

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

**INDIAN RAILWAY
STANDARD SPECIFICATION
FOR
GLASS FILLED NYLON-66 INSULATING LINERS
SERIAL NO. T - 44 - 2020
(First Revision)**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW – 226 011**

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**Government of India
Ministry of Railways
(Railway Board)**

INDIAN RAILWAY STANDARDS SPECIFICATION

FOR

Glass filled Nylon-66 Insulating liners

S. No. T- 44 -2020

0. FOREWORD

- 0.1 This specification was originally issued in 1980. In its first revision in 1987, the tensile and cross-breaking strength values were revised.
- 0.2 In the second revision of the provisional specification issued in 1993, the acceptance tests earlier required to be conducted on “as moulded specimens” were specified to be conducted on liners after the conditioning, except that the cross-breaking load test shall be done on “as moulded” liners.
- 0.3 For deciding whether a particular requirement of this standard is complied with, the final value observed or calculated expressing the results of a test or analysis, shall be rounded off in accordance with IS 2. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
- 0.4 The IRS Specification (provisional)-1993 second revision was discussed in the 66th Track Standards committee meeting and as approved by the Railway Board, the specification has been issued under the fixed serial No.T-44-1995 with minor modification in clause 4.2.2 in the present form.
- 0.5 To improve the quality and serviceability, corrigendum no. 01 to 06 were issued in 2007, 2009, 2010, 2013, 2016 & 2018 respectively.
- 0.6 This specification has now been revised and issued in 2020 to cover the entire Corrigendums issued to this specification till date and updating the latest revision of relevant codes.

1. SCOPE

This specification covers the requirements, method of tests and sampling for Glass filled Nylon-66 insulating liners interposed between the rail and the Elastic Rail Clips in rail fastening assembly mainly to provide electrical insulation.

All the provisions contained RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (titled "*vendor-changes in approved status*") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

2. TERMINOLOGY

- 2.1 **GFN-66:** It is glass filled nylon-66
- 2.2 **As moulded specimen:** It is defined as that specimen which upon immediate removal from the mould is sealed in container impermeable to moisture/water vapour.
- 2.3 **Dry weight:** It refers to the weight of the as moulded specimen
- 2.4 **Conditioning:** It is the process which consists in keeping the liners immersed in boiling water for a period sufficient for the liner to absorb specified percentage of water.
- 2.5 **Type tests:** These refer to the tests given in Table-1 of this specification to be conducted on moulded test specimen to assess the moulding capability/process control of a firm for quality assurance.
- 2.6 **Pre-acceptance tests:** These refer to the tests which are required to be conducted on the test specimen before according clearance to the firm for bulk production of liners.
- 2.7 **Acceptance tests:** These refer to the tests conducted on the liners for purpose of acceptance/rejection of the liners during inspection.

3. REFERENCE DOCUMENTS:

- 3.1 This standard refers to the following/BS/IS/ASTM specifications. These should be available at the manufacturers work for reference.

S. No.	Standard	Title
1.	IS:5762-1970, Reaffirmed 2020	Method for Determination of Melting Point and Melting Range.
2	BS EN ISO 1183-1:2019	Plastics- Method for determining the density of non cellular plastic
3	BS ISO 14309:2019	Rubber, Vulcanized or thermoplastic-

		Determination of volume and/or surface resistivity
4	IS:1998-1962 (Reaffirmed 2018)	Method of test for thermosetting synthetic resin bonded laminated sheets.
5	(ASTM D785 – 08(2015))	Standard test method for Rockwell hardness of plastics and electrical insulating materials.
6	ASTM-D-638-14	Standard test method for tensile properties of plastics.
7	ASTM-D-149-20	Standard test method for dielectric breakdown voltage and dielectric strength of solid electrical insulating materials at commercial power frequency.
8	IS: 2-1960 (Reaffirmed 2016)	Rules for rounding off numerical values.
9	IS:7151-91	Corrugated fiberboard boxes for para-dropping of supplies – specification

- 3.2 The specific provision in this standard will over-ride these in the above specification where these are not in conformity with one another. Any specific requirement given in the drawing of the liner will over-ride the relevant provision of this standard specification.
- 3.3 RDSO drawings relevant to the liner under production should be available for reference at the manufacturer's works.

4 MANUFACTURE

4.1 Material

- 4.1.1 The material used for manufacture of insulating liners shall be glass filled nylon 66 (GFN-66) Moulding Nylon Granules of natural colours with about 33% glass filler equipped with UV resistant properties which should be clearly indicated in the raw material certificate. Addition of any colourants during moulding of liners is not permitted and the reconstituted or recovered material shall not be used for the manufacture of liners.

