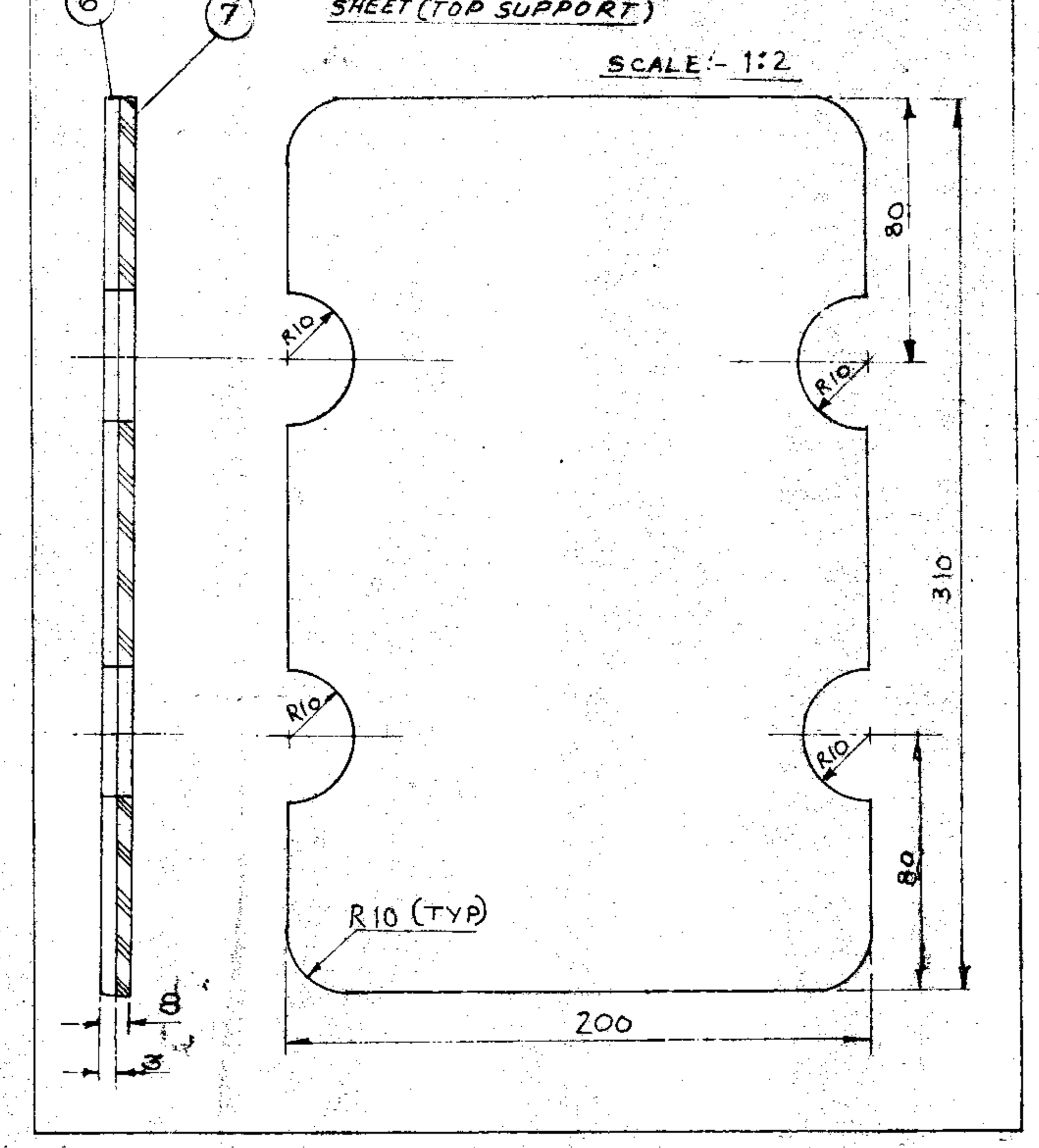
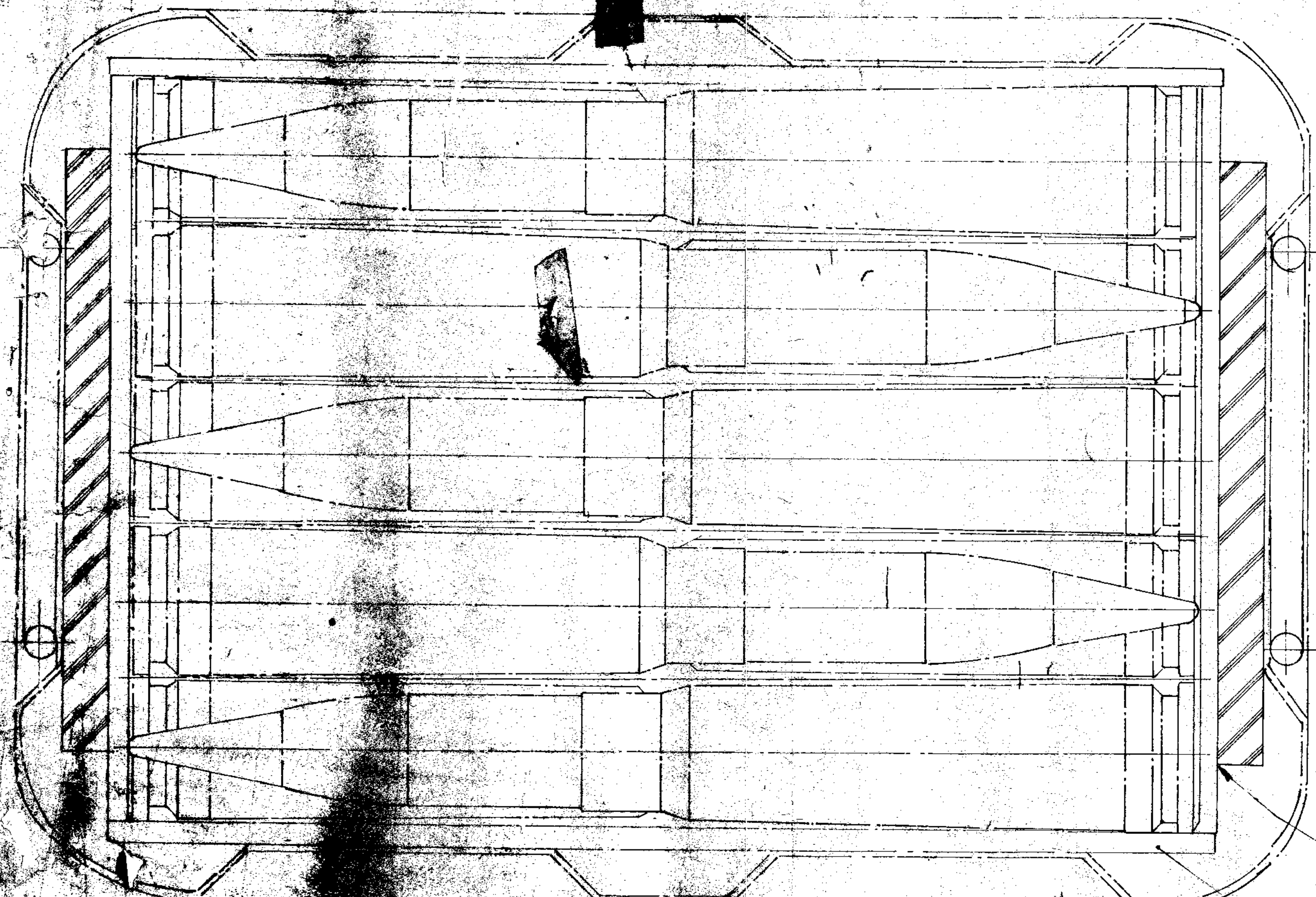
Item Description	PACKING PICES LAMINATED DRG M-3599
Item Specification	PHENOLIC LAMINATED SHEET PACKING PIECES TO SPECN: IS-2036- 1995(SECOND REVISION) GR-P2 AS PER AAIW DRG NO. AAIW-1087R.N 6 DT.27-05-11 EACH SET CONSIST OF FOLLOWING ITEMS.:-1.FRONT AND REAR SIDE PACKING PIECES SIZE 310MMX200MMX4MM THICK = 2 NOS.2.BASE SUPPORT AND TOP SUPPORT PACKING PIECE SIZE 310MMMX200MMX3MM THICK (ONE NO.FOR BASE SUPPORT AND ONE NO.OF TOP SUPPORT) = 2 NOS.3.END SUPPORT PACKING PIECES SIZE 196MMX196MMX6MM THICK = 2 NOS.4.RUBBER CUSHION FOR TOP SUPPORT TO SPECN:IND/ME/677(a) DC NO.2377-ME DT.05-02-81 HEAVY DENSITY PACKING PIECES SIZE 310MMX200MMX5MM THICK=1 NO.5.RUBBER CUSHION FOR END SUPPORT TO SPECN:IND/ME/677(a)DC NO.2377-ME DT.05-02-81 HEAVY DENSITY PACKING PIECES SIZE 158MMX110MMX12MM THICK = 2 NOS.
UOQ	Set

NOTE:- UNTOL. DIMNS. TO IS: 2102 (MED.)

