

दिनांक एवं हस्ताक्षर
SIGN & DATE

SUPERSEDES INVENTORY NO.

सूची संख्या

संस्थान क्रय विनिर्देश (हीप-हरिद्वार)

PLANT PURCHASE SPECIFICATION

(HEEP- HARIDWAR)



HW 28198

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स्वत्वाधिकार एवं गोपनीय

इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोक्ता एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।

DOUBLE GLASS COVERED, VARNISH BONDED RECT. COPPER CONDUCTORS (TEMP. INDEX 155 ° C)

- GENERAL**

This specification governs the quality and technical requirements of epoxy Varnish Bonded (Suitable for temp. index of 155 ° C) double glass covered high conductivity rectangular Copper conductors.
- APPLICATIONS:**

This is used for the manufacture of stator winding bars for electrical machines.
- Compliance with National/International Standards. This specification is generally based on GEN 754.01-Feb. 2008 with certain alternatives/additional requirements.
- SIZES :**
 - 4.1 This conductor shall be supplied to the size specified on our order.
 - 4.2 The sizes shall preferably be selected from table -1 of this specification.
- JOINTS:**

No joints shall be made in the copper after it is drawn. Any joint made during the drawing process shall be only resistance welded. Joints are to be clearly identified with color tape for inspection etc.
- CONDUCTORS:**
 - 6.1 Conductor Material:**

The conductor shall be manufacture from ETP Grade high conductivity annealed copper conforming to IS191:2007 with oxygen content ≤ 400 ppm.

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TSX	B.CHOUDHARY	अनुवादक TRANSLATED BY
QAX	S.K.CHAUHAN	निर्माणकर्ता WORKED BY
ISE	R.C. SRIVASTAVA	जांचकर्ता CHECKED BY
सहमत विभाग AGREED DEPTT	नाम NAME	पर्यवेक्षणकर्ता SUPERVISED BY
	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	VIVEK KUMAR

REVISION REV.NO. 02 SUPERSEDES Dt. 06/12/11	स्वीकृति : APPROVED : PLANT STANDARDS COMMITTEE निर्माण : जारी : PREPARED : EME ISSUED : TSX	PS.NO. 2.65 दिनांक : DATE : 10.3.1981
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6.2 Tolerances on nominal Dimensions:

Tolerance on width and thickness as per table -2 of this specification.

6.3 Radius on corners :

The conductor shall have radiused corners, the radius of curvature being within the range of Table -3. The arc shall merge smoothly into flat and conductor shall be free from sharp, rough and projecting edges.

6.4 Tensile Strength & Elongation:

A sample of conductor 250 mm long between the grips shall be steadily elongated at a rate of 300 mm / minute until conductor fractures. The tensile strength & elongation at fracture shall comply with the following values,

Dimensions Corresponding to			Strength properties #						Type
			Tensile Strength N/mm ²	0.2 Limit N/mm ²	Elongation(δ)				
Round Diameter mm	Flat Thickness mm	Width mm			GL=200mm % min	GL=100mm % min	δ ₁₀ * % min	δ ₅ * % min	
Over 0.5 to 0.9	-		200 to 270	Max. 150	30	-	-	-	Drawn or cold rolled (annealed) *(As per IS:1608)
Over 0.9 to 1.5	Over 0.9 to 1.5	each	200 to 270	Max. 150	33	34	36*	-	
Over 1.5 to 3	over 1.5 to 3	each	200 to 270	Max. 100	35	36	37*	-	
Over 3 to 8	over 3	each	200 to 260	Max. 100	37	38	38	40	

Values of 0.2 limit and % elongation are for (annealed) bare copper. Any one value of % elongation is sufficient. Testing to be done as per IS: 1608.

6.5 Hardness:

The conductor shall have Vicker hardness Hv5 to a value of 40-65.

6.6 Resistance:

The resistance at 20 ° of a conductor of one meter in length & a uniform cross sectional area of 1 mm² in annealed condition shall be not greater than 0.01724 Ohms.

REV. NO. 02

निर्माणकर्ता
WORKED BY

ADITYA
KUMAR

06/12/11

जांचकर्ता
CHECKED BY

N.KOHLI

06/12/11

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SUPERSEDES INVENTORY NO.		7.0 CONDUCTOR INSULATION: 7.1 Glass Covering: 7.1.1 The yarns used, shall be continuous filament glass 'E' fibre yarns containing not more than 1% Alkali calculated as sodium oxide (Na₂O). 7.1.2 Ph value of aqueous extract: When tested in accordance with clauses 9 and 10 of IS: 5596, the PH value of water extract of yarn before its application on the conductor shall be between 8 and 10. 7.1.3 Application of glass covering: The conductor shall be covered with the glass fibre applied evenly and closely & firmly bonded to the conductor with epoxy resin with a limit temperature as per VDE 304-21 of $\geq 155^\circ \text{C}$. 7.1.4 Repairs to insulation: When due to limitation in manufacturing process, it is necessary to make up/repair the glass covering locally by hand, maximum two number repairs per reel will be permitted provided that the length of each repair does not exceed 100 mm. Otherwise, the total number of repaired spots and the total repaired length should be got approved by the customer during inspection but before dispatch. All local repairs are to be subsequently varnished and then clearly identified with colour tape for inspection. 7.2 Increase in dimensions due to covering (To be measured on Minor Axis only): The bare copper conductor dimensions and profile shall be within the tolerance limits as given in Table-2,3 &4 as per clause 6.2, 6.3. The insulation thickness of copper conductor covering shall be $0.27_{-0.02\text{mm}}^{+0.03\text{mm}}$. The maximum and minimum acceptable limits of the size of the insulated copper conductor are calculated as below: Maximum insulated conductor size = Maximum permissible bare copper conductor size (including plus tolerance on Cu) + nominal thickness of insulation covering (0.27 mm). Minimum insulated conductor size = Nominal size of bare Cu conductor (without any tolerance on Cu)+ Minimum thickness of insulation covering (with minus tolerance on insulation). 7.3 Properties of insulation <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="2">Min. Breakdown voltage (conductor to conductor) under a pressure of 2 N/mm² at Room Temperature</th> <th colspan="2">Combined Weight %</th> <th>Density</th> </tr> <tr> <td>Without Heat processing</td> <td>After pressing for 30 Min. with a pressure of 2 N/mm² at 160°C</td> <td>Glass Fibre</td> <td>Bonding Agent</td> <td>(For Reference only)</td> </tr> <tr> <td>1000 V</td> <td>800 V</td> <td>65-90</td> <td>10-35</td> <td>$\approx 1.8 \text{ Kg/dm}^3$</td> </tr> </table> The testing procedure for above is given vide clause 9 & 14 7.1.4 Repairs to insulation: When due to limitation in manufacturing process, it is necessary to make up/repair the glass covering locally by hand, maximum two number repairs per reel will be permitted provided that the length of each repair does not exceed 100 mm. Otherwise, the total number of repaired spots and the total repaired length should be got approved by the customer during inspection but before dispatch. All local repairs are to be subsequently varnished and then clearly identified with colour tape for inspection.							Min. Breakdown voltage (conductor to conductor) under a pressure of 2 N/mm ² at Room Temperature		Combined Weight %		Density	Without Heat processing	After pressing for 30 Min. with a pressure of 2 N/mm ² at 160°C	Glass Fibre	Bonding Agent	(For Reference only)	1000 V	800 V	65-90	10-35	$\approx 1.8 \text{ Kg/dm}^3$
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सामग्री सूची संख्या को				7.4 Quality of Insulation: The lapping must be in two layers, tight, impregnated properly and cured. The upper surface shall be smooth, free from bubbles, pimples and crust, must not be tacky and should have a uniform colour. Dark stains normally are not desired. The supplier shall ensure that the dark stains or non uniform colour of the upper surface, if any, is not due to temperature effect during curing and shall get the same approved by the customer during inspection but before dispatch. The fine glass lapping should stick at the conductor properly in such a way that after peeling off insulation on one edge of the conductor, the remaining insulation still stick to the conductor and does not come out without force.				
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		7.5 Sampling For every approx. 3000 Kgs supply, a specimen of approx. 6 M length is taken (from any coil of customer's choice) for testing and visual inspection as per this specification. The supplier shall confirm that the quality of the total lot in consideration is the same as that of the specimen taken. If the results of all the tests conducted on samples out of this specimen are not found to be conforming to this specification fully, then two more specimen of the same length are taken from two other coils of the same lot for repeat testing and visual inspection. For any test, if any two of the three test results do not satisfy the specification, then the whole lot is to be considered as not conforming to the specification. The whole lot is to be treated as per rejection clause 17 unless the respective deviation is not approved by the customer.						
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी प्रकार का उपयोग बिना हमारे लिखित अनुमति के ग्राहक को नहीं करना		8.0 DIMENSIONAL MEASUREMENT 7 samples each measuring approx. 300 mm to 350 mm length are cut from the conductor specimen taken as per clause 7.5. The remaining part is used for making other required samples. The measurements are taken at about 25 mm away from end on both ends of all samples in the following manner. i) Dimension of the insulated conductors are measured on both ends by a micrometer (calibrated as per applicable national / international norms e.g. DIN 863) having an accuracy of 0.01 mm with measuring surface of dia 6 to dia 8 mm. The weight of the insulated conductor samples is also measured. ii) If the same samples are to be used for dielectric strength test as per Annexure-I, conduct the same test first.						
तारीख एवं सिगनेचर SIGN & DATE 05.01.2012/11		REV. NO. 02		निर्माणकर्ता WORKED BY		ADITYA KUMAR		06/12/11
सामग्री सूची संख्या INVENTORY NO. P-2314				जांचकर्ता CHECKED BY		N.KOHLI		06/12/11

