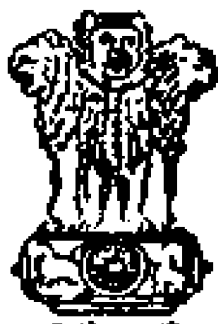


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**INDIAN RAILWAYS STANDARD SPECIFICATION
FOR
LIGHT WEIGHT UNBREAKABLE ENGINEERING
THERMOPLASTIC MATERIAL INSULATOR
FOR
OVERHEAD TELEGRAPH AND TELEPHONE LINES.**

(TENTATIVE)

SPECIFICATION NO. IRS: TC 32-2007

Revision 0

Number of Pages : 19

**TELECOM DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
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DOCUMENT CONTROL SHEET

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DOCUMENT DATA SHEET		
Specification IRS : TC 32-2007		Revision 0
Title of Document Indian Railways Standard Specification for Light weight unbreakable Engineering Thermoplastic Insulator for Overhead Telegraph and Telephone lines.		
Author Shri K. P. Arya Director/ Telecom-III/ RDSO		
Approved by Shri M. Alam Executive Director/ Telecom/ RDSO		
Abstract This document specifies technical specifications of Light weight unbreakable Engineering Thermoplastic Insulator for Overhead Telegraph and Telephone lines.		

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REVISIONS/ VERSION/AMENDMENTS :

Version	Chapter/ Annexure	Revision/Version/ Amendment	Effective Month/Year
IRS:TC 32 - 1984	-	First issue	1984
IRS:TC 32 – 93	-	Revision	1993
IRS:TC 32 – 93	-	Amendment - 1	Feb.1995
IRS:TC 32 –2007	-	Revision	2007

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**INDIAN RAILWAY STANDARD SPECIFICATION
FOR
LIGHT WEIGHT UNBREAKABLE ENGINEERING THERMOPLASTIC
MATERIAL INSULATOR FOR OVERHEAD TELEGRAPH AND
TELEPHONE LINES**

0. FORWARD:

- 0.1 This Specification was first issued in 1984. This revised specification is being issued incorporating all amendments of the previous revision with some additional changes as serial no IRS:TC 32-2007 (Rev.0).
- 0.2 The specification requires reference to the following Indian Standard (IS) specification:
- | | |
|--------------|---|
| IS: 283 – 76 | Specification for porcelain insulators for telegraph and telephone lines (3 rd revision) |
| IS: 2932-79 | Specification for Enamel, synthetic, Exterior [(a) under-coating , (b) finishing] (first revision) |
- 0.3 Wherever reference to any of the above-mentioned specifications appears in this specification, it shall be taken as a reference to the latest issue of the specification.
- 0.4 The stalks for use with these insulators are covered by IS: 1441-1966 (Specification for insulator stalks for telegraph and telephone lines.)

1. SCOPE:-

- 1.1 This standard covers pin type Engineering Thermoplastic material insulators intended for use in supporting telegraph and telephone lines.
- 1.2 This standard does not cover insulators for communication lines running in close proximity to power transmission lines.

2. TERMINOLOGY:-

- 2.1 For the purpose of this standard, the following definition shall apply:

a) **PIN INSULATOR:**

A rigid insulator consisting of a single piece of Engineering thermoplastic material moulded component and intended to be mounted rigidly on the supporting structure by an insulator pin passing up inside the insulator.

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- b) **LOT OF INSULATOR:-**
All insulators of same type and design manufactured under similar conditions of production offered for acceptance. A lot may consist of the whole or part of the quantity ordered.
- c) **TYPE TESTS:-**
Tests carried out to prove conformity with the specification and will cover the raw material as well as the finished product.
- d) **ACCEPTANCE TEST:-**
Test carried out on samples taken from a lot for the purpose of acceptance of the lot .
- e) **ROUTINE TEST:-**
The test carried out on each insulator to check the requirements which are likely to vary during production.

