भा एच ई एल BHEL	CORPORATE PURCHASING SPECIFICATION	AA 109 05
		Rev. No. 08
		PREFACE SHEET

COLD ROLLED GRAIN ORIENTED SHEET STEEL, Gr: 27G051

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1.	AMERICAN	: ASTM A 876-2003 Gr: 27G051, Condition:F5 Ductility: Class 1
2.	IEC	: 404 - Section 8.7

Suggested/Probable suppliers and grades:

1.	Nippon Steel Corporation	- Japan	: Orientcore 27M4
2.	Kawasaki Steel Corporation	- Japan	: Orientcore 27M4
3.	British Steel Corporation	- UK	: 27 M4
4.	ARMCO	- USA	: 27 M4
5.	Ugine De Cahttilon	- France	: 27 M4
6.	Thyssen	- Germany	: 27 M4
7.	Ilva	- Italy	: 27 M4
8.	Allegheny	- USA	: 27 M4
9.	Dofasco	- Canada	: 27 M4

User Plant References:

1. BHOPAL	: PS 10905
2. JHANSI	: -----

Revisions : Ref: TRE/CRGO/SKM dt:28.07.2005			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE -MRC (E)		
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Dt:15.11.2005	Dt :	Year :	BHOPAL	Corp. R&D	AUGUST, 1975

COLD ROLLED GRAIN ORIENTED SHEET STEEL, Gr: 27G051

1.0 GENERAL:

This specification governs the quality requirements of Double side Insulated, Grain oriented, Silicon-Iron Electrical Steel Sheet, Gr: 27G051, Fully processed, in 0.27 mm thick.

2.0 APPLICATION: Used in Transformer Cores.

3.0 CONDITION OF DELIVERY:

The material shall be supplied in side trimmed, continuous coils, coated on both sides in the cold rolled and annealed condition.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of ASTM A 876 -2003 Gr:27G051, Condition: F-5, Ductility : Class 1.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

The steel sheet shall be supplied to the dimensions specified in BHEL order.

5.1.1 Thickness:

The thickness of the sheet shall be 0.27mm.

5.1.2 Width:

The nominal standard width of the coil shall be 790, 840, 915 or 1000mm.

BHEL order shall clearly specify the width of the coil required.

5.1.3 Weight:

The nominal weight of the coil shall be between 1800 to 2500kg.

5.2 Tolerances:

5.2.1 Thickness:

Tolerance on thickness when measured with a contact micrometer at any location, not less than 9.5mm from an edge shall not deviate by more than ± 0.025mm 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 0.305mm.

5.2.2 Camber:

The deviation of a side edge from a straight line over 2440mm length or fraction thereof shall not exceed 3.2mm.

5.3 Width & Waviness:

- Width for side-trimmed coils: - 0 and + 3mm
- **Waviness:**

  Sharp, short waves and buckles are extremely determined 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 150mm, the deviation from flatness (Wave Factor) expressed as a percentage shall not exceed 1.5%.

6.0 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 - Type C2 coating to provide extra surface insulation resistance on both sides as per ASTM A 876 , condition:F5.

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^{0}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, shade difference, dots and patches, etc.

7.0 FREEDOM FROM DEFECTS:

The material shall be clean, bright, smooth and free from dents and 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 to 840^0 C.

8.0 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 and 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.

9.0 TEST METHODS:

Unless otherwise specified, the test shall be conducted in accordance with the relevant method specified in ASTM A 876.

10.0 MECHANICAL TESTS:

10.1 Ductility:

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

The bend test shall be carried on transversely cut test specimen of 60mm long and between 10mm and 30mm wide.

The test specimen shall be initially bent through 90^0, this bend not being counted. The specimen shall then be bent backward and forward through 160^0. The specimen shall complete one bend without fracture.

10.2 Stacking Factor:

The surface quality of the sheets when measured in terms of stacking factor (viz. a minimum of 16 samples under a pressure of 0.35 MPa) shall be 94.5%, minimum.

11.0 ELECTRICAL TESTS:

11.1 Surface Insulation Resistivity:

When tested as per ASTM A 717 -Franklin's method, the surface insulation resistivity per lamination (two surfaces) of single strip specimens (5 on each side) shall show the following readings:

Average value : 10 Ohm-cm^2, minimum

Individual value : 5 ohm-cm^2, minimum.

11.2 Maximum Specific Total Loss:

0.85 watts/kg at 1.5 T and at 50Hz.

11.2.1 Cutting of Test Specimen:

Epstein test specimens measuring 30mm wide and not less than 300mm 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 to 840^{0}C for approximately 1 hour in an atmosphere comprising 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 annealing process.

11.2.3 Testing:

When tested in accordance with ASTM A 343M, the specimens prepared as described in clause 11.2.1 and 11.2.2 shall be tested at a peak magnetic flux density of 1.5 T and a frequency of 50 Hz. The specific total loss shall not be greater than 0.85 watt/kg.

