









जर्नल एवं दिनांक SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार)		HW 19373
		PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		मुख पृष्ठ PREFACE SHEET
सामग्री सूची संख्या को अधिकारित करता है	SUPERSEDES INVENTORY NO.	LP TURBINE SHAFT FORGING WITH DAIMETER \leq 1800MM (Gr : 26NiCrMoV14-5)		
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.		
स्वत्वधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं अप्रयोग किए से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए ।		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 9123 18 08/2002		
जर्नल एवं दिनांक SIGN & DATE	INVENTORY NO. P-2237	स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE		
Rev. No 02 27-01-06	निर्माण PREPARED :	जारी : मानक विभाग ISSUED : STANDARDS DIVISION	दिनांक : DATE : 2-2-06	


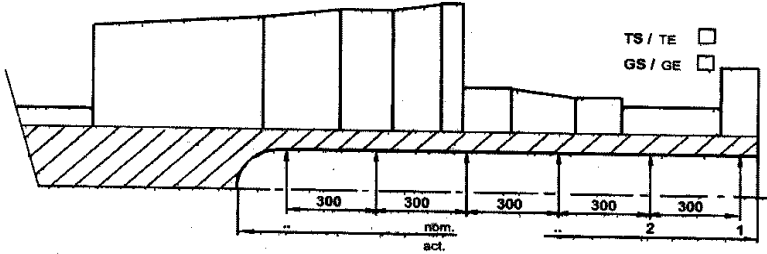
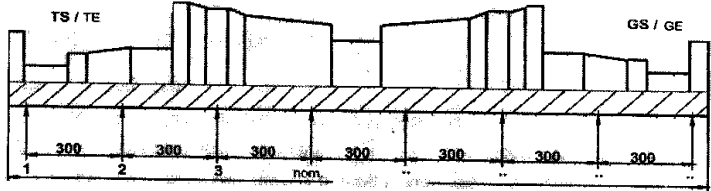
संस्थान का लोगो 	संस्थान क्रय विनिर्देश (हीप - हरिद्वार)		HW 19373	
	PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		पृष्ठ का Page 1 of 7	
SUPERSEDES INVENTORY NO.	LP TURBINE SHAFT FORGING WITH DAIMETER \leq 1800MM (Gr : 26NiCrMoV14-5)			
Based on TLV 9123 18 08/2002				
COPYRIGHT AND CONFIDENTIAL The 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.	1.0 GENERAL: This specification governs the quality of LP Turbine shaft forging of steel grade 26NiCrMoV14-5 (Material no. 1.6957).			
	2.0 APPLICATION: For LP Turbine shafts with diameter < 1800MM.			
	3.0 CONDITION OF DELIVERY: Heat-treated and machined condition as per the ordering drawing.			
	4.0 DIMENSION AND TOLERANCES: Forging shall be supplied to the dimensions and tolerances as per the ordering drawing.			
	5.0 MANUFACTURING:			
स्वतंत्रता एवं गोपनीय इस दस्तावेज के तहत नई प्रतियां बनाई होंगी जो कि गुणवत्ता के दृष्टिकोण से मूल दस्तावेज के समान होंगी। आचार्य एवं के विधि की तहत प्रयोग, जो कि गुणवत्ता के दृष्टिकोण से मूल दस्तावेज के समान होंगी।	5.1 GENERAL REQUIREMENTS: Before starting the production the manufacturer shall submit following documents for BHEL approval, in accordance to the specification QS0001 of Siemens: Manufacturing and inspection sequencing plan (MIP) for forging shall constitute details of: <ul style="list-style-type: none"> • Steel melting, Steel treatment, Ingot pouring • Forging process • Preliminary Heat-treatment • Internal tests and inspections before Quality Heat-treatment • Quality Heat-treatment • Tests and Inspections after Heat-treatment • Test certificate requirements • Marking, Preservation and dispatch • Test instructions for NDE examinations in detail preferably with sketches 			
	5.2 MELTING AND FORGING: Vacuum degassed steel with low silicon content (e.g. VCD steel) or Electro slag re-melted steel shall be used and shall be thoroughly forged. The use of any other melting method and secondary steel treatment shall be agreed upon in advance with BHEL in each individual case.			