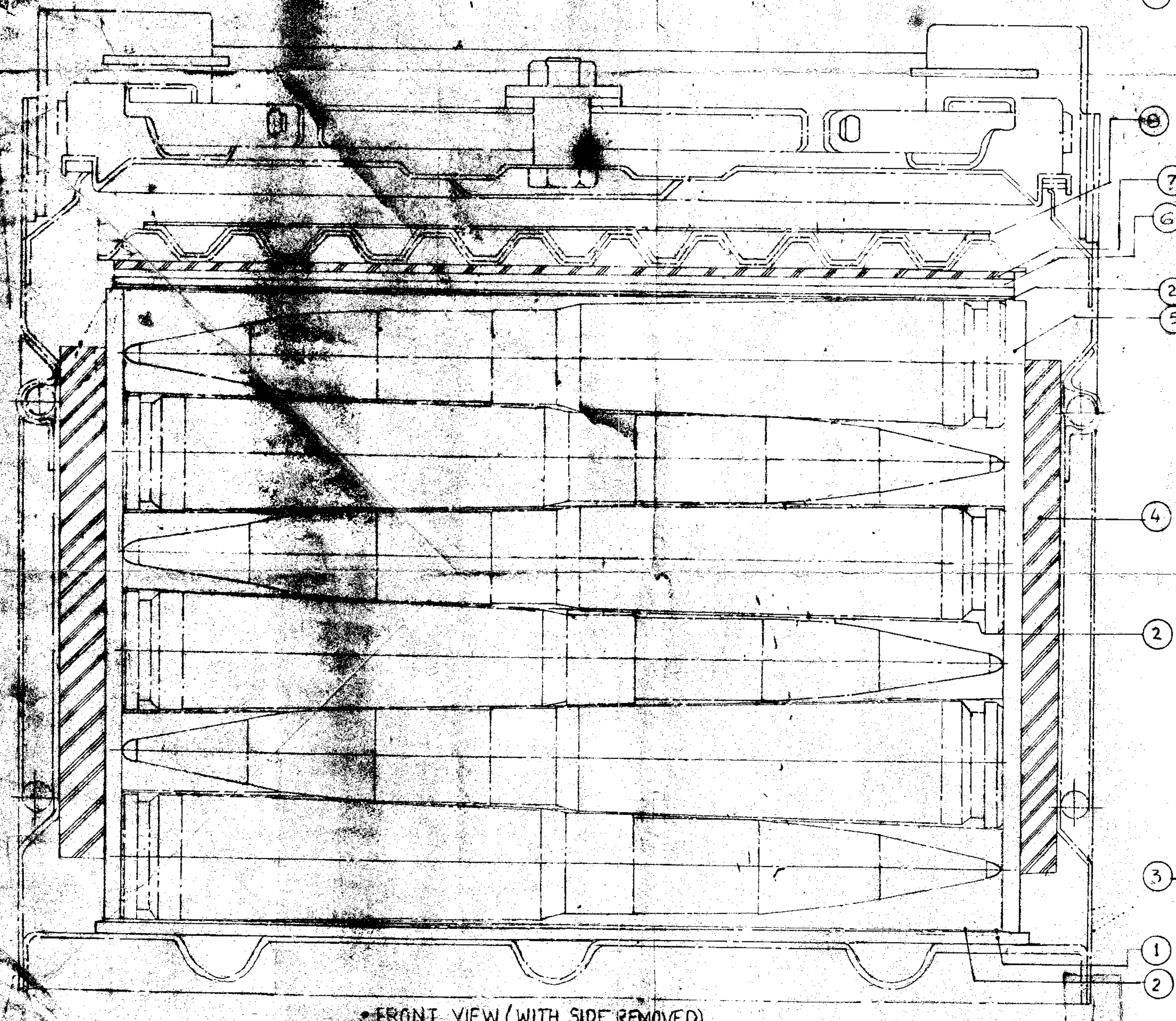


1- 30 ROUNDS TO BE PACKED IN A BOX
2- LENGTH OF DIFFERENT CARTG S TO BE ADJUSTED BY PACKING OF RUBBER CUSHION 158 x 110 x 12 TH TO SPECN NO IND/ME/677 (2a) HEAVY DENSITY.
3- WEIGHT OF SINGLE CARTG (ROUND) = 0.8425 Kg. MAX
4- WEIGHT OF EMPTY BOX = 10.43 Kg. MAX
5- TOTAL WEIGHT OF BOX WITH ROUNDS (FILLED) = APPROX. 38.5 Kg
6- RESIDUAL GAPS, BETWEEN THE CARTG. TO BE FILLED BY WAXED PAPER TO SPECH. DEF 1242 SUITABLY
7- LENGTH OF DIFFERENT CARTGS ARE AS BELOW
   a- CARTG. HE/T = 282.15 - 285.34
   b- CARTG HE/I = 282.152 - 285.35
   c- CARTG AP/I = 281.52 - 284.84
8- INTERNAL DIMNS. OF BOX = 320 x 220 x 215 MM. MAX.
9- AIP TESTED BOXES TO BE USED FOR PACKING OF HE/T HE/I & AP/I
10- BOXES TO BE PAINTED OLIVE GREEN.
11- WIRE SEALING.
12- LEAD RING

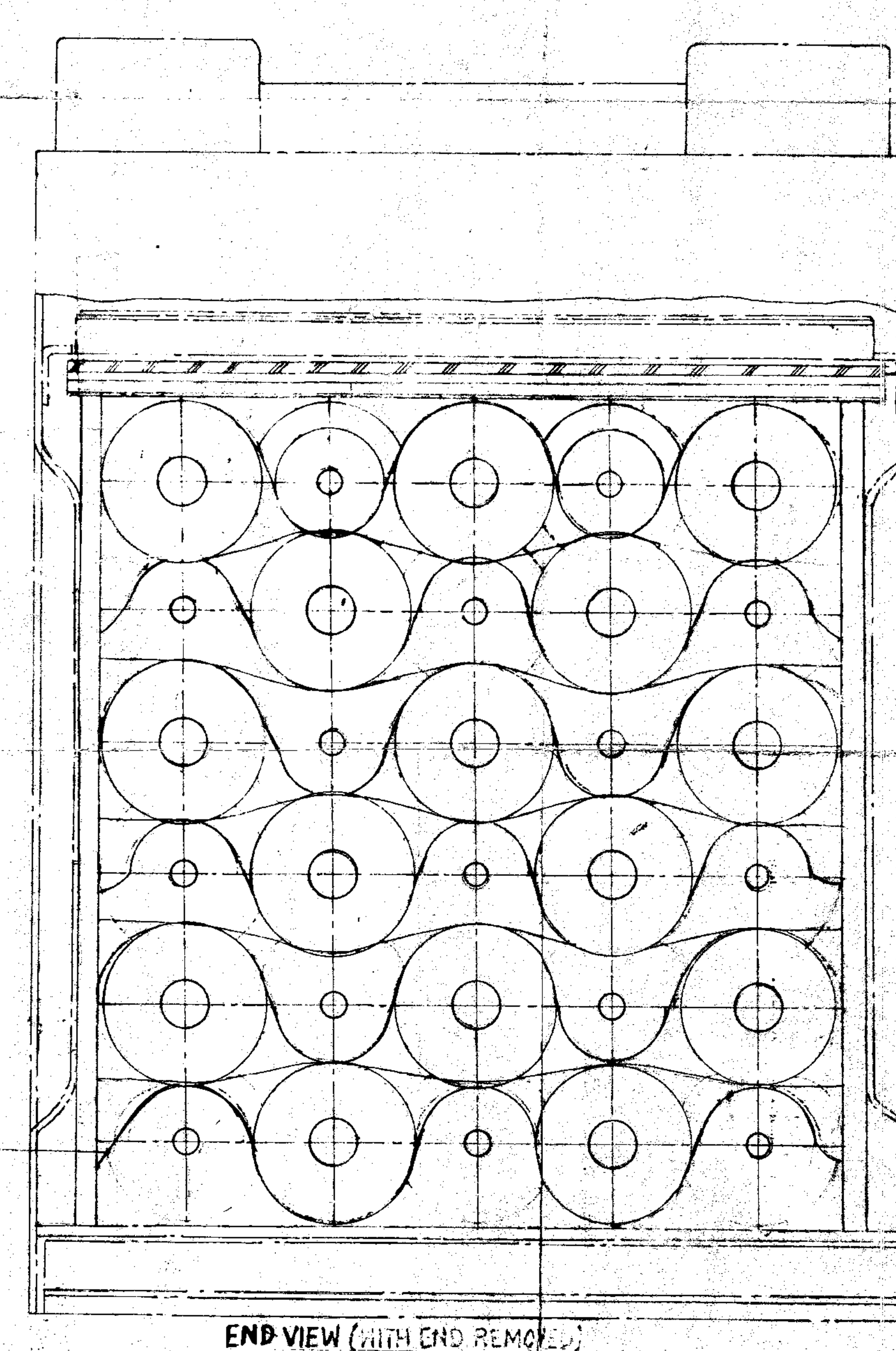


PLAN (WITH TOP REMOVED)

RUBBER CUSHION 158 x 110 x 12 THICK WILL BE PASTED IN THE MIDDLE OF PHENOLIC LAMINATED SHEET (END SUPPORT ITEM NO 5) BY ADHESIVE DUNLOP RUBBER SOLUTION-758



FRONT VIEW (WITH SIDE REMOVED)



END VIEW (WITH END REMOVED)

RUBBER CUSHION SHOULD BE PASTED WITH PHENOLIC LAMINATER (TOP SUPPORT) BY ADHESIVE DUNLOP RUBBER SOLUTION 758.

ITEM NO.	MATERIAL WITH SPECN	NO. OFF	DESCRIPTION
9	STEEL	1	H-60 BOX ASSY WITH SHUTTER
8.	PHENOLIC LAMINATED SHEETS TO SPECN NO IS-[illegible] 1995 (SECOND REVISION) GR P2	2	FRONT + REAR SIDE SUPPORT 310 x 200 x [illegible] THICK
7.	RUBBER CUSHION FOR TOP SUPPORT TO SPECN. NO IND/ME/677 (a) G12 HEAVY DENSITY	1	TOP SUPPORT 310 x 200 x 5 mm THICK
6.	PHENOLIC LAMINATED SHEETS TO SPECN. NO [illegible] 1995 (SECOND REVISION) GR P2	1	TOP SUPPORT 310 x 200 x 3 mm THICK
5.	PHENOLIC LAMINATED SHEETS TO SPECN NO IS-[illegible] 1995 (SEC. REV) GR P2	2	END SUPPORT 196 x 196 x 6 mm THICK
4	RUBBER CUSHION FOR END SUPPORT TO SPECN. NO IND/ME/677 (a) [illegible] HEAVY DENSITY	2	(END SUPPORT) 158 x 110 x 12 mm THICK
3	WAXED PAPER TO SPECN. USS 8135-05 GSM 95 g/m²	6	PAPER WAXED 320 x 280 x [illegible] INTERNAL FITMENT
2.	WAXED PAPER TO SPECN USS 8135-05 GSM 95 g/m²	7	PAPER WAXED 280 x 206 [illegible] INTERNAL FITMENT
1.	PHENOLIC LAMINATED SHEETS TO SPECN [illegible] 1995 (SECOND REVISION) GR P2	1	BASE SUPPORT 310 x 200 x 3 mm THICK

R.No.	DATE	BRIEF RECORD	INITIAL	R.No.	DATE	ZONE	BRIEF RECORD	INITIAL
4	10/4/2000	(i) ITEM No 6 THICKNESS 3 mm WAS 5 mm (ii) ITEM No 7 DIMNS ADDED.		2	[illegible]-5-97		ITEM NO 8 - NO. OFF - 2 WAS NO. OFF - 1 [illegible] 556	
				1	8.3.97	-	DRG NO AAIW 1089 WAS AAIW 1085	
3	11/11/98	THICKNESS OF ITEM NO 2 & 3 DELETED GSM 95 g/m² ADDED					ORIGINAL	

R.No.	DATE	BRIEF RECORD	INITIAL
6	27/5/11	(a) ITEM NO 1, 5, 6 & 8 REF NO-658 (b) ITEM NO 4 [illegible] (c) ITEM NO 7 [illegible]	[illegible]
5	4/7/02	TOL. NOTE ADDED	[illegible]

	INITIAL	DATE	
DRG			DIMN. IN mm
DRN			MATL.-
CHD			ASSY. DRG. NO.
TCD			SCHD. NO.
COMP			D.S. CAT. No.
SCALE 1:1 & 1:2			TITLE :- M.O.R FOR 30 mm GHASHA AVIATION AMMN. IN STEEL BOX H-60-MK-1
TOL			

AAIW KHAMARIA

APPD BY

DRG. No. AAIW (089)

SHT. NO. 1

BASED ON AAIW FILLING MEMO NO AAIW / FILLING / 07 / 97 Dt. 18-2-97 & (OEK) [illegible]

Indian Standard

PHENOLIC LAMINATED SHEETS — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for phenolic resin bonded laminated sheets of one class in which the mechanical properties in directions A and B are of the same order, with asbestos, woven cotton fabric and cellulose paper reinforcements and covers seventeen types.

