Indian Standard

SPECIFICATION FOR RUBBER HOSE FOR OIL SUCTION AND DISCHARGE SERVICES (DOCK AND OFFSHORE OPERATIONS)

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 8 July 1976, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard covers the requirements for hoses used in dock and offshore operations. Hoses used in road and rail tankers will be covered by a separate specification.

0.3 In Appendix A are given recommendations for use, handling and storage of hoses, which if followed, would enhance the life of the hose.

0.4 This standard contains clauses **4.3.2** and **6.1** which call for agreement between the purchaser and the supplier.

0.5 In the preparation of this standard, assistance has been derived from the following publications:

ISO/R 1823-1970 Rubber hoses for oil suction and discharge. International Organization for Standardization.

BS 1435 : 1968 Specification for rubber hose, wire-reinforced, for oil suction and discharge services. British Standards Institution.

0.6 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.

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1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for oil suction and discharge hoses having smooth and

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

abrasion-resisting outer covers, for use with all grades of petroleum and blended products having an aromatic hydrocarbon content not more than 25 percent. These hoses are for use in dock and offshore operations and are suitable for use with products at temperatures from − 20°C to + 80°C.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 7503 (Part I)-1974* shall apply.

3. MAXIMUM WORKING PRESSURE

3.1 The hoses shall be manufactured for use at maximum working pressures of 0·7, 1·0 and 1·5 MN/m²†.

4. REQUIREMENTS

4.1 Material

4.1.1 *Lining and Cover*

4.1.1.1 The lining shall be made from a suitable rubber compound resistant to all grades of petroleum and blended products having an aromatic hydrocarbon content not more than 25 percent.

4.1.1.2 The cover shall be made from an oil-and weather-resistant rubber compound.

4.1.1.3 The lining and the cover shall also comply with the requirements given in Table 1.

4.1.1.4 *Accelerated ageing* — After ageing at 100 ± 1°C for a period of 72 hours according to the method prescribed in **6** of IS : 443-1975‡, the rubbers used for the lining and the cover, when tested according to the method prescribed in **5** of IS : 443-1975‡, shall not vary by more than ± 25 percent for tensile strength and $^{+\ 10}_{-\ 40}$ percent for elongation at break of the corresponding values obtained before ageing.

4.1.2 *Reinforcement* — The reinforcement shall consist of natural or man-made fibre woven fabric, or a combination of these two, and steel wire helix.

4.1.2.1 *Wire* — The wire used for the helical reinforcement shall be galvanized steel wire.

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*Glossary of terms used in rubber industry, Part I.
†1 MN/m² = 10·2 kgf/cm² approximately.
‡Methods of sampling and test for rubber hoses (*second revision*).

TABLE 1 REQUIREMENTS FOR LINING AND COVER

(*Clause* 4.1.1.3)

Sl No.	Characteristic	Requirement		Method of Test, Ref to Cl No.
		Lining	Cover	
(1)	(2)	(3)	(4)	(5)
i)	Tensile strength, MN/m^2, *Min*	7	7	5 of IS : 443-1975*
ii)	Elongation at break, percent, *Min*	250	300	5 of IS : 443-1975*
iii)	Swelling in fuel, percent by mass, *Max*	30	100	11 of IS : 443-1975*, using a mixture of toluene and *iso*octane in the ratio of 30 : 70 (*v/v*) for 48 hours at room temperature
iv)	†Fuel soluble matter, percent by mass, *Max*	3	—	Appendix B

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

†Applicable only to suction hoses used for aircraft fuels.

4.2 Dimensions

4.2.1 *Bore* — The nominal bore when measured in accordance with the method given in **4.2.1** of IS : 443-1975* shall be as given in Table 2.

TABLE 2 NOMINAL BORE OF HOSE

Sl No.	Maximum Working Pressure	Nominal Bore
(1)	(2)	(3)
	MN/m^2	mm
i)	0·7	75, 100, 150 and 200
ii)	1·0	75, 100, 150, 200, 250 and 300
iii)	1·5	150, 200, 250 and 300

4.2.2 *Length* — Hose length shall be measured from face to face of flanges, and when supplied with nipples, from end to end of nipples. For hoses up to 100 mm bore the maximum length shall be 15 metres. For hoses of bore above 100 mm but up to 200 mm the maximum length shall be 9 metres and for hoses above 200 mm bore the maximum length shall be 7·5 metres.

