

Emco Electrodyne Pvt. Ltd.



High Voltage Coils & Bars



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COILS and BARS

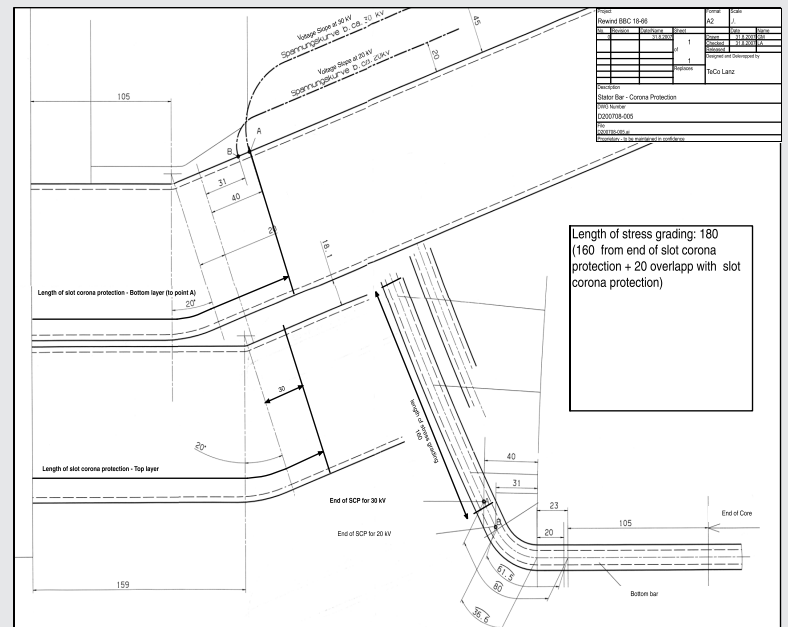
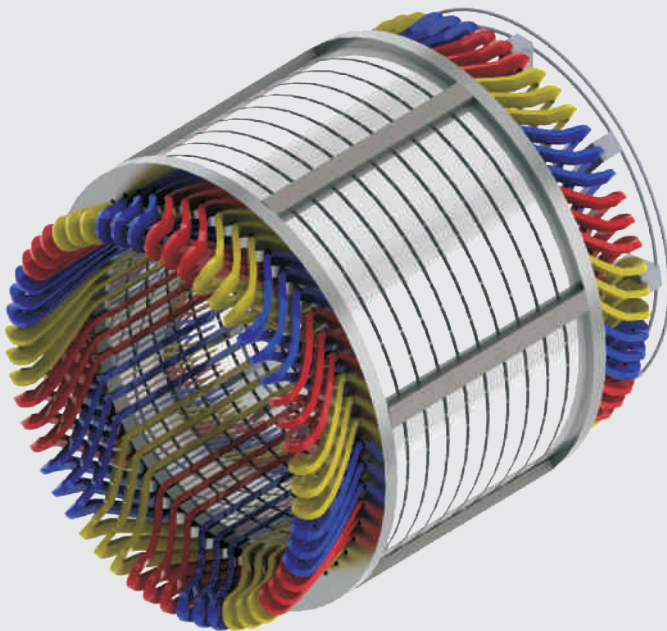
The basic characteristics of both insulation system is the use of mica tape with/without thermosetting resin for bonding. The insulation scheme and the manufacturing processes have been proved over the years, as most outstanding in reliability and performance of the coils/bars and subsequently the machine itself.

The insulated coils/Bars are individually designed looking into all aspects operation of the machines.

The coils/Bars have:

- High breakdown values
- Low power factor (tan) value
- Long life
- Increase resistance to cyclic/mechanical/thermal stresses.
- Class "F" insulation as per relevant international standards.

Design & Ranges



DESIGN

Computerized design on 3D CAD System is done on each coil/bar is done and passed on to the production line for guaranteed winding performance. The insulated coils/Bars are individually designed looking into all aspects accurate modeling of each coil/bar is done and passed on to the production line for guaranteed winding performance.

Multi Turn Formed Coils (Resin Rich & VPI)

- Upto 18 KV
- Max Cell size 35x120x2500 mm
- Turn taping of conductor bunch
- Enamel/glass/Dacron/Mica as basic conductor insulation

Roebel bars (Resin Rich & VPI)

- Upto 27KV
- Max Cell size 35x120x7000 mm
- Transpositions of sub-conductors possible upto 720°
- Copper /Stainless Steel Conductors
- Solid and/or hollow conductors
- Enamelled/glass/dacron /mica as basic conductor insulation



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Infrastructure



INFRASTRUCTURE FOR MANUFACTURING ROEBEL BARS & FORMED COILS

10,000 SQFT of Completely Clean, Dust-free, Air Conditioned Pressurised Coil-Shop Area produces Bars and Coils of World-Class Quality With Back-Up Support From Major Insulation Providers, M/s ISOVOLTA AG, AUSTRIA.