11.3 Magnetic Permeability Test:

When tested in accordance with ASTM A 343M, the Magnetic Permeability at AC Magnetizing Force of 800 A/m shall not be less than 1880 using 25cm Epstein Test frame on 50 Hz.

Alternatively the induction value of 800 A/m magnetizing force shall not be less than 1.81 Tesla.

12.0 TYPE TEST - AGEING: *

When tested at a peak Magnetic Flux Density of 1.5T and at a frequency of 50 Hz, the specific total loss of the specimen which has been heated at a temperature of 225^0 C for 24 hours shall not deteriorate by more than 4% of the measured specific total loss 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 supplier.

13.0 TEST CERTIFICATES:

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to enclose one copy of test certificate along with their despatch documents for quick clearance of the material.

The test certificate shall bear the following information:

AA 10905-Rev 08 / ASTM A 876:Gr:27G051, Condition: F-5, Ductility: Class 1, BHEL 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.

14.0 PACKING AND MARKING:

14.1 Packing:

The material shall be supplied in coils of continuous length. However, if it becomes unavoidable 5% of the coils of the order can be supplied with maximum of two butt weld joints and 95% of the coils shall be in continuous length. The supplier shall ensure that the welds are made in such a manner without causing damage to the areas of the coil adjacent to the weld. The welds shall be clearly marked by suitable tags projecting outside the coil.

Nominal weight of the coil shall be between 1800 and 2500 kg.

The nominal internal diameter of the coil shall be 508mm.

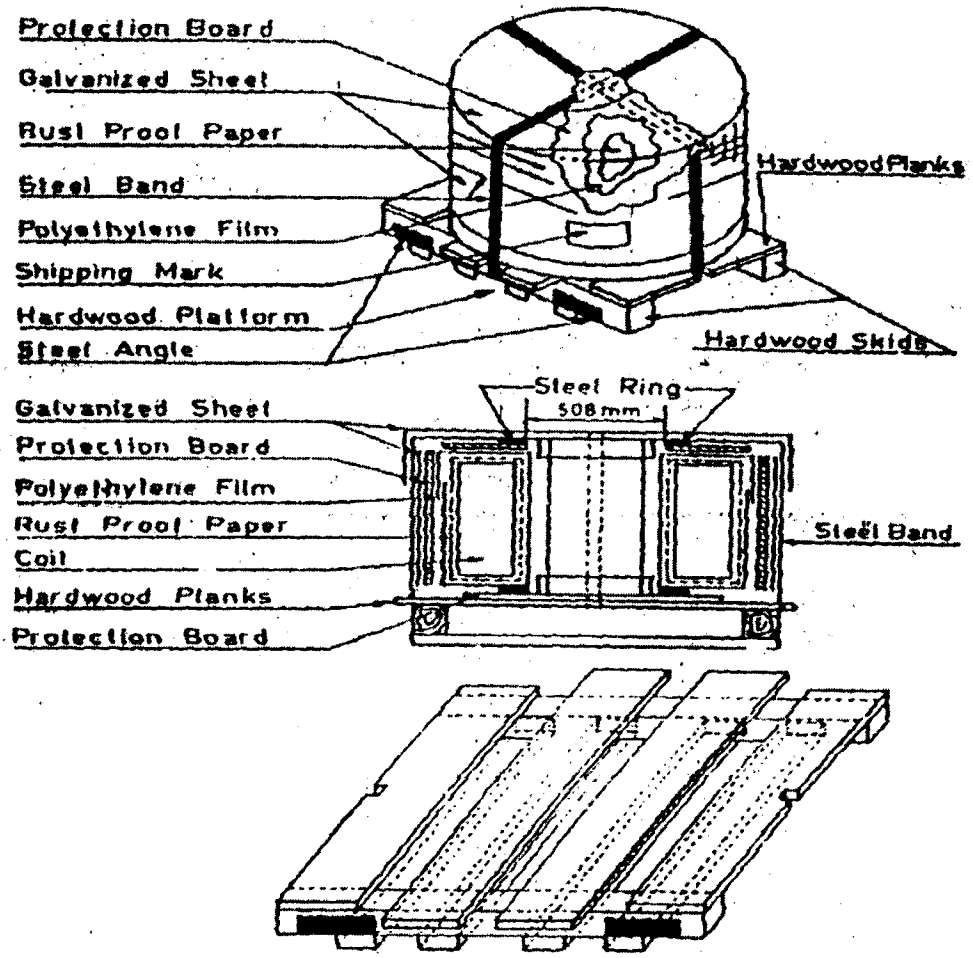
Packing shall be sea-worthy and shall be protected to prevent damage and rusting during transit.

Suppliers Grade/References shall be marked at every one meter intervals throughout the coil length.

Material shall be packed vertically according to the instructions given below and as per drawing detailed in Annexure-I.