दिनांक एवं हस्ताक्षर SIGN & DATE	दिनांक एवं हस्ताक्षर SIGN & DATE	नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	
TSX IPSC STE QAX	AK CHATURVEDI Vikas Malhotra A.K. GOEL N.K. Mawson	दिनांक एवं हस्ताक्षर SIGNATURE दिनांक एवं हस्ताक्षर SIGNATURE	अनुवादक TRANSLATED BY निर्माणकर्ता WORKED BY जांचकर्ता CHECKED BY पर्यवेक्षणकर्ता SUPERVISED BY	दिनांक एवं हस्ताक्षर SIGNATURE & DATE दिनांक एवं हस्ताक्षर SIGNATURE & DATE दिनांक एवं हस्ताक्षर SIGNATURE & DATE दिनांक एवं हस्ताक्षर SIGNATURE & DATE
AGREED DEPTT NAME	NAME	DATE & SIGNATURE	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	
स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE				
REV 02 27.01.06	दिनांक : PREPARED :			
जारी : मानक विभाग ISSUED : STANDARDS DIVISION		दिनांक : DATE : 2-2-06		


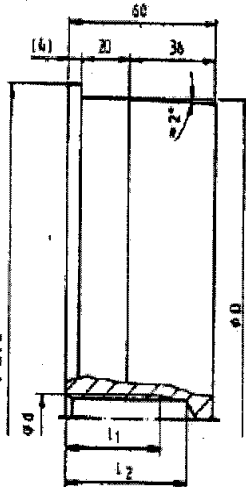

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (डीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		HW 19373 पृष्ठ का Page 2 of 7																																	
शीर्षक एवं संख्या INVENTORY NO. P-2237	SUPERSEDES INVENTORY NO.	Before heat-treatment, clocking symbols 3-6-9-12 shall be stamped on the ends of the rotor. While transferring the symbols during manufacturing, they shall be restamped in the same clock position. The clocking symbol shall be used for reference purpose in recording the position of the defect, bore eccentricity etc.																																			
COPYRIGHT AND CONFIDENTIAL 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.		5.3 HEAT TREATMENT: Before starting the quality heat treatment, the supplier shall submit with dimensions of heat treatment according to QS0001 for BHEL approval. Surplus material shall be left at the transition area from body part to the journals at the location of axial core trepanning. The surplus material at transition between the body and journals at the locations of axial trepan core shall only be machined after quality heat treatment. The rotor shaft forging shall be subjected to water quenching or water spraying. The cooling shall be continued till a temperature less than 80°C is achieved in the center of the rotor body. The duration of quenching as well as actual temperature at the end of cooling to be measured at rotor body and bearing journal and shall be recorded in test certificate. The tempering temperature shall be selected to achieve the prescribed 0.2% yield strength at the best possible toughness. However it shall not be less than 600°C. The duration of tempering as well as the controlled cooling rate are to be chosen to achieve minimum residual stresses. Residual stresses measurement shall be carried out as per PS-0.0001 by KWU-Ring Core method / ASTM E837. The location of residual stress measurement shall be done as per Siemens specification PS-0.0001. The residual stresses shall not exceed 60 N/mm ² at any point on the surface. The requirement of residual stress measurement on the rotor of a particular drawing can be waived off after agreement with the purchaser if the supplier has already carried out the measurement by above method on the rotor of that drawing and results are satisfactory. BHEL reserves the right to control the residual stresses.																																			
