

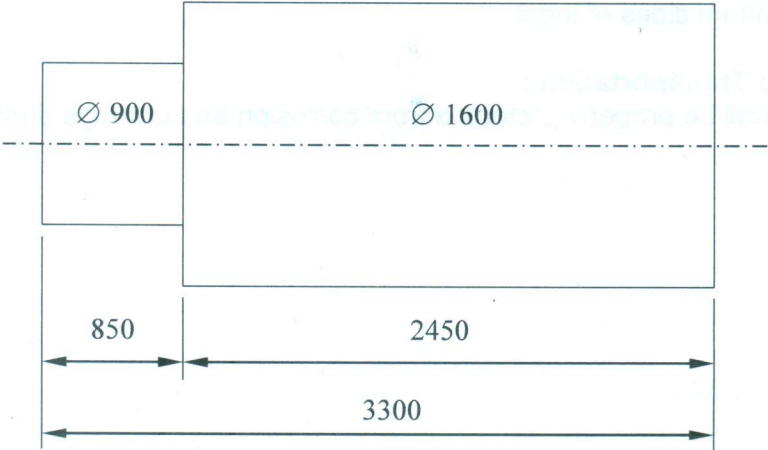
दिनांक एवं हस्ताक्षर SIGN & DATE		संस्थान क्रय विनिर्देश (सी.एफ.एफ.पी-हरिद्वार) PLANT PURCHASE SPECIFICATION (CFFP - HARIDWAR)		FF-04062 Rev00	
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सामग्री सूची संख्या INVENTORY NO	SPECIFICATIONS FOR ESR INGOTS IN GRADE X12CrMoWVNbN 10-11				
COPYRIGHT AND CONFIDENTIAL The information on this documents 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	1.0 GENERAL This specification covers the quality requirements of Ingots made through ESR route.				
	2.0 APPLICATION ESR ingot will be used for Forging Turbine rotors of higher rating.				
	3.0 CONDITION OF DELIVERY ESR ingot shall be supplied in as cast condition with suitable post heat treatment to have a uniform structure throughout the ingot length. Ingot must be free of any visible cracks.				
	4.0 COMPLIANCE WITH NATIONAL STANDARD There are no national / international standard available for procurement of ESR ingot.				
	5.0 DIMENSIONS AND TOLERANCES ESR ingot shall be supplied as per sketch (Pg – 6).				
	6.0 MANUFACTURING:				
स्वत्वधिकार एवं गोपनीय 8 इस पन्ने में दी गयी सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो की कंपनी के हित में हानिकारक हो न किया जाय।	6.1 General Requirements: Before start of manufacturing the supplier shall submit the following informations for BHEL's approval				
	(a) ESR electrode manufacturing route (Steel melting, refining, ingot pouring methods, annealing/make safe treatment given if any, size and weight of each electrode, amount of Hot Top and Bottom discard in % etc)				
	(b) ESR equipments details (Type of ESR, Equipment Capacity, Mould Sizes, Minimum and maximum length of each ingot diameter, flux/slag used in ESR).				
	(c) Experience in making large ingots manufactured by ESR Route (≥ 40 T) in grade X12CrMoWVNbN 10 11 or must have produced steam turbine rotor in same grade by in house ESR facility with Rotor dispatch weight (≥ 17 T). Vendor must have successfully supplied atleast two rotor forgings/ingots in the grade X12CrMoWVNbN10-11 in the past three years. Vendor must submit proof of such supplies along with the test certificates.				
दिनांक एवं हस्ताक्षर SIGN			अनुवादक TRANSLATED BY		
			निर्माणकर्ता WORKED BY	Alok Kr Singh	AKS 5/6/18
			जांचकर्ता CHECKED BY	K.S.RANA	2/5/6/18
			पर्यवेक्षणकर्ता APPROVED BY	G.M.VARMA	5/6/18
सामग्री सूची संख्या INVENTORY NO	सहमत विभाग AGREED DEPT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	स्वीकृति : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE	
	AM 5/6/18	Dr. M.S.RANA	5/6/18	निर्माण: फोर्ज उत्पादन PREPARED: FORGE PROD.	जारी : फोर्ज तकनीकी ISSUED: FORGE TECH
				दिनांक : 23-05-18 DATE: 23-05-18	