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सुपरसेड इन्वेंटरी सामग्री सूची संख्या को iii) Subsequently the glass covering is removed and weight is measured. iv) Then the samples are burnt at 550°C - 600°C, quenched in 10% spirit/ water mixture, dried at 100°C and the weight is measured again. This is done till the weight becomes constant. The weight measured is used for determination of glass/bonding agent as per clause 9. Then the dimensions of the bare copper conductors are measured on both ends. This burning method is followed to determine the percentage of glass/ bonding agent. However, for the purpose of dimensional measurement, suitable alternate methods for the removal of insulation (e.g. by acid cleaning) are also acceptable. v) The insulation thickness at both the ends is calculated by the difference of insulated conductor size and bare conductor size as measured above. vi) The size of Insulated conductor, size of bare conductor and insulation thickness for each sample is calculated by averaging the readings of both ends of that sample separately. Readings of different samples are not to be averaged. All these sizes should be within the specified limit as per clause 7.2 for all samples individually.	
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निर्माणक एवं दिनांक SIGN & DATE Signature: 30/12/11	
सामग्री सूची संख्या INVENTORY NO. P-2314	
REV. NO. 02 निर्माणकर्ता WORKED BY ADITYA KUMAR जांचकर्ता CHECKED BY N.KOHLI 06/12/11 06/12/11	

9.0.

DETERMINATION OF GLASS/ BONDING AGENT CONTENT

The content of glass & bonding agent are to be worked out from the weight measurements done on samples as per clause 8 above. The results should be as per clause 7.3.

10.0

ABRASION TEST

When tested at four different places on either of the wider faces of the glass covered conductor with a needle of diameter 0.6 mm, having to and fro movement of 120 cycles/minute and a transverse length of 6 mm under the load mentioned below, the average of 4 readings so obtained shall not be less than the average value limit and also no single value shall be less than minimum value limit specified below:-

Width of bare conductor (mm)	Load on the needle (Grammes)	No. of strokes (To & fro motion)	
		Average	Minimum
2.00 to 3.50	300	150	100
3.50 to 6.50	500	150	100
6.50 and above	600	150	100



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11. FLEXIBILITY TEST(BEND TESTING)

- 11.1 3 sample are to be bent through 180° around a mandrel having a diameter 5 times the bare width of the conductor when it is bent on edge. When so tested, the crack insulation should not split or loosen from copper. The gaps developed in the braiding layers should be max. 1 mm wide.

12. ADHERENCE TEST

A specimen approx. 300 mm length shall be straightened for example by elongating one percent. The covering shall be removed from all but from the centre 100 mm of the strand. The specimen shall be elongated for an elongation test in a tensile testing machine. The free measuring length shall be between 200 and 250 mm. These shall be elongated at rate of 300 mm/ minute. The covering shall not loose adhesion after an elongation for the appropriate width/thickness ratio as given below. Loss of adhesion of the covering is shown by its being able to slide along the conductor as a whole or being detached in part.

RATIO :	WIDTH/THICKNESS	ELONGATION PERCENT
OVER	UP TO	
-	2:1	5
2: 1	above	10

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INVENTORY NO.

P-2314

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निर्माणकर्ता
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Aditya Kumar

06/12/11

जांचकर्ता
CHECKED BY

N.KOHLI

N. Kohli

06/12/11

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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		13. CURE TEST : Two conductors, each 200 mm long shall be laid flat to flat and bound tightly with polyester fibre tape. The specimen shall then be placed in hot air circulating oven at $120 \pm 2^\circ \text{C}$ and kept for 30 minutes. It shall then be removed and after removing the binding tape, it shall be possible to separate the conductors without damaging the covering. 14. BREAK DOWN VOLTAGE TEST: The conductor shall meet the requirements of 7.3 when tested at room temperature and at elevated temperature respectively. The surface finish is also analysed in the testing as per clause 7.4. 14.1 Test at Room Temperature: Samples shall be subjected to a break down voltage test by the method described in annexure-I. 14.2 Test at Elevated temperature: When tested by the method described in annexure-I at the temperature of 160°C, the specimen shall not break down less than the value given in clause 7.3. 15. TEST CERTIFICATES: Three copies of test certificate shall be supplied which shall give the following information. Our spec. No..... Double Glass Covered. Varnish Bonded Rectangular copper- conductor (Temp. Index 155°C) for stator winding of Turbo generator. Our order No:..... Size and Number of Rolls:..... Batch No:..... The results obtained for electrical and mechanical properties, chemical composition and dimensional tolerances as per specification. Clause 6 & 7.3. Content: a) Glass fibre (%) b) Bonding agent (%) 16 PACKING AND MARKING: The insulated copper conductors must be supplied in coil form wound on wooden bobbins. The packing shall be as per IS: 2069. The weight of the coil and bobbins should amount to 90 to 130 kgs. and should be kept towards upper limit of the weight. The coil shall consist of a single length and should be layer wise smoothly and uniformly wrapped on bobbins. Each coil should be legibly marked or labeled with the following information.			
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Our spec. No.....Double glass covered.
Varnish bonded rectangular copper conductor(Temp. index 155°C)