3. GENERAL REQUIREMENTS:-

3.1 DESIGN:-

3.1.1 Engineering Thermoplastic material insulator shall be manufactured as per drawing shown in Fig.1.

3.1.2 The surface of the Engineering Thermoplastic material insulator shall be glossy, smooth, sound, free from moulding defects such as bubbles, surface sinking, splash marks, burn marks, voids, crazing and blisters of the surface, windows warning, weld lines, lamination, jetting, cracks etc. All edges shall be neatly finished and free from flash.

3.2 RAW MATERIAL:-

3.2.1 10% Glass filled UV stabilised & pigmented polycarbonate material shall be used for manufacturing the insulators. The colour shall be white, as per GERMAN Spec. "RAL 9010" .

3.2.1.1 The guarantee shall be given by the manufacturer that no reconstitute or recovered material has been used for the manufacture of the Engineering Thermoplastic material insulator.

3.2.1.2 Insulation material for Engineering thermoplastic material insulator shall be tough and non hygroscopic suitable for use in temperature range of -10°C to +50°C. Insulator shall also be robust and capable of with-standing such handling as encountered in service, storage, transit and installation.

3.3 THREADING:-

The threads on the insulator shall confirm to the profile shown in fig.2. (extract of IS: 283).

3.3.1 All the manufactured insulators shall be subjected to 'GO' test by the manufacturers.

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4. MARKING:-

Each insulator shall be legibly and indelibly marked to show the following:

- 4.1
 - a) Name or the trade-mark of the manufacturer.
 - b) The legend "IR" to signify that it is the property of the Indian Railways.
- 4.2 The marking on the insulator may be printed in indelible ink or moulded along with the insulator.

5. PACKING:-

- 5.1 The insulator may be packed in card-board boxes in packs of 25 nos. or by any other suitable means taking care that undue abrasion between any two insulators is avoided. The packages should be suitable for rough handling.

6. TESTS:

6.1 GENERAL:-

6.1.1 TYPE TESTS: The following shall constitute the type tests:

- a) Visual examination (cl.6.2)
- b) Raw material test (cl.6.3)
- c) U V stabilisation test (cl.6.4)
- d) Verification of dimensions (cl. 3.1.1 & cl. 6.5)
- e) Temperature cycle test (cl.6.6)
- f) Insulation resistance test (cl.6.7)
- g) Transverse loading test (cl.6.9)
- h) Drop test (cl.6.10)
- i) Salt mist test (cl.6.11)
- j) Marking (cl.4)
- k) Flame Retardancy test report/certificate from the raw material supplier to be submitted.
- l) Colour of Polycarbonate Granules/Insulator (cl. 3.2.1)

6.1.1.1 One sample each for the tests (b), (c) & (d) and two samples each for the remaining tests mentioned above shall be selected at random from the offered lot (minimum 100 insulators) for type tests. In case of failure of any one sample, in any one of the tests, the entire lot shall be rejected.

6.1.1.2 On successful completion of type test, a type approval certificate shall be issued. The certificate shall normally be valid for three years but the Inspecting Authority, under his discretion may draw out samples at more frequent interval. The type approval certificate shall also be not valid if a change in design, material used or manufacturing process is made subsequently unless this change has the specific approval of the purchaser or his authorised nominee.

6.1.2 ROUTINE TEST:-

Following shall be carried out as routine tests:

- a) Verification of dimensions (cl.3.1.1 & cl.6.5)
- b) Routine insulation resistance test (cl.6.8)
- c) Visual examination (cl.6.2)

6.1.3 ACCEPTANCE TEST:-

The following shall constitute the acceptance test which shall be conducted on finished product:

- a) Verification of dimension (cl.6.5)
- b) Specific gravity test (Appendix 'A')
- c) Insulation resistance test (cl.6.7)
- d) Transverse loading test (cl.6.9)
- e) Drop test (cl.6.10)
- f) Temperature cycle test (cl.6.6)
- g) Guarantee letter from the firm (cl. 3.2.1.1)
- h) Marking (cl.4)
- i) GO and No GO test (cl.3.3.1)
- j) % Inorganic contents (glass & pigments - Appendix A)
- k) Visual Examination (cl.6.2)
- l) Flame Retardancy test report/certificate from the raw material supplier to be submitted for every lot.