CONDUCTORS :

- Copper/Stainless Steel, Solid OR Hollow
- Dual Coat Enamelled/ Dacron/mica

STRAIGHTENING, CUTTING AND STRIPPING MACHINE

- CNC machine with high repeatability and accuracy
- Max. Insulated Conductor Sizes (Solid) : 15x4 mm
- Max. Conductor Size (Hollow) : 10x6 mm, 1.8 mm thickness
- Conductor length : 1100mm (min.) and 12000mm (max.)
- Accuracy : ± 2 mm in skinning and overall length

TRANSPOSITION BRIDGES

- For two plane bending for transposition upto 540 deg.
- transposition inlays, stack separator, non-conductive/conductive mastic/fillers can be provided as per customer's requirement.

TAPING MACHINE

- CNC 6-AXIS TAPING MACHINE for taping of RESIN RICH and RESIN-POOR TAPES IN ROEBEL BARS & COILS.
- | | | |
|----|----------------------------|------------------------------|
| a. | X Axis (Length Wise) | : 0-6500 MM max (Servo Axis) |
| b. | Y Axis (Width Wise) | : 0-1200 MM max (Servo Axis) |
| c. | Z Axis (Vertical) | : 0-550 MM max (Servo Axis) |
| d. | Maximum Coil Cross section | : 30x120 MM |

- SEMI-AUTOMATIC GANTRY TYPE TAPING MACHINE

- | | | |
|----|----------------------|------------------------------|
| a. | X Axis (Length Wise) | : 0-3600 MM max (Servo Axis) |
| b. | Coil Cross-section | : 25x100 mm |

- HOT PRESSING

- PLC controlled Hot presses (06 nos.) for curing of cell lengths upto 6000mm and cell size of 40x120mm
- PLC controlled Stack consolidation pres (01nos.) for straight length 6000mm.
- Accuracy of achieved moulded size upto 0.5mm over the entire length of 6000mm

- LOOPING MACHINE

- Suitable for multi-strand coils with loop lengths upto 4000mm with a bunch of 12 conductors in parallel.
- Facility for turn-taping.

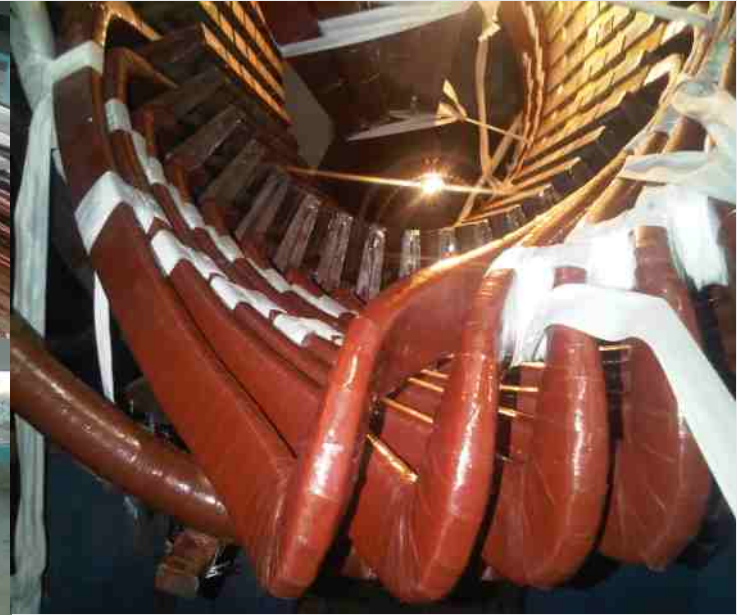
- SPREADING MACHINE (03 MACHINES)

- CNC machine for Hydraulic spreading of closed loop coils efficiently and allowing excellent repeatability
- Maximum Straight lengths : 2500mm
- Max. Stack size : 25x65mm
- Span : 940mm
- End-winding forming integral of the machine.
- Cycle time : 45 sec/coil



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Multi Turn Formed Coils



STRAND & TURN INSULATION

The standard EMCO strand insulation comprises of enamelled and a double glass covering bonded with epoxy. The bunch of conductors can be turn taped with Mica as per insulation requirements. However the other insulation such as dacron, mica, nomex can also be used.

STACKING

The insulated conductors are looped with the requisite turns as per design and then a high resin tape is applied to the loop and is cured in hot presses to ensure high rigidity of the active length of the coil, alignment of the conductors and also act as a turn insulation.

FORMING

After the loops are stacked they are spread in a programmable spreading machine which has tools to give radius to end winding portion also in one operation. The machine ensures high degree of accuracy and repeatability.



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Roebel Bars



STRAND INSULATION

The standard EMCO strand insulation is made up of enamelled double Dacron covering bonded with an epoxy varnish.

STACKING & SHAPING

The stacked bars are tested for any shorts and then taped with a high resin tapes applied and is cured in hot presses to ensure filing of Voids, rigidity of conductor stack in the active part of the bar.