Our order No:-----

Supplier's Name:-----

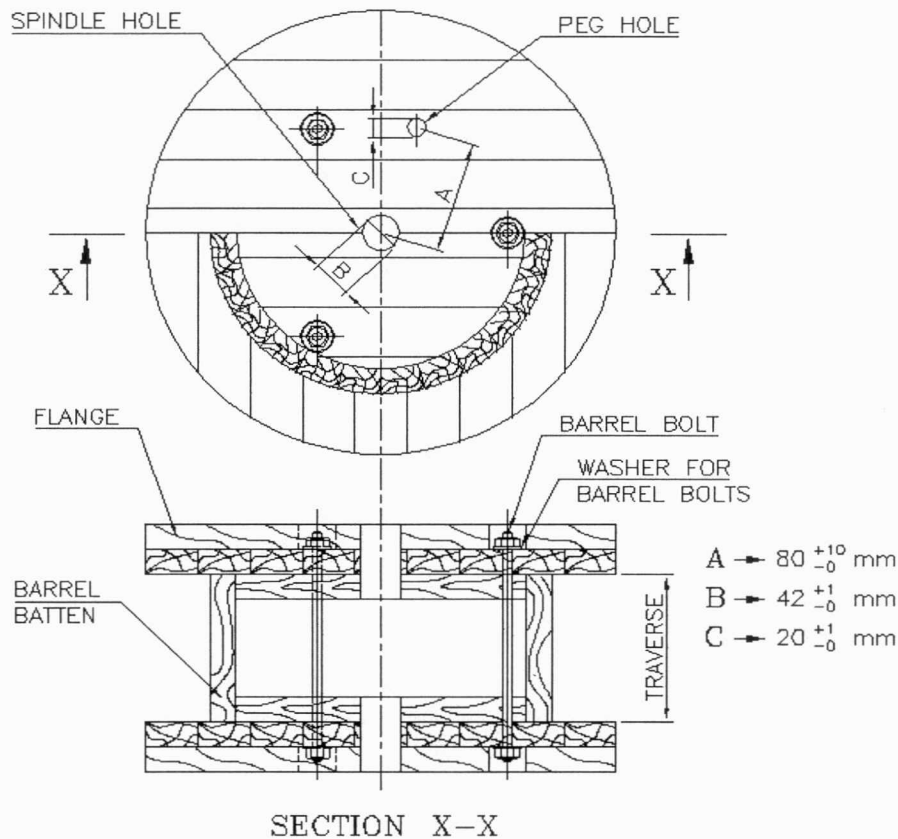
Length and weight of material in package:-----

Each reel coil will be wrapped with suitable moisture resistant plastic sheet to avoid damage & moisture ingress during transport/handling.

The dimensions of the holes of the bobbin shall be as per fig.1.

These bobbins shall be arranged & packed in separate wooden box having additional lining of plastic foil so that the complete box is waterproof & sea worthy during handling and transportation.

However the above scheme of packing of bobbins in the separate wooden box is suggestive scheme. Supplier may pack the bobbins by any alternate method in such a way to ensure that no water (including rain water) ingresses into the bobbins during transportation and storage.



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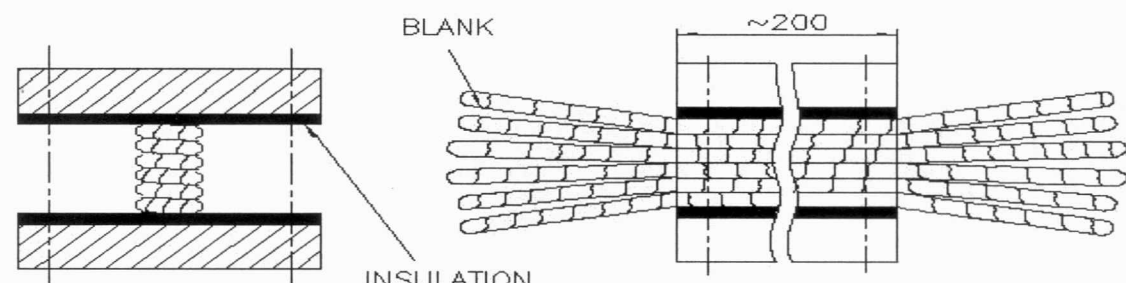
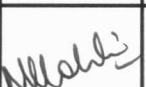
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SUPERSEDES INVENTORY NO. सार्वजनिक सूची संख्या को अधिकाधिकृत करना	17. REJECTION Non compliance of the terms of this standard authorizes for the return of complete consignment objection of a part of a consignment, which is not found at the time of testing, such as objections relating to hidden defects can also be returned at a later point of time. 18. CROSS REFERRED STANDARDS IS: 191 IS: 1608 DIN: 863 VDE: 0304-21 IS: 5596 IS: 2069														
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	ANNEXURE -I METHOD OF TEST FOR ELECTRICAL STRENGTH (CLAUSE 14.1 & 14.2) 1. TEST SPECIMENS: 12 pieces of specimens shall be prepared in 300 to 350 mm length. One end of the specimen is stripped off insulation for electrical connection. Voltage test conductor to conductor is to be carried out on 6 specimens at room temperature & other 6 specimens at elevated temperature. 2. TEST AT ROOM TEMPERATURE: The specimens prepared as above shall be stacked one above the other with bare and on one side and in a pressing fixture of about 200 mm length (Fig. below) clamped with 20 kg/cm² pressure. Then the conductor's ends on both sides are spread so wide from one another that a voltage testing between conductor to conductor is possible. A sinusoidal A.C. voltage of 50 Hz is applied and increased from zero at a uniform rate of approx. 100 volts/ second until break down occurs. 3. TEST AT ELEVATED TEMPERATURE : The samples prepared as per Para 1 above and assembled / stacked as in Para 2 with the support fixture are heated at 160 ° under pressure for 30 minutes and cooled at room temperature. They are then tested for electrical strength as per Para 2 above.														
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हस्ताक्षर एवं दिनांक SIGN & DATE S.Dr. 30/12/11	Fig-2														
सार्वजनिक सूची संख्या INVENTORY NO. P-2314	REV. NO. 02		निर्माणकर्ता WORKED BY ADITYA KUMAR	जांचकर्ता CHECKED BY N.KOHLI	 	06/12/11 06/12/11									