DETAILED INSTRUCTIONS FOR PACKING:

a) An annular protection board shall be placed at either end of coil.
b) The coil shall then be wrapped with waterproof anti-rust proof paper by lapping axially all around the circumference.
c) The coil shall then be covered by polythylene sheet or anti-rust waterproof paper and the ends sealed properly.
d) A galvanized sheet shall be wrapped on the outside of the coil and the top and bottom of the coils. Care shall be taken to ensure that the ends of the top and bottom of the coils extend sufficiently over the inside diameter of the coil.
e) A galvanized 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 (d) above.
f) 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.
g) The coil should 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.
h) The packing shall ensure that there is no seepage of moisture and the coils reach BHEL in completely rust free condition. It shall be strong enough to withstand handling.
i) Coils shall be sufficiently tight-wound to prevent collapse to an extent that would preclude their being mounted on a mandrel appropriate to the ordered internal diameter.
j) Each package should 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.



14.3 Marking:

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.

AA 10905, BHEL Order No, Supplier's Name/Grade/Identification No., Size & Weight, Melt No., Packet/Bundle No.

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) ASTM A 343M
2) ASTM A 876
3) ASTM A 717
4) IEC 404 : Section 8.7

GENERAL INFORMATION FOR CALCUALTION
(NOT TO FORM ACCEPTANCE CRITERION)

Density : 7.65 kg/dm^3

COLD ROLLED GRAIN ORIENTED SHEET STEEL
GR:27 H 103 M

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:

There is no national standard covering this type of material.

However assistance has been drawn from ASTM A 876-03 Condition F-5, Ductility Class 1.

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.

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 2500 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 as per ASTM A 876-03 condition F5.

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, shade difference, dots and patches etc.

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 smaples 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 ASTM A 876-03.

10. MECHANICAL TESTS:

10.1 Ductility:

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

The bend test shall be carried on transversely cut test specimen of 60 mm long and between 10 mm 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 94.5% minimum.

11. ELECTRICAL TESTS:

11.1 Surface Insulation Resistivity:

When tested as per ASTM A 717 - Franklin's method, 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 cm^2, Minimum.
Individual Value - 5 ohms cm^2, 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 ASTM A 343M, 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 1.03 watt/kg.

11.3 Mangentic Permeability Test

When tested in accordance with ASTM A 343M, the Magnetic permeability at AC Magnetizing Force of 800 A/m shall not be less than 1880 using 25 cm Epstein Test frame on 50 Hz.

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

12. TYPE TEST: - Ageing*

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 alongwith their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information.

BP 10988 - Rev. 04, 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, 5% of the coils of the order can be supplied with maximum of two butt weld joints, and 95% of the coils shall be in one continuous length. 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.

The nominal diameter of the coil shall be 508 mm. Packing shall be sea worthy and shall be protected to prevent damage and rusting during transit.

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.

BP 10988 : Cold Rolled Grain Oriented Sheet Steel
Gr: 27 H 103 M.

BHEL Order No.
Manufacturer's/Supplier's name.
Identification/Coil No.
Size and Quantity supplied.

GENERAL INFORMATION FOR CALCULATION

Density - 7.65 Kg/dm^3.

ANNEXURE

DETAILED INSTRUCTIONS FOR PACKING

1. An annular protection board should be placed at either end of the coil.

2. The coil should 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 waterproof kraft paper and the ends sealed properly.

4. A galvanised sheet should be wrapped on the outside of the coil and the two ends. Care should be taken to ensure that the ends extend sufficiently over the inside diameter of the coil.

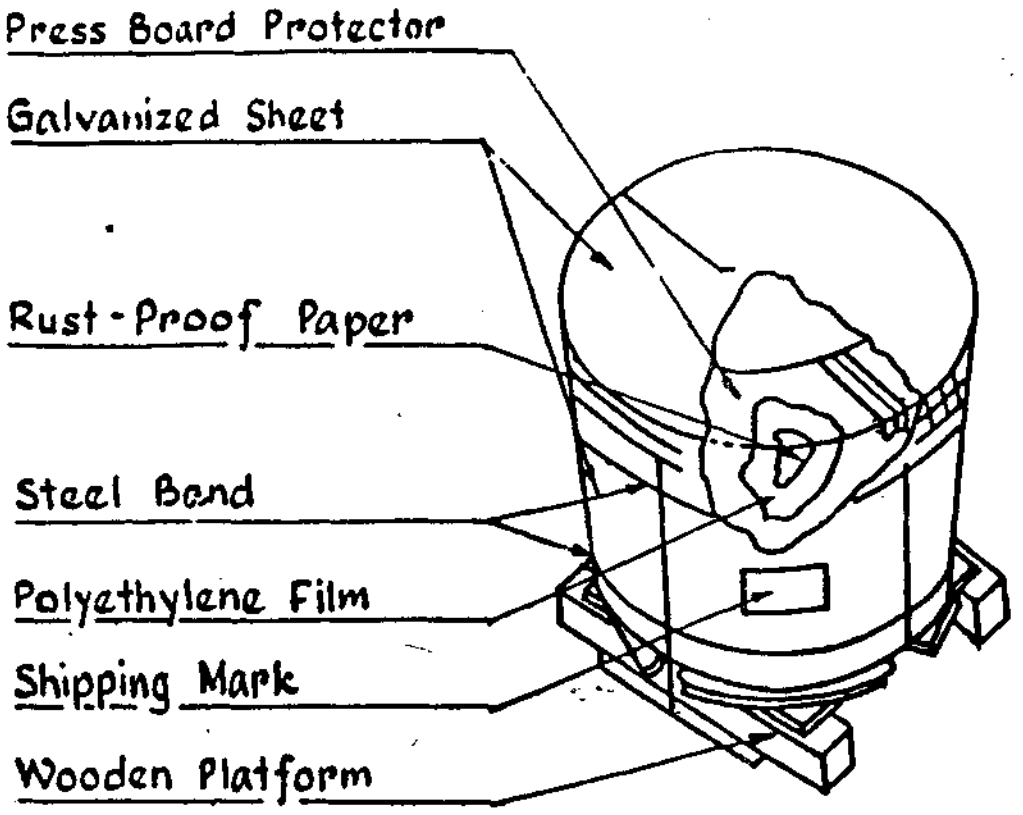
5. A galvanised sheet should be wrapped on the inside of the coil care should be taken that it overlaps sufficiently over the ends of the sheet mentioned in (4) above.