4.1.2 The physical properties of GFN-66 material used for the manufacture of nylon mouldings shall conform to the requirements given against. No. 1,2,3 of Table 1. Other properties as given in Table 1 refer to the as moulded test specimen of GFN-66 material.

TABLE-1

S. No	Property	Units	Values	Test method
1.	Melting point	°C	258-268	IS:5762-1970
2.	Specific gravity	-	1.38-1.43	BS EN ISO 1183-1:2019
3	Glass filler	%	33±2	Appendix III
4	Hardness Rockwell	R	110(min)	ASTM D-785-08(2015)
5	Tensile strength	Kg/mm ²	17.5(min)	ASTM D-638-14
6	Elongation at break	%	10 (max)	-do-
7	Cross-breaking strength	Kg/mm ²	20.0(min)	IS:1998-1962 (Reaffirmed 2018)
8	Dielectric strength	KV/mm	11(min)	ASTM D-149-20
9.	Volume resistivity	Ohm. Cm	10 ⁸ (min)	BS ISO 14309:2019

4.1.3 The conformity of physical properties of raw material to clause 4.1.2, either procured from sources who have been in the business of manufacturing & supplying 'Glass-Filled Nylon 66 (GFN-66) Moulding Granules' or from other sources shall be checked through outside independent agencies i.e. Government laboratory or from lab accredited by Accreditation agency as per extant guideline issued by RDSO or National test House or Regional Test Centre (RTC).

For this purpose, raw material & samples (specifically prepared & sealed in the presence of RDSO officials) shall be sent to such labs / agencies for testing at firm's cost at a frequency of once in three years and /or in the event of change of raw material procurement source.

The test report of such samples shall be directly sent to RDSO by such labs agencies. After receipt of satisfactory report, raw material shall be permitted for use. Responsibility of using the passed raw material for manufacture of liners shall lie on the firm.

The records of raw material procurement, whatever the case may be, shall be maintained along with its consumption details and furnished to RDSO/ Railway Officials as and when required by them. The responsibility of ensuring authenticity of all such records shall lie on the firm.

4.2 MANUFACTURING PROCESS

- 4.2.1 The glass filled nylon-66 liners shall be manufactured by automatic screw type injection moulding machine.
- 4.2.2 The liner shall be conditioned by immersing in boiling water for adequate time to ensure minimum 3% absorption of water as provided in para 7.7 (iii)
- 4.2.3 **Marking:** Each nylon moulding shall be legibly embossed in ohm letters and figures with manufacturer's initials, last two digits of year of manufacture and part number as shown in RDSO drawing.
- 4.2.4 **Freedom From Defects:** The surface of the nylon liners shall be smooth, sound and free from moulding defects such as bubbles, splash marks, burn marks, voids, surface sinking, crazing and blistering of the surface, windows, weld lines, laminations, jotting and cracks. All edges shall be neatly finished and free from flash.

5 PRE ACCEPTANCE TESTS:

- 5.1 **Type tests:** These tests shall be conducted on 'as moulded test specimen' as per scheme of testing given in Appendix I. The results of testing shall conform to the values given in Table 1.
- 5.2 **Product testing:**
 - 5.2.1 All tests shall be conducted on conditioned liners for the properties and scheme of testing as given in Appendix 1(B). The results of the tests shall conform to the requirements of clause 7.
 - 5.2.2 The cross breaking load test shall be conducted as per method of test given in Appendix II. Each test value shall conform to the requirement of test value given in Appendix II.
 - 5.2.3 The dimensions shall be checked by means of inspection gauges, as per RDSO drawings.

6 ACCEPTANCE TESTS

All tests given under Clause 7 shall be conducted on conditioned liners. For water absorption test 10 nos. of 'as-moulded' liners from each lot or part thereof produced from all cavities used for production shall be preserved by the manufacturer for determination of dry weight of the liners.

6.1 **Lot size:** For purpose of inspection of the liners, 10,000 nos. of liners or part thereof duly conditioned shall form a lot.

6.2 **Sample size:** The sample size for tests shall be as given in each test. The samples for different tests shall be drawn at random from each lot.

7. TESTS

Tests as given clause 7.1 to 7.4 shall be conducted on any three of the five sample liners as drawn for internal cavity test under clause 7.5

7.1 Melting point

Three sample liners per lot shall be checked for melting point of the material of the liners. For acceptance of the lot, each individual sample shall pass the requirement of the test value given in Table-1 when tested in accordance with the relevant standard given in Table-1.