संस्थान क्रय विनिर्देश (हीप-हरिद्वार)

PLANT PURCHASE SPECIFICATION (HEEP- HARIDWAR)

HW 28198

पृष्ठ	15	का	10
Page	10	of	15

DIMENSIONS

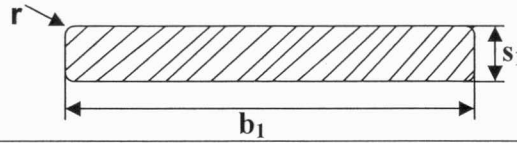


TABLE-1

Width b ₁	Thickness s ₁																								
	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.2	2.5	2.8	3	3.2	3.5	4	4.5	5
Cross Sectional area in mm ² (reduction of cross- sectional area through r is allowed for)																									
1.4	-	-	-	0.98	1.12	1.26	1.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.6	-	-	-	1.14	1.32	1.46	1.62	1.78	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	1.30	1.48	1.66	1.84	2.02	2.13	2.31	2.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	1.46	1.66	1.86	2.06	2.19	2.39	2.59	2.79	2.99	3.19	-	-	-	-	-	-	-	-	-	-	-	-
2.2	-	-	-	1.62	1.84	2.06	2.21	2.43	2.65	2.87	3.09	3.31	3.53	3.65	-	-	-	-	-	-	-	-	-	-	-
2.5	-	-	1.65	1.86	2.11	2.35	2.54	2.79	3.04	3.29	3.54	3.79	4.04	4.19	4.44	4.69	-	-	-	-	-	-	-	-	-
2.8	-	-	1.86	2.10	2.38	2.66	2.87	3.15	3.43	3.71	3.99	4.17	4.45	4.73	5.01	5.29	5.85	-	-	-	-	-	-	-	-
3	-	1.72	2.00	2.26	2.56	2.86	3.09	3.39	3.69	3.99	4.19	4.49	4.79	5.09	5.39	5.69	6.29	7.19	-	-	-	-	-	-	-
3.2	-	1.84	2.14	2.42	2.74	3.06	3.31	3.63	3.95	4.27	4.49	4.81	5.13	5.45	5.77	6.09	6.73	7.69	8.41	-	-	-	-	-	-
3.5	-	2.02	2.35	2.66	3.01	3.36	3.64	3.99	4.34	4.69	4.94	5.29	5.64	5.99	6.34	6.69	7.39	8.20	9.25	9.95	-	-	-	-	-
3.8	-	2.20	2.56	2.90	3.28	3.66	3.97	4.35	4.73	5.11	5.39	5.77	6.15	6.53	6.91	7.29	8.05	8.95	10.1	10.9	11.6	-	-	-	-
4	1.45	2.32	2.70	3.06	3.46	3.86	4.19	4.59	4.99	5.39	5.69	6.09	6.49	6.89	7.29	7.69	8.25	9.45	10.7	11.5	12.3	13.5	15.5	-	-
4.5	2.20	2.62	3.05	3.46	3.91	4.36	4.74	5.19	5.64	6.09	6.44	6.89	7.34	7.79	8.24	8.45	9.35	10.7	12.1	13.0	13.9	15.2	17.1	19.4	-
5	2.45	2.92	3.40	3.85	4.36	4.66	5.29	5.79	6.29	6.79	7.19	7.69	8.19	8.69	9.19	9.45	10.5	12.0	13.5	14.5	15.5	16.6	19.1	21.6	24.1
5.5	2.70	3.22	3.75	4.26	4.81	5.36	5.84	6.39	6.94	7.49	7.94	8.49	9.04	9.59	10.1	10.5	11.6	13.2	14.9	16.0	16.7	18.4	21.1	23.9	26.6
6	2.95	3.52	4.10	4.66	5.26	5.86	6.39	6.99	7.59	8.19	8.69	9.29	9.89	10.5	11.1	11.5	12.7	14.5	16.3	17.5	18.3	20.1	23.1	26.1	29.1
6.5	3.20	3.82	4.45	5.06	5.71	6.36	6.94	7.59	8.24	8.89	9.44	10.1	10.7	11.4	12.0	12.5	13.8	15.7	17.7	19.0	19.9	21.9	25.1	28.4	31.6
7	3.45	4.12	4.80	5.46	6.16	6.86	7.49	8.19	8.89	9.59	10.2	10.9	11.6	12.3	13.0	13.5	14.9	17.0	19.1	20.5	21.5	23.6	27.1	30.6	34.1
7.5	3.70	4.42	5.15	5.86	6.61	7.36	8.04	8.79	9.54	10.3	10.9	11.7	12.4	13.2	13.9	14.5	16.0	18.2	20.5	22.0	23.1	25.4	29.1	32.9	36.6
8	3.95	4.72	5.50	6.26	7.06	7.86	8.59	9.39	10.2	11.0	11.7	12.5	13.3	14.1	14.9	15.5	17.1	19.5	21.9	23.5	24.7	27.1	31.1	35.1	39.1
9	4.45	5.32	6.20	7.06	7.96	8.86	9.69	10.6	11.5	12.4	13.2	14.1	15.0	15.9	16.8	17.5	19.3	22.0	24.7	26.5	27.9	30.6	35.1	39.6	44.1
10	4.95	5.92	6.90	7.86	8.86	9.86	10.8	11.8	12.8	13.8	14.7	15.7	16.7	17.7	18.7	19.5	21.5	24.5	27.5	29.5	31.1	34.1	39.1	44.1	49.1
11		6.52	7.60	8.66	9.76	10.9	11.9	13.0	14.1	15.2	16.2	17.3	18.4	19.5	20.6	21.5	23.7	27.0	30.3	32.5	34.3	37.6	43.1	48.6	54.1
12		7.12	8.30	9.46	10.7	11.9	13.0	14.2	15.4	16.6	17.7	18.9	20.1	21.3	22.5	23.5	25.9	29.0	33.1	35.5	37.5	41.1	47.1	53.1	59.1
13			9.00	10.3	11.6	12.9	14.1	15.4	16.7	18.0	19.2	20.5	21.8	23.1	24.4	25.5	28.1	32.0	35.9	38.5	40.7	44.6	51.1	57.6	64.1
14			9.70	11.1	12.5	13.9	15.2	16.6	18.0	19.4	20.7	22.1	23.5	24.9	26.3	27.5	30.3	34.5	38.7	41.5	43.9	48.1	55.1	62.1	69.1
15				11.9	13.4	14.9	16.3	17.8	19.3	20.8	22.2	23.7	25.2	26.7	28.2	29.5	32.5	37.0	41.5	44.5	47.1	51.6	59.1	66.6	74.1
16				12.7	14.3	15.9	17.4	19.0	20.6	22.2	23.7	25.3	26.9	28.5	30.1	31.5	34.7	39.5	44.3	47.5	50.3	55.1	63.1	71.1	79.1
18					16.1	17.9	19.6	21.4	23.2	25.0	26.7	28.5	30.3	32.1	33.9	35.5	39.1	44.5	49.9	53.5	56.7	62.1	71.1	80.1	89.1
20						19.9	21.8	23.8	25.8	27.8	29.7	31.7	33.7	35.7	37.7	39.5	43.5	49.5	55.5	59.5	63.1	69.1	79.1	89.1	99.1
22							24.0	26.2	28.4	30.6	32.7	34.9	37.1	39.3	41.6	43.5	47.9	54.5	61.1	65.5	69.5	76.1	87.1	98.1	109
25									32.3	34.8	37.2	39.7	42.2	44.7	47.2	49.5	54.5	62.0	69.5	74.5	79.1	86.6	99.1	112	124
28										39.0	41.7	44.5	47.3	50.1	52.9	55.5	61.1	69.5	77.9	83.5	88.7	97.1	111	125	139
30											44.7	47.7	50.7	53.7	56.7	59.5	65.5	74.5	83.5	89.5	95.1	104	119	134	149
32												50.9	54.1	57.3	60.5	63.5	69.9	79.5	89.1	95.5	102	111	127	143	159
35														62.7	66.2	69.5	76.5	87.0	97.5	104	111	122	139	157	174
38															71.9	76.5	83.1	94.5	106	113	121	132	151	170	189
40																79.5	87.5	99.5	111	119	127	139	159	179	199
42																	91.9	104	117	125	134	146	167	188	209
45																		112	125	134	143	157	179	202	224
48																		119	134	143	153	167	191	215	239
50																		124	139	149	159	174	199	224	249
52																		129	145	155	166	181	207	233	259
55																		137	153	164	175	192	219	247	274
60																		149	167	179	191	209	239	269	299
65																		162	181	194	207	227	259	292	324
70																		174	195	209	223	244	279	314	349
75																		187	209	224	239	262	299	337	374
80																		199	223	239	255	279	319	359	379
85																		212	237	254	271	297	339	382	424
90																		224	251	269	287	314	359	404	449
95																		237	265	284	303	332	379	417	474
100																		249	279	299	319	349	399	449	499