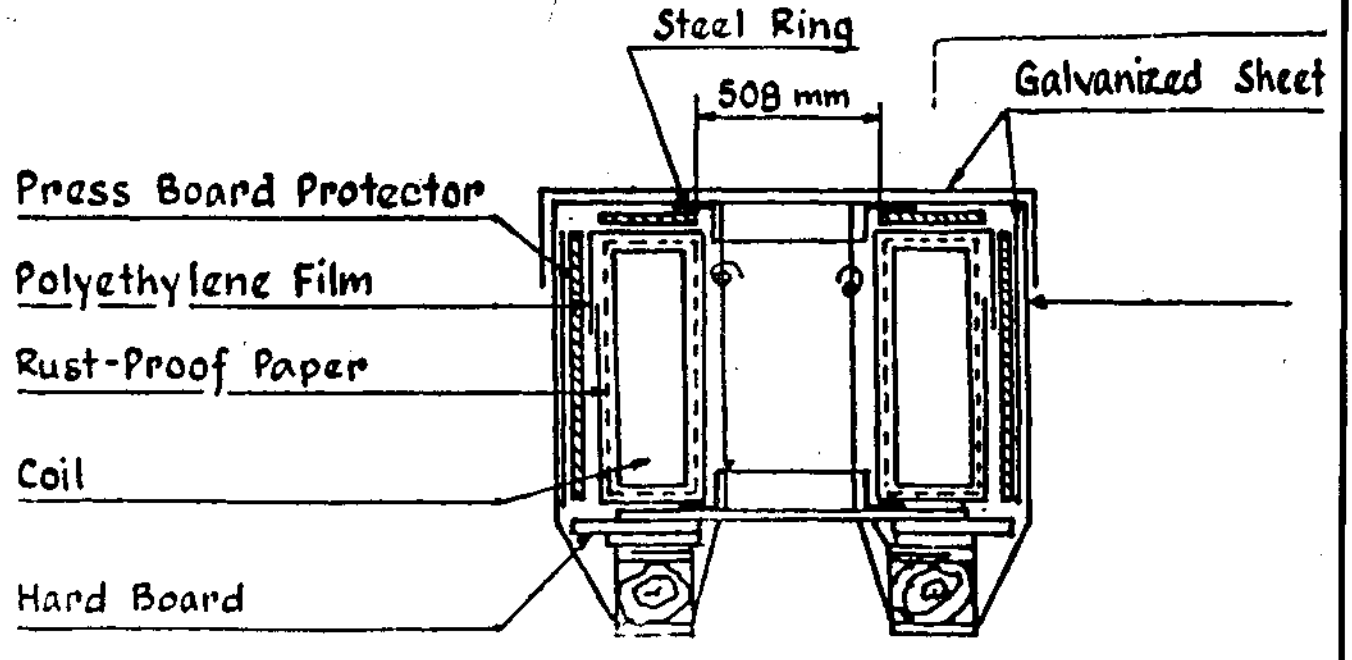
6. Steel rings made from thick angle sheets should be placed on the rims of the inner and outer diameters at both ends of the coil. The rings should be held at either ends at four points by steel bands.

7. The coil should then be mounted on woodenskids held together by steel bands.

8. The packing should ensure that there is no seepage of moisture and the sheets 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 should be sufficiently tight wound to prevent collapse to an extent that would preclude their being mounted on a mandrel appropriate to the ordered internal diameter.