दिनांक एवं हस्ताक्षर SIGNATURE		संस्थान क्रय विनिर्देश (सी.एफ.एफ.पी-हरिद्वार) PLANT PURCHASE SPECIFICATION (CFFP - HARIDWAR)		FF-04062 Rev00																
				पृष्ठ 6 का 2 Page 2 of 6																
SUPERSEDES INVENTORY NO. समूची सूची संख्या से अधिकतम	(d) Post Heat treatment cycle detail. The ESR ingot shall be clean enough to meet the UT requirements of the forging produced and shall be free from segregation which are harmful to the forgings produced from the ingot. The forging UT acceptance standard for information is based on 2mm isolated flat bottom hole after it is processed at BHEL works. The finished ingot shall meet the following inclusion content requirements as per ASTM E 45 method D. <table border="1"> <thead> <tr> <th>Field Number</th> <th>Thin Inclusion Max</th> <th>Thick Inclusion Max</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>1</td> <td>0.5</td> </tr> <tr> <td>B</td> <td>0</td> <td>0</td> </tr> <tr> <td>C</td> <td>0.5</td> <td>0.5</td> </tr> <tr> <td>D</td> <td>1</td> <td>1</td> </tr> </tbody> </table> The supplier shall clearly state the acceptance standard. Slight deviation from the above could be considered. 6.2 MELTING ESR ingots shall be melted either directly from the cast electrode or from a pre forged electrodes of suitable diameter. The ratio between electrode dia and the ESR ingot dia to be mentioned. Multiple electrodes of the same cast or of differently cast electrodes can be used for remelting the ingots. If multiple casts are used in such cases chemical composition of each cast electrodes shall be also reported and their relative position with respect to the ingot may be given for reference.					Field Number	Thin Inclusion Max	Thick Inclusion Max	A	1	0.5	B	0	0	C	0.5	0.5	D	1	1
Field Number	Thin Inclusion Max	Thick Inclusion Max																		
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B	0	0																		
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दि नाम स्वतंत्राधिकार एवं गोपनीय 8 इस पृष्ठ से दी गयी सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ती है इसका प्रयोग एवं अन्वेषण बस से कि नगर प्रयोग को की कंपनी के हिस्से में अधिकार है न कि अन्य																				
समूची सूची संख्या INVENTORY NO.	निर्माणकर्ता WORKED BY आंचकर्ता CHECKED BY	<i>AKS</i> <i>5/6/18</i> <i>5.C.18</i>	स्वीकृती APPROVED : निर्माण: फोर्ज उत्पादन PREPARED : FORGE PROD.	संस्थान मानक समिति PLANT STANDARDS COMMITTEE जारी : फोर्ज तकनीकी ISSUED : FORGE TECH	दिनांक : 23-05-18 DATE : 23-05-18															

दिनांक एवं हस्ताक्षर DATE & SIGN		संस्थान क्रय विनिर्देश (सी.एफ.एफ.पी-हरिद्वार) PLANT PURCHASE SPECIFICATION (CFFP - HARIDWAR)		FF-04062 Rev00 पृष्ठ 6 का 3 Page 3 of 6																																											
सामग्री सूची संख्या INVENTORY NO	6.3 CHEMICAL COMPOSITION (X12CrMoWVNbN 10-11) The Chemical composition of the ESR ingot shall be as follows :																																														
	<table border="1"> <thead> <tr> <th></th> <th>C</th> <th>Si</th> <th>Mn</th> <th>P</th> <th>S</th> <th>Cr</th> <th>Mo</th> <th>Ni</th> <th>W</th> <th>V</th> <th>Al</th> <th>N</th> <th>Nb</th> </tr> </thead> <tbody> <tr> <td>Min</td> <td>0.11</td> <td>---</td> <td>0.40</td> <td>---</td> <td>---</td> <td>10.2</td> <td>1.0</td> <td>0.7</td> <td>0.95</td> <td>0.15</td> <td>---</td> <td>0.045</td> <td>0.04</td> </tr> <tr> <td>Max</td> <td>0.13</td> <td>0.12</td> <td>0.50</td> <td>0.012</td> <td>0.003</td> <td>10.6</td> <td>1.1</td> <td>0.8</td> <td>1.05</td> <td>0.25</td> <td>0.01</td> <td>0.060</td> <td>0.06</td> </tr> </tbody> </table>						C	Si	Mn	P	S	Cr	Mo	Ni	W	V	Al	N	Nb	Min	0.11	---	0.40	---	---	10.2	1.0	0.7	0.95	0.15	---	0.045	0.04	Max	0.13	0.12	0.50	0.012	0.003	10.6	1.1	0.8	1.05	0.25	0.01	0.060	0.06
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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.	The percentage of tramp elements Cu, Sn, As and Sb shall also be as low as possible and shall be reported in the inspection documents. A sample from top and bottom of final ESR ingot shall be tested for chemical analysis and to be reported in the inspection document.																																														
	6.4 GAS ANALYSIS Gas analysis (Hydrogen and Oxygen) achieved in the Electrodes (per cast analysis) and that achieved in the ESR ingot also to be measured. The location of these gas analysis shall be same as that of chemical analysis. In any case Oxygen content in the ESR ingot shall not be higher than 20 ppm and Hydrogen Content is not higher than 1.5 ppm.																																														
	6.5 POST HEAT TREATMENT ESR ingot shall be post heat treated to reduce the ingot solidification stresses and to obtain uniform fine grain.																																														
स्वत्वाधिकार एवं गोपनीय 8 इस प्रलेख में दी गयी सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो की कंपनी के हित में अधिकारक हो न किया जाय।	7.0 SURFACE QUALITY The ingot surface shall have good surface finish, free from cracks, slagpatches, scabbing, discontinuity, loose metal skin etc. The ESR ingot shall be free from bends. Maximum permissible bend is 5 mm over the entire length. Slag runoff during remelting at any stage is not acceptable.																																														
	8.0 ADDITIONAL REQUIREMENTS The Manufacturer shall mention the amount of Top and Bottom Discards to be given in the mentioned ingot. This discards will suffice to have high integrity of forgings without any defects. The hot topping practice should be in such way that the top surface of the ingot shall be flat without depression. Surface imperfections if any may be removed by grinding the same longitudinally and the depth of the grinding shall not exceed 10 mm on each location. The depression shall be blended smoothly to the surface.																																														
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सामग्री सूची संख्या INVENTORY NO	निर्माणकर्ता WORKED BY AKS	8/6/18	स्वीकृती : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE																																												
	जांचकर्ता CHECKED BY 	5-6-18	निर्माण: फोर्ज उत्पादन PREPARED : FORGE PROD.	जारी : फोर्ज तकनीकी ISSUED : FORGE TECH	दिनांक : 23-05-18 DATE : 23-05-18																																										

