



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		उत्पाद मानक PRODUCT STANDARD		HG 06001 REV 02 पृष्ठ 6 का 1
		CAST STEEL POLE END PLATES (PEP)		
<p>1. INTRODUCTION: This PRODUCT STANDARD covers the technical requirements for manufacturing and acceptance norms for cast steel Pole End Plates, used in Hydro generators.</p> <p>2. QUALIFICATION OF SUPPLIER: The PEP is one of the most critical items of hydro generator, loaded under constant centrifugal force due to winding underneath and self centrifugal forces. The manufacturing process of the cast PEP's must be controlled throughout and hence the foundry must fulfill the requirements of IS 12117:1996, Class A, with an in-house electric heat-treatment furnace with programmable temperature controller for accurate temperature control and capacity sufficient to accommodate at least one melt charge of PEP's. The foundry must have AOD (ARGON OXYGEN DECARBONISATION) or VOD (VACCUM OXYGEN DECARBONISATION) facility in-house.</p> <p>3. MATERIAL: The manufacturers shall decide upon the chemical composition to achieve the required mechanical, physical and electrical properties and good weldability. Chemical compositions for a few grades are given for GUIDANCE only. Supplier shall furnish complete manufacturing process plan, indicating the chemistry of material chosen, melting procedure, heat treatment procedure, and cycle (rate of heating, soaking, and rate of cooling) and information on weldability along with test report on magnetic properties, if available, and applicable welding procedure specification before commencement of bulk manufacturing.</p> <p>4. STRENGTH GRADES The following strength grades are covered in this standard:</p>				
संशोधन : 01 DATE : 14/3/07 संशोधन : 02 DATE : 02/06/07		हाइड्रोजनरेटर इंजीनियरिंग विभाग भारत हेवी इलेक्ट्रिकल्स लिमिटेड		
		तैयारकर्ता -Sd-	अनुमोदनकर्ता -Sd-	जारी करने की दिनांक 16 10 2002
		P. CHAUDHURI	S.L	



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S. No	Yield Strength or 0.2% Proof Stress N/mm ² , min	Tensile Strength N/mm ² , min	Elongation (50 mm GL) (min.)	HARDNESS (MIN.)	Charpy V-notch(J) Average of 3 samples	
					At 20°C	At 0°C
01	275	480-650	22	245 BHN	40	27
02	320	520-670	20	245 BHN	40	27
03	375	540-690	20	280 BHN	40	27
04	470	630-780	18	280 BHN	40	27
05	540	690-840	15	300 BHN	40	27

5. SUGGESTED CHEMISTRY (NOT MANDATORY)

S NO	C	Si	Mn	S	Ph	Cu*	Ni*	Cr*	Mo*	V*	Ti*
	MAX	MAX	MAX	MAX	MAX	MAX	MAX	MAX	MAX	MAX	MAX
01	0.25	0.6	1.2	0.04	0.04	0.3	0.5	0.5	0.2	0.03	
02	0.25	0.6	1.6	0.04	0.04	0.3	0.4	0.3	0.25 (Mo+W)		
03	0.25	0.6	1.8	0.04	0.04		0.4	0.3			
04	0.25	0.5	1.3	0.04	0.04		0.4	0.25	0.3		
05	0.25	0.5	1.2	0.04	0.04		0.4	0.25	0.3	.02	.02

*Total of these elements shall not exceed 1%.

6. THE MATERIAL SHALL SHOW THE FOLLOWING MAGNETIC PROPERTIES:

MAGNETIC PROPERTIES	UNIT				
Flux Density	Tesla	1.39	1.55	1.70	1.78
Magnetizing Force	AT/m	3400	4200	10400	14800



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7. IDENTIFICATION

Each casting shall have the melt number embedded in 6 mm letter size as shown in the body portion (Ref. Fig. 1). Proper heat treatment record (charts from oven) shall be furnished by the supplier.

8. GENERAL REQUIREMENTS

The cast, heat treated and rough machined pole end plates shall meet all the requirements stipulated in the drawing and this standard.

The residual stress shall not exceed 60 N/mm^2 , which shall be achieved by proper heat treatment as mentioned above.

The pole end plate is divided in two zones (Zone 1 and Zone 2) as shown in fig. 1 for inspection purposes.

The casting shall not show any cracks or non – permissible inclusions. No welding is allowed in Zone 1. Written permission is to be taken from BHEL for weld repair in Zone 2. Diagrams of such areas shall be furnished to BHEL. Prior MCD shall be done in the areas for weld repair to ensure no defect.

The weld repair proposed shall indicate the location and size of defect areas, welding procedure specification, pre/post heat treatment, and other things. BHEL reserves the right to reject or accept the weld repair proposal to its discretion. BHEL also reserves the right to visit manufacturer's premise any time during manufacturing of the PEPs.

Two numbers of magnetic test piece samples (dia 13 mm x 50 mm long) shall be supplied to BHEL for testing and ascertaining magnetic properties, irrespective of whether supplier has got facilities for magnetic testing or not.



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9. QAP & TESTING.

The inspection and testing at supplier's works shall be done as per the approved QA Plan. QA Plan shall be prepared and submitted by the supplier for approval prior to bulk manufacturing.

Test piece may be integrally cast as shown in Fig. 1 on one or both sides as required. Cutting of test piece from one PEP and stamping shall be done after final heat treatment in presence of BHEL's representative, unless otherwise agreed. 1 no tensile test piece and 6 nos. impact test pieces shall be taken from each melting charge/lot for heat treatment. Prior intimation shall be given to BHEL to witness testing if called for in the approved QA Plan, otherwise test certificate shall be submitted before dispatch of PEP's for final clearance.