6.1.3.1 The number of insulators to be selected at random from the lot for these tests shall be in accordance with the following:

Lot size (1)	Sample size of insulators (2)
Upto 500	4
501 to 1000	7
1001 to 5000	10
5001 and above	13

6.1.3.2 The acceptance test shall be conducted as follows:

S.No.	Tests	No. of specimens to be tested			
		Upto 500	501 to 1000	1001 to 5000	Above 5000
a	Verification of dimensions	2+	4+	6+	8+
b	Insulation resistance test	2+	4+	6+	8+
c	Transverse loading test	1	1	2	3
d	Drop test	1	2	3	4
e	Specific gravity test	1	1	1	1
f	Temperature cycle test	2	2	3	4
g	Marking	5	8	10	12
h	GO and No GO test	2	3	5	7
i	% Inorganic contents (glass & pigments)	2	2	2	2
j	Visual Examination	5	8	15	20

NOTE:-

In case of failure in any one of the tests, only once, double the quantity specified for the tests shall be subjected to re-test, should any of the re-testing samples fail to meet the requirements, the entire lot shall be rejected.

6.1.4 The test equipments required to carry out acceptance and routine tests shall be available at manufacture's premises. These equipments shall be calibrated periodically at a test house approved by accepting authority.

6.2 VISUAL EXAMINATION:

6.2.1 The insulator shall be visually inspected for compliance with requirement of clause 3.1.2 of this specification.

6.3 TEST ON RAW MATERIAL:

6.3.1 Various parameters of the raw material shall conform to the values given in Appendix 'A'.

6.3.2 TENSILE TESTS:

The tensile test shall be conducted on "As moulded specimens" which are defined as those upon immediate removal from the mould are sealed in containers impermeable to water vapours and storage shall not exceed period of fifteen days under any circumstances. After taking the specimen out of the container the tensile tests shall be completed within one hour. The specimen for tensile test shall conform to Fig. 4. The test shall be conducted on six specimens and the average value shall be within the prescribed limits as shown in Appendix 'A'.

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6.4 U V STABILISATION TEST:

6.4.1 The detailed test procedure to be followed is as under:

- i) prepare a solution of polycarbonate material to be used in Methylene Dichloride (Spectrophotometric grade) maintaining a concentration of the material in solution slightly higher than 1%
- ii) Filter the solution to remove all suspended particles, glass fibre and pigments.
- iii) Measure the precise concentration of solution by petrie dish method.
- iv) Make up the solution to achieve exact 1% solution.
- v) Use a double beam UV spectrophotometer (Perkin Elmar type)
- vi) Fill up one spectrophotometer cell with the solution and the other with the solvent.
- vii) Scan over a wave length range of 300 to 400 nm (nano metre).
- viii) A sharp peak at 343 nm (there could be another peak nearby which should be ignored) indicates presence of specified UV stabiliser in material.

6.5 VERIFICATION OF DIMENSIONS:

6.5.1 The screw gauge (Fig.2) shall freely work in the threaded portion of the insulator. The wall thickness and body diameter at various place may be checked with a vernier calliper. The radii shown are for guidance purpose only.

6.6 TEMPERATURE CYCLE TEST:

6.6.1 The insulator shall be quickly and completely immersed in a water bath maintained at a temperature of $70^{\circ} \pm 5^{\circ}\text{C}$ and left for a period of 15 minutes. They shall then be withdrawn quickly and completely immersed without being placed in an intermediate container, in a bath of cold water for the same period of 15 minutes. The temperature of bath of cold water shall be maintained at $23^{\circ}\text{C} (\pm 5^{\circ}\text{C})$.