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सामग्री सूची संख्या SUPERSIDES INVENTORY NO	Manufacturers must indicate the quality checks performed on the ingot to assure that the final forging is free from ultrasonic indications caused due to entrapped inclusions. Metallographic examination on samples from top and bottom side of the ingot to determine the inclusion rating and presence of delta ferrite. No delta ferrite is permitted. Inclusion rating shall meet requirements of clause 6.1 d			
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स्वत्वाधिकार एवं गोपनीय 8 इस प्रलेख में की गयी सूचना भारत हिंदी इंस्टीट्यूट्स की संपत्ती है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से भी याद प्रयोग जो की कंपनी के हित में सन्निहित हो न किया जाय ।	10.0 PRE INSPECTION The entire results of the test performed are deciding factors for the clearance of Delivery of the ESR Stock. BHEL shall evaluate the total results with respect to Intended operational requirement of the forgings and judge accordingly. The clearance does not relieve the manufacture from responsibility for hidden impermissible defects, which may be found after forging is made and traced to the defect existing in the ingot.			
दिनांक एवं हस्ताक्षर DATE & SIGNATURE	निर्माणकर्ता WORKED BY		5/6/18	स्वीकृती : संस्थान मानक समिति APPROVED : PLANT STANDARDS COMMITTEE निर्माण: फोर्ज उत्पादन PREPARED : FORGE PROD.
सामग्री सूची संख्या INVENTORY NO	जांचकर्ता CHECKED BY		5-6-18	जारी : फोर्ज तकनीकी ISSUED : FORGE TECH दिनांक : 23-05-18 DATE : 23-05-18

दिनांक एवं हस्ताक्षर SUPPLIES INVENTORY NO.			संस्थान क्रय विनिर्देश (सी.एफ.एफ.पी-हरिद्वार) PLANT PURCHASE SPECIFICATION (CFFP - HARIDWAR)		FF-04062 Rev00	
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BHEL representative shall have all reasonable facilities offered to him, at any time, by the supplier to satisfy himself that the material is being furnished in accordance with this specification. The representative shall have free access at all times to the manufacturing works during the manufacturing process of the ingot.						
11.0 Marking : The following details shall be marked clearly on the ESR ingots. (a) Melt No. (b) Grade (c) Manufacturer's Stamp (d) BHEL Inspector's Stamp (e) Top and Bottom sides of ingot						
12.0 Packing and Transportation : ESR Stock shall be properly protected from corrosion and damage during transit.						
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निर्माणकर्ता WORKED BY <i>AKS</i> <i>5/6/18</i>						
स्वीकृती APPROVED : संस्थान मानक समिति PLANT STANDARDS COMMITTEE						
जांचकर्ता CHECKED BY <i>Ans</i> <i>S. G. 18</i>						
निर्माण: फोर्ज उत्पादन PREPARED : FORGE PROD.						
जारी ISSUED : फोर्ज तकनीकी FORGE TECH						
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समग्री सूची संख्या INVENTORY NO.	दिनांक एवं हस्ताक्षर DATE		संस्थान क्रय विनिर्देश (सी.एफ.एफ.पी-हरिद्वार) PLANT PURCHASE SPECIFICATION (CFFP - HARIDWAR)		FF-04062 Rev00
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SUPERSEDES INVENTORY NO. समग्री सूची संख्या को अधिकतम		ESR INGOT DIMENSIONS Weight = 42,900 Kg  TOLERANCE ON ALL DIMENSIONS + 25 , - 0 (All dimensions are in mm)			
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दिनांक दिनांक					
निर्माणकर्ता WORKED BY	स्वीकृती APPROVED :	संस्थान मानक समिति PLANT STANDARDS COMMITTEE			
जांचकर्ता CHECKED BY	निर्माण: फोर्ज उत्पादन PREPARED : FORGE PROD.	जारी : फोर्ज तकनीकी ISSUED : FORGE TECH	दिनांक : 23-05-18 DATE : 23-05-18		