

# Specifications of NON GRAIN ORIENTED ELECTRICAL STEEL for MACHINES

Doc No: CRNGO/DC814-03



- Application** : Electrical Machine lamination for Electric Vehicle.
- Type** : Cold rolled, insulated (double side), non-grain oriented magnetic steel coil rolls in finally annealed condition in 0.35 and 0.20 mm thickness.
- Basic requirement** : High frequency application, Electrical steel with high permeability, low core loss @ high magnetic flux density and good mechanical properties.

**REFERRED STANDARDS (Latest Publications including Amendments):** 1) DIN 50462 2) DIN EN 10106 3) ASTM A 717

**Insulation coating** :

The insulation coating used for the steel shall be uniformly applied, tightly adherent and shall be as per AISI/ASTM, C-5 of the filler base type on both sides, pigmented varnish and also suitable for fully impregnated electrical machines (VPI). The insulation coating thickness of any individual point shall lie between as specified in below table, provided the maximum value is not of repetitive nature.

**Typical insulation resistance ( $\Omega\text{-cm}^2$  /side):** as specified in below table.  
(Insulation measurement: Franklin test according to ASTM A717 or EN60404 -11:2013)

**Temperature capability in air (continuous)/ Inert gas (intermittent):** as specified in below table (as per standard IEC/CEI 60404-12:1992)

**Coating colour:** brown or grey or any regular

**Good resistance to corrosion, organic solvents oil & lubricant oil**

| Thickness (mm) | Average coating thickness in microns (per side) | AISI class | Typical insulation resistance ( $\Omega\text{-cm}^2$ /side) | The insulation coating thickness of any individual point shall lie between | Temperature capability in air (continuous)/ Inert gas (intermittent) |
|----------------|---|------------|---|--|--|
| 0.35           | 2.0 $\pm$ 0.5                                   | C5         | $\geq$ 40   | 1.5 to 3 microns   | $\geq$ 200 °C/800 °C   |
| 0.2            | 2.0 $\pm$ 0.5                                   | C5         | $\geq$ 40   | 1.5 to 3 microns   | $\geq$ 200 °C/800 °C   |

## CONDITION OF DELIVERY:

- Cold rolled, finally annealed.
- The material shall be supplied in coil rolls to the required thickness as below.

## Required CRNGO electrical steel

| Sl No. | Item                                 | Quantity      |
|--------|--------------------------------------|---------------|
| 1.     | CRNGO Electrical steel 0.35 mm thick | 5 Metric Tons |
| 2.     | CRNGO Electrical steel 0.2 mm thick  | 5 Metric Tons |

## Dimensions:

| Grade        | Thickness tolerance(mm) | Coil Width (mm) | Width tolerance(mm) |
|--------------|-------------------------|-----------------|---------------------|
| 0.35mm thick | *                       | 500             | +1<br>0             |
| 0.2mm thick  | *                       | 500             | +1<br>0             |

Preferred coil roll weight is around 1 Metric Ton and pallet weight around 1.5 Metric Ton.

\* The permissible deviation in nominal thickness shall be  $\pm$  8%. The variation in thickness in a direction parallel to the direction of rolling shall not exceed  $\pm$  8% of the nominal thickness. The variation in thickness in a direction perpendicular to the direction of rolling shall be  $\pm$  0.020 mm. The measuring points should be at least 40 mm away from the edges of the sheets.

## Required values

| Grade        | Minimum polarization (T) |           | Guaranteed core loss             |
|--------------|--------------------------|-----------|----------------------------------|
|              | 2500(A/m)                | 5000(A/m) |                                  |
| 0.35mm thick | 1.49                     | 1.60      | 2.35 W/kg or better @ 50Hz, 1.5T |
| 0.2mm thick  | 1.55                     | 1.62      | 15W/kg or better @ 400Hz, 1.0T   |

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### Typical core loss at different flux density and frequency

| Grade        | Core Loss (W/kg) |       |        |         |
|--------------|------------------|-------|--------|---------|
|              | B (T)            | @50Hz | @400Hz | @2500Hz |
| 0.35mm thick | 1                | 0.95  | 16.9   | 349     |
| 0.35mm thick | 1.5              | 2.35  | 41.2   | -       |
| 0.2mm thick  | 1                | 0.95  | 15     | 200     |
| 0.2mm thick  | 1.5              | 2.4   | 30     | -       |

### Mechanical Properties

| Grade        | Tensile Strength(MPa)<br>(in all directions) | Yield point<br>(MPa) | Hardness (HV) | Stacking Factor |
|--------------|--|----------------------|---------------|-----------------|
| 0.35mm thick | 530-590                                      | 410-470              | 210-240       | ≥0.93           |
| 0.2mm thick  | 440-530                                      | 340-400              | 170-200       | ≥0.95           |

- **Delivery time required** after placing Purchase Order shall be clearly mentioned in the offer.
- Supplier shall send MATERIAL TEST CERTIFICATE for dispatch clearance.
- **NOTE:** Supplier/Vendor shall submit duly signed and stamped specifications sheet for compliance as per BHEL requirement.