF CUSTOMER/PROJECT		NAME OF PRODUCT OR TYPE OF CUSTOMER/PROJECT		NAME OF PRODUCT OR TYPE OF CUSTOMER/PROJECT	
STATUS OF DRAWING 'U'		STATUS OF DRAWING 'U'		STATUS OF DRAWING 'U'	
DISTRIBUTION OF PRINTS		DISTRIBUTION OF PRINTS		DISTRIBUTION OF PRINTS	
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QUALITY ASSURANCE DEPARTMENT

QA PLAN FOR: FORGINGS
QA PLAN NO: QSP/HG/104

DATE: 13/10/1993

PI NO: 240380726
REVISION: 01

SHEET 1 of 2
DATE: 14/01/2016

SL. NO.	COMPONENT/ASSY/ OPERATION	CHARACTERISTICS	CLASS	TYPE	QUANTUM OF CHECK	REF. DOC.	RECORD FORMAT	INSPECTION AGENCY	REMARKS
1.0	Forging stock (ingot or bloom)	a) Material certification	Major	Review	100%	Spec/ Drawing	TC	Supplier/BHEL/ Customer	
		b) Material identification	Major	Review	100%	Spec/ Drawing	TC	Supplier/BHEL/ Customer	
1.2	Forging	a) Visual and process checks	Major	Review	100%	Approved forging process	Supplier QC record	Supplier/BHEL/ Customer	
		b) Heat treatment	Critical	Heat treatment	100%	Spec	TC	Supplier/BHEL/ Customer	
		c) Marking of test samples as per drawing	Major	Review	100%	Drawing	Supplier QC record	Supplier/BHEL/ Customer	
		d) Chemical analysis	Major	Chem	Sample	Spec	TC	Supplier/BHEL/ Customer	
		e) Mechanical analysis	Major	Mech	Sample	Spec	TC	Supplier/BHEL/ Customer	
		f) Ensure proof marking for availability of machining allowance	Major	Dimensional	100%	Drawing	Supplier QC record	Supplier/BHEL/ Customer	
		g) Marking of PF nos., etc. before rough machining	Major	Review	100%	Drawing	Supplier QC record	Supplier/BHEL/ Customer	
		h) Visual & dimensional checks of rough machined forgings	Major	Visual/ Dimensional	100%	Drawing	Supplier QC record	Supplier/BHEL/ Customer	

PREPARED BY: -SD-

CHECKED BY: -SD-

APPROVED BY: -SD-

DATE: 13/10/1993

REVISION 01: 1) "Important note" has been added. 2) The "Type" field was blank for 1.2 c) & 1.2 g). 3) The "Record format" field was blank for SI. No. 1.2 c). 4) The format has been updated.

PREPARED BY: *[Signature]* 14/01/2016

CHECKED BY: *[Signature]* 14/01/2016

APPROVED BY: *[Signature]*

DATE: 14/01/2016

कृष्णा चो. बंडारु
KRISHNA C BANDARU
वरि अभियंता (अभिकल्प) / Sr. Engineer (D)
एच.जी.ई. प्रभाग / HGE Division
बी.एच.ई.एल., भोपाल / BHEL, BHOPAL

रितेश गजबिघे / RITESH GAJBHIRE
वरि प्रबंधक (अभिकल्प) / Sr. Manager (D)
एच.जी.ई. प्रभाग / HGE Division
बी.एच.ई.एल., भोपाल / BHEL, BHOPAL



QA PLAN FOR: FORGINGS
QA PLAN NO: QSP/HG/104

DATE: 13/10/1993

QUALITY ASSURANCE DEPARTMENT

PI NO: 240380726
REVISION: 01

SHEET 1 of 2
DATE: 14/01/2016

SL. NO.	COMPONENT/ASSY/ OPERATION	CHARACTERISTICS	CLASS	TYPE	QUANTUM OF CHECK	REF. DOC.	RECORD FORMAT	INSPECTION AGENCY	REMARKS
		i) UT on forging and boroscopic examination	Major	NDT	100%	Drawing	TC	Supplier/BHEL/ Customer	
		j) Final marking of PF nos., heat nos., identification, etc.	Major	Review	100%	Drawing	TC	Supplier/BHEL/ Customer	
		k) Painting, preservation, and packing	Major	Review	100%	Drawing	TC	Supplier/BHEL/ Customer	

ABBREVIATIONS: NDT - Non Destructive Testing, Mech - Mechanical, Chem - Chemical, Elec - Electrical, Spec - Specification, TC - Test Certificate, QC - Quality Control

IMPORTANT NOTE: Some of the above-mentioned tests may be witnessed by the customer. This shall be intimated at a later date.

