IS : 10733 - 1983
(Reaffirmed 1996)

Indian Standard

SPECIFICATION FOR ELECTRICALLY BONDED ROAD AND RAIL TANKER HOSE OF RUBBER, RESISTANT TO PETROLEUM PRODUCTS

UDC 625·245·62.621·643.3 [678·4·029·5] :620·193-471-2

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 1984

Gr 3

Indian Standard

SPECIFICATION FOR ELECTRICALLY BONDED ROAD AND RAIL TANKER HOSE OF RUBBER, RESISTANT TO PETROLEUM PRODUCTS

Rubber Products Sectional Committee, PCDC 13

Chairman	*Representing*
DR D. BANERJEE	Escon Consultants Pvt Ltd, Calcutta
Members	
SHRI M. L. BAHRANI	Ministry of Defence (R & D)
SHRI K. D. CHAUDHARY (*Alternate*)	
DR P. S. BHARGAVA	Alkali & Chemicals Corporation of India Ltd, Rishra
SHRI N. C. SAMAIDAR (*Alternate*)	
SHRI A. T. BASAK	Directorate General of Supplies and Disposals, New Delhi
SHRI A. K. BOSE	Directorate General of Technical Development, New Delhi
SHRI R. N. P. DUBEY (*Alternate*)	
DR S. N. CHAKRAVARTY	Modi Rubber Ltd, Modipuram
SHRI L. K. MATHUR (*Alternate*)	
SHRI W. G. DESAI	All India Rubber Industries Association, Bombay
SHRI P. SRIDHARAN (*Alternate*)	
SHRI O. P. DHAMIJA	Export Inspection Council of India, Calcutta
SHRI P. K. CHATTERJEE (*Alternate*)	
SHRI B. DUTTA	Bengal Waterproof Ltd, Calcutta
SHRI S. B. GANGULI	Dunlop India Ltd, Calcutta
SHRI T. V. RAMACHANDRAN (*Alternate*)	
SHRI A. GEORGE JOHN	Madras Rubber Factory Ltd, Madras
SHRI K. J. ABRAHAM (*Alternate*)	
SHRI A. GHOSH	National Test House, Calcutta
SHRI R. C. JHINGAN	Indian Oil Corporation Ltd, Bombay
SHRI M. K. JAIN (*Alternate*)	
JOINT DIRECTOR (RUBBER)	Research, Designs and Standards Organization, Lucknow
DEPUTY DIRECTOR (STAT) (MP) (*Alternate*)	
SHRI LALIT MOHAN JAMNADAS	Cosmos India Rubber Works Pvt Ltd, Bombay
SHRI PULIN L. KINARIWALA (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI S. V. LATHIA	Lathia Rubber Manufacturing Co Pvt Ltd, Bombay
SHRI Y. S. LATHIA (*Alternate*)	
SHRI S. K. MAHESHWARI	Indian Petrochemicals Corporation Ltd, Vadodara
SHRI R. S. PATEL (*Alternate*)	
DR R. N. MEHROTRA	Synthetics and Chemicals Ltd, Bombay
DR B. SURYANARAYANAN (*Alternate*)	
DR W. MILLNS	Indian Rubber Manufacturer's Research Association, Thanu
SHRI N. NAGARAJAN	Sundram Industries Pvt Ltd, Madurai
SHRI P. VIJAYARAGHAVAN (*Alternate*)	
SHRI S. C. NANDY	Bata India Ltd, Calcutta
SHRI SUNIL SARKAR (*Alternate*)	
SHRI R. R. PANDIT	Bayer (India) Ltd, Bombay
HRI D. J. BHARUCHA (*Alternate*)	
SHRI K. S. RADHAKRISHNAN	National Rubber Manufacturing Ltd, Calcutta
SHRI R. P. MATHUR (*Alternate*)	
SHRI B. C. SEN	Ministry of Defence (R & D)
SHRI V. BHATTACHARYA (*Alternate*)	
SHRI E. V. THOMAS	The Rubber Research Institute of India, Kottayam
DR M. G. KUMARAN (*Alternate*)	
SHRI M. S. SAXENA, Director (P & C)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI T. R. RAJAGOPALAN
Deputy Director (P & C), ISI