स्वतंत्रता एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत के ही इस्तेमाल के लिए है। इसका प्रयोग एवं प्रसारण अन्य किसी भी तरह से बिना भारत के ही इस्तेमाल के लिए नहीं किया जा सकता है।		6.0 PROPERTIES AND TESTS: 6.1 CHEMICAL COMPOSITION IN %: <table border="1"> <tr> <td>C</td> <td>0.28 max</td> <td>Si</td> <td>0.07 max</td> <td>Mn</td> <td>0.40 max</td> <td>P</td> <td>0.007 max</td> </tr> <tr> <td>S</td> <td>0.007 max</td> <td>Cr</td> <td>1.40 - 1.80</td> <td>Mo</td> <td>0.30 - 0.45</td> <td>Ni</td> <td>3.40 - 3.80</td> </tr> <tr> <td>V</td> <td>0.15 max</td> <td>Al total</td> <td>0.010 max</td> <td>Sn</td> <td>0.015 max</td> <td>Sb</td> <td>0.0015 max</td> </tr> <tr> <td>As</td> <td>0.020 max</td> <td>Cu</td> <td>0.15 max</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>For the element P and Sn, a sum of 150ppm max shall be aimed at. Check analysis shall be carried out according to PS-0.0003 and recorded. Slight deviation in chemical composition is permissible only after agreement with BHEL, provided service properties are not affected.</p>				C	0.28 max	Si	0.07 max	Mn	0.40 max	P	0.007 max	S	0.007 max	Cr	1.40 - 1.80	Mo	0.30 - 0.45	Ni	3.40 - 3.80	V	0.15 max	Al total	0.010 max	Sn	0.015 max	Sb	0.0015 max	As	0.020 max	Cu	0.15 max				
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दिनांक DATE 29/10/06		6.2 MECHANICAL PROPERTIES 6.2.1 Tangential or Radial Specimens: The manufacturer shall test Tangential or radial test specimens taken from locations indicated on the drawing. The individual values of 0.2% Yield strength and tensile strength may only differ by 50 N/mm ² maximum. The test rings shall not be cut free																																			
शीर्षक एवं संख्या INVENTORY NO. P-2237		निर्माणकर्ता WORKED BY ASHISH		21.01.06																																	
Rev 02		जांचकर्ता CHECKED BY P. IVAR		21.01																																	

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार)		HW 19373		
		PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		पृष्ठ का Page 3 of 7		
SUPERSEDES INVENTORY NO.	समीचीन सूची संख्या को अधिग्रहित करता है	before quality heat treatment. The location of tensile and impact specimens (distance from the heat-treatment surface) shall be in a distance of 40mm from the heat-treated surfaces and shall be indicated in the drawing. The following properties shall be achieved at room temperature: 0.2% Yield strength: 700 – 800 N/mm ² Tensile strength: 980 N/mm ² max % Elongation(lo = 5d) 15% min. % Reduction in Area 45 % min. Impact Strength 100 J min. (Average of 3 Charpy V-notch specimens)				
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.		6.2.2 Axial Core: An axial core of diameter ≥ 60 mm is to be taken out from the journal area of the shaft. The location of the axial core is shown in the order drawing. Apart from the data on the drawing, the position of the shaft in the forged ingot shall be such that the axial core lies on the topside (output end). Release for boring will be authorised by BHEL after review of the test results like T1 & T2 mechanical tests, including UT & residual stress values, submitted by the manufacturer. Position and number of specimens, test temperature shall be as per latest issue of PS-0.0003. Following properties shall be achieved in radial direction: 0.2% Yield Strength : 700 N/mm ² min. FATT : $\leq -30^\circ\text{C}$ Impact Strength (at $+20^\circ\text{C}$) : 90 J min. (Avg. of 3 Charpy V-notch specimens) BHEL reserves the right to extend the axial core below the barrel, if required. In this case it will be based on a revised drawing. The following properties shall be achieved in the barrel area in radial direction: 0.2% Yield Strength : 700 N/mm ² min. FATT : $\leq \pm 0^\circ\text{C}$ Impact Strength (at $+20^\circ\text{C}$) : 70 J min. (Avg. of 3 Charpy V-notch specimens)				
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत भारती इलेक्ट्रिकल्स की संपत्ति है इसका प्रसारण एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।		6.2.3 Tangential Cores: In special cases, if instructed in the order drawing, tangential cores of diameter 26mm are to be taken out from the middle of the body part. Position, number of specimens and testing temperature are to be taken from PS-0.0003. The following properties shall be achieved: Distance from heat treatment surface: ≥ 200 mm ≥ 300 mm 0.2% yield strength $\geq 700\text{N/mm}^2$ $\geq 700\text{N/mm}^2$ FATT $\leq -20^\circ\text{C}$ $\leq \pm 0^\circ\text{C}$ Impact strength at $+20^\circ\text{C}$ $\geq 90\text{ J}$ $\geq 70\text{ J}$ (Avg. of 3 Charpy V notch specimens)				
दिनांक एवं हस्ताक्षर SIGN & DATE	P-2237	Rev 02				
समीचीन सूची संख्या INVENTORY NO.	निर्माणकर्ता WORKED BY	ASHISH	Arunjan	21.01.06		
जांचकर्ता CHECKED BY	P.NATH	उत्तम	21.01			

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार)		HW 19373	
सामग्री सूची संख्या को INVENTORY NO.	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.	PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		पृष्ठ का	Page 4 of 7
स्वतंत्रता एवं गोपनीय इस प्रलेख में को नई सूचना भारत देशी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयुक्त एवं आध्यात्म रूप से किसी भी तरह प्रयोग, जो कि कम्पनी के हित में हानिकारक हो न किया जाए।		6.2.4 Testing:		The manufacturer shall carry out testing of axial and tangential cores (if any). The axial and tangential cores must be clearly marked, so that their original position can be allocated to the shaft easily. Traceability of the trepanned core to the forging shall be confirmed by the stamp of the manufacturer's authorised inspector in the area of the identification number. If for any reason the axial core is to be taken from input end (bottom end), the existing drawing shall not be valid. The sampling of the trepanned core will then be done according to a new drawing.	