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

4.2.2.1 *Tolerance on Length* — The actual length of the finished hose ose as defined in **4.2.2** shall not differ from the nominal length of the hose by more than $\begin{matrix}+2\\-1\end{matrix}$ percent. For this purpose the hose shall be measured before being subjected to hydrostatic test.

4.3 End Connections

4.3.1 The hose shall have built-in nipples.

4.3.2 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.

4.3.3 The nipples shall be so constructed as to provide good anchorage for the hose ends. This shall be done by welding or brazing to them circumferential bends of the same material as the nipples. The exterior of the hose over the nipples shall taper smoothly into the body of the hose and shall be without any outside bands or clips. The length of the nipples outside the hose shall be as given in Table 3.

TABLE 3 PROJECTION OF END-CONNECTIONS

Sl No.	Nominal Bore of Hose	Projection to End of Nipple	
		Min	*Max*
	mm	mm	mm
(1)	(2)	(3)	(4)
i)	75	130	150
ii)	100	150	180
iii)	150	150	180
iv)	200	165	190
v)	250	180	200
vi)	300	180	200

4.4 Electrical Bonding — Each length of the hose shall be electrically bonded between the nipples. This shall be done by bonding the nipples to the buit-in wire. Braided copper wire with minimum 9 strends may be secured by brazing, soldering or welding one end with the embedded helical wire and the other end with the nipple. The bonding shall satisfy the requirements of **5.1.3.**

4.5 Construction

4.5.1 *Hoses Having Rough Bore* — The hoses having rough bore shall be constructed with the materials in the following order:

a) Internal wire helix connected to the nipples by welding or brazing,

b) Ply of a textile fabric impregnated with oil-resistant rubber,

c) Oil-resistant rubber lining,

d) Plies of textile fabric impregnated with oil-resistant rubber,

e) Embedded wire helix spiralled over the nipples to a point beyond a second band and finished off with at least two close turns anchored together by soldering or welding,

f) Oil-resistant rubber filler,

g) Plies of textile fabric thoroughly impregnated with oil-resistant rubber, and

h) Smooth cover resistant to ageing and abrasion.

4.5.2 *Hoses Having Smooth Bore* — The hoses having smooth bore shall be constructed with the materials in the following order:

a) Inner tube or lining of oil-resistant rubber,

b) Ply or plies of textile fabric impregnated with oil-resistant rubber,

c) Embedded wire helix spiralled over the nipples to a point beyond a second band and finished off with at least two close turns anchored together by soldering or welding,

d) Oil-resistant rubber filler,

e) One or more plies of textile fabric impregnated with oil-resistant rubber,

f) Embedded wire helix spiralled over the nipples to a point beyond a second band and finished off with at least two close turns anchored together by soldering or welding,

g) Oil-resistant rubber filler,

h) One or more plies of textile fabric impregnated with oil-resistant rubber, and

j) A smooth cover resistant to ageing and abrasion.

4.5.3 *Joining of Wires* — Constructional helical reinforcement wires may be joined by welding provided that:

a) There shall be no joint in the internal wire helix,

b) The welding of wires shall be carried out by using electrical butt welding method,

c) No weld shall be within 1·5 m of a nipple end in the hose or of another weld in the same wire, and

d) The number of welds shall not exceed one in a hose up to 6 m in length and shall not exceed two in a hose above 6 m in length 2.

4.6 Mass — The maximum mass of the hose shall be as given in Table 4.

TABLE 4 MAXIMUM MASS OF HOSE

Sl No.	Nominal Bore	Maximum Mass					
		Maximum Working Pressure 0·7 MN/m²		Maximum Working Pressure 1·0 MN/m²		Maximum Working Pressure 1·5 MN/m²	
		Rough bore	Smooth bore	Rough bore	Smooth bore	Rough bore	Smooth bore
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	mm	kg/m	kg/m	kg/m	kg/m	kg/m	kg/m
i)	75	10·0	7·5	12·0	10·0	—	—
ii)	100	15·0	11·0	18·0	14·0	—	—
iii)	150	30·0	22·5	36·0	24·0	48·0	31·5
iv)	200	45·0	28·5	51·0	36·0	63·0	43·5
v)	250	—	—	66·0	49·5	78·0	66·0
vi)	300	—	—	81·0	66·0	93·0	80·0