Hoses Subcommittee, PCDC 13 : 3

Convener

HRI LALIT MOHAN JAMNADAS	Cosmos India Rubber Works Pvt Ltd, Bombay

Members

SHRI S. G. JAMBHEKAR (*Alternate* to Shri Lalit Mohon Jamnadas)	
SHRI S. N. AGGARWAL	Directorate General of Technical Development, New Delhi
DR V. R. B. MATHUR (*Alternate*)	
SHRI A. K. BANDYOPADHAYA	Ministry of Defence (DGI)
SHRI V. BHATTACHARYA (*Alternate*)	
DR S. N. BANERJEE	Ministry of Agriculture and Irrigation
SHRI B. K. VERMA (*Alternate*)	
SHRI N. R. CHOUDHARI	Super Seals (India) Pvt Ltd, Faridabad
SHRI C. P. BHATIA (*Alternate*)	
SHRI O. P. DHAMIJA	Export Inspection Council of India, Calcutta
SHRI P. K. CHATTERJEE (*Alternate*)	
SHRI A. GHOSH	National Test House, Calcutta

(*Continued on page* 12)

Indian Standard

SPECIFICATION FOR ELECTRICALLY BONDED ROAD AND RAIL TANKER HOSE OF RUBBER, RESISTANT TO PETROLEUM PRODUCTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 November 1983, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 The hose is primarily intended for loading and off-loading of road and rail tanker vehicles carrying petroleum and blended products having an aromatic hydrocarbon content of approximately 25 percent (maximum).

0.3 This standard covers 3 types of hoses. Type 1 and Type 2 hoses are designed for road and rail tanker services as dry hoses which are drained after each period of service. Type 3 is a smooth bore reeling hose without helical wire reinforcement. For continuous service and/or for products having higher aromatic content, the manufacturer should be consulted.

0.4 Tests under **4.4, 4.5, 4.7** and **4.8** may be carried out on press cured test slabs made from the same mix and vulcanized to the same degree or state of cure as that of the finished hose.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements, methods of sampling and test for electrically bonded road and rail tanker hose of rubber, resistant

*Rules for rounding off numerical values (*revised*).

to petroleum products having maximum 25 percent aromatic hydrocarbon content, and suitable for −26°C to 65°C working temperature range.

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 7503 (Part 1)-1974* and IS : 443-1975† shall apply.

3. TYPES

3.1 This standard covers following three types of hoses:

Type 1A Rough bore hose, with internal and external helical wire reinforcement, corrugated outer cover and for a working pressure of 0·35 MN/m².

Type 1B Smooth bore hose, with embedded helical wire reinforcement plain or corrugated outer cover and for a working pressure of 0·35 MN/m².

Type 2A Rough bore hose, similar to type 1A but for a working pressure of 0·7 MN/m².

Type 2B Smooth bore hose, similar to type 1B but for a working pressure of 0·7 MN/m².

Type 3 Smooth bore reeling hose without helical wire reinforcement for a working pressure of 0·7 MN/m². (1MN/m² =10·2 kgf/cm² approximately).

4. REQUIREMENTS

4.1 Materials

4.1.1 *Lining* — The lining shall consist of a suitable rubber compound resistant to petroleum products, uniform in thickness, concentric and free from air blisters, porosity and splits. It shall be seamless up to nominal bore size 75·0 mm. Above 75·0 bore size lining may be formed by using rubber sheet in such a way that at any point, the thickness of lining shall not be less than that specified in **4.3.4.**

4.1.2 *Reinforcement* — The reinforcement shall be of either woven textile or braided textile consisting of natural or synthetic fibre or combination thereof. In case of woven textile reinforcement, it shall be well

*Glossary of terms used in rubber industry, Part 1.
†Methods of sampling and test for rubber hoses (*second revision*).

rubberized from both sides with a suitable rubber compound, applied on bias at approximately 45° angle. The finishing end of the last ply shall overlap the start of the first ply at least by 6 mm. The braided textile reinforcement shall consist of yarns with two under two over type construction. It shall be firmly and evenly braided over the lining and the braided plies shall be impregnated with suitable rubber compound.

4.1.3 *Helical Wire* — The wire used for helical reinforcement shall be galvanized steel wire.

