MATERIAL AND EQUIPMENT STANDARD

FOR

GENERAL USE HOSES

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APPENDICES:

1. SCOPE

This Standard specification gives the minimum technical requirements for hoses which is used by Iranian Oil, gas and/or petrochemical industries.

2. REFERENCES

Through this Standard the following standards are referred to. The edition of these standards that are in effect at the time of publication of this standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards that occur after the date of this standard, shall be mutually agreed upon the Company and the Vendor/Consultant.

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 3 (1973)	"Preferred Numbers-Series of Preferred Numbers"
ISO/R 36 (1985)	"Rubber, Vulcanized-Determination of Adhesion to Textile Fabric"
ISO 37(1977)	"Rubber, Vulcanized-Determination of Tensile Stress-Strain Properties"
ISO 188 (1982)	"Rubber, Vulcanized-Accelerated Aging or Heat-Resistance Tests"
ISO 1402 (1984)	"Rubber and Plastics Hoses and Hose Assemblies-Hydrostatic Testing"
ISO 1746 (1983)	"Rubber or Plastics Hoses and Tubing-Bending Tests"
ISO 6133 (1981)	"Rubber and Plastics. Analysis of Multi-Peak Traces Obtained in Determinations of Tear Strength and Adhesion Strength"
ISO 6801 (1983)	"Rubber or Plastics Hoses-Determination of Volumetric Expansion"
ISO 6808 (1984)	"Plastics Hoses for Suction and Low-Pressure Discharge-Petroleum Liquids Specification"
ISO 7326 (1989)	"Rubber and Plastics Hoses-Assessment of Ozone Resistance Under Static Conditions"
ISO 8031 (1987)	"Rubber and Plastics Hoses and Hose Assemblies-Determination of Electrical Resistance"
ISO 8033 (1985)	"Rubber and Plastics Hoses-Determination of Adhesion Between Components"

BSI (BRITISH STANDARDS INSTITUTION)

BS 903 Part A 19 (1986)	"Heat Resistance and Accelerated Aging Tests"
BS 3212 (1975 or 1983)	"Specification. Flexible Rubber Tubing and Hose for Use in LPG Vapor Phase and LPG/Air Installations"

Flexible rubber tubing and hose (Including connections where fitted and safety recommendations) for use in LPG vapor phase and LPG/air installations.

3. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard the following terms and definitions apply:

3.1 Armoured Hose

A hose with a protective covering, generally applied as a braid or helix, to minimize physical damage.

3.2 Bend Radius

Radius of the innermost arc formed by bending the hose in a single plane.

3.3 Burst Pressure

The pressure at which burst occurs.

3.4 Capped End

A formed end, integral with the hose, totally enclosing the internal components.

3.5 Collapsible Hose

A softwall hose which, when unpressurized internally, can be rolled flat on itself.

3.6 Cover

The outer material covering the reinforcement.

3.7 End Reinforcement

Extra reinforcing material applied to the end of a hose to provide additional strength or stiffness.

3.8 Hose

A flexible conduit comprising an inner lining, reinforcement and usually an outer cover.

3.9 Hose Assembly

A length of hose with a coupling attached to one or each end.

3.10 Hydrostatic Stability

The ability to resist, within limits, changes in length and/or diameter and/or twist at a specified pressure, usually the proof pressure.

3.11 Impulse

A pressure of short duration which may be cyclic, which produces sudden stress.

3.12 Insulating Layer

The rubber between plies of reinforcement.

3.13 Kinking

The distortion of a hose induced by excessively bending, leading to closure of the hose.

3.14 Knitted Hose

A hose with textile reinforcement applied in an inter-locking looped configuration.

3.15 Lay

The direction and amount of advance of a strand of reinforcing material for one complete turn along its length axis.

3.16 Lining

The innermost component of a hose.

3.17 Pitch

The distance from one point on a helix to the corresponding point on the next turn of the helix measured parallel to the axis.

3.18 Plain End

The uncapped or otherwise unprotected end of a hose.