REV. NO. 02

निर्माणकर्ता
WORKED BY

ADITYA
KUMAR

06/12/11

जांचकर्ता
CHECKED BY

N.KOHLI

06/12/11

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इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोक्ता एवं प्रसारण बिना लेखिका की लिखित अनुमति के किये जाने पर दंडात्मक कार्यवाही की जायेगी

हस्ताक्षर एवं
SIGN & DATE

सामग्री सूची
INVENTORY

P-2314
30/12/11



संस्थान क्रय विनिर्देश (हीप-हरिद्वार)

PLANT PURCHASE SPECIFICATION

(HEEP- HARIDWAR)

HW 28198

पृष्ठ	15	का	10
Page	10	of	15

DIMENSIONS

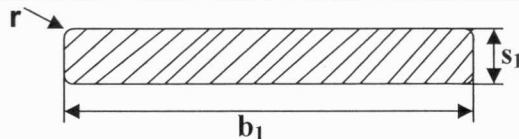


TABLE-1

Width b ₁	Thickness s ₁																			
	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.2	2.5	2.8	3
Cross Sectional area in mm ² (reduction of cross- sectional area through r is allowed for)																				
1.4	-	-	-	0.98	1.12	1.26	1.40	-	-	-	-	-	-	-	-	-	-	-	-	-
1.6	-	-	-	1.14	1.32	1.46	1.62	1.78	1.87	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	1.30	1.48	1.66	1.84	2.02	2.13	2.31	2.49	-	-	-	-	-	-	-	-	-
2	-	-	-	1.46	1.66	1.86	2.06	2.19	2.39	2.59	2.79	2.99	3.19	-	-	-	-	-	-	-
2.2	-	-	-	1.62	1.84	2.06	2.21	2.43	2.65	2.87	3.09	3.31	3.53	3.65	-	-	-	-	-	-
2.5	-	-	1.65	1.86	2.11	2.35	2.54	2.79	3.04	3.29	3.54	3.79	4.04	4.19	4.44	4.69	-	-	-	-
2.8	-	-	1.86	2.10	2.38	2.66	2.87	3.15	3.43	3.71	3.99	4.17	4.45	4.73	5.01	5.29	5.85	-	-	-
3	-	1.72	2.00	2.26	2.56	2.86	3.09	3.39	3.69	3.99	4.19	4.49	4.79	5.09	5.39	5.69	6.29	7.19	-	-
3.2	-	1.84	2.14	2.42	2.74	3.06	3.31	3.63	3.95	4.27	4.49	4.81	5.13	5.45	5.77	6.09	6.73	7.69	8.41	-
3.5	-	2.02	2.35	2.66	3.01	3.36	3.64	3.99	4.34	4.69	4.94	5.29	5.64	5.99	6.34	6.69	7.39	8.20	9.25	9.95
3.8	-	2.20	2.56	2.90	3.28	3.66	3.97	4.35	4.73	5.11	5.39	5.77	6.15	6.53	6.91	7.29	8.05	8.95	10.1	10.9
4	1.45	2.32	2.70	3.06	3.46	3.86	4.19	4.59	4.99	5.39	5.69	6.09	6.49	6.89	7.29	7.69	8.25	9.45	10.7	11.5
4.5	2.20	2.62	3.05	3.46	3.91	4.36	4.74	5.19	5.64	6.09	6.44	6.89	7.34	7.79	8.24	8.45	9.35	10.7	12.1	13.0
5	2.45	2.92	3.40	3.85	4.36	4.66	5.29	5.79	6.29	6.79	7.19	7.69	8.19	8.69	9.19	9.45	10.5	12.0	13.5	14.5
5.5	2.70	3.22	3.75	4.26	4.81	5.36	5.84	6.39	6.94	7.49	7.94	8.49	9.04	9.59	10.1	10.5	11.6	13.2	14.9	16.0
6	2.95	3.52	4.10	4.66	5.26	5.86	6.39	6.99	7.59	8.19	8.69	9.29	9.89	10.5	11.1	11.5	12.7	14.5	16.3	17.5
6.5	3.20	3.82	4.45	5.06	5.71	6.36	6.94	7.59	8.24	8.89	9.44	10.1	10.7	11.4	12.0	12.5	13.8	15.7	17.7	19.0
7	3.45	4.12	4.80	5.46	6.16	6.86	7.49	8.19	8.89	9.59	10.2	10.9	11.6	12.3	13.0	13.5	14.9	17.0	19.1	20.5
7.5	3.70	4.42	5.15	5.86	6.61	7.36	8.04	8.79	9.54	10.3	10.9	11.7	12.4	13.2	13.9	14.5	16.0	18.2	20.5	22.0
8	3.95	4.72	5.50	6.26	7.06	7.86	8.59	9.39	10.2	11.0	11.7	12.5	13.3	14.1	14.9	15.5	17.1	19.5	21.9	23.5
9	4.45	5.32	6.20	7.06	7.96	8.86	9.69	10.6	11.5	12.4	13.2	14.1	15.0	15.9	16.8	17.5	19.3	22.0	24.7	26.5
10	4.95	5.92	6.90	7.86	8.86	9.86	10.8	11.8	12.8	13.8	14.7	15.7	16.7	17.7	18.7	19.5	21.5	24.5	27.5	29.5
11		6.52	7.60	8.66	9.76	10.9	11.9	13.0	14.1	15.2	16.2	17.3	18.4	19.5	20.6	21.5	23.7	27.0	30.3	32.5
12		7.12	8.30	9.46	10.7	11.9	13.0	14.2	15.4	16.6	17.7	18.9	20.1	21.3	22.5	23.5	25.9	29.5	33.1	35.5
13			9.00	10.3	11.6	12.9	14.1	15.4	16.7	18.0	19.2	20.5	21.8	23.1	24.4	25.5	28.1	32.0	35.9	38.5
14			9.70	11.1	12.5	13.9	15.2	16.6	18.0	19.4	20.7	22.1	23.5	24.9	26.3	27.5	30.3	34.5	38.7	41.5
15				11.9	13.4	14.9	16.3	17.8	19.3	20.8	22.2	23.7	25.2	26.7	28.2	29.5	32.5	37.0	41.5	44.5
16				12.7	14.3	15.9	17.4	19.0	20.6	22.2	23.7	25.3	26.9	28.5	30.1	31.5	34.7	39.5	44.3	47.5
18					16.1	17.9	19.6	21.4	23.2	25.0	26.7	28.5	30.3	32.1	33.9	35.5	39.1	44.5	49.9	53.5
20						19.9	21.8	23.8	25.8	27.8	29.7	31.7	33.7	35.7	37.7	39.5	43.5	49.5	55.5	59.5
22							24.0	26.2	28.4	30.6	32.7	34.9	37.1	39.3	41.6	43.5	47.9	54.5	61.1	65.5
25								32.3	34.8	37.2	39.7	42.2	44.7	47.2	49.5	54.5	62.0	69.5	74.5	79.1
28									39.0	41.7	44.5	47.3	50.1	52.9	55.5	61.1	69.5	77.9	83.5	88.7
30										44.7	47.7	50.7	53.7	56.7	59.5	65.5	74.5	83.5	89.5	95.1
32											50.9	54.1	57.3	60.5	63.5	69.9	79.5	89.1	95.5	102
35												62.7	66.2	69.5	76.5	87.0	97.5	104	111	122
38													71.9	76.5	83.1	94.5	106	113	121	132
40														79.5	87.5	99.5	111	119	127	139
42															91.9	104	117	125	134	146
45																112	125	134	143	157
48																119	134	143	153	167
50																124	139	149	159	174
52																129	145	155	166	181
55																137	153	164	175	192
60																149	167	179	191	209
65																162	181	194	207	227
70																174	195	209	223	244
75																187	209	224	239	262
80																199	223	239	255	279
85																212	237	254	271	297
90																224	251	269	287	314
95																237	265	284	303	332
100																249	279	299	319	349