1.2 This standard covers only sheets of a nominal thickness from 0·4 to 50 mm for cellulose paper based types and nominal thickness from 0·4 to 100 mm for woven cotton fabric and asbestos reinforced types.

1.3 This standard prescribes requirements for phenolic resin bonded paper laminated sheet sanded on one side, of nominal thickness in the range 0·4 mm to 3 mm inclusive.

NOTE — It is permissible for sheet complying with this standard to contain additives, for example colouring matter.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of the standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard over encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
1998 : 1962	Methods of test for thermosetting synthetic resin bonded laminated sheets (Amendment 1)
2259 : 1963	Methods of test for determination of insulation resistance of solid insulating materials (Amendment 1)
2584 : 1963	Methods of test for electric strength of solid insulating materials at power frequencies (Amendment 1)
4486 : 1967	Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths
13360 (Part 1) : 1992	Plastics – Methods of testing : Part 1 Introduction
13360 (Part 2/Sec 4) : 1992	Plastics – Methods of testing : Part 2 Sampling and preparation of test specimens, Section 4 Preparation of test specimens by machining
13411 : 1992	Glass reinforced polyester dough moulding compounds (DMC)

3 DEFINITIONS

For the purpose of this standard the definition given in IS 1998 : 1962 and the following shall apply.

3.1 Phenolic Laminated Sheet

Sheet consisting of superimposed layers of paper, felt, fabric or veneer which have been coated or impregnated with a thermosetting phenolic resin and bonded together under heat and pressure.

3.2 Flatwise

Perpendicular to the plane of lamination.

3.3 Edgewise

Parallel to the plane of lamination.

3.4 Direction A and B

Two directions in the plane of a sheet which are at right angles to each other. For fabric and wood based laminates these directions are related to the surface layer of fabric or wood veneer. One of these directions is parallel either to the warp threads of a fabric or to the grain of a wood veneer. For paper or felt reinforced sheet, one of these directions is parallel to the edge of the sheet.

4 CLASSIFICATION

4.1 General

The sheets covered by this specification are classified in accordance with their composition into groups A, F and P, with subdivision into types, as described in **4.2**.

4.1.1 *Group A*

Sheets with asbestos reinforcement comprising the following types:

Type	*Reinforcement*
A1	Asbestos felt
A2 and A5	Asbestos paper
A3 and A4	Woven asbestos cloth

NOTES

1 With a woven asbestos cloth reinforcement the numbers of threads per unit length of warp and weft fall usually, but not necessarily into following ranges:

Type	*Threads*/cm
A3	7 to 20
A4	3 to 7

2 All types of asbestos reinforcement used in the manufacture of Group A sheets contain up to 15 percent of organic fibre, which is essential for the manufacture of these reinforcements.

4.1.2 *Group F*

Sheets with fabric reinforcement made from cotton, or cotton/synthetic fibre mixture comprising Types F1, F2, F2/1, F3, F4 or F5.

NOTE — The numbers of the threads per unit length of warp and weft of the fabric reinforcement fall usually, but not necessarily, into the following ranges:

Type	*Threads*/cm
F1	37 to 43
F2, F2/1, F4 and F5	18 to 39
F3	12 to 20

4.1.3 *Group P*

Sheets with cellulose paper reinforcement comprising types P1, P2, P2/1, P3, P3/1 and P4.

4.2 The types covered by this standard together with applications and distinguishing properties are given in Table 1.

Table 1 Types

Types	Reinforcement	Applications and Distinguishing Properties
A1	Asbestos felt	Mechanical applications. Heat resistant.
A2	Asbestos paper	Mechanical applications. Heat resistant.
A3	Woven asbestos cloth	Mechanical applications. Mechanically better than A2. Heat resistant.
A4	do	do
A5	Asbestos paper	Mechanical applications. Heat resistant.
F1	Fine weave, bleached cotton fabric	Mechanical applications. Recommended for small parts, requiring extremely fine machining.
F2	Fine weave, cotton fabric	do
F2/1	Medium weave, scoured cotton fabric	Mechanical applications. Recommended for small parts, requiring fine machining superior machining and punching properties and better resistance to chemicals compared to the materials of F3.
F3	Coarse-weave, grey cotton fabric	Mechanical applications. Good mechanical properties, strong and tough with good machining properties. Suitable for applications requiring high impact strength.
F4	Coarse-weave, cotton fabric	Mechanical and electrical applications.
F5	Fine weave, cotton fabric	Mechanical and electrical applications.
P1	Cellulose paper	Mechanical applications. Mechanical properties better than other P types. Poor electrical properties under normal humidity. Also available in hot punching versions.
P2	do	High voltage applications at power frequencies. High electric strength under oil. Good electric strength in air under normal humidity.
P2/1	do	Electrical and mechanical applications. Good electrical properties under normal humidity. Also available in hot punching versions.
P3	do	Good electrical properties even under humid conditions. Good machining and hot punching properties. Suitable for high tension electrical applications at power frequencies.
P3/1	do	Similar properties to these of P3 but has better punching properties.
P4	do	Electrical and electronic applications. Good stability of electrical properties under high humidity. Also available in cold or hot punching versions.

NOTE — It should not be inferred from Table 1 that laminates of any particular type are necessarily unsuitable for applications other than those listed for them, or that specific laminates will be suitable for all applications within the wide descriptions given.

5 REQUIREMENTS

5.1 Appearance and Workmanship

5.1.1 Sheets shall be free from blisters, wrinkles and cracks and from other visible defects. Sheets shall be of uniform appearance and be free from other small defects, for example, scratches, dents inclusions, excessive mottling and discolouration. Sheets shall be supplied with trimmed edges.

NOTE — Untrimmed edges may be supplied if specified by the purchaser.

5.1.2 The types of surface finish shall be as agreed to between the purchaser and the supplier.

5.2 Flatness

When any sheet of nominal thickness 3 mm or more is placed without restraint, concave side up, on a flat horizontal surface, the departure at any part of the upper surface of the sheet from a light straightedge laid in any direction upon it shall not exceed the values given in Table 2.

Table 2 Departure from Straightedge

All dimensions in millimetres.

Thickness	Department from Straightedge	
	1 000 mm Straightedge	500 mm Straightedge
3 to 8 inclusive	8	2
Over 8	6	1·5

5.3 Nominal Thickness and Permissible Deviations

The thickness of a sheet at any point shall not deviate from the nominal thickness by more than the values given in Table 3. If the nominal thickness is not one of the preferred values, the permissible deviation for the next higher preferred nominal thickness shall apply.

Thickness shall be measured using an external micrometer having measuring faces not greater than 8 mm diameter.

NOTES

1 The preferred nominal thicknesses are given in Table 3.

2 The permissible deviations from nominal thickness given in Table 3 define upper and lower limits of thickness which are symmetrically disposed about the nominal thickness. By agreement between the purchaser and the supplier, limits disposed asymmetrically about the nominal thickness may be applied. In such cases, the maximum range of tolerance should not exceed twice the value given in Table 3.

5.4 Machinability

When sawn, drilled turned, routed, milled or punched in accordance with the manufacturer's recommendations the sheet shall not show any sign of splitting, cracking or delamination.

NOTES

1 Chipping can occur with certain materials and in such instances an agreement between the purchaser and the supplier would be required.

2 For materials designated cold-punching, (for example, Type P3/1), with good punching practice sheets up to and including 1·6 mm in thickness may be punched at a temperature not less than 27°C, and in thickness over 1·5 mm up to and including 3 mm when heated to a temperature up to 60°C.

5.5 Resistance to Hot Oil

Sheets when tested in accordance with 11 of IS 1998 : 1962 shall not show any sign of splitting, blistering, disintegration, appreciable warping or delamination.

NOTES

1 This requirement does not apply to sheet of Types P3/1, A1, A2, A3, A4 or A5.

2 Types A1, A2, A3, A4 and A5 are subject to the alternative test requirement for crushing strength after heating (*see* Table 4).

5.6 Physical and Electrical Properties

When determined by appropriate test methods, various types of the material shall further comply with the requirements in Tables 4 to 6.

6 OPTIONAL REQUIREMENTS

The requirements given in Table 7 are optional. The material shall also comply with any one or all the optional requirements given in Table 7 as may be agreed to between the purchaser and the supplier.

7 SANDED SHEETS

7.1 General Quality

Sanded sheets of types P2/1, P3, P3/1 and P4 of any nominal thickness in the range 0·4 mm to 3 mm shall be produced by sanding one or both sides. Before sanding, the sheets shall comply with the basic requirements given in 5 except those in 5.3, and also with any of the optional requirements given in 6 that are specified by the purchaser. After sanding, the sheets shall comply with 7.2 to 7.4

7.2 Deviations of Thickness of Sanded Sheets

The thickness of a sanded sheet at any point shall not deviate from the nominal sanded thickness by more than ± 0·050 mm for thickness up to and including 1·6 mm and by not more than ± 0·1 mm at higher values up to and including 3 mm.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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ANNEX J

[*Table* 4, *Sl No.* (x)]

DETERMINATION OF CRUSHING STRENGTH AFTER HEATING

J-1 APPARATUS

J-1.1 Compression Testing, as described in C-2.1.

J-1.2 Parallel Flat Anvils, for insertion in each jaw of the testing machine.

J-1.3 Drying Oven Range, 0·200°C.

J-1.4 Bath, of fusible metal, capable of being maintained at a temperature of 400 ± 10°C.