6.6.2 The complete test shall comprise 5 transfers viz cold to hot, hot to cold, cold to hot, hot to cold, cold to hot. The time taken to transfer the insulator from one bath to the other shall be as short as possible and shall not exceed ten (10) seconds. The quantity of water temperature variation of more than 5°C in the water when the insulators are immersed.

6.6.3 The insulators on removal from the bath shall be subjected to insulation resistance tests as per clause 6.7.

6.7 INSULATION RESISTANCE TEST:

6.7.1 Insulators shall be kept immersed as described under clause 6.7.2 at temperature of $25 \pm 2^{\circ}\text{C}$ for at least 30 minutes.

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6.7.2 METHOD OF SETTING UP FOR TEST:

The level of water in the tank and the space between the sheds shall be 25 mm from the edge of the outer shed. The level of water in the screw-thread cavity shall be 25mm below the edge of the inner shed.

6.7.3 TEST CONDITIONS:

Insulation resistance to be measured:

- a) Between water in the tank and inner shed cavity, and
- b) Between water in the inner shed cavity and screw thread cavity.

6.7.4 MEASUREMENTS:

The insulation resistance shall be measured at D.C. potential of 500V with a million meg ohm meter. The insulation resistance shall not be less than 50,000 meg ohms for both (a) and (b) mentioned in clause 6.7.3.

6.8 ROUTINE INSULATION RESISTANCE TEST:

- 6.8.1 In case of routine insulation resistance test, the insulator shall be completely immersed in inverted position in water for not less than 12 hours. They shall then be kept immersed in inverted position in the water to a depth mentioned in clause 6.7.2 for 3 period of 4 hours before the insulation resistance tests are conducted as per clause 6.7.3 and 6.7.4.

6.9 TRANSVERSE LOADING TEST:

- 6.9.1 The insulators shall be mounted on a test bench with a head identical to the one which is used in actual service. The pin shall be fixed upright to a metal bracket on a test machine. A flexible wire rope about 6 mm in diameter shall be looped round the tie wire groove and shall be pulled at right angle to the axis of the insulator. The pull shall be increased gradually and evenly to exert a total load of 600 Kg and maintained for one minute. There shall be no fracture of the insulator.

- 6.9.2 The tests arrangements are shown in Fig.3.

6.10 DROP TESTS:

- 6.10.1 The insulator shall be allowed to fall freely under gravity from a height of 5 metre on a hard concrete floor with the skirt striking the floor first. The insulator shall not develop any crack. After drop test the insulation resistance shall be conducted as per clause 6.7.

6.11 SALT MIST TEST:

- 6.11.1 Salt mist test shall be conducted as per clause 7.3 (Procedure 1) of IS specification no. IS:9000 (Part XI).
- 6.11.2 After tests, no deterioration shall be observed on visual inspection (clause 6.2), and electrical characteristics (clause 6.7)

APPENDIX 'A' (cl. 6.1 b)

RAW MATERIAL TEST

MATERIAL : 10% Glass filled polycarbonate UV stabilised.

COLOUR : White

S.No.	Parameters	Test method	Specified values
1.	Specific gravity	ASTM D792/ISO 1183	1.26 (Min.) 1.30 (Max.)
2.	Izod Impact strength (unnotched)	ISO 180	No break with 5.5 joule Hammer (Min.)
3.	Tensile strength, at Yield	ASTM D-638M/ ISO R 527	570 Kg/ Sq.Cm. (Min.)
4.	Tensile elongation at Rupture/ Break	ASTM D-638M/ ISO R 527	10% (Min.) 25% (Max.)
5.	Water absorption 24 hrs immersion at room temperature	ASTM D-570/ ISO 62	0.08% (Min.) 0.12% (Max.)
6.	Dielectric strength (in Transformer Oil Medium)	ASTM D-149	11KV/mm (Min.)
7.	% Inorganic contents (Glass & Pigments)	By Ash	7.5% (Min.) 12.5% (Max.)
8.	Melt Flow Index	ASTM D-1238	6.5 (Min.) 10.5(Max.) gm/10 minutes at 300°C & 1.2 Kg load.

