



TSD 6207A

**PLANT PURCHASEING SPECIFICATION
BHOPAL****BP 10987****Rev No : 05****PAGE 1 OF 8****SUPERSEDES
BP 10987 Rev 04****COLD ROLLED GRAIN ORIENTED SHEET STEEL
GR:27 H 100M / 27HP100****1 GENERAL:**

This specification governs the quality requirements of double side insulated, cold rolled, grain oriented magnetic steel sheets of thickness 0.27mm

2 APPLICATION:

Used in transformer cores.

3 CONDITION OF DELIVERY:

Cold rolled and annealed.

The sheet shall be supplied in side trimmed continuous coils, With insulation coating on both sides, as specified in clause 6.

4 COMPLIANCE WITH NATIONAL STANDARDS:

This standard is based on IS:3024

5 DIMENSIONS AND TOLERANCES:**5.1 Sizes:**

The steel sheet shall be supplied to the dimensions specified on the order

5.1.1 Thickness

The thickness of the sheet shall be 0.27 mm.

Revision: Cl. 4, 5.1.3, 6, 9, 10.2, 11.1, 11.2.2, 11.3, 13, 14 & Annexure modified Brought upto date

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- 5.1.2 Width:
The nominal standard width of the coil shall be 790, 840, 915 or 1000 mm.
The order shall clearly specify the width of the coil required.
- 5.1.3 Weight:
The nominal weight of the coil shall be between 1800 and 4000 kg.
- 5.2 Tolerances:
- 5.2.1 Thickness:
Tolerance on thickness when measured with a contact micrometer at any location, not less than 9.5 mm from an edge shall not deviate more than ± 0.025 mm from the average thickness of the test lot or coil. The outer limits of acceptable thickness shall be within the range of 0.241 to 0.305 mm.
- 5.2.2 Width:
The tolerance of width for side trimmed coil shall be - 0 and + 3 mm.
- 5.2.3 Edge Camber:
The deviation of a side edge from a straight line over 2440 mm length or fraction thereof shall not exceed 3.2 mm .
- 5.3 Waviness:
Sharp, short waves and buckles are extremely detrimental to the effective use of grain oriented electrical steel in flat laminations and shall be avoided in the delivered materials.
For material of width greater than 150 mm, the deviation from flatness (Wave Factor) expressed as a percentage, shall not exceed 1.5 %.
- 6 MANUFACTURE:
The sheet shall be of low carbon, silicon steel having silicon content around 3.15%. High permeability and low core-loss in the direction of rolling is to be achieved by appropriate metallurgical processes.
The thermally flattened material shall be coated with an inorganic surface coating type C2 and an inorganic surface coating, type C5. applied over the inherent C2 coating to provide extra surface insulation resistance on both sides



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The steel sheets shall be uniformly coated on both sides with an insulation as stated above, as part of its manufacturing process, which will withstand stress relief annealing without deterioration of its adhesion or electrical insulation value at a temperature of 790 to 840 deg.C. There shall be no change in colour of the insulation after annealing

The insulation, coating shall be uniform throughout the length of the coil. There shall be no line marks, rough spots, dots and patches etc.

Note: Not to be confused with some discoloration / shade difference of the insulation inherent to the manufacturing process.

7 FREEDOM FROM DEFECTS:

The material shall be clean, bright, smooth and free from dents, surface defects such as holes, scabs, pits, blisters, slivers, mill marks etc. and also free from oil, grease, dust scale and rust.

The sheet surface shall not exhibit any of these defects even after stress relief annealing at 790 deg.C to 840 deg.C.

8 TEST SAMPLES:

Test samples shall be selected from the consignment as follows:

8.1 Maximum specific Total Loss:

One from each coil.

8.2 Electrical & Mechanical Tests:

One sample per consignment/lot for Mechanical Tests and Electrical Tests (Surface Insulation Resistivity and Magnetic Permeability Tests).

8.3 The test samples shall be sufficient in size to provide the necessary test pieces.**9 TEST METHODS:**

Unless otherwise specified, the test shall be conducted in accordance with the relevant method specified in IS 3024

10 MECHANICAL TESTS:**10.1 Ductility:**

Material shall possess good shearing and punching properties and shall be sufficiently ductile to permit normal working.



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The bend test shall be carried on transversely cut test specimen of not less than 152 mm long and 30 mm wide

The test specimen shall be initially bent through 90 degrees, this bend not being counted. The specimen shall then be bent backward and forward through 160 degrees. The specimen shall complete one bend without fracture.

10.2 Stacking Factor:

The surface quality of the material when measured in terms of stacking factor (viz. a minimum of 16 samples under a pressure of 0.35 MPa) shall be 95% minimum.

11 ELECTRICAL TESTS:**11.1 Surface Insulation Resistivity:**

When tested as per IS 649 Section -2, the surface insulation resistivity per lamination (two surfaces of single strip specimens (5 on each side), shall show the following readings.

