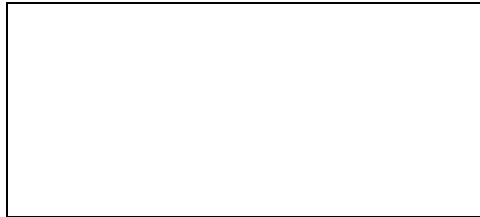


## **SPECIFICATION FOR** **WINDING WIRE**

APPROVED BY

**CEE/TM**



<b>SPECIFICATION FOR WINDING WIRE</b> <b>FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS</b> <b>WEST BENGAL , INDIA</b> <b>No. 4TMS.096.099 Alt.2</b> <b>First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)		(Reviewed by)	
SSE/TMDO		Dy.CEE/ TMD	

ALTERATION SHEET				
Alt. No.	Description of modification	Authority	Signature	Date
1.	Para 3.2.0 added at Page: 4 of 7, para 11.0 added at page 7 of 7 & Note deleted at page 5 of 7.	Dy.CEE/TMD	Digitally signed by Dy.CEE/TMD	14.02.2023
2.	Para 3.2: Type of Insulation modified at Page - 3 of 7, Para 3.2.1 deleted at page - 4 of 7 & Para 10.0(d) added at page - 7 of 7 vide note No. CLW/TM/9164 dtd. 06.07.2023 and note No. CLW/TM/9164 dtd. 17.07.2023.	Dy.CEE/TMD		

<b>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)  SSE/TMDO		(Reviewed by)  Dy.CEE/ TMD	
---	--	----------------------------------	--

## SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo 13CR

### 1.0 General:

#### 1.1 Scope:

This specification covers the manufacture and supply of “Winding wire flat FI Cu Fo 13 CR” used in 3-Phase Traction Motor type 6FRA 6068 & 6FXA 7059. Winding wire flat FI Cu Fo 13 CR is used to manufacture stator coils.

#### 1.2 Reference:

In the preparation of this specification assistance has been taken from ABB delivery Instruction No. HIFE 650030.

### 2.0 Description, Definition

The insulation of Winding wire consists of a three layer corona-resistant polyimide (PI) foil tape coated on one side with FEP (e.g. Teflon FEP). The tape is wound  $\geq 53$  % overlapped (FEP on the inside) and welded by heat treatment.

The insulation will resist temperatures of up to 220°C.

The nominal thickness of the insulation (IA = insulation coating) is 0.115 mm on each side.

### 3.0 Details of Raw Material:

#### 3.1 Conductor

Material : E-Cu 58 according to DIN 1787 (material number 2.0065)  
 Dimensions, tolerances : see IEC-317-0-2  
 DC resistance : see IEC-317-0-2

#### 3.2 Insulation

Type of insulation : FI Cu Fo 13 CR /150 FCR 019/150 FCRC 019 of M/s Dupont or L50CR11 of M/s Kaneka/USA\*

Construction

3- layers- foil	: 0.024 mm polyimide cr	} DI-HIFE 650029
Adhesive layer (fusible)	: 0.013 mm FEP (on one side)	
Tape widths	: 8 mm... 12.5 mm	
Number of layers	: 1 (FEP on the inside)	
Type of winding	: $\geq 53$ % overlapped	
Temperature index	: up to 220 °C according to IEC 172	

*\*Insulating film L50CR11 of M/s Kaneka/USA is allowed for regular use and its performance will be under watch for a period of two years. After this, it would be reviewed.*

<b>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)  SSE/TMDO	(Reviewed by)  Dy.CEE/ TMD
---	----------------------------------

### **SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo 13CR**

**3.2.0** The foil tape insulation must be welded evenly and without any flaws, and must meet the requirements in section 4.1 "Properties" over the entire length of the wire. Compliance with the required breakdown voltage over the length of the wire must be proved by a continuous voltage test (e.g. during manufacture) of 4.0 kV so that faults sites can be indicated, registered and marked with self-adhesive labels in a signal colour. A maximum of 5 faults per km of wire length will be permitted for acceptance for a delivery. Foil joints within a wire length must be clearly marked with heat-resistant adhesive tape in a signal colour.