J-1.5 Desiccator, containing dry calcium chloride or similar desiccant.

J-2 TEST PIECES AND NUMBER OF TEST SPECIMENS

J-2.1 Cut cubes of sides 10 ± 0·2 mm from the sheet. Alternatively, composite test pieces may be prepared from a sheet of thickness less than 10 mm, provided that the test pieces remain reasonable flat after heating.

J-2.2 Test two test specimens.

J-3 PROCEDURE

Heat two test pieces in the oven at 135 ± 5°C for 17 ± 1h and then at 170 ± 5°C for 6h ± 15 min. Then immerse the test pieces in the bath of fusible metal at a temperature of 400 ± 10°C for 30 ± 2 min, remove the test pieces from the bath of metal and allow them to cool to room temperature in the desiccator. Then place each test pieces in turn between the parallel flat anvils of the test machine and apply a steadily increasing compressive force, so that the test piece fails in 30 ± 15s. The maximum force shall be noted. Apply the force in a direction normal to the plane of the laminate (flatwise direction).

J-4 EXPRESSION OF RESULTS

Record the arithmetic mean of the two crushing forces in kilonewtons as the test results.

ANNEX K

[*Table 7, Sl No.* (i)]

DETERMINATION OF RESISTANCE TO FLATWISE COMPRESSION

K-1 TEST SPECIMEN

Use a test specimen 25 ± 0·25 mm square. For material less than 17 mm thick, build the test specimen up from a number of thicknesses, each with its original surfaces intact, so that the built-up test specimen has an overall thickness as near as possible to 25 mm. Remove any burrs from all edges of the test specimen.

K-2 CONDITIONING

Condition the test specimen in accordance with IS 13360 (Part 1) : 1992, (27 ± 2°C and 65 ± 5 percent RH for at least 16 h).

K-3 PROCEDURE

Test at a temperature of 27 ± 2°C.

Put the test specimen between parallel plates and apply the force in the flatwise direction uniformly over the whole area of the test specimen. Apply a force of 9 kN and, after 1 min, make the first measurement of thickness of the test specimen (whether single or composite).

Increase the force steadily at such a rate that a proof force of 53 kN, including the 9 kN initial force, is reached in approximately a further 2 min, Maintain the force of 53 kN for 1 min and determine the final thickness of the test specimen with the force on. After removal of the force, examine each component of the test specimen for sign of failure, that is, significant cracking or fracture.

K-4 EXPRESSION OF RESULTS

Calculate the reduction in thickness as a percentage of the initial thickness of the test specimen under the 9 kN force. Report any sign of failure.

ANNEX G

[*Table* 4, *Sl No.* (vii) and (viii)]

DETERMINATION OF DISSIPATION FACTOR AND PERMITTIVITY AT 1 MHz

G-1 GENERAL

Carry out the test as described IS 4486 : 1967 and as modified by G-2 and G-3.

G-2 PROCEDURE

Perform the test at 27 ± 2°C. Determine for each test specimen the power factor and permittivity at 1 MHz as described in IS 4486 : 1967.

G-3 EXPRESSION OF RESULTS

Record the arithmetic mean of the two measurements of power factor and arithmetic mean of the two measurements of permittivity as the test results.

ANNEX H

[*Table* 4, *Sl No.* (ix)]

DETERMINATION OF INSULATION RESISTANCE AFTER IMMERSION IN WATER

H-1 GENERAL

Carry out the test as described in IS 2259 : 1963 and as modified by H-2 to H-4.

H-2 NUMBER AND DIRECTION OF TEST SPECIMENS

Test two test specimens with their lengths in direction A and two with their lengths in direction B.

H-3 PROCEDURE

Maintain the distilled water at a temperature of 27 ± 2°C. Complete the electrical resistance measurement between 1·5 min and 2 min after the removal of each test specimen from the water.

H-4 EXPRESSION OF RESULTS

Calculate the arithmetic mean of the insulation resistance of the two direction A test specimens and the arithmetic mean of the insulation resistance of the two direction B test specimens. Record the lower of these two mean values in megohms as the test results.

ANNEX D

[*Clause* 7.4, *Table* 4, *Sl No.* (iv) and *Table* 5]

DETERMINATION OF WATER ABSORPTION

D-1 GENERAL

Carry out the test as described in Annex D of IS 13411 : 1992 and modified by D-2 to D-4.

D-2 FORM OF TEST SPECIMEN

The specimen shall be 50 ± 1 mm square and shall be machined from the sheet under test [*see* IS 13360 (Part 2/Sec 4) : 1992].

The thickness of the test specimen shall be the same as that of the sheet under test if the nominal thickness of the sheet is equal to or less than 25 mm.

If the nominal thickness of the sheet exceeds 25 mm, reduce the thickness of the test specimen to 22·5 ± 0·2 mm, leaving one face of the sheet intact.

D-3 NUMBER OF TEST SPECIMENS

Test three test specimens.

D-4 EXPRESSION OF RESULTS

Record the arithmetic mean of the water absorptions of the three test specimens as the test results.

ANNEX E

[*Table* 4, *Sl No.* (v) and *Table* 7]

DETERMINATION OF ELECTRIC STRENGTH, FLATWISE

E-1 GENERAL

Carry out the test as described in IS 2584 : 1963 and as modified by E-2 to E-4.

E-2 NUMBER OF TEST SPECIMENS

Test at least three test specimens.

E-3 PROCEDURE

Perform the test in oil at 90±2°C. Immerse the test specimens in oil at this temperature for not less than 30 min and not more than 1 h before the test.

E-4 EXPRESSION OF RESULTS

Record the arithmetic mean of two valid electric strength measurements in megavolts per metre as the test result. Express all voltages as root mean square (rms).

ANNEX F

[*Table* 4, *Sl No.* (vi)]

DETERMINATION OF ELECTRIC STRENGTH, EDGEWISE

F-1 GENERAL

Carry out the test as described in IS 2584 : 1963 and as modified by F-2 to F-4.

F-2 NUMBER OF TEST SPECIMENS

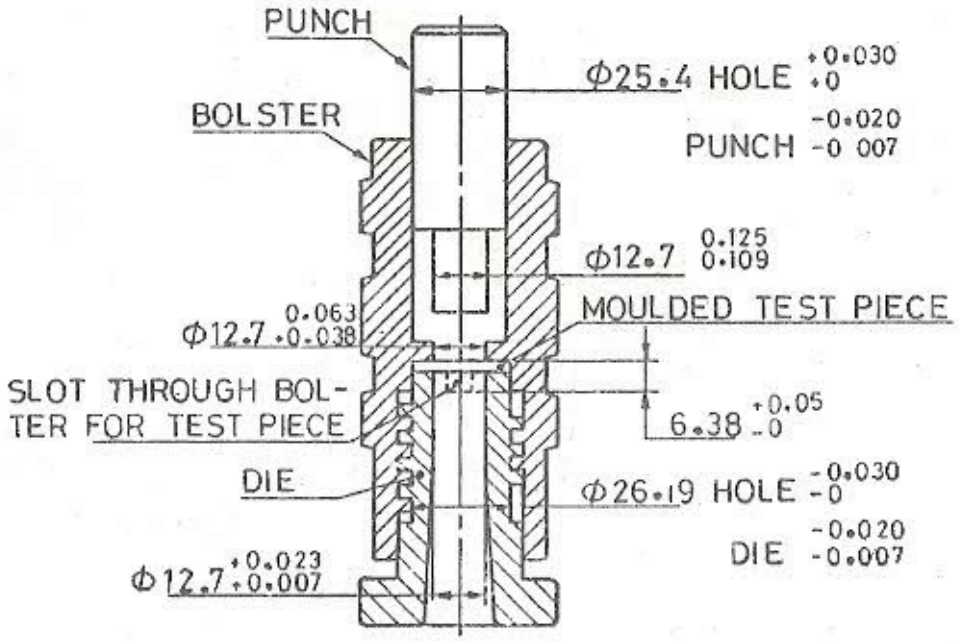
Test at least three test specimens.

F-3 PROCEDURE

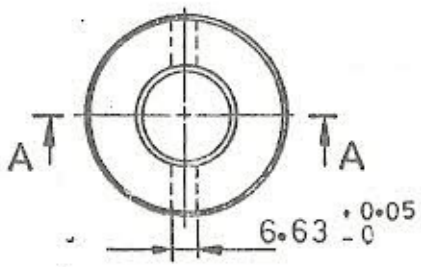
Perform the test in oil at 90±2°C. Immerse the test specimens in oil at this temperature for less than 30 min and not more than 1h before the test.

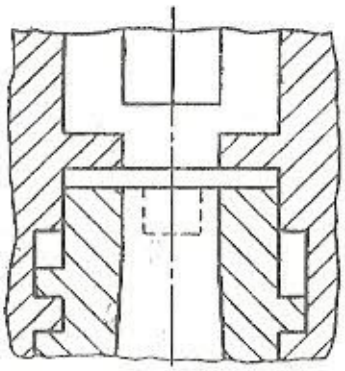
F-4 EXPRESSION OF RESULTS

Record the arithmetic mean of two valid electric strength measurements as the test results expressed in Kilovolts. Express all voltages as root mean square (rms).

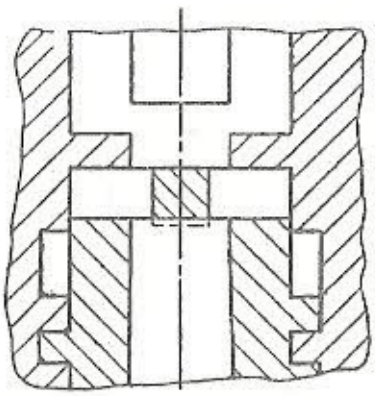


SECTION A A





ENLARGED VIEW SHOWING POSITION OF TEST PIECE USED



ENLARGED VIEW SHOWING POSITION OF TEST PIECE USED

All dimensions in millimetres.

FIG. 3 PUNCHING TOOL ASSEMBLY

ANNEX C

[*Table* 4, *Sl No.* (iii) and *Table* 7]

DETERMINATION OF SHEAR STRENGTH, FLATWISE

C-1 GENERAL

A test piece in the form of a 6·4 mm wide rectangular bar is tested so that both ends of the bar are simultaneously sheared using a specified punching tool assembly. A factor K is used in calculation to allow for the cylindrical curvature of the sheared surfaces.

C-2 APPARATUS

C-2.1 Compression Testing Machine

Which shall be power-driven and capable of maintaining a constant rate of movement such that the test piece fractures within 15s to 45s. A continuous indication of the force applied to the test piece, preferably recorded autographically, with a permanent indication of the maximum force, shall be provided. The force scale shall be calibrated by a suitable method to ensure that error does not exceed ±0·2 percent.