5. TESTS

5.1 Tests on Finished Hoses — Each hose shall be subjected to the tests given in **5.1.1** to **5.1.3**.

5.1.1 *Hydrostatic Test* — The hose shall not show any sign of failure or defect when tested as follows:

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/m².
c) Measure the overall length of the hose assembly.
d) Increase the pressure over a period of 5 minutes, from 0·07 MN/m² to half the maximum working pressure marked on the hose. Hold this pressure for 10 minutes, then reduce the pressure over a period of 5 minutes to zero.
e) Raise the pressure over a period of 5 minutes up to the maximum working pressure and hold for 10 minutes.
f) Before releasing the full test pressure, measure the overall length of the hose assembly to ascertain the temporary elongation and record the increase as percentage of the original length measured at 0·07 MN/m².
g) Reduce the pressure over a period of 5 minutes to zero.
h) After an interval of at least 15 minutes raise the pressure again to 0·07 MN/m².
j) Measure the overall length of the hose assembly to ascertain the permanent elongation and record the increase as a percentage of the original length measured at 0·07 MN/m².

5.1.2 *Elongation* — When tested in accordance with **5.1.1** the temporary elongation shall not exceed 10 percent for the hose of maximum working pressure 0·7 MN/m² and 7·5 percent for the hoses of maximum working pressures 1·0 MN/m² and 1·5 MN/m². The permanent elongation shall not exceed 2·5 percent and 1·5 percent in the above two cases respectively.

5.1.3 *Electrical Continuity* — Electrical continuity shall remain maintained between the nipples of each length of hose during and after subjection to hydrostatic test. The continuity shall be ascertained by using a 4·5-volt battery and a 4-volt, 0·3-ampere test lamp. A dimly lighted lamp is sufficient to indicate a satisfactory electric continuity.

5.2 Test on Production Sample

5.2.1 The test shall be carried out as follows:

Stage 1 — The hydrostatic test shall be carried out as given in **5.1.1.**

Stage 2 — The hose shall be bent to the appropriate radius specified in Table 5. While in bent position, the test specified in **5.1.1** (b), (d) and (e) shall be repeated.

TABLE 5 BEND RADIUS

Sl No.	Nominal Bore	Bending Radius					
		Maximum Working Pressure 0·7 MN/m²		Maximum Working Pressure 1·0 MN/m²		Maximum Working Pressure 1·5 MN/m²	
		Rough bore	Smooth bore	Rough bore	Smooth bore	Rough bore	Smooth bore
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	mm	m	m	m	m	m	m
i)	75	0·85	0·70	1·00	0·85	—	—
ii)	100	1·10	1·00	1·25	1·00	—	—
iii)	150	1·60	1·40	1·85	1·60	2·15	2·00
iv)	200	2·15	1·85	2·50	2·15	3·10	2·80
v)	250	—	—	3·10	2·70	3·70	3·40
vi)	300	—	—	3·70	3·30	4·00	4·00

Stage 3 — The hose shall then be released from the bent position and a presssure four times the maximum working pressure in case of ordinary dock and offshore hoses and five times the working pressure in case of offshore marine hoses shall be applied. This pressure shall be attained over a period of 15 minutes without failure of any kind. The pressure shall then be raised until the hose fails and the pressure at which it fails shall be recorded.

5.2.2 Unless a production sample test is specifically requested by the purchaser, the manufacturer shall supply a certificate that a production sample test on a hose representative of current manufacture of the hose in question has been carried out in accordance with this standard.

6. PACKING AND MARKING

6.1 Packing — The hoses shall be packed as agreed to between the purchaser and the supplier. However the following precautions shall be observed during packing and transportation:

a) The hoses shall be suitably wrapped in hessian over their entire length. They may be crated if desired. Flanged ends shall be protected by circular disks slightly greater than the diameter of the flange, bolted in two places diametrically opposite.

b) The hoses shall be laid straight and supported evenly on carrier. Lifting points shall be clearly marked on the package to show permitted points for handling.

c) Small-diameter hoses may be coiled and crated. Such crates shall be of suitable dimensions to ensure that the hose is not bent more than the minimum bending radius recommended. All flanged ends shall be well covered by hessian to prevent damage to other parts of the coiled hose.