REV. NO. 02

निर्माणकर्ता
WORKED BY

ADITYA
KUMAR

06/12/11

जांचकर्ता
CHECKED BY

N.KOHLI

06/12/11

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इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं प्रसारण बिना उसे लिखी की रचना परमेश्वर को बिना किसी

दस्तावेज एवं दिनांक
SIGN & DATE

सामग्री सूची संख्या
INVENTORY

P-2314 30/12/11



PLANT PURCHASE SPECIFICATION

(HEEP- HARIDWAR)

पृष्ठ

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Page

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of

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TABLE-1 CONTD.

Width b ₁	Thickness s ₁																							
	5.5	6	6.5	7	7.5	8	9	10	11	12	13	14	15	16	18	20	22	25	30	35	40	50		
	Cross Sectional area in mm ² (reduction of cross- sectional area through r is allowed for)																							
5.5	29.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6	32.1	35.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6.5	34.9	38.1	41.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
7	37.6	41.1	44.6	48.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
7.5	40.4	44.1	47.9	51.6	55.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
8	43.1	47.1	51.1	55.1	59.1	63.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
9	48.6	53.1	57.6	62.1	66.6	71.1	80.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10	54.1	59.1	64.1	69.1	74.1	79.1	89.1	99.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11	59.6	65.1	70.6	76.1	81.6	87.1	98.1	109	119	-	-	-	-	-	-	-	-	-	-	-	-	-		
12	65.1	71.1	77.1	83.1	89.1	95.1	107	119	130	142	-	-	-	-	-	-	-	-	-	-	-	-		
13	70.6	77.1	83.6	90.1	96.6	103	116	129	141	154	167	-	-	-	-	-	-	-	-	-	-	-		
14	76.1	83.1	90.1	97.1	104	111	125	139	152	166	180	194	-	-	-	-	-	-	-	-	-	-		
15	81.6	89.1	96.6	104	112	119	134	149	163	178	193	208	223	-	-	-	-	-	-	-	-	-		
16	87.1	95.1	103	111	119	127	143	159	174	190	206	222	238	254	-	-	-	-	-	-	-	-		
18	98.1	107	116	125	134	143	161	179	196	214	232	250	268	286	322	-	-	-	-	-	-	-		
20	109	119	129	139	149	159	179	199	218	238	258	278	298	318	358	398	-	-	-	-	-	-		
22	120	131	142	153	164	175	197	219	240	262	284	306	328	350	394	438	482	-	-	-	-	-		
25	137	149	162	174	187	199	224	249	273	298	323	348	373	398	448	498	548	623	-	-	-	-		
28	153	167	181	195	209	223	251	279	306	334	362	390	418	446	502	558	614	698	-	-	-	-		
30	164	179	194	209	224	239	269	299	328	358	388	418	448	478	538	598	658	748	898	-	-	-		
32	175	191	207	223	239	255	287	319	350	382	414	446	478	510	574	638	702	798	958	-	-	-		
35	192	209	227	244	262	279	314	349	383	418	453	488	523	558	628	698	768	873	1050	1220	-	-		
38	208	227	246	265	284	303	341	379	416	454	492	530	568	606	682	758	834	948	1140	1330	-	-		
40	219	239	259	279	299	319	359	399	438	478	518	558	598	638	718	798	878	998	1200	1400	1600	-		
42	230	251	272	293	314	335	377	419	460	502	544	586	628	670	754	838	922	1050	1260	1470	1680	-		
45	247	269	292	314	337	359	404	449	493	538	583	628	673	718	808	898	988	1120	1350	1570	1800	-		
48	263	287	311	335	359	383	431	479	526	574	622	670	718	766	862	958	1050	1200	1440	1680	1920	-		
50	274	299	324	349	374	399	449	499	548	598	648	698	748	798	898	998	1100	1250	1500	1750	2000	2500		
52	285	311	337	363	389	415	467	519		622			778	830		1040		1300	1560	1820	2080			
55	302	329	357	384	412	439	494	549		658			823	878		1100		1370	1650	1920	2200			
60	329	359	389	419	449	479	539	599		718			898	958		1200		1500	1800	2100	2400			
65	357	389	422	454	487	519	584	649		778			973	1040		1300		1620	1950	2270	2600			
70	384	419	454	489	524	559	629	699		838			1050	1120		1400		1750	2100	2450	2800			
75	412	449	487	524	562	599	674	749		898			1120	1200		1500		1870	2250	2620	3000			
80	439	479	519	559	599	639	719	799		958			1200	1280		1600		2000	2400	2800	3200			
85	467	509	552	594	637	679	764	849		1020			1270	1360		1700		2120	2550	2970	3400			
90	494	539	584	629	674	719	809	899		1080			1350	1440		1800		2250	2700	3150	3600			
95	522	569	617	664	712	759	854	949		1140			1420	1520		1900		2370	2850	3320	3800			
100	549	599	649	699	749	799	899	999		1200			1500	1600		2000		2500	3000	3500	4000			
120								1200		1440			1800	1920		2400								
140								1400					2100	2240		2800								
160								1600					2400	2560		3200								
180								1800					2700	2880		3600								
200								2000					3000	3200		4000								