7.2 Specific gravity

Three sample liners per lot shall be checked for specific gravity of the material of the liners. Specimen for specific gravity shall be taken from middle portion of the liners. For acceptance of lot, each individual sample shall pass the requirement of the test value given in Table-1, when tested in accordance with the relevant standard given in Table-1.

7.3 Glass filler

Three sample liners per lot shall be checked for glass filler (percent) of the material of the liners. For acceptance of the lot, each individual sample shall pass the requirement of test value given in Table-1 when tested and calculated in accordance with the method given in Appendix III.

7.4 Hardness Test (Method of testing as per ASTM D-785-08 (2015))

Three tests sample liners per lot shall be checked for hardness (Rockwell) of the liners at three different locations on the surface of the liners. For acceptance of the lot each individual value on the three sample liners shall not be less than 100 Rockwell.

7.5 **Internal cavity test:**

Five sample liners per lot shall be checked for internal cavities. On sectioning along “y-y” shown in the PLAN of the liner in fig.1, no sample liner shall reveal any internal cavities when examined visually or with the help of a magnifying glass, for acceptance of the lot.

7.6 **Dimensional check:**

7.6.1

(i) Dimensional checking shall be done with approved inspection gauges as per RDSO drawings. For acceptance, each sample liner should pass the requirement of the gauges. Sampling shall be done as per 7.6.1 (ii).

(ii) **Sampling:**

(a) 2% liners per lot shall be checked for dimensions in the first 1,00,000 liners of one design manufactured by a firm.

(b) 0.5% liners per lot shall be checked for dimensions consequent to 1,00,000 liners of one design being found satisfactory. In case, any lot is rejected for dimensions, 2% liners per lot shall be checked from next lot onwards till 1,00,000 liners (in one or more lots) are found satisfactory, and thereafter the sampling rate shall be 0.5% per lot again.

7.7 **Percent water absorption test:**

(i) Three sets, each set consisting of 10 liners, shall form the sample for this test. Average weight of each set shall be considered individually as weight of liner after conditioning.

(ii) For calculation of percent water absorption of liners, the dry weight of liners shall be the average weight of 10 liners, as in para 6 and retained by the manufacturer before conditioning.

(iii) For acceptance of the lot, the percent water absorption for the three sets considered individually shall not be less than 3% when calculated in the manner given in Appendix IV.

7.8 **Cross- breaking load test:** Three samples of liners per lot shall be tested and accepted as explained in clause 5.2.2 above.

8. **RE-TEST**

8.1 Should any of the test specimen fail in either melting point or specific gravity or Glass filler percent, no re-testing shall be undertaken.

- 8.2 Should only one test sample fail in Hardness for internal cavity or cross breaking load, twice the number of samples drawn earlier for testing, shall be tested for that particular test in which the earlier sampled failed. In this re-testing all the samples should pass the test value for acceptance of the lot represented by these samples.
- 8.3 Should any one test sample fail in dimensions the manufacturer may re-offer the liners lot wise after sorting out the defectives. The re-offered lot shall be inspected for all tests in terms of acceptance test clause 7.
- 8.4 Should the liners fail in percent water absorption, the liners may be re-conditioned and re-offered for inspection. The re-offered lot shall be inspected for all tests in terms of acceptance test clause 7.

9. FINAL INSPECTION/TESTING AND DOCUMENTATION

The manufacturer shall carry out the final inspection and testing internally in accordance with the plan of testing given under the acceptance test clause and shall maintain the records as per Appendix V to Appendix VII, to ensure that the liners have passed the inspection criteria.

10. PACKING

- 10.1 The liner shall be packed in multiple of 100 nos., in polybags / gunny bags so as to avoid loss or damage during transit and 3 to 5 nos. of these polybags / gunny bags shall be put in sturdy corrugated box as per IS:7151-91 and sealed.
- 10.2 For transportation by road, the sealed cartons containing the liners shall be transported in a vehicle exclusively for the liners and no other consignments shall be loaded with the liners in the same vehicle.

11. TEST FACILITIES

The liner manufacturer shall be required to install all the necessary test facilities for inspection of liners in a separate well lit, clean and properly ventilated laboratory room provided with easily maintainable floor and platform.

12. INSPECTION GAUGES

The inspection gauges for dimensional check shall conform to RDSO drawings. The manufacturer shall submit two sets of inspection gauges for the approval of inspecting authority. One set shall be used as 'Master gauge' and shall be preserved safely by the liner manufacturer. The second set shall be for use by

the inspecting official. For internal quality control, the firm should use an additional set of gauges as per drawing.