TRANSPPOSITION

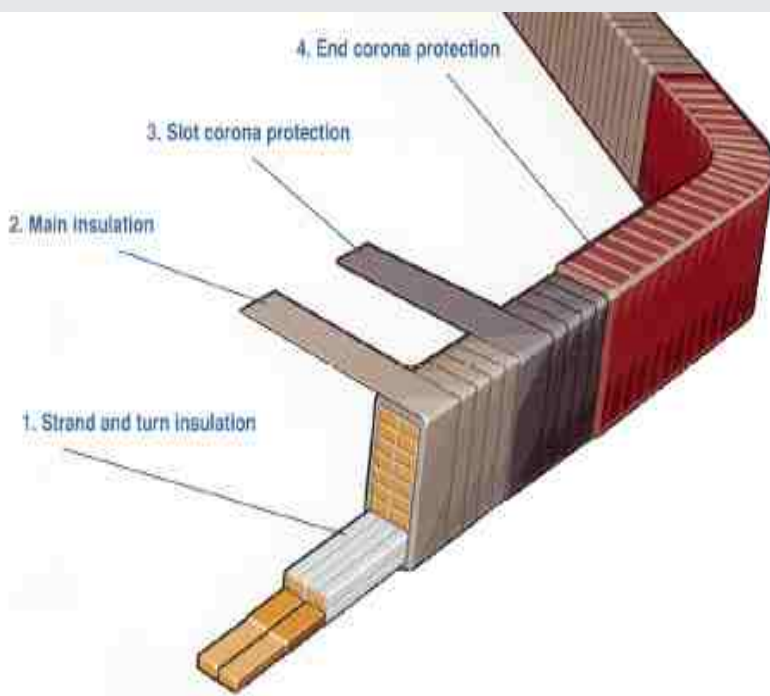
The sub conductors are then transposed as per design with special tools and machines which ensure zero short circuit between conductors and also at times enables to have increased transposition level such as 360 degrees to 540 degree and so on. To fill voids of the transpositions a strip of special epoxy resin is hot pressed.



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Main, Endwinding Insulation & Corona Protection

With the latest developments in the insulation technology EMCO has adopted a scheme which is suitable for long life and withstand high voltage stresses and also reduce costs.



MAIN INSULATION

RESIN RICH TECHNOLOGY

The active straight part of the coil/bar is taped with number of layers of mica with epoxy tapes using CNC-6 Axis & automatic taping machines thereby increasing the reliability of the ground wall insulation and the active part is then hot pressed to achieve a rigid cell of desired dimensions.

VPI TECHNOLOGY

The entire coils/ bar is taped with porous mica tape using CNC 6-axis & automatic taping machine. The coils / bars are then V.P.I.ed in mold boxes and then thermally cured to achieve a reliable electrically and thermally stable insulation.

ENDWINDING INSULATION

RESIN RICH TECHNOLOGY

The endwinding insulation is taped with the flexible mica tapes and subsequent layer of heat shrinkable reinforcement tape or sealing tape is applied.

VPI TECHNOLOGY

The endwinding is taped with the same porous mica tape with the requisite layer and then a layer of sealing tape is applied.

CORONA PROTECTION

CONDUCTIVE LAYER

The straight part of the coil /bar is taped with a conductive layer which has a resistance of 500-1500 Ω . This ensures that the corona is discharged effectively as well as the laminations are not shorted.

STRESS GRADING LAYER

The bend on the overhang is taped with a silicon carbide coated tape to the required length and overlaps the conductive layer and serves as a controller of the of the high voltages transitions from the overhang bend to the edge of the core.

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Testing & Quality Control

Quality and Testing is done accordance to the relevant international standards and in accordance with ISO 9001 quality Management system.



Each Coil / bar undergoes various tests and meet/exceed relevant IEEE/IEC standards or the customer requirements:-

INCOMING RAW MATERIAL TEST

Control of quality is verified by manufacturers test results and EMCO incoming inspection checks.

SUB CONDUCTOR TESTS:

After stacking and hot pressing the individual sub conductors and checked at 220 V AC to ensure no shorting is present

TURN TEST(FOR MULTITURN FORMED COILS)

The coils after stacking and also after application of main insulation are checked by applying a surge voltage as per IEC 60034/15 or IEEE 522.

DIMENSIONAL AND PROCESS CHECKS

Each coil/bar is checked for any abnormality such as voids, cracks, disfigure of shape which may occur during processing and handling. Dimensions are critically checked and recorded and undergo a range of GO/NO-GO tests to ensure proper fitment and winding.

HI POTENTIAL TEST

After hot pressing or VPI cycle, the coils /bars undergo a hi-pot tests as per IEC 60034-15 or IEEE- 4 for 60 seconds. Leakage currents are also recorded.

TAN DELTA AND CAPACITANCE MEASUREMENT

Each Winding set undergoes $\tan\delta$ (and also tip up) tests as per IEC 60034 and IEEE 286

RESISTANCE OF CONDUCTIVE COATING

The resistance of the conductive layer is measured across the straight length of the coil/ bar.

CLIENTS SPECIFIC REQUIREMENTS

EMCO welcomes any additional tests that the customer may demand to improve reliability.



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