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NAME

SATENDER KUMAR AJAY KUMAR GUPTA

A.K. GOYAL

PLANT STANDARDIZATION COMMITTEE

ISSUED: TSX

संस्थान मानकीकरण समिति

DOC REV NO.: 4 संस्थान क्रय विनिर्देश (हीप: हरिद्वार) HW12086 SION & DATE भी एम है एम PLANT PURCHASE SPECIFICATION पष्ट (HEEP: HARIDWAR) Page SUPERSEDES INVENTORY NO. BARE RECTANGULAR HOLLOW COPPER CONDUCTOR **GENERAL:** ernet geb neur bl afteiffer wem b This specification covers high conductivity soft copper conductors of hollow rectangular section for stator windings of Turbo-generators. 2. APPLICATION: COPYRIGHT AND CONFIDENTIAL
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Heavy Beacheal Limited It must not be used directly or
advectly in any way destinantal to the interest of the compar Used for manufacturing of water cooled stator windings bus bars of turbo-generators. 3. COMPLIANCE WITH INTERNATIONAL STANDARD: This standard is based on BS EN 13600:2013 and BHEL experience. **DIMENSIONS AND TOLERANCES:** 4.1 Dimensions & Permissible tolerances: According to figure-1 on Page 5. 4.2 Length of Profile: In straight length of 7000mm (Min. acceptable) 4.3 The conductor shall have radiused corners, both inside and outside as figure-1 on er sie al. in od gety, uter belt beltspress feltet. De melt de tress verg et singer on de facil et sex velte, al. its word de facil pellement of fenjane. Page 5. No joints shall be made in hollow copper conductor after it is drawn or extruded. 5. स्वत्तात्रिकार एवं गोपनीव CONDUCTOR: 6. Conductor Material: The hollow copper conductor shall be made of copper of Cu-HCP (CW021A) grade as per BS EN 13600:2013 and chemical composition as per clause 8.1 of this specification. 6.2 Freedom from defects: External and internal surface of the rectangular hollow copper conductor shall be bright, free from dirt and smooth without cracks, blisters and pits. The rectangular hollow copper conductor shall have shining surface free of doubling, cracks, chips, scabbing/scaling, metal dust and oxidation products. The inner surface of rectangular hollow copper conductor must be reasonably clean, degreased, free of copper pitting, copper chips, wrinkles and oxidation products on and directly below the surface.

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# PLANT PURCHASE SPECIFICATION (HEEP: HARIDWAR)

### 7. DEVIATION OF PROFILE ALIGNMENT:

The broad side of tubing cannot curve inward (concave). An outward curved shape(convex) is permissible but is limited by the dimensional tolerances. The radii must be tangential to the rectangular tubing surface and must blend smoothly with these surfaces without any sharp corners.

The allowable center line deviation is 10% of the wall thickness.

### 8. PROPERTIES & TESTING

### 8.1 CHEMICAL COMPOSITION:

The hollow copper conductor shall be manufactured from copper of Cu-HCP (CW021A) grade as per BS EN 13600:2013 with the following composition:

Constituents	Composition, in % by weights			
Cu	99.95ª Min.			
Bi	Max. 0.0005			
. Р	0.002 to 0.007			
0	b			
Pb	0.005			
Other elements	Total 0.03 (excluding Ag, P)			

<sup>&</sup>lt;sup>a</sup> Including silver, up to a maximum of 0.015%.

NOTE: The total of other elements (excluding Cu, Ag, P) is defined as the sum of As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.

### 8.2 MECHANICAL PROPERTIES:

The mechanical properties shall conform to the appropriate requirements as per BS EN 13600 -2013 given in the table below:

********	Tensile Strength	0.2% proof strength	Elongation		
Material condition	(R <sub>m</sub> ) N/mm <sup>2</sup>	(Rp <sub>0.2</sub> ) N/mm <sup>2</sup>	A % (Min.)		
R200	200-250	Max. 120	35		

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b The oxygen content shall be such that the material conforms to the hydrogen embrittlement requirements as per EN 1976. Hydrogen Embrittlement Test as per ISO 2626.

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# PLANT PURCHASE SPECIFICATION (HEEP: HARIDWAR)

### 8.3 ELECTRICAL PROPERTIES (at 20° C):

The electrical properties shall conform to the appropriate requirements as per BS EN 13600-2013 given in the table below:

S DESIGN OF AN EXPENSE SPECIAL	Volume Resistivity (Max)	Conductivity		
Material condition	ΩX mm² m	MS/m (Min.)	% IACS (Min.)	
R200	0.01724	57.0	98.3	

Determination of electrical conductivity should be carried out as per IS3635. Alternatively, the method of measurement employing Eddy current probes as per ASTM-E 1004 is also acceptable.

- 8.4 <u>DIMENSIONAL CHECK:</u> Window dimensions of the hollow copper conductor is to be checked by shadowgraph method on the sample copper as mentioned in "selection of test sample" at serial no. 9 of this specification. Supplier has to supply a copy of shadowgraph along with test certificates, in support of dimensional accuracy of the window dimensions of the hollow copper conductor.
- 8.5 <u>TESTING FOR DOUBLING FREEDOM:</u> The sample will be cut from one tube taken randomly from every charge and test for flattening and doubling will be done as per IS:2501.
- 8.6 TESTING FOR ERROR FREEDOM OF THE INNER SURFACE: The flat pressed cutting or samples are to be cut in longitudinal direction for the proof of error freedom of tube inner surface and subjected to a visual inspection below the microscope.

### 9. HYDROGEN EMBRITTLEMENT TEST:

Hydrogen embrittlement test shall be performed on each finished tube. Testing should be as stipulated in EN ISO 2626 and EN13600.

#### 10. SELECTION OF TEST SAMPLES

For the testing, a sample of approximately 3 meters is taken from every 500Kg and all the tests stipulated in the specification are to be conducted. If the results are not up to the stipulated standards as mentioned in this specification, a second sample of 3 meters is taken and all the tests has to be repeated. If the results are still not up to the standards set in, the whole lot of 500Kg is rejected.

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aftern um t Inventory NO.	11. TEST CERTIFICATES  Three copies of test certificates on the obtained test results shall be supplied along with following information: -  > HW 12086  > BHEL P.O. No.  > Size and Quantity  > Batch no.											
The information and the document is the property of Sharat Heavy Electrical Limitation to the incomment of the property of Sharat Heavy Electrical Limitation to the incomment of the company	<ul> <li>Size and Quantity</li> <li>Batch no.</li> <li>Supplier's Name.</li> <li>Certificate for electrical and mechanical properties.</li> <li>Certificate for chemical composition and hydrogen embrittlement test.</li> <li>Certificate for test for doubling freedom and error freedom.</li> <li>Certificate for Dimensional report along with window dimension of rectangular hollow copper conductor.</li> <li>Certificate for Grease freedom on inner surface.</li> <li>12. PACKING         <ul> <li>The tubes shall be suitably packed to prevent damage during transit. Each piece is to be legibly marked or labelled with the following information.</li> <li>Size</li> <li>BHEL P.O. No.</li> <li>Supplier's name</li> </ul> </li> </ul>											
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