3.19 Ply/Plies

The number of layers of reinforcing material. To be quantified in hose design.

3.20 Proof Pressure

The pressure applied during a non-destructive test held for a specified period of time to prove the integrity of the construction.

3.21 Reinforcement

The non-rubber strengthening member of a hose.

3.22 Straight End

The end of a hose, the structure and dimensions of which are identical to those of the body of the hose. It is produced by simply cutting the hose.

3.23 Tubing

A flexible polymeric conduit, without reinforcement.

3.24 Twist

The turn about the longitudinal axis of a hose when subjected to internal pressure or external torsional forces.

3.25 Warping

A deviation in the length direction of a hose, when pressurized, caused by asymmetric or faulty construction, being manifest as a curve in the hose.

3.26 Working Pressure

The maximum pressure at which a hose is designed to be serviceable.

3.27 Woven Hose

A hose in which the reinforcement has been applied by circular weaving.

3.28 Wrapped Ply Hose

A hose in which a reinforcement of woven fabric is wrapped in layers.

4. UNITS

This Standard is based on International System of Units (SI) , except where otherwise is specified.

5. SPECIFIC REQUIREMENTS FOR HOSES

5.1 General Requirements for Rubber and Plastic Hoses

5.1.1 Hoses shall be as uniform as commercially practicable in color, opacity and other physical properties. The reinforcing and flexible components of the wall shall be fused and free from visible cracks, porosity, foreign inclusions or other defects causing the hose to be unserviceable.

5.1.2 If required hoses shall be electrically bonded between couplings.

5.1.2.1 Electrical Continuity if needed as well as the other requirements shall be the responsibility of the supplier/manufacturer and shall be carried out to the satisfaction of Company.

5.1.3 Proof pressure ratio

The ratio of proof pressure to design working pressure shall be in accordance with Table 1, unless otherwise specified in data-sheet or in specific requirements of different hoses.

5.1.4 Minimum burst pressure ratio

The ratio of minimum burst pressure to design working pressure shall, be in accordance with Table 1, unless otherwise specified, in data-sheet or in specific requirements of different hoses.

TABLE 1 - PROOF AND MINIMUM BURST PRESSURES

No.	TYPE OF SERVICE (FOR GUIDANCE ONLY)	RATIO OF PROOF PRESSURE TO DESIGN WORKING PRESSURE	RATIO OF MINIMUM BURST PRESSURE TO DESIGN WORKING PRESSURE
1	Light service	1.25	2.5
2	General service	1.6	3.15
3	Irregular heavy service (shock loads) Textile and wire reinforced hoses for hydraulic use	2.0	4.0
4	For use with gaseous media	2.5	5.0
5	For use with media which at working pressure change into the gaseous state	3.15	6.3
6	For use with steam	5.0	10.0

5.1.5 All rubber hoses when tested in accordance with ISO 7326, shall show no sign of cracking.

5.1.6 Tolerances on bore diameters

5.1.6.1 Unless otherwise specified "in data sheet or in specific requirements for specified hoses" the tolerances on bore diameters for general purpose industrial use textile reinforced hoses shall conform with Table 2.

TABLE 2 - TOLERANCES ON BORE DIAMETERS FOR TEXTILE REINFORCED HOSES FOR GENERAL PURPOSE INDUSTRIAL APPLICATIONS

Values in millimeters

NOMINAL BORE DIAMETER	TOLERANCE	NOMINAL BORE DIAMETER	TOLERANCE
5	±0.5	63	±1.50
10	±0.75	100	±1.50
12.5	±0.75	125	±2.00
16	±0.75	160	±2.00
20	±0.75	200	±2.00
25	±1.25	250	±3.00
50	±1.25	315	±3.00

For nominal bore diameters in between the specified values, relevant tolerances shall be calculated from inter polation.

5.1.6.2 Unless otherwise specified "in data-sheet or in specific requirements for specified hoses" the permitted ranges for bore diameters for textile and wire reinforced hoses for hydraulic application shall conform with Table 3.