13. DISPOSAL OF REJECTED LINERS

The rejected liners shall be cut into pieces and made un-usable.

14. REPORT

The inspection official shall report the test observations in the format of Appendix V to VII.

15. GENERAL

15.1 The liner manufacturer shall furnish at his cost, the liners required for all tests and shall provide necessary manpower and facilities for carrying out tests at his cost.

15.2 Purchaser/inspecting officer or his representative shall have free access to the works of the manufacturer at all reasonable times and shall be at liberty to inspect the manufacture at any stage and to call for records, pertaining to manufacture which shall be made available to him within reasonable time.

15.3 Type tests may be repeated at any stage during currency of the contract, at the discretion of the inspecting authority.

15.4 The material shall be offered for inspection as per call letter given in appendix VIII.

SCHEME OF TESTING FOR ACCEPTANCE TESTS

(A) TYPE TESTS

S. No.	Property	No. of samples to be tested	Criteria value for acceptance/rejection	No. of samples to be drawn
1	Tensile strength	5	Individual	7
2	Elongation at break	5	Individual	-
3	Cross breaking strength	5	Average	7
4	Di-electric strength	3	Individual	3
5	Volume resistivity	3	-do-	3
6	Hardness	3	-do-	3
7	Melting point	3	-do-	-
8	Specific gravity	3	-do-	-
9	Glass filler	3	-do-	-

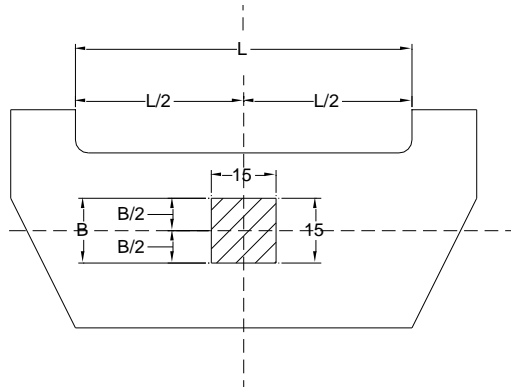
- Note: (i) Tests at S.No.7, 8 & 9 shall be conducted on broken pieces after the tensile test.
- (ii) Tensile strength and Elongation at break tests shall be conducted at speed of 5mm per minute.
- (iii) Tensile strength & Elongation at break tests shall be done on the same samples.
- (iv) Samples shall be signed by the firm's representative & the inspecting official drawing the samples.
- (v) For tests at S.No.1 & 3, two extra samples have been shown to be drawn. These shall be used for setting the test equipment before final testing.

(B) PRODUCT TESTING

S. No.	Property	No. of samples to be tested	Criteria value for acceptance/rejection	No. of samples to be drawn
1	Cross-breaking load	10	Individual	12
2	Melting point	3	-do-	
3	Specific gravity	3	-do-	
4	Glass filler	3	-do-	
5	% water absorption	8	Average	8
6	Hardness	3	Individual	3
7	Internal cavity test	3	-do-	3
8	Dimensions	8	-do-	8

- Note:
- (i) Tests at S. No. 2, 3, 4 shall be done on cut pieces of samples after internal cavity test (S. No. 7)
 - (ii) Test at S. No. 5 shall be done as per Appendix IV.
 - (iii) % water absorption test shall be ensured at firm's premises by the sample drawing authority before collection of samples.
 - (iv) Samples shall be signed by the firm's representative and the inspecting official drawing the samples.
 - (v) For cross-breaking load test, 2 extra samples have been shown to be drawn. These shall be used for setting the test equipment before final testing.
 - (vi) Test piece for specific gravity shall be taken from middle portion of the liner.

“Test piece for specific gravity shall be taken from middle portion of liner as shown in the sketch”



TEST FOR CROSS BREAKING LOAD OF LINER

1. METHOD

1.1 The test shall be carried out as per IS:1998 with the following changes:

- i) The liner will be tested in a manner as shown in Fig.1
- ii) The radius of support points and of loading point shall be 1.5 mm.
- iii) The distance between the support points, rate of traverse of jaws of the testing machine and the acceptable value of cross-breaking load shall be as given in the table below:

S.No	Drawing No	Distance between support points(x)	Rate traverse of jaws	Cross breaking load (min)
1.	RDSO/T-2505	45mm	50mm/mt	360kg
2.	RDSO/T-3516	45mm	50 mm/mt	420kg
3	RDSO/T-3702	60mm	5 mm/mt	480kg
4	RDSO/T-3706	60mm	5 mm/mt	390kg
5	RDSO/T-3707	60mm	5 mm/mt	720kg
6	RDSO/T-3708	60mm	5 mm/mt	960kg
7	RDSO/T-3723	45mm	5 mm/mt	600kg

B. CLEAR-PERCENT

1. METHOD

1.1. Take a crucible and heat it by keeping in a muffle furnace till a constant weight is obtained of the crucible. Let its weight be = W_C

1.2 Take approximately 2 gm of the specimen of the GFN-66 liner in the above crucible and find the weight of the crucible and specimen as above.