6.2.5 Reduced Fracture Deformations:		If reduced values of the fracture deformations are achieved, the manufacturer has to prove that these are caused by local impurities only.			
6.2.6 Release for Further Manufacturing:		On receipt of all test results, BHEL will decide further course of action for the shaft.			
6.3 NON DESTRUCTIVE EXAMINATION (Outer & Inner Quality):	6.3.1 SCOPE OF INSPECTION		6.3.1.1 Ultrasonic Test :		Ultrasonic test and acceptance shall be carried out as per the Siemens specification PA14/24.51 .
6.3.1.2 Magnetic Particle inspection:	Magnetic particle inspection of the axial bore and of any radial bore, if any, shall be carried out . Magnetic particle inspection findings shall be evaluated as per PA14/24.51.				
6.4 DIMENSIONAL MEASUREMENT:	The dimensions and tolerances given in the ordering drawing shall be applicable. The supplier shall carry out the following dimensional inspection in delivery condition:		<ul style="list-style-type: none"> All outer diameters and outer length of the rotor, surface roughness of the journal area with limited reference value and actual value are to be provided. Length, diameter and surface roughness of the axial bore is to be measured according to Annexure -01 at 100mm intervals. 		
7.0 MARKING:	The marking shall be carried out as per standard PA 14/24.51(latest edition).				
8.0 DOCUMENTATION:	The supplier shall furnish 4 copies of test certificates in accordance to EN10204B, unless and otherwise stated on the order. The test certificates shall bear the following information:		BHEL Reference:		
a) Identification number	दिनांक एवं हस्ताक्षर SIGN & DATE 		सामग्री सूची संख्या INVENTORY NO. P-2237		Rev 02
निर्माणकर्ता WORKED BY	ASHISH		21.01.06		
जांचकर्ता CHECKED BY	P.NATH	21.01	21.01		

संपत्ति सूची संख्या को INVENTORY NO. P-2237	दिनांक एवं हस्ताक्षर SIGN & DATE 21/01/06		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)		HW 19373 पृष्ठ का Page 5 of 7	
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल लिमिटेड की संपत्ति है इसका प्रयोग एवं आगमन रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।		b) Purchase Order No. c) Drawing number d) Specification number Supplier's Reference : a) Name of supplier b) Material Identification c) Melt Number & melting process d) Details of steel ingot & forging process: Dimension, ingot weight, forging process and degree of forging ratio (F_{max}/F_{end} at the largest diameter) e) Details of heat treatment, method of cooling, actual time and temperature sequence, soaking time, heating and cooling rate. Test Results: a) Melt analysis along with tramp elements. b) Mechanical test results (all individual values & test piece locations are to be indicated). c) Ultrasonic examination results according to PA 14/24.51 d) Results of the MPI of axial and if applicable radial bores according to PA14/24.51. e) Result of residual stress measurement, if carried out. 9.0 CLEARANCE FOR DELIVERY : The entire results of test performed are deciding factors for the clearance of the delivery. BHEL shall evaluate the total results with respect to intended operational requirements for the forging and judge accordingly the permissibility of deviations (if any) of the properties of the item required. The clearance does not relieve the manufacturer from the responsibility for hidden impermissible defects, which may be found later on. 10.0 DEVIATIONS : Deviations from this Purchase Specification, which arise during manufacturing, may be submitted to BHEL in writing, giving full details of the deviation. Acceptance of concession request will be at the sole discretion of BHEL. 11.0 PACKING & DISPATCH: Before dispatch, the forging shall be suitably packed to prevent corrosion and damage during transit. Support points shall be protected against corrosion and mechanical damage. Axial bore shall be sealed air tight by means of a plastic plug (polycarbonate). The details are given in Annexure-02. Prior to sealing, the whole surface of the bore shall be protected with a waterdisplacing slushing oil (dewatering fluid). BHEL must be informed about the used product. 12.0 CROSS REFERRED STANDARDS: 1. QS0001 2. PS-0.0001 3. PS-0.0003 4. PA 14/24.51 5. EN10204.				