Press Board Protector
Galvanized Sheet
Rust-Proof Paper
Steel Band
Polyethylene Film
Shipping Mark
Wooden Platform


Steel Ring
508 mm
Galvanized Sheet
Press Board Protector
Polyethylene Film
Rust-Proof Paper
Coil
Hard Board

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

QP/PT/CRGO/890

STANDARD MANUFACTURING QUALITY PLAN FOR SUBMISSION TO CUSTOMER

QUALITY PLAN FOR CRGO LAMINATION (Power, DT Transformer)

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

SUB VENDORS / VENDORS / CONTRACTORS WORKS

QP.No.: QP/PT/CRGO/890
REV.No:00
DATE: 26.04.11

Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.1	RAW MATERIAL CRGO LAMINATION (Grade-ZDKH 90. or Grade-ZDKH 85 or Grade –MOH or Grade M4)	A) Visual Check (Material should be free from defect)	B	V	100 %	-For Grade-ZDKH 90 : BP10985 & JS10999 -For Grade-ZDKH 85 : BP10984	-For Grade-ZDKH 90 : BP10985 & JS10999 -For Grade-ZDKH 85 : BP10984	Mill Manufacturer TC	V	V	-	
		B) Waviness	B	V	100%				V	V	-	
		C) Specific loss	B	T	One Sample/ Supplier different size	-For Grade –MOH: BP10987 & 10988 -For Grade M4: CPS-AA 10905 (As per PO)	-For Grade –MOH: BP10987 & 10988 -For Grade M4: CPS-AA 10905 (As per PO)		V	V	-	
		D) Bend test	B	T					V	V	-	
		E) Ageing test (Type test)	B	T					V	V	-	
		F) Surface Resistivity	B	T					V	V	-	
		G) Stacking Factor	B	T					V	V	-	
		H) Magnetic Permeability Test	B	T					V	V	-	
		I) Verification of purchase documents	B	V	100%	Purchase Order	Purchase Order	Supplier TC	V	V	-	
1.2	LAMINATION ON FINISHED / LABOUR BASIS	A) Tests /Inspection after slitting & cropping				-For Grade-ZDKH 90 : BP10985 & JS10999 -For Grade-ZDKH 85 : BP10984 -For Grade –MOH: BP10987 & 10988 -For Grade M4: CPS-AA 10905 (As per PO)	-For Grade-ZDKH 90 : BP10985 & JS10999 -For Grade-ZDKH 85 : BP10984 -For Grade –MOH: BP10987 & 10988 -For Grade M4: CPS-AA 10905 (As per PO)	Supplier TC				
		1) Thickness	B	I	One Sample/ Supplier different size				P	V	.	
		2) Surface insulation resistivity	B	T					P	V	.	
		3) Watt loss	B	T					P	V	.	
		4) Magnetic permeability	B	T					P	V	.	
		B) Dimensional check (Tolerances)										
		1) Length	B	I	One Sample/ Supplier different size	TR 15035C	TR 15035C As per computer sheet/Drg.	As per checklist for CRGO Lamination (CQX / 181-A)	P	V	-	
		2) Width	B	I					P	V	.	
		3) Holes	B	I					P	V	.	
		4) Angle of Mitre	B	I					P	V	.	
		5)Edge Bow	B	I					P	V	.	
		C) Dimensional check for each stage of lamination cutting							P	V	.	
		1) Burr level	B	I	100%	As per computer sheet/Drg		Dimensional report (CQX / 181-B)				
		2) Stack height	B	I								

Prepared by

(Sunil Kumar)

QC ENGINEER

Checked & Approved by

(R R Verma)

MANAGER (CQX)

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

BHEL/CQX/ QP/PT/CRGO/890

STANDARD MANUFACTURING QUALITY PLAN FOR SUBMISSION TO CUSTOMER

QUALITY PLAN FOR CRGO LAMINATION (Power DTT & ESP Transformer)

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

SUB VENDORS / VENDORS / CONTRACTORS WORKS

QP.No.:QP/PT/CRGO/890
REV.No:00
DATE: 26.04.11
PAGE: 02 OF 02

Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.3	Packing & Dispatch	1) Packing should be in Sturdy wooden pallets with proper covering & bind the core with resin impregnated fibre glass after putting core to coil packing in position tape (packing as per TR15031C).	B	V	100%	Purchase Order	Purchase Order	Dimensional report (CQX / 891-B)	P	V	-	Dimensional report (CQX / 181-C) should be pasted on each pallet respectively.
			B	I					P	V	-	
		2) Stacked in ready to built core condition & stack should be suitable to prevent ingress of dust and moisture as well as to avoid slippage/damage of the core lamination during transit & handling.	B	I					P	V		
		3) Width of wooden pallet (Total width of pallet should be 50 mm more than max. width of sheet to avoid damage during handling)	B	I					P	V		
		4) Following information should be provided on packing, a) PO no. b) Set No. c) Supplier name d) Identification no.										