C-2.2 Punching Tool (*See* Fig. 3)

Which shall consist of a bolster, into one end of which is screwed a die, and a cylindrical punch which is a close sliding fit in the other end of the bolster. The cutting edges of the punch and die shall be re-ground as necessary to maintain maximum sharpness.

The bolster shall be provided with rectangular slots to accept the rectangular bar test piece.

C-3 TEST PIECE

Each test piece shall be a rectangular bar, 6·4 ± 0·2 mm and not less than 32 mm long. The thickness of the test piece shall be the thickness of the sheet under test, except that where this exceeds 6·35 mm the thickness of the test piece shall be reduced to 6·10 ± 0·25 mm, one original surface of the sheet being left intact.

C-4 NUMBER AND DIRECTION OF TEST SPECIMENS

Test three test specimens with their lengths in direction A and three with their lengths in direction B.

C-5 CONDITIONING OF TEST SPECIMEN

Condition the test specimens in accordance with IS 13360 (Part 1) : 1992 (27° ± 2°C, 65 ± 5 percent RH for at least 16h).

C-6 PROCEDURE

Perform the test at a temperature of 27 ± 2°C. Measure the thickness and width of the test piece at several points along the excepted lines of shear and determine the mean value of these measurements to the nearest 0·01 mm.

Immediately following conditioning and measurement, position the test piece symmetrically in the punching tool and screw the die home against the test piece in the bolster. Use only sufficient force to ensure that there is no clearance between the test piece and adjacent die and bolster surfaces.

Mount the punching tool assembly between the anvils of the testing machine and apply a steadily increasing force to the test piece by means of the punch so that the test piece fractures within 15s to 45s. Record the maximum force (F) sustained by the test piece.

Repeat the test with the remaining test pieces.

C-7 CALCULATION AND EXPRESSION OF RESULTS

C-7.1 Calculate the shear strength of each test piece using the following equation:

$$S = \frac{F}{2\,BTK} + \frac{F}{2{\cdot}096\,BT}$$

where

S is the shear strength (in MPa) of the test piece;

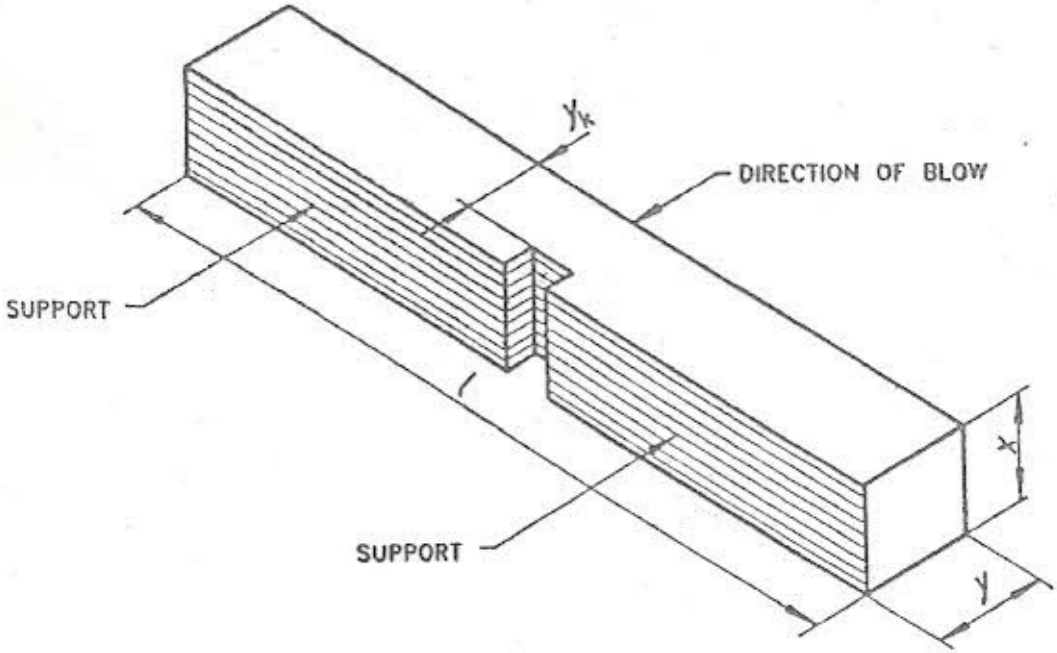
F is the force (in N) at fracture;

B is the mean width (in mm) of the test piece;

T is the mean thickness (in mm) of the test piece; and

K is the factor of constant value 1·048, introduced to allow for the cylindrical curvature of the sheared surfaces.

C-7.2 Calculate the arithmetic mean of the shear strength of the direction A test specimens and the arithmetic mean of the shear strength of direction B test specimens. Record the lower of the two means as the test result.



NOTE — A U-notch is shown but the figure is equally applicable to a V-notch

FIG. 2 NOTCHED TEST SPECIMEN FOR LAMINATED SHEET TESTED IN THE EDGEWISE DIRECTION

moulding skin may be exhibited; such breaks are acceptable.

B-7 CALCULATION AND EXPRESSION OF RESULTS

B-7.1 The charpy impact strength, of notched specimens tested edgewise, α_k in kJ/m² is given by the formula :

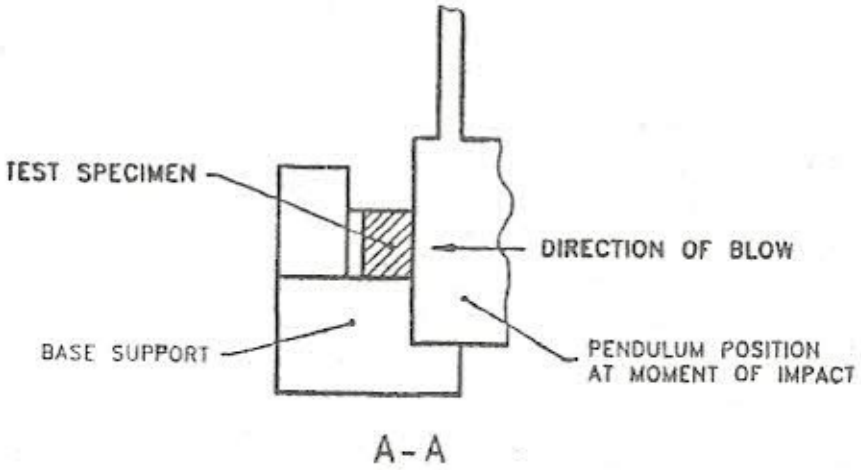
$$\alpha_k = \frac{A_k}{x.y_k} \times 10^3$$

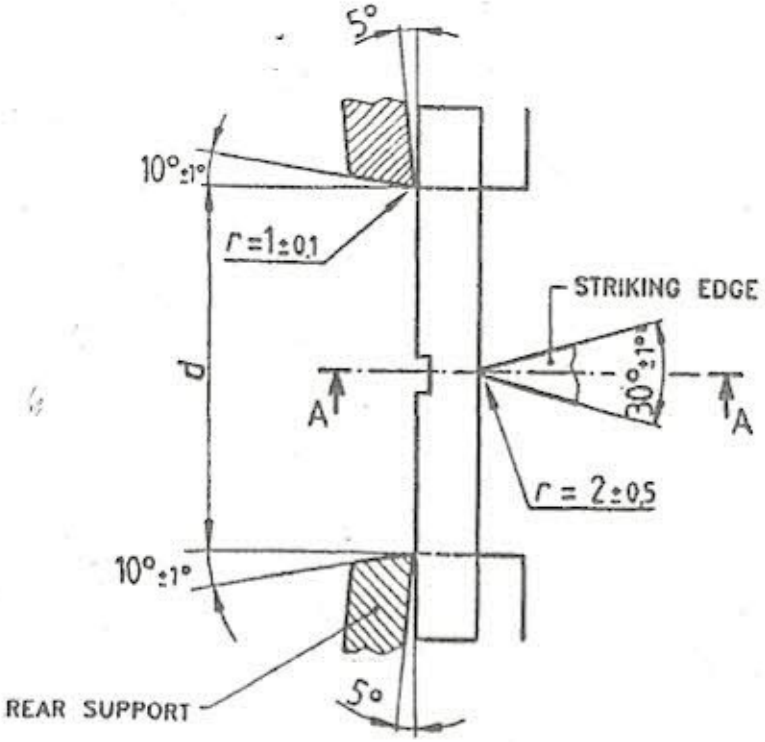
where

A_k is the impact energy, in joules absorbed by the notched specimen;

x is the dimension x, in millimetres, of the test specimens; Y_k is the dimension Y_k in millimetre of the test specimen.

B-7.2 Calculate the arithmetic mean of the impact strengths of the direction A test specimens and the arithmetic mean of the impact strength of the direction B test specimens. Record the average of the two means as the test results.





All dimensions in millimetres.

FIG. 1 STRIKING EDGE AND SUPPORT BLOCKS FOR STANDARD TEST SPECIMENS

B-2.1.3 The machine shall be securely fixed to a foundation having a mass of at least 40 times that of the heaviest pendulum in use. It shall be adjusted so that the orientations of the striker and supports are as specified in B-2.1.4 and B-2.1.6.

B-2.1.4 The striking edge of the pendulum shall be tappered to an included angle of 30 ± 1° and shall be rounded to a radius of 2 ± 0·5 mm. It shall pass midway, to within ± 0·2 mm, between the test specimen supports, and shall be aligned so that it makes contact across the full width of rectangular test specimens. The line of contact shall be within ±2° of perpendicular to the longitudinal axis of test specimen.

B-2.1.5 The distance between the axis of rotation and the centre of percussion of the pendulum shall be within ±1 percent of the distance from the axis of rotation to the centre of the test specimen.

B-2.1.6 The test specimen support shall comprise two rigidly mounted smooth blocks so arranged that the longitudinal axis of a perfectly rectangular test specimen is horizontal to within 1 in 200, and the striking face of such a test specimen is parallel to the striking edge of the pendulum to within 1 in 200 at the moment of impact.

The shape of the blocks shall be as shown in Fig. 1 and the separation of the blocks (distance between lines of supports) shall be 70 mm (d). Means shall be provided to centre test specimens, in relation to the striker, to within ± 0·5 mm. Separate support blocks may be required for each test specimen type.

B-2.2 Micrometers and Gauges

Micrometers and gauges suitable for measuring the essential dimensions of test specimens to an accuracy of 0·02 mm are required.