NOTE:-

- 1) Besides the Raw Materials Test for parameters of Appendix 'A' given above, manufacturers of insulators to submit detailed material test report of various other properties of the material. This report may be either from the quality assurance department of raw material supplier or from National Test House.
- 2) Specific gravity, % Inorganic contents and tests shall be carried out on raw material as well as insulators.
- 3) Appendix B & C indicating test methods for % Inorganic contents & % Water absorption test respectively.

APPENDIX 'B'

PERCENTAGE INORGANIC CONTENTS (GLASS & PIGMENTS):-

This test is to be carried out on raw material (polycarbonate granules) as well as test piece cut from an insulator.

TEST METHOD:-

- i) A crucible shall be heated in a muffle furnace till a constant weight of the crucible is obtained.
Weight of the crucible thus measured = W_c .
- ii) Approximately 2 gm of specimen is put in the crucible. Weight of the crucible & the specimen thus measured = W_{cp} .
- iii) The specimen shall then be burnt by keeping the crucible in the muffle furnace at a temperature of 600°C (Approx.) till the shining glass is noticed. Thereafter it shall be cooled down to the room temperature.

Weight of the crucible & inorganic contents thus measured = W_{ci}

Calculation of % Inorganic Contents:-

Weight of polycarbonate specimen $W_p = W_{cp} - W_c$

Weight of the Inorganic Contents $W_i = W_{ci} - W_c$

Therefore, % Inorganic Contents (Glass & Pigments) = $\frac{W_i}{W_p} \times 100$

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APPENDIX 'C'

WATER ABSORPTION TEST:-

The moduled specimen of the polycarbonate granules (10% glass filled UV Stabilised), prepared as per ASTM D-570/ ISO 62 method is immersed in water at room temperature for 24 hours. The amount of water absorbed by the specimen shall then be measured after wiping off all surface water over the specimen with a dry cloth.

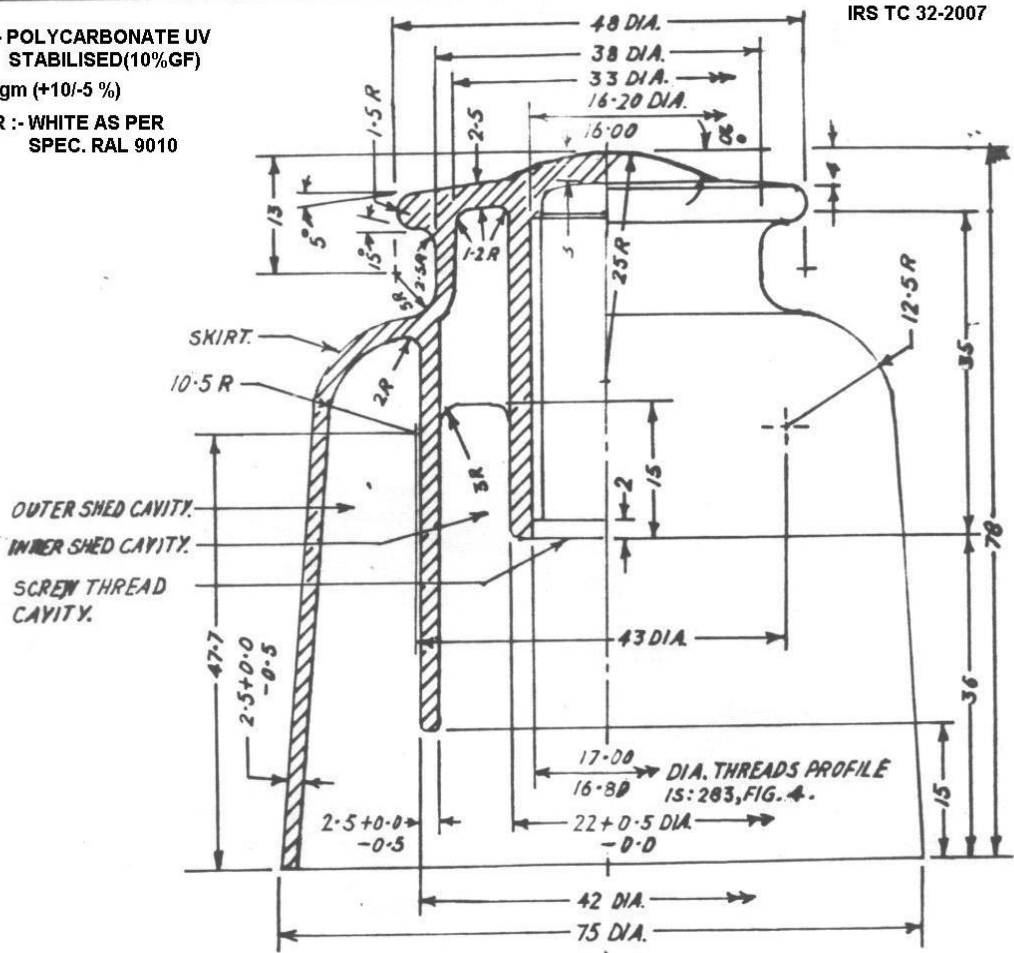
Weight of the specimen at room temperature = W_1
(before immersion in water)