Lot combined weight = W_{CGN}

1.3 Then burn the nylon of the specimen by keeping the crucible in the muffle furnace till shining glass is noticed. Allow it to cool to the room temperature.

1.4 Then weigh the above crucible and glass after cooling. Let its combined weight be = W_{CG}

2 GLASS FILLER % CALCULATION

2.1 Find out weight of GFN-66 specimen as:

$$W_{GN} = W_{CGN} - W_C$$

2.2 Find out weight of Glass filler as:

$$W_G = W_{CG} - W_C$$

2.3 Therefore, weight of Glass filler % = $\frac{W_G}{W_{GN}} \times 100$

**PERCENT WATER ABSORPTION
(CONDITIONING)**

1. PROCESS:

- 1.1 The GFN-66 liners shall be immersed in boiling water in a water tank for 20 hours or as necessary after which the amount of water absorbed shall be checked.
- 1.2 The amount of water absorption may be checked by taking the weight (W_b) of 10 liners before and (W_a) after immersion in boiling water.
- 1.3 Water absorption %
$$= \frac{W_a - W_b}{W_b} \times 100$$

**Appendix-V
(IRS-T-44-2020)**

Name of the firm:
M/s

TEST RESULTS
OF:

- (1) Internal cavity
- (2) Cross breaking load
- (3) Water absorption

- (1) Liner to drg. No.
- (2) Qty on order
- (3)Railway's P.O. No

Internal cavity test				Cross breaking load test		Water absorption test	
Lot No	Qty. in Nos.	Sample No	Free from internal cavity yes/No	Sample No.	Cross breaking (Load) (kg)	Sample No	% water absorption
1	10000	1		1		1	
		2		2		2	
		3		3		3	
		4					
		5					
2	10000	1		1		1	
		2		2		2	
		3		3		3	
& so on		4					
		5					

**Appendix-VI
(IRS-T-44-2020)**

Name of the firm:

M/s

- TEST RESULTS OF
- (1) Melting point
 - (2) Specific gravity
 - (3) Glass filler &
 - (4) Hardness

- (1) Liner to drg. No.
- (2) Qty. on order
- (3)Railway's P.O. No

Lot No	Qty. in nos.	Sample No.	Melting point 258-268°C	Specific gravity 1.38-1.43	Glass filler 31-35%	Hardness 100R (min)
1	10,000	1				
		2				
		3				
2	5,000	1				
		2				
		3				

**Appendix-VII
(IRS-T-44-2020)**

Name of the firms:

M/s

TEST RESULTS OF:

DIMENSIONS

- (1) Liner to drg. No.
- (2) Qty. on order:
- (3) ...Railway's P.O. No.

Lot No	Qty in nos.	Sample size	Dimensions	
			As per gauges to drg. No	Failing in dimension
1	10,000	50	Satisfactory	-

Letter of offer from the firm

(Address of inspecting agency)

Sub: Call letter for inspection of GFN-66 insulating liner to drg. No. RDSO/T..

Ref: ...Railway P.O. No..... dt..... for GFN-66 liner to drg. No. RDSO/T...

GFN-66 insulating liners as per following details are offered for inspection in terms of the above referred purchase order. These have been internally checked and found satisfactory as per drawing no. RDSO/T.... and relevant IRS specification.

The test results are mentioned in the proforma as prescribed in the IRS specification.

1. Lot No.
2. Quantity on order
 - (a) Against original order
 - (b) Against extension
3. Quantity previously inspected and passed
4. Quantity now offered for inspection
 - (a) Against original order
 - (b) Against extension
5. Rate per liner
6. Marking on liner
7. Delivery period
 - (a) Original
 - (b) Extended
 - (c) Letter No. (for extension)
8. Consignee
9. Consignee letter of authority No.
10. Packing
11. Test certificate of raw material

Thanking you,

Yours faithfully,

(Signature with date of the firm's authorized person)

Name:

Status in the firm