B-3 FORM OF TEST SPECIMEN

The dimensions of the test specimens shall be as follows:

Length, l = 120±2 mm
Dimension, y = 15 ± 0·5 mm
Preferred value of dimensions, x = 10 ± 0·5 mm

For test specimens cut from sheet of nominal thickness from 5 mm to 10 mm, inclusive, the thickness of the test specimen shall be that of the sheet. Test specimen, from sheets of nominal thickness greater than 10 mm shall be machined uniformly on both sides to achieve a thickness of 10 ± 0·5 mm.

The shape and dimensions of the notch shall be as shown in Fig. 2, y_k = 6·7 ± 0·3; n = 2 ± 0·2.

B-4 CONDITIONING

Condition the test specimen in accordance with IS 13360 (Part 1) : 1992. (27 ± 2°C, 65 ± 5 percent RH for at least 16 h).

B-5 NUMBER OF DIRECTION OF TEST SPECIMENS

Test five test specimens with their lengths in direction A and five with their lengths in direction B.

B-6 PROCEDURE

B-6.1 Check that the pendulum machine is of the correct energy range and that it has the specified striking velocity (B-2.1.2).

The selected pendulum shall consume at least 10 percent, but not more than 80 percent, of its stored energy in breaking the test specimen. If more than one of the pendulums described in B-2.1.2 meet these requirements, the pendulum having the highest energy shall be used.

B-6.2 Adjust the pointer on the energy scale so that it touches the driving pin when the pendulum is in the starting position. Carry out a blank test, that is, without a specimen in place and ensure that the total frictional losses do not exceed the values given in B-2.1.2.

B-6.3 Measure the dimensions x and y of the test specimens, in the centre, to the nearest 0·02 mm. In the case of notched specimen, carefully measure the dimension Y_k using, for example, a micrometer fitted with an anvil of width 2 to 3 mm and of suitable profile to fit the shape of the notch. Carry out two measurements one at each end of the notch, and calculate the mean value.

B-6.4 Lift and arrest the pendulum, and adjust the pointer in accordance with B-6.2. Place the specimen on the supports of the machine in such a manner that the striking edge will hit the centre of the specimen. Carefully align notched specimens so that the centre of the notch is located directly in the plane of the impact, with the notch in the face of the specimen opposite the impact face (*see* Fig. 1).

B-6.5 Carefully release the pendulum. Read from the scale the impact energy absorbed by the specimen and apply such corrections for frictional losses, etc, as may be necessary. Perform the test at a temperature of 27±2°C.

B-6.6 For calculation of test results, only completely broken specimens shall be taken into consideration. Hinged breaks where the specimen remains joined by a very thin

ANNEX A

[*Table* 4, *Sl No.* (i)]

DETERMINATION OF CROSS BREAKING STRENGTH

A-1 GENERAL

Carry out the test as described for flexural stress at rupture in Annex F of IS 13411 : 1992 and as modified by A-2 to A-6.

A-2 FORM OF TEST SPECIMEN

For sheet of thickness greater than 10 mm reduce the thickness to 10 mm, one face being left intact.

The length and thickness of the test piece shall be

$$l, Min = 20\ h,$$

where

l = length, and

h = thickness.

The width of the test piece may be any value between 10 and 25 mm except for materials with very coarse fillers for which the width shall be 20 to 50 mm.

A-3 NUMBER AND DIRECTION OF TEST SPECIMEN

Test five specimens with their lengths in direction A and five with their lengths in direction B.

A-4 CONDITIONING

Condition the test specimens in accordance with IS 13360 (Part 1) : 1992 (27 ± 2°C, 65 ± 5 percent RH for at least 16 h).

A-5 PROCEDURE

Perform the test at a temperature of 27 ± 2°C. Carry out the test flatwise, with the original surface of the sheet against the supports. Use a rate of relative movement of the loading member and the supports such that fracture occurs in 15s to 45s.

A-6 EXPRESSION OF RESULTS

Calculate the arithmetic means of the cross-breaking strengths of the direction A test specimens and the arithmetic mean of the cross-breaking strengths of direction B test specimens. Record the average of the two means as the test result.

ANNEX B

[*Table* 4, *Sl No.* (ii)]

DETERMINATION OF IMPACT STRENGTH, EDGEWISE (CHARPY METHOD)

B-1 GENERAL

The test specimen, supported as a horizontal beam, is broken by a single swing of a pendulum, with the line of impact midway between the supports and, in the case of notched specimens, directly opposite the notch.

B-2 APPARATUS

B-2.1 Testing Machine

B-2.1.1 The testing machine shall be of the pendulum type and shall be of rigid construction. It shall be capable of measuring the impact energy required in breaking a test specimen, the value of which shall be taken as equal to the difference between the initial potential energy in the pendulum and the energy remaining in the pendulum after breaking the test specimen. The energy scale shall be accurately corrected for friction and air resistance losses and scale errors.

B-2.1.2 The machine shall have the following characteristics which shall be periodically checked:

Impact Energy, J	*Velocity at Impact*, m/s	*Maximum Permissible Frictional Loss*, percent	*Permissible Error After Correction*, J
0·5	2·9 (± 10 %)	4	0·01
1·0	do	2	0·01
2·0	do	1	0·01
4·0	do	0·5	0·02
5·0	do	0·5	0·02
2·7	3·8 (± 10 %)	0·5	0·02
7 5	do	do	0·05
15·0	do	do	0·05
25·0	do	do	0·10
50·0	do	do	0·10

7.3 Insulation Resistance of Sanded Sheets

The insulation resistance of sanded sheets shall be determined in accordance with Annex H. The test results shall not be less than the following:

Types	*Values*, mΩ
P2/1	30
P3	500
P3/1	100
P4	1 000

7.4 Water Absorption of Sanded Sheets

The water absorption of sanded sheets shall be determined in accordance with Annex D. The test results shall not exceed the limits obtained by adding the following increments to the limits given in Table 5 or to the limits derived from Table 5 by straightline interpolation.

Types	*Values*, mg
P2/1	35
P3	20
P3/1	20
P4	15

8 PACKING AND MARKING

8.1 Packing

The material shall be supplied in packages as agreed to between the purchaser and the supplier.

8.2 Marking

The consignment shall be marked suitably with the following:

a) Indication of the source of manufacture and trade-mark, if any;

b) Name and type of the material;

c) Nominal thickness of the sheet; and

d) Batch No. or Code No.

8.3 BIS Certification Marking

8.3.1 The sheets may also be marked with the Standard Mark.

8.3.2 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 SAMPLING AND CRITERIA FOR CONFORMITY

9.1 Lot

All the packages of phenolic laminated sheets of the same group and type, produced under uniform conditions of manufacture shall constitute a lot.

9.1.1 *Number of Samples*

For ascertaining the conformity of the material in a lot to the requirements of the specification, tests shall be carried out on each lot separately. The number of packages to be selected from the lot shall depend upon the size of the lot and shall be in accordance with Table 8.

Table 8 Scale of Sampling

Lot Size (No. of Packages)	No. of Packages to be Selected in a Sample
(1)	(2)
Up to 150	3
151 to 500	4
501 and above	5

9.1.2 Each package in the sample shall be selected at random from each lot. For this purpose reference may be made to IS 4905 : 1968 'Methods of random sampling, (Amendment No. 1)'.

10 NUMBER OF TESTS

10.1 From each package selected in the sample, the sheets shall be tested for appearance and workmanship (**5.1**), flatness (**5.2**), and nominal thickness and permissible deviations (**5.3**).

10.2 The sheets having been found satisfactory as per **10.1**, shall then be further tested for the various requirements given in Tables 4, 5 and 6. The sheets shall also be tested for machinability (**5.4**) and resistance to hot oil (**5.5**). For this purpose the requisite number of sheets shall be selected at random, approximately equal in number, from each package selected as per col 2 of Table 8. The number of test specimens shall be cut from different portions of the sheets, which shall be sufficient for carrying out all the above tests.

11 CRITERIA FOR CONFORMITY

11.1 Any sample sheet failing in one or more requirements of the specification shall be termed as defective.

11.1.1 No defective sheet shall be found in the sample for the lot to be considered as conforming to the specification.

Table 5 Limits for Water Absorption

(*Clause* 5.6)

Mean Measured Thickness[1] mm	Maximum Water Absorption, mg for Types																
	A1	A2	A3	A4	A5	F1	F2	F2/1	F3	F4	F5	P1	P2	P2/1	P3	P3/1	P4
0·4	—	—	—	—	66	186	186	—	—	—	—	413	330	111	62	62	35
0·5	—	—	—	—	68	191	191	—	—	—	—	419	343	115	63	63	36
0·6	—	—	—	—	70	195	195	—	—	—	—	424	354	119	65	65	37
0·8	—	234	—	—	72	201	201	133	201	133	133	435	374	125	67	67	39
1·0	—	236	—	—	76	206	206	136	206	136	136	446	393	129	69	69	40
1·2	—	238	—	—	80	211	211	139	211	139	139	457	403	134	71	71	41
1·6	460	242	357	318	84	220	220	145	220	145	145	478	426	142	76	76	43
2·0	490	246	372	331	90	229	229	151	229	151	151	500	440	150	80	80	46
2·5	530	252	389	347	98	238	238	157	238	157	157	521	465	160	85	85	48
3·0	575	257	407	363	104	245	245	162	245	162	162	550	482	169	90	90	50
4·0	660	268	444	396	116	256	256	169	256	169	169	587	509	186	100	100	54
5·0	750	278	480	428	128	267	267	176	267	176	176	620	527	200	110	—	57
6·0	840	289	517	461	140	277	277	183	277	183	183	645	545	216	118	—	60
8·0	1 010	310	588	526	156	294	294	194	294	194	194	689	579	242	135	—	63
10	1 190	332	661	590	168	309	309	204	309	204	204	721	601	268	149	—	65
12	1 360	353	733	655	180	324	324	214	324	214	214	747	621	292	162	—	66
14	1 540	374	807	720	192	339	339	224	339	224	224	772	642	315	175	—	68
16	1 710	395	878	784	204	354	354	234	354	234	234	794	852	332	186	—	69
20	2 060	437	1 020	913	228	384	384	253	384	253	253	830	692	364	202	—	71
25	2 500	488	1 210	1 070	260	420	420	277	420	277	277	862	718	397	219	—	74
22·5	3 000	—	1 450	1 290	—	504	504	333	504	—	—	1 030	860	476	263	—	89
One face machined[2]																	

[1] If the mean measured thickness of the test specimens is intermediate between two consecutive thickness given the limit is determined to the nearest mg, by straightline interpolation. If the mean measured thickness is less than the minimum thickness for which a limit is given for a type, the limit for that minimum thickness applies. For example, for type A1, if the mean measured thickness is 1·5 mm the limit is 460 mg. If the mean measured thickness is greater than the maximum thickness for which a limit is given for the type, the limit for that maximum thickness applies. For example, for type P 3/1, if the mean measured thickness is 4·1 mm, the limit is 100 mg.