REV. NO. 02

निर्माणकर्ता
WORKED BY

ADITYA
KUMAR

06/12/11

जांचकर्ता
CHECKED BY

N.KOHLI

06/12/11

सुपरसेड्स
INVENTORY NO.

सामग्री सूची संख्या
को अनिवार्यतः भरना

कॉपीराइट और कॉन्फिडेंटIAL
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

TOLERANCE ON THICKNESS

TABLE - 2

Width		Thickness s ₁						
b ₁	Pera. Var.	0.5 Up to 1	Over 1 Up to 3	Over 3 Up to 6	Over 6 Up to 10	Over 10 Up to 18	Over 18 Up to 30	Over 30 Up to 5
		Permissible variations						
UP to 3	± 0.03	± 0.02	± 0.03	-	-	-	-	-
OVER 3 to 6	± 0.04			-	-	-	-	-
OVER 6 to10	± 0.07			± 0.04	± 0.07	-	-	-
OVER 10 to18	± 0.1					± 0.1	-	-
OVER 18 to 30	± 0.15	± 0.03	± 0.04	± 0.06	± 0.08	± 0.12	± 0.15	-
OVER 30 to 50	± 0.2	-	± 0.05	± 0.08	± 0.1	± 0.15	± 0.18	± 0.2
OVER 50 to 80	± 0.25	-	± 0.06	± 0.1	± 0.12	± 0.15	± 0.18	± 0.2
OVER 80 to 120	± 0.3	-	± 0.08	± 0.12	± 0.15	± 0.18	± 0.2	± 0.25
OVER 120 to 160	± 0.35	-	-	-	± 0.18	± 0.2	± 0.25	-
OVER 160 to 200	± 0.5	-	-	-	± 0.2	± 0.25	± 0.3	-

स्वत्वाधिकार एवं गोपनीय
इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं

कॉपीराइट और कॉन्फिडेंटIAL
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EDGE RADIUS

TABLE - 3

WIDTH b ₁	Thickness s ₁																								
	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.2	2.5	2.8	3	3.2	3.5	4	4.5	5
Radius r																									
1.4	-	-	-	0.4	0.4	0.4	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.6	-	-	-	0.4	0.4	0.4	0.4	0.4	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
2.2	-	-	-	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	-	-	-	-	-	-	-	-	-	-	-
2.5	-	-	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	-	-	-	-	-	-	-	-	-
2.8	-	-	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-	-	-	-
3	-	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-	-	-
3.2	-	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	-	-	-	-	-	-
3.5	-	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	-	-	-	-	-
3.8	-	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	-	-	-	-
4	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-	-
4.5	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1	1	1
5	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	1	1	1	1
5.5	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
6	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
6.5	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
7	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
7.5	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
8	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
9	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
10	0.25	0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
11		0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
12		0.3	0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
13			0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
14			0.35	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
15				0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
16				0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
18					0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
20						0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
22							0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
25								0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
28									0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
30										0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
32											0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
35												0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
38													0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
40														0.6	0.6	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
42															0.8	0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
45																0.8	0.8	0.8	0.8	0.8	1	1	1	1	1
48																	0.8	0.8	0.8	0.8	1	1	1	1	1
50																	0.8	0.8	0.8	0.8	1	1	1	1	1
52																	0.8	0.8	0.8	0.8	1	1	1	1	1
55																	0.8	0.8	0.8	0.8	1	1	1	1	1
60																	0.8	0.8	0.8	0.8	1	1	1	1	1
65																	0.8	0.8	0.8	0.8	1	1	1	1	1
70																	0.8	0.8	0.8	0.8	1	1	1	1	1
75																	0.8	0.8	0.8	0.8	1	1	1	1	1
80																	0.8	0.8	0.8	0.8	1	1	1	1	1
85																	0.8	0.8	0.8	0.8	1	1	1	1	1
90																	0.8	0.8	0.8	0.8	1	1	1	1	1
95																	0.8	0.8	0.8	0.8	1	1	1	1	1
100																	0.8	0.8	0.8	0.8	1	1	1	1	1



संस्थान क्रय विनिर्देश (हीप-हरिद्वार)
PLANT PURCHASE SPECIFICATION
(HEEP- HARIDWAR)

HW 28198

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EDGE RADIUS

TABLE - 3 Contd.

Width b_1	Thickness s_1																							
	5.5	6	6.5	7	7.5	8	9	10	11	12	13	14	15	16	18	20	22	25	30	35	40	50		
Radius r																								
5.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.5	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.5	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	1	1	1	1	1	1	1	1	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	1	1	1	1	1	1	1	1	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	1	1	1	1	1	1	1	1	1.6	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-
14	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-
15	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-
16	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-	-	-	-
18	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-	-	-
20	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-	-
22	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-	-
25	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-	-
28	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-
30	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-
32	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-
35	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-
38	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-
40	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-
42	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-
45	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-
48	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
50	1	1	1	1	1	1	1	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
52	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
55	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
60	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
65	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
70	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
75	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
80	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
85	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
90	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
95	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
100	1	1	1	1	1	1	1	1		1.6			1.6	1.6		1.6		1.6	1.6	1.6	1.6	1.6	1.6	
120								1		1.6			1.6	1.6		1.6								
140								1					1.6	1.6		1.6								
160								1					1.6	1.6		1.6								
180								1					1.6	1.6		1.6								
200								1					1.6	1.6		1.6								

TABLE-4

TOLERANCES ON RADIUS CROSS SECTIONAL AREA DUE TO EDGE RADIUS

RADIUS R	0.25	0.3	0.35	0.4	0.4	0.5	0.6	0.8	1	1.6
Permissible Variation in r	Not specified for thicknesses up to 0.8 mm				± 0.06	± 0.08	± 0.09	± 0.12	± 0.15	± 0.25
Reduction of cross-sectional area in mm^2 through r	0.054	0.077	0.105	0.14	0.14	0.21	0.31	0.55	0.86	2.2

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06/12/11



संस्थान क्रय विनिर्देश (हीप-हरिद्वार)
PLANT PURCHASE SPECIFICATION
(HEEP- HARIDWAR)