Weight of the specimen after 24 hrs. immersion in water = W_2

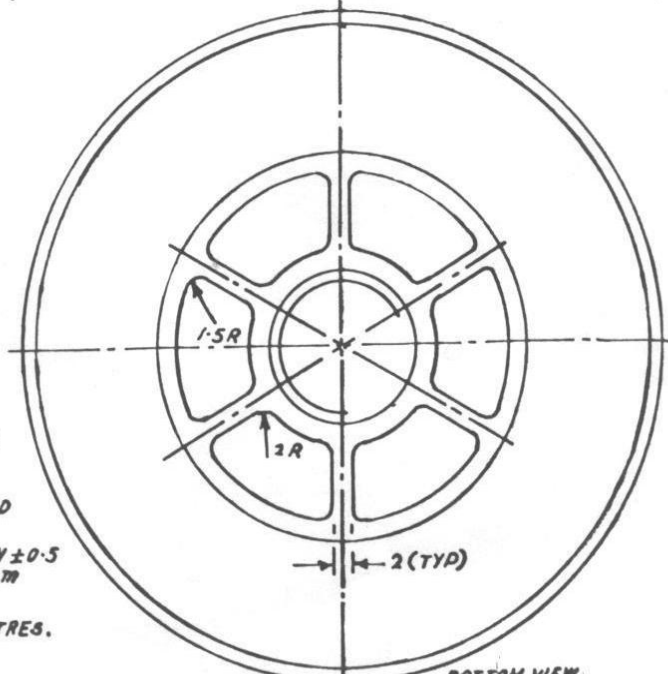
Therefore, % water absorption = $\frac{W_2 - W_1}{W_1} \times 100$