[2] If the nominal thickness of the sheet exceeds 25 mm the test specimen is reduced to 2·5 ± 0·2 mm, one face being left intact (*see* Annex D), and the limits given apply.

Table 6 Requirements for Electric Strength, Flatwise, in Oil

(*Clause* 5.6)

Mean Measured Thickness[1] mm	Minimum Electric Strength[2], MV/m							
	A5	F1	F2	F2/1	F3	F4	F5	P2, P2/1 P3, P3/1 and P4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0·4	6·0	2·72	1·01	—	—	—	—	16·2
0·5	5·9	2·50	0·98	—	—	—	—	15·0
0·6	5·8	2·30	0·95	—	—	—	—	14·1
0·8	5·5	1·97	0·89	1·97	0·89	7·0	9·6	13·1
1·0	5·1	1·72	0·84	1·72	0·84	6·3	8·7	11·8
1·2	4·8	1·50	0·80	1·50	0·80	5·8	8·1	10·8
1·6	4·4	1·21	0·72	1·21	0·72	5·1	7·3	9·4
2·0	4·0	1·03	0·65	1·03	0·65	4·6	6·6	8·3
2·5	3·5	0·94	0·57	0·94	0·57	4·2	6·0	7·4
3·0	3·0	0·94	0·50	0·94	0·50	4·0	5·5	6·4
4·0	—	—	—	—	—	—	—	7·2[3]
5·0	—	—	—	—	—	—	—	6·3[3]
6·0	—	—	—	—	—	—	—	5·5[3]
8·0	—	—	—	—	—	—	—	4·7[3]
10·0	—	—	—	—	—	—	—	4·1[3]
12·0	—	—	—	—	—	—	—	3·7[3]
14·0	—	—	—	—	—	—	—	3·4[3]

[1] If the mean measured thicknesses of the test specimens is intermediate between two consecutive thickness, the limit is determined by straightline interpolation. If the mean measured thickness is less than the minimum for which a limit is given for a type, the limit for that minimum thickness applies. For example, for type F2/1, if the mean measured thickness is 0·79 mm the limit is 1·97 MV/m. If the mean measured thickness is greater than the maximum thickness for which a limit is given for a type, the limit for that maximum thickness applies. For example, for type F1, if the mean measured thickness is 3·1 mm, the limit is 0·94 MV/m.

[2] All values are given as r.m.s.

[3] These are optional requirements (*see* Table 7).

Table 7 Optional Requirements

(*Clause* 6)

Types	Resistant to Flatwise Compression %, *Max*	Electric Strength Flatwise, in Oil at 90°C. MV/m *Min*	Shear Strength Flatwise MPa, *Min*	Temperature at Deflection Under Load, °C, *Min*	Flammability
(1)	(2)	(3)	(4)	(5)	(6)
A1	3·0	—	—	—	Values and the test method to be agreed between the purchaser and the supplier
A2	2·5	—	—	—	
A3	—	—	—	—	
A4	—	—	—	—	
A5	2·5	—	—	—	
F1	—	—	—	—	
F2	—	—	—	—	
F2/1	—	—	—	—	
F3	—	—	—	—	
F4	—	—	—	—	
F5	—	—	—	—	
P1	3·0	—	—	—	
P2	3·0	As given in Table 6	70	Values to be agreed between the purchaser and the supplier	
P2/1	3·0		70		
P3	3·0		60		
P3/1	3·5		50		
P4	2·5		60		
Test Method	Annex K of this standard	Annex E of this standard	Annex C of this standard	Annex H of IS 13411 : 1992	

In addition test specimen are to show no sign of failure

Table 4 Requirements for Physical Characteristics

(Clause 5.6)

Sl No.	Characteristics	Unit	Nominal Thickness to which Requirement Applies	Requirements for Types																Method of Test Ref to Annex of This Standard
				A1	A2	A3	A4	A5	F1	F2	F2/1	F3	F4	F5	P1	P2	P2/1	P3	P3/1	P4	
i)	Cross breaking strength, (average of direction A and direction B)	MPa	Not less than 1·6 mm	135	90	105	70	125	135	110	85	100	100	100	130	110	130	85	70	70	A
ii)	Impact strength edgewise (charpy method), (average of direction A and direction B), *Min*	kJ/m²	Not less than 5 mm	9·8	2·9	15	10	6·0	6·0	7·0	6·0	8·8	7·0	6·0	—	—	—	—	—	—	B
iii)	Shear strength, flatwise, *Min*	MPa	Less than 1.6 mm	—	55	—	—	55	65	65	65	65	60	65	75	70	70	60	50	60(1)	C
iv)	Water absorption, *Max*	mg	All thickness	As shown in Table 5																	D
v)	Electric strength, flatwise, in oil at 90°C, *Min*	MV/m	Not greater than 3 mm	As shown in Table 6																	E
vi)	Electric strength, edgewise in oil at 90°C, *Min*	kV	Greater than 3 mm	—	—	—	—	3	2	1	7	1	15	20	—	20	20	25	25	30	F
vii)	Dissipation factor (Loss tangent) at 1 MHZ, *Max*	—	Not greater than 3 mm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0·045	0·045	0·036	G
viii)	Permittivity at 1 MHZ, *Max*	—	do	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5·7	5·2	5·0	G
ix)	Insulation resistance after immersion in water, *Min*	MΩ	Not greater than 25 mm	—	0·5	—	—	20	3·0	0·5	50	0·5	50	150	1·0	10	100	1×10^3	1×10^3	3×10^4	H
x)	Crushing strength after heating, *Min*	kN	Not less than 10mm	13·5	13·5	13·5	13·5	—	—	—	—	—	—	—	—	—	—	—	—	—	J

1) For thickness of 0·8 mm and less than limit is 40.

Table 3 Nominal Thickness and Permissible Deviation

(*Clause* 5.3)

All dimensions in millimetres.

Preferred Nominal Thickness	Permissible Deviation from Nominal Thickness (Plus or Minus)				
	Type A2, F2, F2/1 F3, F4 and F5	Type A1, A3 and A4	Type A5	Type F1	Type P1, P2, P2/1, P3, P3/1 and F4
0·4	[1]	—	0·10	0·09	0·06
0·5	[1]	—	0·11	0·10	0·07
0·6	[1]	—	0·12	0·11	0·08
0·8	0·19	—	0·13	0·13	0·09
1·0	0·20	—	0·14	0·15	0·11
1·2	0·21	—	0·15	0·16	0·12
1·6	0·24	0·63	0·18	0·19	0·14
2·0	0·27	0·65	0·20	0·21	0·16
2·5	0·31	0·68	0·23	0·23	0·18
3·0	0·34	0·70	0·26	0·25	0·20
4·0	0·40	0·75	0·30	0·29	0·24
5·0	0·45	0·79	0·33	0·33	0·28
6·0	0·50	0·83	0·37	0·37	0·32
8·0	0·59	0·92	0·41	0·46	0·39
10·0	0·68	1·01	0·46	0·53	0·45
12·0	0·76	1·10	0·48	0·60	0·50
14·0	0·84	1·19	0·51	0·65	0·56
16·0	0·91	1·28	0·54	0·70	0·61
20·0	1·06	1·46	0·59	0·80	0·72
25·0	1·24	1·68	0·66	0·92	0·85
30·0	1·41	1·91	—	1·03	0·98
35·0	1·56	2·13	—	1·13	1·10
40·0	1·71	2·35	—	1·23	1·23
45·0	1·87	2·57	—	1·33	1·33
50·0	2·05	2·79	—	1·43	1·43
60·0	2·42	3·23	—	1·63	—
70·0	2·80	3·68	—	1·83	—
80·0	3·20	4·12	—	2·03	—
90·0	3·60	4·56	—	2·23	—
100·0	4·00	5·01	—	2·43	—

[1] The thickness tolerance for this nominal thickness should be agreed between the purchaser and the supplier.

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5-2-81

Advance 21.4.84
for C. I. M. E. Kirkee

IND/ME/677(a)
Based on Def Stn 93-6
- 8th Dec. 1969.

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IND/ME/677(a)

AMENDMENT RECORD

Amendment DGI No.	Amendment date	Authority letter from DI (Armts)	Clauses affected	Remarks

..... 3/-

IND/ME/677(a)

RUBBER, EXPANDED, SHEET, NON-TARNISHING

C O N T E N T S

.....4/-

0. FOREWORD

0.1 This specification has been prepared by the CONTROLLERATE OF INSPECTION (MILITARY EXPLOSIVES) KIRKEE, PUNE-411 003.

0.2 For additional copies or any other enquiry regarding this specification reference should be made to the Inspecting Authority named in the tender or contract(i.e. C.I.(M.E.), Kirkee.).

1. SCOPE

1.1 This specification is meant to govern manfacture, supply and inspection of rubber, expanded, sheet, non-tarnishing for use as a cushioning material, primarily in packaging as follows :-

(a) Grade 1 - Medium density

(b) Grade 2 - Heavy density

1.2 The materials of both grades (hereafter collectively termed "the material") are similar except that grade 2 has a higher apparent density and a higher resistance to compression strain than grade 1 and is therefore preferred when higher load carrying capacity is necessary.

1.3 The material has low water absorption and is therefore suitable for use outside a water vapour barrier. It is non-silver-staining (to the extent required by BS 3106) and is primarily intended for use when it is necessary to minimise the possibility of tarnishing or corrosion of metallic components, particularly of silver, copper, brass and copper containing alloys with which it may be in contact or close proximity.

1.4 The material has superior heat resistance to and is recommended for use (to the extent required by Bs 3106) when resistance to degradation under tropical storage conditions is an important consideration.

1.5 It is not resistant to mineral lubricating oil or gasoline, and it is not free from organic compounding ingredients which may stain painted surfaces under certain conditions of use. Some stiffening of the cell walls may occur due to crystallisation if stored at low temperature, particularly around -25° C, even for relatively short periods.

1.6 The material has no fire-retardant properties and will burn readily.

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2. RELATED DOCUMENTS

2.1 The related documents mentioned at clause 2.2 are those applicable at the date of publication of this specification. It is contractors responsibility to confirm their current applicability and to obtain from the Authority Holding Sealed Particulars (i.e. C.I.(M.E.), KIFKEE.) information concerning any change that may be necessary due to cancellation, replacement or supersession of any of these documents.