4.1.4 *Electrical Bonding* — Low resistant electrical bonding wire shall be provided between or incorporated in the reinforcement plies and arranged in such a manner that reliable electrical continuity is maintained along the length of the hose in service and possibility of fracture of the strands is minimized. If the hose is supplied without end connections, the bonding wire shall protrude at least 40 mm at each end of the hose and shall be folded into the hose bore. Where the hose is supplied with built-in end connections, the bonding wire shall be anchored to the nipples in a manner which shall ensure reliable electrical continuity throughout the length of the hose.

4.1.5 *Cover* — The cover shall be of suitable rubber compound resistant to weather, abrasion and petroleum products. It shall be reasonably uniform in thickness, free from air blisters, porosity and splits. The cover may have a cloth marked finish and with either plain or corrugated surface as specified.

4.1.6 *End Connections* — If the hose has to be supplied with the end connections of built-in type, the flanges shall be attached to the nipples by welding or the nipples shall be threaded so as to fit the threaded flanges. The threads shall be as agreed to between the purchaser and the supplier.

4.2 Construction

4.2.1 *Types 1A and 2A* — Type 1A and type 2A hoses having rough bore, shall be constructed with materials in the following order:

a) Internal wire helix (connected to the nipples by welding or brazing, if the hose is built on type);

b) Ply of a textile reinforcement impregnated with oil resistant rubber;

c) Oil resistant rubber lining;

d) Plies of textile reinforcement impregnated with oil resistant rubber;

e) Rubber cover resistant to oil, weather and abrasion, applied in such a manner that the hose shall have a corrugated surface; and

f) External armouring wire properly secured at each end.

4.2.2 *Types 1B and 2B* — Type 1B and type 2B hoses having smooth bore shall be constructed with materials in the following order:

a) Inner lining of oil resistant rubber;

b) Ply or plies of textile reinforcement impregnated with oil resistant rubber;

c) Embedded wire helix spiralled over the nipples to a point beyond second band and finished off with at least two close turns anchored together by soldering or welding if the hose is built-in type;

d) Oil resistant rubber filler;

e) Ply or plies of textile reinforcement with oil resistant rubber; and

f) Rubber cover resistant to oil, weather and abrasion. Surface of cover shall be either plane or corrugated as agreed to between the purchaser and the supplier.

4.2.3 Type 3 hoses having no helical wire, but only electrically bonded wire and textile reinforcement shall be constructed with the materials in the following order:

a) Inner lining of oil resistant rubber;

b) Plies of textile reinforcement impregnated with oil resistant rubber and having embedded electrically bonded wire; and

c) Rubber cover resistant to oil, weather and abrasion.

4.2.4 If the hoses are to be supplied without built-in type end connections, then the hose ends shall have soft ends (without helical wire reinforcement) of approximately 125 mm length. (This length shall be included in the length of the hose.)

4.3 Dimensions and Tolerances

4.3.1 *Bore Size* — The nominal bore size of the hose when measured according to the method prescribed in **4.2.1.2** of IS : 443-1975*, shall be as given in Table 1 for all the three types of hoses.

*Methods of sampling and test for rubber hoses (*second revision*).

4.3.1.1 The dimensions of end connections shall be as agreed to between the purchaser and the supplier.

4.3.2 *Mass of the Hose* — The mass of the hose excluding the mass of end connections shall be as given in Table 1.

TABLE 1 TOLERANCE ON BORE SIZE AND MAXIMUM MASS OF HOSE

Sl No.	Nominal Bore Size	Tolerance on Bore Size for All Types	Maximum Mass per Metre of Hose for Type				
			1A	1B	2A	2B	3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	mm	mm	kg/m	kg/m	kg/m	kg/m	kg/m
i)	25	±1·25	—	—	—	—	1·28
ii)	31·5	±1·50	1·05	1·35	1·80	1·95	1·65
iii)	38	±1·50	1·35	1·65	2·10	2·40	1·88
iv)	50	±1·50	1·88	2·25	2·78	3·00	2·25
v)	63	±1·50	2·25	3·00	3·68	4·13	—
vi)	75	±2·50	3·00	3·75	5·00	5·25	—
vii)	100	±3·00	4·13	4·80	6·75	8·25	—

4.3.3 *Length* — The hoses shall be supplied in lengths as agreed to between the purchaser and the supplier. Tolerance on any hose length shall be ±1 percent.