MATL :- POLYCARBONATE UV
STABILISED(10%GF)
Wt :- 75gm (+10/-5 %)
COLOUR :- WHITE AS PER
SPEC. RAL 9010

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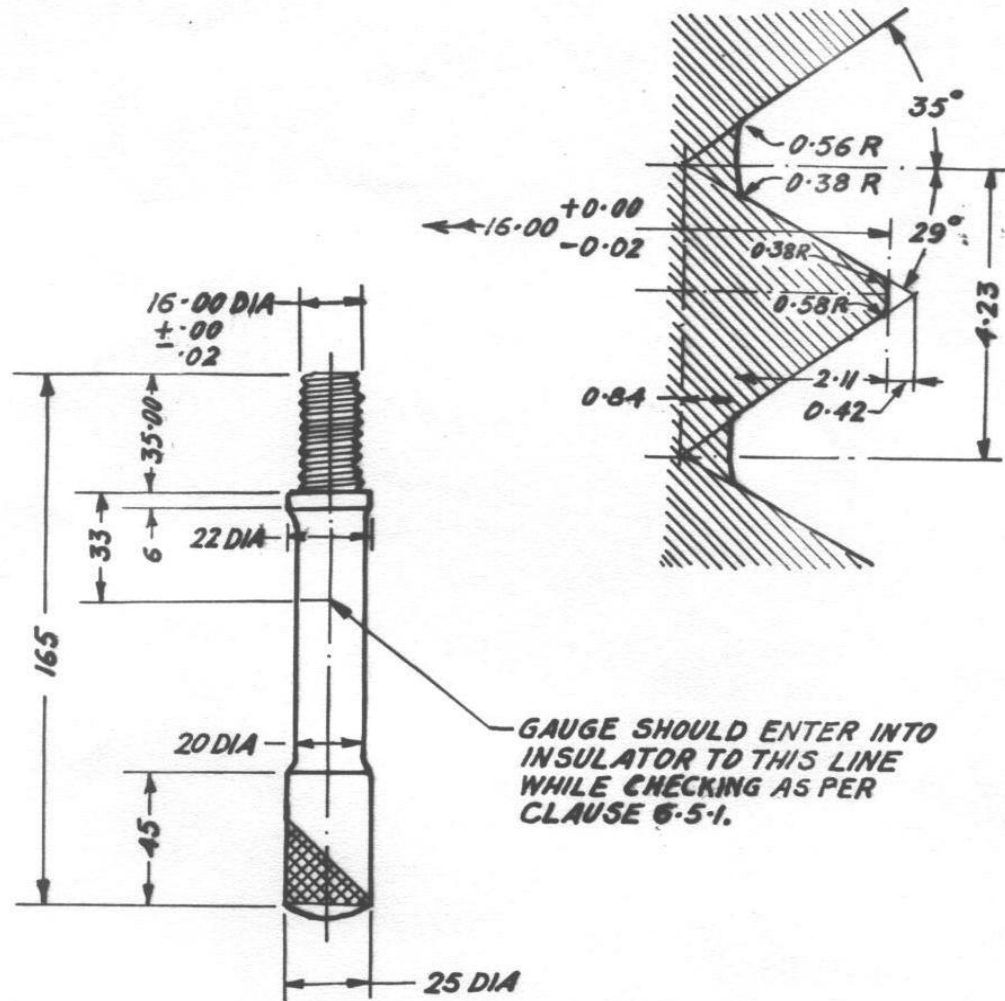
4. MANUFACTURERS NAME AND YEAR MANUFACTURER'S MARK TO BE INCORPORATED SUITABLY.
3. SUITABLE DRAFT MAY BE PROVIDED WITHIN TOLERANCES ALLOWED.
2. ALL DIMENSIONS SHALL BE WITHIN ± 0.5 UP TO 40 MM & ± 1.0 BEYOND 40 MM UNLESS OTHERWISE SPECIFIED.
1. ALL DIMENSIONS ARE IN MILLIMETRES.



BOTTOM VIEW

FIG. 1 LIGHT WEIGHT PLASTIC INSULATOR FOR TELEGRAPH & TELEPHONE OVER HEAD LINES.