LEGEND:

CLASS
A : CRITICAL
B : MAJOR
C : MINOR

TYPE OF CHECK
V : VISUAL
I : MEASUREMENT
T : TEST

AGENCY
M : MANUFACTURER / SUB CONTRACTOR
C : CONT/ NOMINATED INSPECTION AGENCY
N : CUSTOMER

SCOPE OF AGENCY
P : PERFORMER
V : VERIFICATION
W : WITNESS
PO : PURCHASE ORDER

FORMAT OF RECORD
TC : TEST CERTIFICATE
OS : OBSERVATION SHEET
DRG : DRAWING
CHECK LIST : CHECK LIST
AA/JS/PS/BP : BHEL PURCHASE SPECIFICATION

Prepared by
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Checked & Approved by
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MANAGER (CQX)

CQ/FISI-A
Rev No. 00

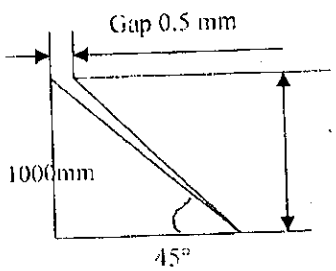
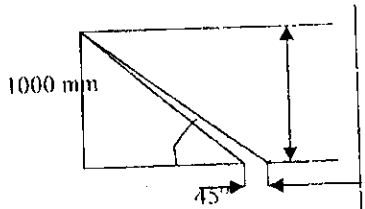
CENTRAL QUALITY SERVICES
BHEL JHANSI

Sub: Checkpoints of Transformer Core Lamination Sheets Tolerances.

Name of supplier: Material (CRGO Lamination)

PO No :

All the laminations made as per computer sheet pages 1 to 6 comply with the following requirements of TR15035 C.

Clause	Tolerances as per TR15035C	Comments of Inspector
3.0		
3.1)	Length +0/-2.0	
3.2)	width 0/-0.5	
3.3)	Holes	
a)	On holes dia +0.1mm	
b)	Distance between first and last hole +0.25 mm	
c)	Distance between successive holes + 0.1mm	
d)	Off set perpendicular to centre line + 0.1mm	
3.4)	Angle of Mitre- Angle 45 + 1 minute (See fig 1 & 2)  Fig. 1  Fig. 2 Gap 0.5 mm	
3.5)	Edge Bow 0.50 mm / meter or proportionate there of with a max of 1.5mm)	
3.6)	Burr Level up to 30 microns	
3.7)	Inspector has to ensure compliance of proper check of TC & documents provided by supplier.	

Inspector's Signature, Name, Date

CQX/181-B
Rev. No.: 00

DIMENSIONAL REPORT OF CRGO LAMINATION
AFTER CROPPING
(FOR 3 LIMB CORE)

PO No. :

Item no. of PO :

Supp. Name :

Date of observation:

WO No.:

Set NO. :

All nomenclature / Dimension as per computer sheet

Sl. NO.	Width (mm)	Leg/Yoke Punch Drg. No. (As per computer sheet)	Shape Confirmation (Put Y for confirm)	Dimension 'A' as per computer sheet		Dimension 'C' as per computer sheet		Required Stack height For Lam width (mm)	Observed Stack height (mm)	Pallet Nos. – Containing the sheets (To be filled after stacking) For details please see after stacking record CQX/891-B.
				Reqd.	Obsd.	Reqd.	Obsd.			
		DRG NO 1 (L1 + L2)								
		DRG NO 2 (L2)		----	----					
		DRG NO 3 (Y1 + Y2)		----	----					
		DRG NO 4 (Y2 + Y3)								
		DRG NO. 1								
		DRG. NO. 2		---	---					
		DRG. NO. 3		---	---					
		DRG.NO. 4								
		DRG. NO. 1								
		DRG. NO. 2		---	---					
		DRG. NO. 3		---	---					
		DRG.NO. 4								
		DRG. NO. 1								
		DRG. NO. 2		---	---					
		DRG. NO. 3		---	---					
		DRG.NO. 4								

Total Pallet Nos. :

Total Net Wt. :

Total Gross Wt. :

Prepared by:

Sign:

Designation:

Inspected / Checked By:

CQX/181 C
Rev No.: 00

DIMENSIONAL REPORT OF CRGO LAMINATION AFTER STACKING (FOR 3 LIMB CORE)

PO No. :

Item no. of PO :

Supp. Name :

Date of observation :

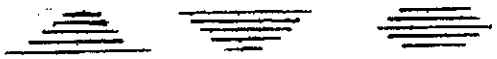
WO No. , KVA rating & Set No.:

Pallet No. :

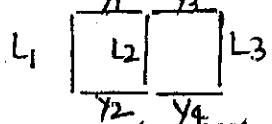
Limb/Yoke:

(Put ✓ on used type of stacking)

Stacked as : Straight / Reversed / Combined



Stacking of Lamination : L1 / L2 / L3 / Y1 / Y2 / Y3 / Y4



All dimension & Nomenclature as per computer sheet

Item No. (As per computer sheet)	Leg/Yoke Punch Drg. No. (As per computer sheet)	Width of Lam (mm)	Required step Stack height (mm) (L1/4, L2/2, L3/4, Y1/4, Y2/4, Y3/4, Y4/4) (As per computer sheet)	Observed step Stack height (mm)	Weight of Lamination (KG)	Remarks

Net Weight (Kgs) :

Pallet Weight(Kgs):

Gross Weight(Kgs):

Inspector has to ensure compliance of
1) All points of Sl. No. 1.3 of QAP regarding packing & dispatch before clearance of material.
2) Anti rust panting on cut edge after stacking.