PREPARED BY: -SD-

CHECKED BY: -SD-

APPROVED BY: -SD-

DATE: 13/10/1993

REVISION 01: 1) "Important note" has been added. 2) The "Type" field was blank for 1.2 c) & 1.2 g). 3) The "Record format" field was blank for Sl. No. 1.2 c). 4) The format has been updated.

PREPARED BY: 14/01/2016

CHECKED BY: 14/01/16

APPROVED BY: 14/01/2016

DATE: 14/01/2016

कृष्णा चै. बंडारु

KRISHNA C BANDARU

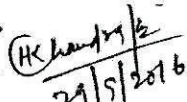
वरि अभियंता (अभिकल्प) / Sr. Engineer (D)
एच.जी.ई. प्रभाग / H Division
बी.एच.ई.एल., भोपाल / BHEL, BHOPAL

रितेश गजमिये / RITESHGAJBHAYE

वरि प्रबंधक (अभिकल्प) / Sr. Manager (D)
एच.जी.ई. प्रभाग / H GED Division
बी.एच.ई.एल., भोपाल / BHEL, BHOPAL



(8)

				SPECIFICATION OF ALLOY STEEL FORGINGS-HARDENED AND TEMPERED FOR HYDROGENERATOR		HG 06004 Rev. 01 PAGE 1 OF 7	
गोपनीय एवं अधिकार सुरक्षित इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुँचाने के लिए कदापि उपयोग नहीं किया जावे		<u>ALLOY STEEL FORGINGS - HARDENED AND TEMPERED</u> 1. GENERAL : This specification governs the quality of forged alloy steel forgings in Hardened & Tempered Condition. 2. APPLICATION : Pole end plates, shafts and other components for generators. 3. CONDITION OF DELIVERY : Forged, Hardened & Tempered in the "rough machined" condition. Forgings shall be commercially straight. 4. COMPLIANCE WITH BHEL / NATIONAL STANDARDS : There is no Indian Standard covering this type of material. 5. DIMENSIONS AND TOLERANCES : The dimensions and tolerances shall be as specified on the order/drawing, and shall not exceed these dimensions. A tolerance of 3 mm for finish has been provided in specifying the rough turned dimensions. Any forging which is bent to interfere with its finishing to desired sizes shall be rejected. 6. MANUFACTURES : Forgings shall be manufactured from steel produced by the open-hearth, electric or such other process as may be agreed to between the BHEL and the supplier. The 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. Forgings shall not be over heated.					
		Rev.01 Date: 29/09/2016 - Ref. of BHEL standard BP19389 is removed from Sr. No. 4 - Sr. No.11 ,Mechanical Properties UTS, elongation & Hardness updated  29/09/16  29/9/2016  29/9/16		हाइड्रोजेनरेटर इंजीनियरिंग विभाग भारत हेवी इलेक्ट्रिकल्स लिमिटेड		तैयारकर्ता -Sd- ANUPAM KUMAR	अनुमोदनकर्ता -Sd- P.CHAUDHURI

(7)

**SPECIFICATION OF ALLOY STEEL
FORGINGS-HARDENED AND TEMPERED
FOR
HYDROGENERATOR**

**HG 06004
Rev. 01**

PAGE 2 OF 7

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

The coupling or driven end of the shaft shall be indicated on the drawing. These ends shall correspond to the bottom of the ingot.

7. HEAT TREATMENT :

After forging and rough turning, the forgings shall be hardened & tempered. Forgings shall be free from uneven internal stresses, and shall have homogeneous grain structure.

Details of heat treatment shall be furnished to BHEL as and when called for.

8. FREEDOM FROM DEFECTS :

The forging shall be homogeneous, free from excessive hardness, slag spots, sand seams, blow holes, clinks, cracks or other imperfections.

9. CHEMICAL COMPOSITION :

The chemical composition of the material based on melt analysis shall comply with the following requirement.

Element	% Minimum	% Maximum
Carbon	0.19	0.25
Manganese	0.60	1.00
Silicon	-	0.35
Sulphur	-	0.03
Phosphorus	-	0.03
Nickel	0.35	0.75
Chromium	0.35	0.65
Molybdenum	0.15	0.25

Note : Carbon equivalent shall not be exceed 0.50 percent when calculated from the formula given below :

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

10. TEST SAMPLES :

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

गोपनीय एवं अधिकार सुरक्षित
इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुँचाने के लिए कदापि उपयोग नहीं किया जावे

			SPECIFICATION OF ALLOY STEEL FORGINGS-HARDENED AND TEMPERED FOR HYDROGENERATOR	HG 06004 Rev. 01 PAGE 4 OF 7										
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		SPECIFICATION OF ALLOY STEEL FORGINGS-HARDENED AND TEMPERED FOR HYDROGENERATOR		HG 06004 Rev. 01 PAGE 7 OF 7																																											
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