4.3.4 *Thickness of Lining and Cover* — The thickness of lining shall not be less than 2·00 mm and that of cover shall not be less than 1·25 mm for all the three types of hoses, when measured according to the method prescribed in **4.2.2** of IS : 443-1975*.

NOTE — In case of built-in type hoses, supplier's certificate for the thickness shall be accepted.

4.4 Tensile Strength and Elongation at Break for the Lining and Cover— The tensile strength and elongation at break for the rubber used for the lining and cover of the hose, when tested according to the method prescribed in **5** of IS : 443-1975*, shall be as specified in Table 2.

4.5 Accelerated Ageing Test — After ageing at 100 ± 1°C for 72 h when tested according to the method prescribed in **6** of IS : 443-1975*, the

*Methods of sampling and test for rubber hoses (*second revision*).

TABLE 2 TENSILE STRENGTH AND ELONGATION AT BREAK FOR LINING AND COVER FOR ALL THE THREE TYPES

(*Clause* 4.4)

SL NO.	REQUIREMENT	LINING	COVER
(1)	(2)	(3)	(4)
i)	Tensile strength, MN/m^2*, *Min*	7·0	7·0
ii)	Elongation at break, percent, *Min*	250	300

*$1 MN/m^2 = 10·2 kgf/cm^2$

rubber used for the lining and cover of the hose shall not vary by more than ±25 percent for tensile strength and $^{+10}_{-45}$ percent for elongation at break of the corresponding values obtained before ageing.

4.6 Adhesion Test — For all types of hoses except those with built-in type of fittings, adhesion shall be such that the rate of separation shall not exceed 25 mm/min under a load of 4·5 kg, when tested according to the method prescribed in 7 of IS : 443-1975* for the following:

a) Between braids or plies;

b) Between lining and braid or ply; and

c) Between cover and braid or ply.

4.7 Swelling Test — Representative samples of rubber lining and cover of the hose when tested according to the method prescribed in IS : 3400 (Part 6)-1983†, immersing in a mixture of toluene and *iso*-octane in the ratio of 30 : 70 (*v/v*) for 48 hours at room temperature, the increase in volume shall be not more than 35 percent for the lining and 75 percent for the cover.

4.8 Fuel Soluble Matter — The rubber lining when tested according to the method prescribed in Appendix A, shall not have fuel soluble matter more than 5 percent.

4.9 Resistance to Vacuum — The hose shall be capable of withstanding vacuum of 500 mm of mercury without any structural or permanent damage to the hose.

4.10 Hydrostatic Pressure Tests

4.10.1 *Elongation under Working Pressure and Permanent Elongation of the Hose* — The elongation under working pressure and permanent

*Methods of sampling and test for rubber hoses (*second revision*).

†Methods of test for vulcanised rubbers: Part 6 Resistance to liquids.

elongation of hose when tested according to the method given below shall not exceed 10 percent for elongation under working pressure and 2·5 percent for permanent elongation for type 1A, type 1B and type 2A and type 2B hoses. For type 3 hose, elongation under working pressure and permanent elongation shall not exceed 5 percent and 2·5 percent, respectively.

4.10.1.1 *Procedure*

a) Lay out the hose as straight as possible;

b) Fill with water, venting to remove all air and apply a pressure of 0·07 MN/m^2;

c) Mark off a 1-metre test length clear of end connections;

d) Increase the pressure at a rate of 0·075 to 0·15 MN/m^2 per second to the designed working pressure and hold for 5 minutes;

e) Measure the distance between the two marks made during (c) and record the increase as a percentage of original test length to get elongation at working pressure; and

f) Reduce the pressure to 0·07 MN/m^2 and mea sure the distance between the two marks made during (c) again after 5 minutes. Record the increase as a percentage of original test length to get the permanent elongation.

4.10.2 *Proof Pressure and Bending and Proof Pressure Test* — The hose when subjected to internal hydraulic pressure twice the working pressure for a period of 5 minutes, shall not show any leakage or rupture. Also at this pressure when the hose is bent in a semi-circle round a drum of radius given in Table 3 and straightened, the hose shall not show any sign of failure.