10. THE FOLLOWING TESTS SHALL BE CONDUCTED ON FINISHED PEP'S:

- I Tensile test to ASTM A370/IS 1608,
- II Charpy V-notch impact test to IS 1757 / EN10045,
- III Hardness test to IS 1500 – Heat affected Zone shall also be tested in case of weld repair.
- IV Magnetic property test,
- V Dimensional checking w.r.t. drawing.
- VI Non destructive testing of each PEP as detailed below:

- a. **ULTRASONIC EXAMINATION:** All castings shall be subject to UT as per BHEL Std. AA-0850118. The acceptance norm shall be category 1 for Zone 1 and category 2 for Zone 2 as per fig. 1. In case of doubt in UT, radiography shall be done to ascertain the correct size & location of the defect.

Weld repair areas shall be additionally tested with appropriate normal and angular testing probes. Doubtful or disputed indications anywhere will be resolved by radiography to ascertain the flaw size. However, the acceptance norm will remain unchanged.

- b. **MAGNETIC CRACK DETECTION** shall be performed on the whole surface. Linear indications are not acceptable for Zone-1, for Zone-2, level 2 of AA-0850134 shall apply.



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- c. **RADIOGRAPHY TESTING** – 1 Out of every 50 PEP's shall be subjected to radiography test and must comply to the requirements as per ASTM E446 Level – II. BHEL may carry out surveillance check to this effect on supplied PEP's.

11. TEST CERTIFICATE:

The Test Certificate (in triplicate) for each heat shall indicate the following :

I	Chemical analysis	II	UT results
III	Details of heat treatment	IV	MCD results
V	Mechanical properties	VI	Dimensional record.

Acceptance of the Test Certificate does not absolve the manufacturer of the responsibility regarding latent defects that might be detected at a later date.

12. APPLICABLE STANDARDS :

- I Ultrasonic Testing to AA-0850118.
- II MCD Testing to AA-0850133.
- III MCD Acceptance norm to AA-0850134.

13. INFORMATION REQUIRED FROM SUPPLIER

13.1 ALONG WITH OFFER

- (i) Qualification requirement details -- as per clause 2 above.
- (ii) Complete manufacturing plan refer clause 3
- (iii) QA Plan Refer Clause 9
- (iv) Deviation if any

In the absence of above document the suppliers offer will not be considered.

13.2 ALONG WITH SUPPLY

- (i) Test certificates as per clause 11.
- (ii) Heat treatment record Refer Clause 7.
- (iii) Details of weld repair done as per clause 8.

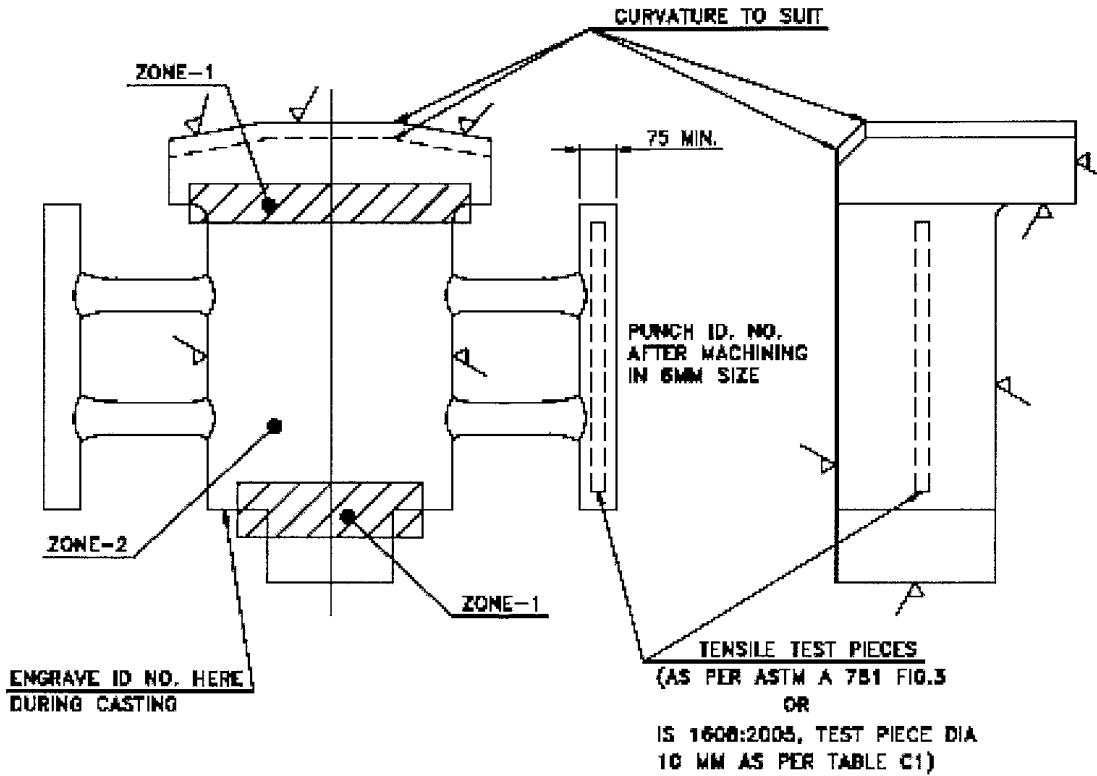


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**FIG . 1 : ROUGH MACHINED CAST POLE END PLATE
(FOR DIMENSIONS REFER DRAWING)**

REV . 01: QUALIFICATION OF SUPPLIER AT SL. NO. 02 UPDATED , BHN HARDNESS NUMBER IS ADDED AGAINST EACH GRADE IN TABLE FOR STRENGTH GRADES & DETAIL OF RADIOGRAPHT TEST AT CLAUSE 10. (VI) C ADDED.

REV. 02: CLAUSE NO.9 AND FIG.1 MODIFIED.