### **3.3 Acceptance of new products**

Attainment of the properties listed is not in itself sufficient to the acceptance of new, previously unaccepted products. Only if after particular experiments, practical service tests and if necessary, other considerations have been taken into account, it appears that the new product is acceptable and interchangeable, may we decide to convert to it.

### **3.4 Supplier's Product Designation**

Semi-finished product corona resistant polyimide film must receive from the supplier a designation of quality which must be changed if alterations are made to the composition, the quality of the raw materials, the method of manufacture or other factors that could influence the technological properties of the semi finished product.

<div>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</div>		<div>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</div>	
<div>(Prepared &amp; checked by)  SSE/TMDO</div>		<div>(Reviewed by)  Dy.CEE/ TMD</div>	

**SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo 13CR****4. Requirements****4.1 Properties**

SN	Size, term	Unit	Values	Test method
1.	Insulation coating over width 1)	mm	$0.23 \pm 0.03$	IEC-851-2, Para.3 (=SEV 3634-2.1987)
2.	Springiness angle for thicknesses over 0.560...0.800mm	Degree	max. 6.0	IEC-851-3, Para. 4 (= SEV 3634-3)
	> 0.800...1.50 mm		max. 5.5	
	> 1.50.... 3.00mm		max. 5.0	
	> 3.00 mm		max. 4.5	
3.	Elongation at rupture of the wire up to 2.5 mm wire thickness	%	$\geq 30$	IEC-851-3, Para. 3 (= SEV 3634-3.1987)
	over 2.5 mm wire thickness		$\geq 32$	
4.	Adherence (on elongation) Section detached	%	$\geq 20$	IEC-851-3, Para. 5.5 (= SEV 3634-3.1987)
5.	Flexibility in mandrel winding test edge $\varnothing = 2b$	—	no cracks	IEC-851-3, Para. 5.1 (= SEV 3634-3)
	flat surface $\varnothing = 2s$		no cracks	
6.	Thermal shock resistance on bent samples 220 °C edge $\varnothing = 2b$	—	no cracks	IEC-851-6, Para. 3 (= SEV 3634-6.1987)
	flat surface $\varnothing = 2s$		no cracks	
7.	Dielectric breakdown voltage straight	KV	$\geq 7$	IEC-851-5, Para. 4
	after bending test		$\geq 4$	
	after thermal shock		$\geq 4$	

1. The Insulation thickness (=2IA): Insulated dimension minus bare dimension. The insulation tolerances may be exceeded if the outside dimensions of insulated winding wire are not exceeded when the permissible tolerances of bare wire and insulation are added together.
2.  $\varnothing$  = diameter of bending mandrel, expressed as a multiple of the wire width b or thickness.
3. At least 4 out of 5 straight samples or 7 out of 8 curved samples of the same section of wire must meet the required breakdown voltage.

<b>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)  SSE/TMDO	(Reviewed by)  Dy.CEE/ TMD
---	----------------------------------

### SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo 13CR

#### **5.0 QAP and other requirements:**

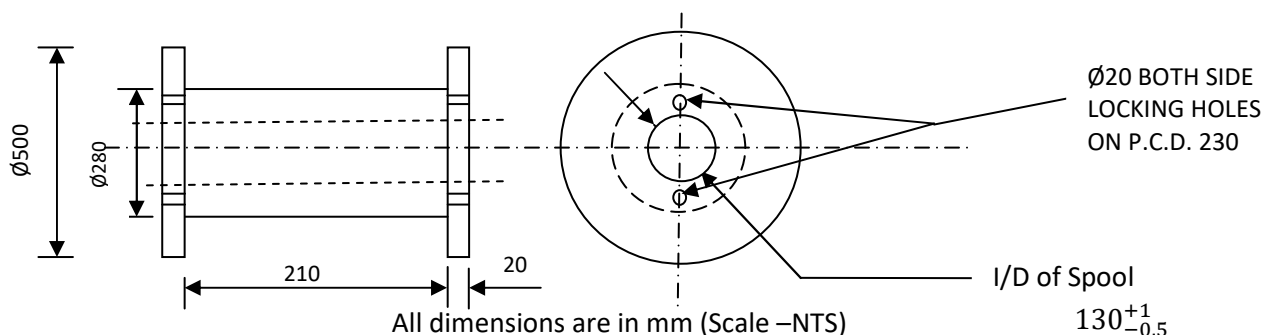
- 5.1 The tenderer shall submit the process of manufacturing in the form of QAP which includes quality plan from the stage of raw material procurement, through in process and final tests. The tenderer must submit their QAP along with tender.  
After getting order, QAP shall be duly approved by the competent authority before going of Prototype inspection.
- 5.2 All the test specified in the specification shall be carried out at manufacturer's works. The manufacturer shall arrange all the necessary machinery, apparatus, labour and assistance required for conducting the tests without extra cost.
- 5.3 Inspection authority must check original Challan/invoice of imported raw material. Quantity of Raw material consumed against P.O under Inspection must be endorsed on Challan/Invoice.
- 5.4 In case of import, the firm must produce original TC, GC & imported document to the Inspection authority.

#### **6.0 Bulk Manufacture**

- 6.1 Only after clear written approval of the results of the tests on the prototype is communicated by the Dy. CEE/TMD, to the manufacture, shall he take-up bulk manufacture of the Winding wire which shall be strictly with the same material and process as adopted for the prototype.
- 6.2 Any testing and approval by the purchaser of the design, drawing and prototype shall in no way absolve the supplier of his responsibilities under the terms and conditions of the contract.

#### **7.0 Packing**

The winding wire shall be wound evenly and compactly on spools. The separators shall be inserted in between each layer of winding wire and a layer of thick paper shall be given over the last layer of wire to protect the winding wire from external damages. The net weight of the winding wire per spool shall be a maximum 50 Kg to 65 Kg. The construction of the spool shall be as per sketch shown.



<b>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)		(Reviewed by)	
SSE/TMDO		Dy.CEE/ TMD	

**SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo 13CR****8.0 Consignment****8.1 Form of the Consignment**

Dimension of the conductor in mm		Reels acc. to with IEC-264-2-1
over	up to + width	
b x s	2.00 x 0.80	250 Ø mm
2.00 x 0.80	4.00 x 1.00	355 Ø mm
4.00 x 1.00	7.10 x 2.00	500 Ø mm
7.10 x 2.00		710 Ø mm

Reels made up in accordance with IEC 264-2-1 are recommended as delivery units. Other reels for delivery in accordance with IEC 264-2-1 are permitted, depending on the facilities available for winding off from the reels.

Each delivery unit may contain one length of wire. If, in exceptional cases, two or more lengths of wire are permitted on the same reel, this must be clearly marked on the outside of the unit.

**9.0 Transport**

The shipment is to be made by rail or road transport in such a way that it can be unloaded easily. Full reels must only be transported with their axes horizontal.

**10.0 Marking:**

Each roll shall be legibly marked at both ends with the following information:-

- Manufacture's name or trademark.
- Purchase order reference and date.
- Item Name, size, Quality, batch no. of mfg. and date of expiry.
- Type and make of Insulation film used with reference to para 3.2.

**11.0 Test Certificate**

Each consignment must be accompanied by a manufacturer's test certificate in accordance with DIN 50049-2.3, confirming by the results of tests on the consignment itself or on defined test units, of which the consignment forms part, that the consignment meets the requirements under section 4.

<b>SPECIFICATION FOR WINDING WIRE FLAT FI Cu Fo13 CR</b>	<b>CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL , INDIA No. 4TMS.096.099 Alt.2 First Issued on:09.12.2022</b>
--	--

(Prepared & checked by)  SSE/TMDO		(Reviewed by)  Dy.CEE/ TMD	
---	--	----------------------------------	--