6.2 Marking — Each length of the hose shall be indelibly marked adjacent to each end with:

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

b) The hose denomination, type of bore and maximum working pressure;

c) The factory test pressure; and

d) The month and year of manufacture.

6.2.1 Each length of 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.

7. SAMPLING

7.1 The sampling shall be done according to **3** of IS : 443-1975*.

7.2 For the purpose of ascertaining conformity of a lot in a consignment, each length shall be subjected to visual inspection, length measurement, and hydrostatic, elongation and electrical continuity tests. All other requirements shall be tested on production sample.

APPENDIX A

(*Clause* 0.3)

RECOMMENDATIONS FOR USE, HANDLING AND STORAGE OF HOSES

The following recommendations are useful in obtaining maximum service from the hoses. The user should, therefore, give utmost thought to these recomendations:

a) The hoses should be regularly flushed with water after use.

b) The hoses should be laid out straight on solid supports. Light-weight hoses should be laid out in such a way that they are not subject to flattening.

c) The hoses should be covered to protect them from sunlight. A cool, dark, dry storage place is preferred.

d) The oldest hose according to the month and year of manufacture should be issued first.

e) Before returning a hose to storage after use, it should be completely drained.

f) The hoses used in white oil or crude oil should be flushed to remove any potential explosive vapours and stored in such a way that air can circulate freely through them.

g) Condition of the hoses should be determined by frequent internal and external inspections and hydrostatic tests.

h) Smooth-bore hoses should be looked into the ends for irregularities in the liner. Outside cover should be checked for serious defects or permanent deformation of the hose body.

j) The hoses in service should be tested at least once every 6 months to the maximum working pressure and so kept for 5 minutes to examine the hose carefully for leaks at the nipples or anywhere else or for indication of weakness in the structure of the hose.

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

k) Test record of each hose should be kept so as to compare the same with the original test results.

m) The temporary elongation under test pressure of a hose in use should not exceed 1·5 times the temporary elongation of the new hose.

n) A hose should not be lifted from a single point with the ends hanging down. The hose should be supported at least by two slings located near the reinforced ends, and if possible, a lifting bar should be used.

p) The hoses should not be dragged over docks or decks. They should be carried on dolleis or rollers or moved by derricks.

q) A hose should not be rolled more than one revolution unless it is supported in such a way as to prevent the flanges from rolling faster than the hose and thereby twisting the body of the hose. Lightweight hose should not be twisted or kinked.

r) Sharp bends at nipples and end connections should be avoided. In use, a hose should be supported every 3 m by a belt sling. The hose should not be bent to a radius more than that recommended. When disconnecting at the end of an operation, the hose should be drained, the flange faces protected with blank flanges and care taken that the hose is not dropped on the dock or the deck. The hose should not be allowed to lie in pool of oil or other liquids which might affect the rubber compounds.

s) Reciprocating pumps should be adjusted to reduce pulsation to the minimum. Relief valves should be set not to exceed 125 percent of the pressure rating of the hose. All valves should be checked before oil is admitted to the hose and care should be taken not to shut off the valves suddenly while the fluid is flowing.

t) The hoses should be kept from chafing against the dock or any part of the ship. They should not be permitted to touch any hot surface. They should be closely watched during operation in order to avoid any undue stresses.

APPENDIX B

(*Table* 1)

DETERMINATION OF FUEL SOLUBLE MATTER

B-1. PROCEDURE

B-1.1 Cut the sample into pieces of size approximately 3 × 3 mm. Extract 5 g of these pieces 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 ± 1°C, adequate 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 that on the filter paper 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 ± 3°C. Carry out a blank determination on solvent mixture using the same volume as used in the test.

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

B-2. CALCULATION

$$\text{Fuel soluble matter, percent by mass} = \frac{M_2 - M_3}{M_1} \times 100$$

where

M_2 = mass in g of the residue left in the test with the sample,
M_3 = mass in g of the residue left in blank determination, and
M_1 = mass in g of the sample taken.

(*Continued from page* 2)

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