Prepared by:

Sign:

Designation:

Inspected / Checked by:

CQX/181-B
Rev. No.: 00

DIMENSIONAL REPORT OF CRGO LAMINATION AFTER CROPPING
(FOR 5 LIMB CORE)

PO No. :

Date of observation:

WO No.:

Item no. of PO :

Supp. Name :

Set NO. :

All nomenclature / Dimension as per computer sheet

Sl. NO.	Width (mm)	Leg/Yoke Punch Drg. No. (As per computer sheet)	Shape Confirmation (Put Y for confirm)	Dimension 'A' as per computer sheet		Dimension 'C' as per computer sheet		Required Stack height for Lam width (mm)	Observed Stack height (mm)	Pallet Nos. – Containing the sheets (To be filled after stacking) For details please see after stacking record CQX/891-B.
				Reqd.	Obsd.	Reqd.	Obsd.			
		DRG NO 1								
		DRG NO 2								
		DRG NO 3								
		DRG NO 4								
		DRG NO 5								
		DRG NO 6								
		DRG NO 7								
		DRG NO 8								
		DRG NO 9								
		DRG NO. 1								
		DRG NO. 2								
		DRG NO. 3								
		DRG NO. 4								
		DRG NO. 5								
		DRG NO. 6								
		DRG NO. 7								
		DRG NO. 8								
		DRG NO. 9								

Total Pallet Nos. :

Total Net Wt. :

Total Gross Wt. :

Prepared by:

Inspected / Checked By:

Sign:

Designation:

CQX/181-C
Rev: 00

DIMENSIONAL REPORT OF CRGO LAMINATION AFTER STACKING (FOR 5 LIMB CORE)

PO No. :

Item no. of PO :

Supp. Name :

Pallet No. :

Limb/Yoke:

(Put ✓ on used type of stacking)

Stacked as : Straight / Reversed / Combined

Date of observation :

Rev. No.: 00

WO No. , KVA rating & Set No.:

Stacking of Lamination : L1 /L1A/L1B/L2/ L2A /L2B/ L3 /L3A/L3B/L4/L5/ Y1 Y2 / Y3 / Y4/Y5/Y6/Y7/Y8

All dimension & Nomenclature as per computer sheet

Item No. (As per computer sheet)	Leg/Yoke Punch Drg. No. (As per computer sheet)	Width of Lam (mm)	Required Stack height (mm)	Observed Stack height (mm)	Weight of Lamination (KG)	Remarks

Inspector has to ensure compliance of

1) All points of Sl. No. L3 of QAP regarding packing & dispatch before clearance of material.

2) Anti rust painting on cut edge after stacking.

Prepared by:

Sign:

Designation:

Net Weight (Kgs) :

Pallet Weight(Kgs):

Gross Weight(Kgs):

Inspected / Checked by:

REF COMP. drg

PAGE 1 OF 3

TITLE: - DIMENSION AND TOLERANCES FOR CORE

General : This specification govern the dimensions and tolerances on core assembly

Compliance with standards : There is no National /International standards covering the above requirements. However following dimensions and tolerances are derived to control the process of core manufacturing. In case of any deviation, it should be referred to Engineering Department for review and clearance.

1.0 CORE DIMENSIONS :-

1.1 **DIAMETER :-** This is to be multiple of 2mm.

1.2 **LEG LENGTH :-** This is to be multiple of 2mm.

1.3 **LEG CENTER :-** This is to be multiple of 2mm.

1.4 **No. OF PACKETS** :- This is to be as given below –

CORE DIA IN mm.	MAIN LEG NO.OF PACKETS	MAIN YOKE & AUX.LEG / YOKE NO. OF PACKETS**
Up to 500	10	4
502 -760	12	4 -5
More than 760	15 Or more as specified	5

** The width and area of main and auxiliary yoke packet after merging should always be more than width and area of the packets before merging .
Refer sheet TR 10137C (pages 1 to 3 for figures.)

1.5 LAMINATION WIDTH :- This is to be multiple of 10mm, however for main yokes and outer legs of 5 limbed cores, the center packed lamination can be multiple of 5 mm.

REF | COMP. dtg

2.0 TOLERANCES ON CORES :-

2.1

Core Dia in mm	ToL. On Dia in mm	ToL. On total built up thickness in mm.
Up to 400	+0 -3	+3 -0
402 -760	+0 -4	+4 -0
762 -1100	+0 -5	+5 -0
Above 1100	+0 -7	+6 -0

2.2 TOLERANCE BETWEEN CENTER LINE OF TOP & BOTTOM YOKE +2, -0 mm.

2.3 TOLERANCE BETWEEN CENTER LINE OF 2 CONSECUTIVE MAIN LEGS.+1, -0 MM.

2.4 TOLERANCES ON CORE LEANING
- 2 mm PER METER ON MAIN LEG INCLUDING YOKES.
- 3 mm PER METER ON AUX LEG INCLUDING YOKES.