Average Value 10 ohms cm², Minimum.

Individual Value. 5 ohms cm², Minimum

11.2 Maximum Specific Total Loss:**11.2.1 Cutting of Test Specimen:**

Epstein test specimens measuring 30 mm wide and not less than 300 mm long, shall be cut from the sample with sharp shears. All the strips shall be cut parallel to the direction of rolling.

11.2.2 Stress - Relief Annealing:

The Epstein test specimens cut as described above, shall be annealed at a temperature of 790 deg.C to 840 deg.C for approximately 1 hour in an atmosphere comprised of a combination of pure Nitrogen and pure Hydrogen (2 to 15%). Provision shall be made for obtaining essentially perfect flatness in the magnetic test specimen in the stress relief anneal.

11.2.3 Testing

When tested in accordance with IS 649, the specimens prepared as described in clause 11.2.1 and 11.2.2 shall be tested at a peak magnetic flux density of 1.7 T and a frequency of 50 Hz. The specific total loss shall not be greater than 1.00 watt/kg.

11.3 Magnetic Permeability Test

The induction value at 800 A/m magnetising force shall not be less than 1.88 Tesla



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When tested at a peak Magnetic Flux Density of 1.7T and at a frequency of 50 Hz, the specific total loss of the specimen which has been heated at a temperature of 225 deg.C for 24 hours shall not deteriorate by more than 4% of the measured specific total loss (clause 11.2) of the coil concerned.

*Note: Type tests shall be carried out when "Type Approval" to a supplier is given and repeated once in two years for the approved sources.

13 TEST CERTIFICATES:

Unless otherwise stated, three copies of certificates shall be supplied alongwith each consignment.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents / shipping list to facilitate quick clearance of the material

The test certificate shall bear the following information.

BP 10987 - Rev. 05, Order No, Supplier's Name/Grade/ Identification No, Size & Weight, Packet/Bundle No, Test Results of Dimensions & Tolerances, Freedom from Defects, Details of Insulation Coating, Type Test, Properties of (a) Specific Total Loss of each coil (b) Mechanical & Electrical properties for one random coil of each lot/ consignment, (c) Results of chemical composition for information only.

14 PACKING AND MARKING

The material shall be supplied preferably in coils of continuous length. However, if it becomes unavoidable, the coils of the order can be supplied with maximum of three butt weld joints. The supplier shall ensure than the welds are made in such a manner without causing damage to the areas of coil adjacent to the weld. The welds shall be clearly marked by suitable tags projecting outside the coil.

Sheets shall be packed vertically according to the instructions and drawings given in the Annexure.

A metal label / tag shall be securely attached with each coil or drum or bundle outside its wrapping and shall be legibly marked with the following information.



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27HP100

BHEL Order No.

Manufacturer's/Supplier's name. Identification / Coil No.

Size and Quantity supplied.

GENERAL _INFORMATION FOR CALCULATION

Density - 7.65 kg/dm³.



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Annexure

DETAILED INSTRUCTIONS FOR PACKING

The nominal weight of each coil shall be 1800-4000 kg.

The nominal internal diameter of coil shall be 508 mm.

Packing shall be sea-worthy and shall protect the coils from damage and rusting during transit.

The supplier's grade/reference shall be marked at every one metre intervals throughout the coil length. Coils shall be vertically packed according to the instructions and drawing given below.

- 1 An annular protection board shall be placed at either end of the coil.
- 2 The coil shall then be wrapped with waterproof anti-rust crepe kraft paper by lapping axially all around the circumference.
- 3 The coil shall then be covered by polyethelene sheet or anti-rust waterproof paper and the ends sealed properly.
- 4 A galvanized sheet shall be wrapped on the outside of the coil and the top and bottom of the coil. Care shall be taken to ensure that the ends of the tops and bottom of the coils extend sufficiently over the inside diameter of the coil.
- 5 A galvanised sheet shall be wrapped on the inside of the coil. Care shall be taken that it overlaps sufficiently over the ends of the sheet mentioned in (4) above.
- 6 Steel ring made from thick angle sheets shall be placed on the rim of the inner diameter at both ends of the coil. The rings shall be held at either ends at four points by steel bands.
- 7 The coil shall then be mounted on wooden skids, held together by steel bands. Wooden skids must have cutouts to house the steel bands for tight fit and to avoid slippage.
- 8 The packing shall ensure that there is no seepage of moisture and the coils reach BHEL in completely rust free condition. It should be strong enough to withstand handling at the docks, at sea and on the road.
- 9 Coils shall be sufficiently tight wound to prevent coil lapse to an extent that would preclude their being mounted on a mandrel appropriate to the ordered internal diameter.
- 10 Each package shall indicate the, Sling Position, for lifting without damage. It is preferable to fix a suitable size of, 'Sheet Steel Angle', at the position where the Sling Rope is to be fitted to avoid slippage/damage/ breakage of the wooden skid at four places



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