2.2 Copies of the related specifications mentioned in this specification are obtainable as follows :-

B.S. Specifications
B.S. 903 - Parts F1 to F9 of 1956
B.S. 3106-1959

Indian Standards Institution
Manak Bhavan
9, Bahadur Shah Zafar Marg
NEW DELHI - 110 002.

3. DESCRIPTION

3.1 The material shall be supplied in the form of sheets of substantially uniform thickness. Depending on thickness, the sheets may have a smooth continuous thin skin on one or both surfaces or no skin on either surface. Each sheet shall be substantially uniform in texture and free from flaws, abnormal voids, and other imperfections likely to affect its service life or utility.

3.2 Colour - For identification purposes, the colour of each sheet shall be as follows or as stipulated in the contract.

(1) Grade 1 material - pale blue-green

(2) Grade 2 material - yellow

4. COMPOSITION

4.1 The material shall be cellular rubber in which the cells are substantially non-intercommunicating. It shall be made from masticated and suitably compounded natural and/or synthetic cis-polyisoprene rubber using a sulphurless or sulphur-donating curing system, and it shall contain not less than 1 phr of a suitable non-staining anti-oxident. No significant amount of elemental sulphur shall be used in the mix.

4.2 The method of manfacture shall be such that the compression stress-strain properties become substantially constant within 48 hours after vulcanization.

5. DIMENSIONS

5.1 When measured in accordance with B.S. 903 : Part F2 the dimensions of each sheet shall comply with the following requirements.

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1) Thickness, upto but not including 13 mm - nominal thickness ± 10 percent.

2) Thickness, 13 mm and above - nominal thickness + 10 and - 5 percent.

3) Length and width - nominal figure + 3 and - 7 percent.

5. TENDER SAMPLE

6.1 The contractor shall submit two tender samples each of 500g essentially from the same batch/lot of manfacture, free of charge and conforming to this specification.

7. PRE-INSPECTION

7.1 Before tendering the store to the Inspector, the supplier shall carry out a thorough inspection of each delivery to satisfy himself that the store fully conforms to this specification and shall render a certificate to that effect to the Inspecting Officer.

8. INSPECTION

8.1 Rubber, expanded, non-tarnishing and the packages in which it is contained shall be subject to inspection by and to the final approval of the Inspecting Officer/Inspecting Authority.

8.2 The samples of the material and the packages in which it is contained may be taken from any portion of a consignment.

8.3 If, on examination, any sample be found not to conform to this specification, the whole consignment may be rejected.

8.4 The foregoing provisions shall apply equally to prime contractors and to sub-contractors, if any.

9. SAMPLING

9.1 Normally two representative samples each of 500g of the material, shall be drawn from each batch/lot. However the number of samples to be drawn will be at the discretion of the Inspecting Officer.

10. TEST REQUIREMENTS

10.1 Samples taken from any portion of the supply shall comply with clauses 3, 4 & 5 above and shall also conform to the following test requirements :-

..... 7/-

Sl. No.
1.
2.
3.
4.
5.
NO

Sl. No.	Characteristic		Passing Grade 1	Standard Grade 2	Test Method
1.	Apparent density kg/m³	max	400	560	BS 903 Part F3 Procedure A
2.	Compression strain under stress of :-				BS 903 Part F4 Tested as supplied (i.e. with or without skins).
	a) 0.7 bar[ø] ...Percent	Max	30	13	
		Min	20	7	
	b) 2.1 bar[ø] ...percent	Min	45	-	
	c) 3.5 bar[ø] ...percent	Min	-	40 and not less than 4 times the value obtained at(a)	
3.	Compression set, Percent	Max	48	40	Appendix A (BS 903 Part F6 1956 reproduced).
4.	Freedom from water-soluble corrosive impurities				
	i) Free alkali to phenolphthalein calculated as KOH	percent Max	0.03	0.03	
	ii) Chlorides* calculated as Cl,	percent Max	0.10	0.10	
	iii) Free acid to bromocresol green		Nil	Nil	
	iv) Sulphates* calculated as SO_4	percent Max	0.20	0.20	BS 903 Part F9
5.	Freedom from silver staining		Stain not darker than standard shade		Appendix 'B'

NOTE (1) ø 1 bar = 10^5 N/m²

* The material may be regarded as complying with the requirements for chlorides and sulphates if the electrical resistivity, determined as described in B.S. 903 Part F9 of a portion of the aqueous extract is not less than 6500 ohm-cm.

..... 8/-

PACKING AND MARKING

11.1 Packing

11.1.1 (a) Components : Rubber components shall be packed loose in a wooden box/card board box/paper carton and shall be adequately dusted with french chalk; where wooden boxes are used they shall be lined internally with brown paper

(b) Sheets : Sheets in running length shall be rolled. The rolls shall be covered with brown paper and then packed in hessian cloth. Sheets shall be dusted with french chalk during rolling.

11.1.2 The material offered in any other packages shall have the prior approval of the Inspecting officer.

11.1.3 The inclusion of any foreign matter or impurities in any of the packages shall render the whole consignment liable to rejection.

11.2 Marking

11.2.1 All packages constituting a consignment shall each be legibly and durably marked with the following details as applicable :-

i) Nomenclature and specification number of the material.

ii) Name and address of the consignee.

iii) A/T / S.O. No. and date.

iv) Consignment number.

v) Lot No./Batch No. and date of manfacture

vi) Gross and net mass

vii) Consecutive number of package and total number of packages.

viii) Date of supply

ix) Contractors initials or recognised trade mark

11.2.2 The components will be appropriately marked with initials/ trade marks of the manfacturer date of manfacture, if specified on the relevant component drawing.

.....9/-

11.2.3 The sheets of the store shall bear the markings of grade 1 or grade 2 (as applicable). date of manfacture and initials/trade mark of manfacturer. The paint used for marking shall be contrast colour and to the satisfaction of the Inspecting officer.

11.2.4 In addition to above, the Inspecting officer may suggest some more markings/identification at the time of inspection.

11.2.5 The paint used for marking shall be ~~of~~ good quality (conforming to I.S. 133-1969) and to the satisfaction of the Inspecting officer. 1981

Sd/- XXX XXX XXX
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DIRECTOR
CONTROLLER OF INSPECTION (MILITARY EXPLOSIVES)
for DIRECTOR OF INSPECTION (ARMAMENTS)

12. APPENDICES

COMPRESSION SET

APPENDIX 'A'

SECTION 1 - DEFINITIONS

Compression stress :- The average load per unit area of the original cross section. Compression stress is applied so as to cause decrease in dimension of the test piece in the direction of the applied stress.

Compression strain :- The alteration of shape or dimensions resulting from stress. Compression strain is the decrease in dimension produced in a piece of rubber by a compression stress; it is the decrease in the direction of the stress, expressed as a percentage of the original thickness.

Compression set :- The residual strain in a rubber test piece after it has been strained under compression to a given extent for a given time and then allowed to recover for a given time, the temperature being susbstantially constant during the test.

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SECTION 2 - EXPLANATORY NOTE

This method is intended to measure the relative ability of various cellular rubber to retain elastic properties after the prolonged application of compressive strains. It does not appear that the precautions applied to solid soft vulcanized rubber as to friction between the clamps and the surface of the piece need be closely defined as far as this material and the test are concerned.

Stressing in service of cellular rubbers may involve :-

1) The maintenance of a definite deformation.

2) The application of a known constant load; or

3) The rapidly repeated deformation and recovery resulting from intermittent compressive forces.

The compression set test described below is intended to simulate only the first of these conditions of use.

SECTION 3 - TEST PIECES

Standard test pieces shall be cut from sheet material. The two surfaces which have been in contact with the mould shall have substantially continuous skins and be parallel to one another and the other surfaces shall expose the cellular structure of the material.

The test piece shall be a square, the length of side of which shall be not less than twice the thickness. In no case shall the size of the test piece be less than 2 in. x 2 in.(51mm X 51mm) which is the preferred size.

SECTION 4 - APPARATUS

The compression device shall consist of two or more flat steel plates between the parallel faces of which the test piece is compressed. Steel spacers in the form of bars and of thinkness such as to give the required percentage compression shall be provided to control the thickness of the test piece during the test.

SECTION 5 - PROCEDURE

All test pieces shall be conditioned as described in part F.1 before being tested.

The initial thickness of the test piece shall be accurately measured as described in part F.2.

The test piece shall then be compressed to 75 per cent (50 per cent for latex foam) of its initial thickness between the parallel steel plates, which shall be larger than the test piece. Steel spacers shall be equivalent to 75% of the initial thickness of the material (equivalent to 50% in case of latex foam). Steel spacers shall be used between the plates, sufficient clearance being allowed for the bulging of the test piece and care being taken to avoid displacement of the test piece.

After being compressed for the period and at the temperature given in Table 1 the test piece shall be removed from the clamp while still at the test temperature and allowed to recover for 30 minutes, at room temperature. The thickness of the test piece shall then be measured again.

TABLE 1 TIME AND TEMPERATURE OF COMPRESSION

Type of rubber	Temperature	Time
Sponge rubber and latex foam rubber	70 ± 1°C	22 hours
Expanded rubber	20 ± 2°C	70 hours

SECTION 6 - EXPRESSION OF RESULTS

The compression set is the difference between the original thickness of the test piece and that after recovery expressed as a percentage of the initial applied compression.

If t_o is the original thickness of the test piece

t_r is the thickness after recovery, and

t_s is the thickness of the spacer, then the compression set at

constant strain $= \frac{t_o - t_r}{t_o - t_s} \times 100$

At least two test pieces shall be tested, and the results shall be averaged.

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1084 to 1091 = (21)

TC

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APPENDIX 'B'

METHOD OF TEST FOR FREEDOM FROM SILVER STAINING

Stain tester

The stain tester shall consist of a rectangular piece of clear photographic film with a strip of the standard shade, 3 mm wide, across it, equidistant from each end. The diffuse visual density, type VI-b of the photographic film background shall be not greater than 0.050 when determined in accordance with BS 1384 and the difference in density between the standard shade and the background shall be 0.012 ± 0.005.

Procedure

Place two pieces of the material, preferably about 25 mm square and thickness that of the sheet from which they are cut, on a larger piece of analytical silver foil which has been thoroughly cleaned and polished with jeweller's rouge and water and rubbed dry with clean cloth, so that one piece has an original surface, and the other pieces a freshly cut surface, in contact with the silver.

Place the foil with the pieces resting on it, in a suitable air oven maintained at 70°C ± 2 degC for 30 minutes, then remove the rubber from the foil, allow to cool to room temperature, and examine the silver visually for stain. If any stain is observed, view it through the clear part of the stain tester film adjacent to the standard shade.

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