ABOVE TO BE MEASURED USING PLUMB. LOCAL WAVINESS IN YOKES AT LEG LOCATION SHALL BE CHECKED AND SUITABLY ADDED / SUBTRACTED IN ABOVE VALUES DEPENDING UPON THE CORE BEHAVIOUR.

2.5 TOLERANCE ON TOP INDIVIDUAL CORE PACKET +- 0.75 MM.

2.6 TOLERANCE ON TOP/ BOTTOM YOKE WAVINESS:
UPTO 750 Tk : ±5 mm.
UPTO 1000 Tk : ±10 mm.
ABOVE 1000 Tk : ±15 mm,

2.7 TOLERANCE ON MAIN/ AUX LEG LAMINATION WAVINESS:
UPTO 750 Tk : ±5 mm.
From 750 to 1000 Tk : ±7 mm.
ABOVE 1000 Tk : ±9 mm,

Rev.	SHEET REVISED. CLAUSE 2.7 ADDED	वितरण DISTRIBUTION.	सं.	स्वीकृत किया : APPROVED : sd/- BSB, MKS		
6A		TRE/TRM/FTM TRX/TTG QC-TCB/QA-TCB/ JHANSI		तैयार किया PREPD. Sd/- HKM	जारी किया ISSUED टीआरई/मानक TRE/STD.	दिनांक DATE 17.06.91
दि. Dt. 45/10	AKD SGB SSK					

RIF COMP. drg

PAGE 3 OF 3

3.0 TOLERANCES ON LAMINATIONS

3.1 LENGTH - +0.0 mm
-1.5 mm

3.2 WIDTH - UPTO 250 mm: +0 / -0.2mm
MORE THAN 250 mm: +0 / -0.25mm

3.3 HOLES (A) ON HOLE DIA ± 0.1mm
(B) DISTANCE BETWEEN FIRST AND LAST HOLE ±0.25 mm
(C) DISTANCE BETWEEN SUCCESSIVE HOLES ± 0.1 mm.
(D) OFF- SET PERPENDICULAR TO CENTRE LINE ± 0.1 mm

3.4 ANGLE OF MITRE- ANGLE 45° ± 1 MIN.
THIS CAN BE MEASURED AS FOLLOWS: USING A FIXED 45 ° SET- SQUARE, THE DEVIATION OF ANGLE OF THE MITRE OVER A MAX. WIDTH OF 1000 mm SHALL NOT EXCEED 0.5 mm GAP (AS SHOWN IN THE FIG, 1&2 WHEN MEASURED BY A FILLER GAUGE) OR PROPORTIONATE THERE OF FOR OTHER WIDTH.

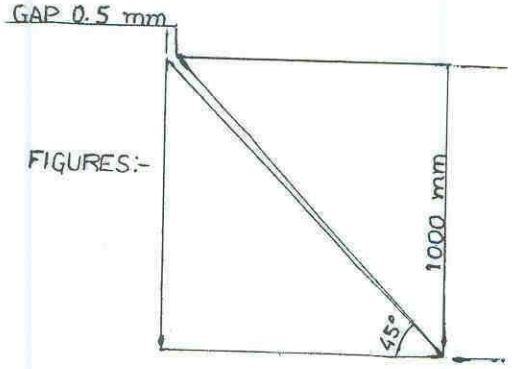


FIG.1

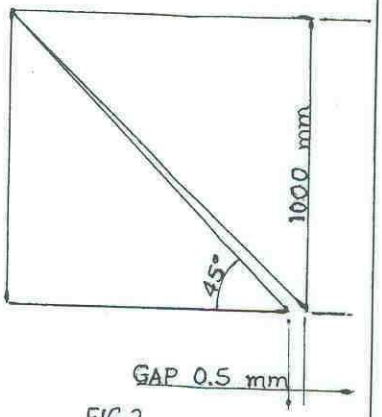


FIG.2

3.5 **EDGE BOW :-** THIS SHOULD NOT EXCED 0.50 mm / METRE OR PROPORTIONATE THERE OF, WITH A MAXIMUM OF 1-5 mm

3.6 **BURR LEVEL :-** THE MAXIMUM PERMISSIBLE BURR LEVEL IS 30 MICRONS.

Rev	SHEET REVISED. CLAUSE	वितरण DISTRIBUTION.	सं.	स्वीकृत किया : APPROVED :sd/- BSB RKS SCB		
6A Dt 45/10	2.7 ADDED AKD SGB TSK	TRE/TRM/FTM TRX/TTG/ QC-TCB/QA-TCB/ JHANSI		तैयार किया PREPD. Sd/- GSG	जारी किया ISSUED टीआरई/मानक TRE/STD.	दिनांक DATE 17.06.91