HW 28198

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WEIGHTS

TABLE - 5

Width b_1	Thickness s_1																								
	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.2	2.5	2.8	3	3.2	3.5	4	4.5	5
(Weight in kp / 1000 m $\approx$)																									
1.4	-	-	-	8.7	10.0	11.2	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.6	-	-	-	10.1	11.6	13.0	14.4	15.8	16.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	11.6	13.2	14.8	16.4	18.0	19.0	20.6	22.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	13.0	14.8	16.6	18.3	19.5	21.3	23.1	24.8	26.6	28.4	-	-	-	-	-	-	-	-	-	-	-	-
2.2	-	-	-	14.4	16.4	18.3	19.7	21.6	23.6	25.5	27.5	29.5	31.4	32.5	-	-	-	-	-	-	-	-	-	-	-
2.5	-	-	14.7	16.6	18.8	21.0	22.6	24.8	27.1	29.3	31.5	33.7	36.0	37.3	39.5	41.7	-	-	-	-	-	-	-	-	-
2.8	-	-	16.6	18.7	21.2	23.7	25.5	28.0	30.5	33.0	35.5	37.1	39.6	42.1	44.6	47.1	52.1	-	-	-	-	-	-	-	-
3	-	15.3	17.8	20.1	22.8	25.5	27.5	30.2	32.8	35.5	37.3	40.0	42.6	45.3	48.0	50.6	56.0	64.0	-	-	-	-	-	-	-
3.2	-	16.4	19.0	21.5	24.4	27.2	29.5	32.3	35.2	38.0	40.0	42.8	45.7	48.5	51.4	54.2	59.9	68.4	74.8	-	-	-	-	-	-
3.5	-	18.0	20.9	23.7	26.8	29.9	32.4	35.5	38.6	41.7	44.0	47.1	50.2	53.3	56.4	59.5	65.8	73.0	82.3	88.6	-	-	-	-	-
3.8	-	19.6	22.8	25.8	29.2	32.6	35.3	38.7	42.1	45.5	48.0	51.4	54.7	58.1	61.5	64.9	71.6	79.7	89.8	96.6	103	-	-	-	-
4	17.4	20.6	24.0	27.2	30.8	34.4	37.3	40.9	44.4	48.0	50.6	54.2	57.8	61.3	64.9	68.4	73.4	84.1	94.8	102	109	120	138	-	-
4.5	19.6	23.3	27.1	30.8	34.8	38.8	42.2	46.2	50.2	54.2	57.3	61.3	65.3	69.3	73.3	75.2	83.2	95.2	107	115	123	135	153	173	-
5	21.8	26.0	30.3	34.4	38.8	43.3	47.1	51.5	56.0	60.4	64.0	68.4	72.9	77.3	81.8	84.1	93.0	106	120	129	138	148	170	193	215
5.5	24.0	28.7	33.4	37.9	42.8	47.7	52.0	56.9	61.8	66.7	70.7	75.6	80.5	85.4	90.2	93.0	103	118	132	142	149	164	188	213	237
6	26.3	31.3	36.5	41.5	46.8	52.2	56.9	62.2	67.6	72.9	77.3	82.7	88.0	93.4	98.7	102	113	129	145	155	163	179	206	233	259
6.5	28.5	34.0	39.6	45.0	50.8	56.6	61.8	67.6	73.3	79.1	84.0	89.8	95.6	101	107	111	122	140	157	169	178	195	224	253	282
7	30.7	36.7	42.7	48.6	54.8	61.1	66.7	72.9	79.1	85.4	90.7	96.9	103	109	116	120	132	151	170	182	192	210	242	273	304
7.5	32.9	39.3	45.8	52.2	58.8	65.5	71.6	78.2	84.9	91.6	97.4	104	111	117	124	129	142	162	182	195	206	226	259	293	326
8	35.2	42.0	49.0	55.7	62.8	70.0	76.5	83.6	90.7	97.8	104	111	118	125	133	138	152	173	195	209	220	242	277	313	348
9	39.6	47.3	55.2	62.8	70.8	78.9	86.2	94.3	102	110	117	125	133	141	149	155	171	195	219	235	249	273	313	353	393
10	44.1	57.7	61.4	70.0	78.9	87.8	96.0	105	114	123	131	140	149	157	166	173	191	218	244	262	277	304	348	393	437
11		58.0	67.6	77.1	86.9	96.7	106	116	125	135	144	154	164	173	183	191	211	240	269	289	306	335	384	433	482
12		63.4	73.9	84.2	94.9	106	116	126	137	148	157	168	179	189	200	209	230	262	294	316	334	366	420	473	526
13			80.1	91.3	103	114	125	137	149	160	171	182	194	206	217	227	250	284	319	342	363	397	455	513	571
14			86.3	98.4	111	123	135	148	160	173	184	197	209	222	234	244	269	307	344	369	391	428	491	553	615
15				106	119	132	145	158	172	185	198	211	224	238	251	262	289	329	369	396	420	460	526	593	660
16				113	127	141	155	169	183	197	211	225	239	254	268	280	308	351	394	422	448	491	562	633	704
18					143	159	174	190	206	222	238	254	270	286	302	316	348	396	444	476	505	553	633	713	793
20						177	194	212	230	247	264	282	300	318	335	351	387	440	494	529	562	615	704	793	882
22							214	233	253	273	291	311	330	350	369	387	426	485	543	583	619	678	776	873	971
25									287	310	331	353	376	398	420	440	485	551	618	663	704	771	882	994	1110
28										347	371	396	421	446	471	494	543	618	693	743	790	865	989	1110	1240
30											398	424	451	478	505	529	583	663	743	796	847	927	1060	1190	1330
32												453	481	510	538	565	622	707	793	850	904	989	1130	1270	1420
35													558	590	618	680	774	867	930	989	1080	1240	1390	1550	
38														640	672	739	841	942	1010	1080	1180	1350	1510	1680	
40															707	778	885	992	1060	1130	1240	1420	1590	1770	
42																	817	930	1040	1120	1190	1300	1490	1670	1860
45																		996	1120	1200	1270	1390	1590	1800	2000
48																		1060	1190	1280	1360	1490	1700	1920	2130
50																		1110	1240	1330	1420	1550	1770	2000	2220
52																		1150	1290	1380	1470	1610	1840	2080	2310
55																		1220	1370	1460	1560	1710	1950	2200	2440
60																		1330	1490	1600	1700	1860	2130	2400	2660
65																		1440	1610	1730	1840	2020	2310	2600	2890
70																		1550	1740	1860	1990	2170	2480	2800	3110
75																		1660	1860	2000	2130	2330	2660	3000	3330
80																		1780	1990	2130	2270	2480	2840	3200	3550
85																		1890	2110	2260	2410	2640	3020	3400	3770
90																		2000	2240	2400	2560	2800	3200	3600	4000
95																		2110	2360	2530	2700	2950	3370	3800	4220
100																		2220	2490	2670	2840	3110	3550	4000	4440

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इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग

हस्ताक्षर एवं
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