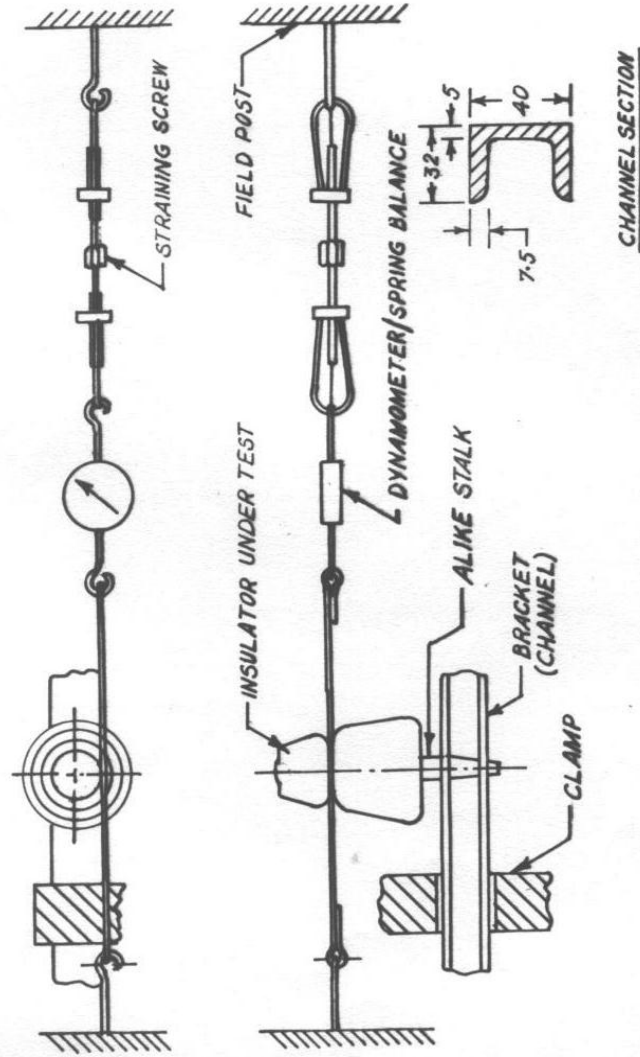
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2. ALL DIMENSIONS SHALL BE WITHIN ± 0.1 UNLESS OTHERWISE SPECIFIED.
1. ALL DIMENSIONS IN MILLIMETRES.

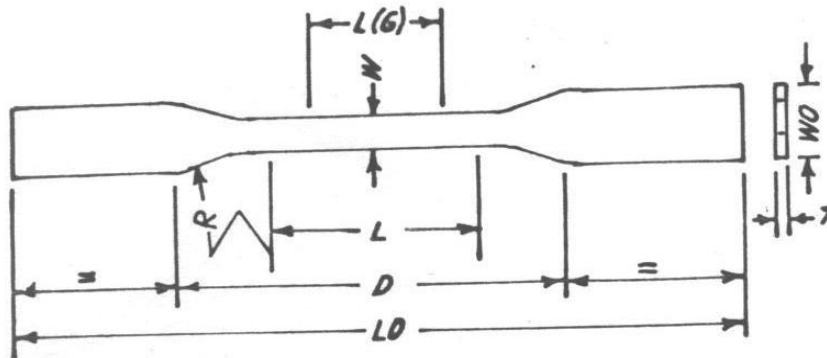
FIG.2 PROFILE OF INSULATOR THREADS

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**FIG.3 TRANSVERSE LOADING TEST
ARRANGEMENT FOR INSULATOR**

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DIMENSIONS FOR TEST SPECIMEN

DESIGNATION	DIMENSIONS	TOLERANCE
W-WIDTH OF NARROW SECTION	10	± 0.5
L-LENGTH OF NARROW SECTION	60	± 1.5
L(G)-GAUGE LENGTH	50	± 0.5
W ₀ -WIDTH OVERALL	20	± 0.5
L ₀ -LENGTH OVERALL	200(MIN)	
D-DISTANCE BETWEEN GRIPS	115	± 0.5
R-RADIUS OF FILLET	60	± 0.5
T-THICKNESS	3.5	± 0.5

4. THE SPECIMEN SHALL BE FREE OF DRAFT OR FIN.
3. SPEED OF TESTING SHALL BE 5MM/MIN.
2. MIN. AREA OF CROSS SECTION WITHIN GAUGE LENGTH SHALL BE ADOPTED FOR CALCULATION OF TENSILE STRENGTH.
1. ALL DIMENSIONS IN MILLIMETRES.

**FIG. 4 SPECIMEN FOR TENSILE STRENGTH
AND
PERCENTAGE ELONGATION TESTS**