संपत्ति सूची संख्या INVENTORY NO. P-2237		दिनांक एवं हस्ताक्षर SIGN & DATE 21/01/06		निर्माणकर्ता WORKED BY ASHISH Arayan 21.01.06		जांचकर्ता CHECKED BY P. NATH 21.01

दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)	HW 19373 पृष्ठ का Page 6 of 7																				
समीची सूची संख्या INVENTORY NO. समीची सूची संख्या को अधिकृत किया गया है	ANNEXURE-01																						
LP Turbine Shaft: Inspection of Axial Bore																							
Test Record:																							
Job Name:		PO No:																					
Drawing No.:		Material Spec.:																					
Roughness: Nom./Act. Diameter : Nom.																							
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REV 02		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">निर्माणकर्ता WORKED BY</td> <td style="width: 20%;">ASHISH</td> <td style="width: 20%;">A. Rayan</td> <td style="width: 40%;">21.01.06</td> </tr> <tr> <td>जांचकर्ता CHECKED BY</td> <td>P. NATH</td> <td>9.1.06</td> <td>21.01</td> </tr> </table>		निर्माणकर्ता WORKED BY	ASHISH	A. Rayan	21.01.06	जांचकर्ता CHECKED BY	P. NATH	9.1.06	21.01												
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निर्माक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (हीप - हरिद्वार) PLANT PURCHASE SPECIFICATION (HEEP - HARIDWAR)	HW 19373 पृष्ठ का Page 7 of 7																	
समीची सूची संख्या INVENTORY NO.	SUPERSEDES INVENTORY NO.	ANNEXURE-02 Plugs for trepanning bores in turbine and generator rotors.																		
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.	समीची सूची संख्या को अधिकारित करता है	 <p> $\varnothing D$ (Paßmaß Stopfen) = Bohrungsdurchmesser Weite + 0,25 Tol. + 0,05 $\varnothing D$ (fit of plug) = bore diameter of rotor + 0,25 tolerance + 0,05 </p> <table border="1" data-bbox="386 1176 1079 1344"> <thead> <tr> <th>Gewindemaße thread dimensions</th> <th>$\varnothing d$</th> <th>l_1</th> <th>l_2</th> </tr> </thead> <tbody> <tr> <td>$\varnothing D \leq 60$ mm</td> <td>M 16</td> <td>31</td> <td>40 ⁺¹</td> </tr> <tr> <td>$\varnothing D > 60 - \leq 130$ mm</td> <td>M 20</td> <td>31</td> <td>42 ⁺¹</td> </tr> <tr> <td>$\varnothing D > 130$ mm</td> <td>M 27</td> <td>31</td> <td>44 ⁺²</td> </tr> </tbody> </table>			Gewindemaße thread dimensions	$\varnothing d$	l_1	l_2	$\varnothing D \leq 60$ mm	M 16	31	40 ⁺¹	$\varnothing D > 60 - \leq 130$ mm	M 20	31	42 ⁺¹	$\varnothing D > 130$ mm	M 27	31	44 ⁺²
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, को किसी कंपनी के हित में हानिकारक हो न किया जाए।	स्वत्वाधिकार एवं गोपनीय																			
हस्ताक्षर एवं तिथि SIGN & DATE																				
समीची सूची संख्या INVENTORY NO.	P-2237	REV 02	निर्माणकर्ता WORKED BY	ASHISH Arayan 21.01.06																
			जांचकर्ता CHECKED BY	P. NATH 21.01																