TABLE 3 MINIMUM BENDING RADII FOR PROOF PRESSURE TEST

Sl No.	Nominal Bore Size	Minimum Bending Radii for Type				
		1A	1B	2A	2B	3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mm	mm	mm	mm	mm	mm
i)	25	—	—	—	—	190
ii)	31·5	130	130	190	190	230
iii)	38	155	155	230	230	280
iv)	50	205	205	305	305	360
v)	63	255	255	380	380	—
vi)	75	305	305	460	460	—
vii)	100	410	410	560	560	—

4.10.3 *Bursting Pressure Test* — When tested according to the method prescribed in **8.2** of IS : 443-1975*, the bursting pressure for type 1A, type 1B, shall be not less than 1·4 MN/m^2 and that for types 2A, 2B and type 3 shall be not less than 2·8 MN/m^2.

4.11 Electrical Bonding — Each hose shall have electrical continuity after carrying out test described in **4.10.2.**

NOTE — A suitable method of determining electrical continuity is by the use of a 4·5-V battery and 3·5 V, 0·3A test bulb. A dimly lighted bulb is sufficient to indicate satisfactory continuity.

5. PACKING AND MARKING

5.1 Packing — The hose shall be packed as agreed to between the purchaser and the supplier.

5.2 Marking — Each length of hose shall be indelibly marked at least once every 3 m with the following information:

a) The manufacturer's name or recognized trade-mark, if any;

b) Nominal diameter and type of hose; and

c) Month and year of manufacture.

5.2.1 Each length of the hose may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. SAMPLING AND CRITERIA FOR CONFORMITY

6.1 For the purpose of ascertaining the conformity of the hose in a consignment to the specification, the scale of sampling and the criteria for conformity shall be as prescribed in 3 of IS : 443-1975*.

7. TESTS

7.1 Unless otherwise agreed to between the purchaser and the supplier, all tests shall be carried out within three months of the date of receipt of material by the purchaser.

*Methods of sampling and test for rubber hoses (*second revision*).

APPENDIX A

(*Clause* 4.8)

METHOD FOR DETERMINATION OF FUEL SOLUBLE MATTER

A-1. PROCEDURE

A-1.1 Cut the sample into pieces approximately 3×3 mm and extract 5 g of the comminuted sample with 100 ml of a mixture of 30 parts by volume of pure toluene and 70 parts by volume of pure *iso*-octane in a glass flask for 96 hours at $40 \pm 1°C$, suitable precautions being taken to prevent loss by evaporation. Filter the contents, while still hot, into a hemispherical glass dish of suitable size, washing both the residue in the flask and the filter with a further quantity of the solvent mixture. Evaporate the contents of the dish on a boiling water bath and heat the residue in a ventilated air-oven for 2 hours at $150 \pm 3°C$. Carry out a blank determination on the solvent mixture and correct the result as necessary.

NOTE — If fuel soluble determination is made on a sample of lining taken from the hose, buff to remove any adhering reinforcement fabric before comminuting.

(*Continued from page* 2)

Members	*Representing*
SHRI S. G. JAMBHEKAR	All India Rubber Industries Association, Bombay
SHRI R. P. MATHUR (*Alternate*)	
SHRI R. C. JHINGAN	The Indian Oil Corporation Ltd, Bombay
SHRI P. N. A. PADMANABHAN (*Alternate*)	
JOINT DIRECTOR (RUBBER)	Ministry of Railways
ASSISTANT RESEARCH OFFICER CM-III (*Alternate*)	
SHRI R. P. MATHUR	The National Rubber Manufacturers Ltd, Calcutta
DR C. K. DAS (*Alternate*)	
SHRI V. N. MAKAR	Oriental Rubber Industries Ltd, Bombay
SHRI C. T. PATEL (*Alternate*)	
DR R. N. MEHROTRA	Synthetics and Chemicals Ltd, Bombay
DR B. SURYANARAYANAN (*Alternate*)	
SHRI M. MITRA	Escon Consultants Pvt Ltd, Calcutta
SHRI B. CHAKAVARTY (*Alternate*)	
SHRI M. M. MUBEEN	Korula Rubber Co Pvt Ltd, Bombay
SHRI N. A. KHANOLKAR (*Alternate*)	
SHRI V. D. PENDSE	Swastik Rubber Products Ltd, Pune
SHRI R. M. KHALADKAR (*Alternate*)	
SHRI B. ROY	East India Rubber Works Pvt Ltd, Calcutta
SHRI A. SEN	Dunlop India Ltd, Calcutta
SHRI S. SAHGAL (*Alternate*)	