TABLE 3 - PERMITTED RANGES FOR BORE DIAMETERS OF WIRE REINFORCED HOSES FOR HYDRAULIC APPLICATIONS

Values in millimeters

NOMINAL BORE DIAMETER	HOSES OF BRAIDED AND LIGHT SPIRAL CONSTRUCTION	HOSES OF HEAVY SPIRAL CONSTRUCTION
5	4.5 to 5.4	4.5 to 5.4
10	9.3 to 10.1	9.3 to 10.1
12.5	12.3 to 13.5	12.3 to 13.7
16	15.4 to 16.7	15.7 to 16.9
20	19.8 to 21	20 to 21.2
25	25.0 to 26.4	25.4 to 27
50	49 to 51.0	49.8 to 51.5

5.1.7 Tolerance on length

5.1.7.1 Unless otherwise specified for textile reinforced hoses for general purpose industrial applications the tolerances on cut lengths shall be as shown in Table 4.

TABLE 4 - TOLERANCE ON LENGTH FOR TEXTILE REINFORCED HOSES FOR GENERAL PURPOSE INDUSTRIAL APPLICATIONS

Values in millimeters

LENGTH	TOLERANCE max.	
Up to 300	±1.5 for radiator hoses and	±3 for other uses
Over 300 to 600	±3 for radiator hoses and	±4.5 for other uses
Over 600 to 900		±6
Over 900 to 1200		±9
Over 1200 to 1800		±12
Over 1800		±1%

5.1.7.2 Unless otherwise specified textile and wire reinforced hoses for hydraulic applications shall be supplied in lengths as specified by the Company subject to a tolerance on the specified lengths of ±1%.

5.2 Requirements for Plastics Hoses

5.2.1 Textile-reinforced plastics (rubber) hoses for water

5.2.1.1 General requirements of textile-reinforced plastics hoses for water shall conform with subclause 5.1.1 and shall consist of:

a) A flexible thermoplastic lining ;
b) a reinforcing layer(s) of synthetic textile ;
c) a flexible thermoplastic cover. The color of thermoplastic cover may be different from that of the lining.

5.2.1.2 Nominal bore size shall be as required which will be selected from the following sizes 10 mm, 12.5 mm (½ inch), 16 mm, 20 mm, 25 mm,(1 inch) 50 mm (2 inch) and 100 mm(4 inch).

5.2.1.3 Cut length of hoses shall be as denoted lengths in requisition and the tolerance on cut lengths shall be as specified in Table 4.

5.2.1.4 Pressure rating

The design working pressure of the hoses shall comply with the requirements of Table 5. During and after tests, hoses shall show no evidence of leakage, cracking and abrupt distortion indicating irregularity in materials or manufacturer or other signs of failure.

TABLE 5 - PRESSURES AT STANDARD LABORATORY TEMPERATURE

MATERIAL	TYPE	DESIGN WORKING PRESSURE		PROOF PRESSURE		MINIMUM BURST PRESSURE	
		bar	(PSI)	bar	(PSI)	bar	(PSI)
Plastics	1	6	(87.0)	7.5	(108.8)	15.0	(217.6)
	2	25.0	(362.6)	50.0	(725.4)	100.0	(1450.8)

5.2.1.5 When the hose tested by the method specified in ISO 1746, using a minimum radius of curvature of five times the nominal bore size, shall show no signs of collapse.

5.2.1.6 The hose outside diameter of water suction hoses shall not show appreciable collapse, nor shall the lining show evidence of separation from the reinforcement. However, hoses with textile reinforcement without helix-wire support may show collapse of not more than 20% if tested in .vacuum.

5.2.1.7 The adhesion between the various elements shall be not less than 1, 4 kN/m compliance shall be verified according to ISO/R 36.

5.2.1.8 Marking

The packages of hoses shall be marked using a contrasting indelible ink with the following information or as specified by Company:

a) The manufacturer's name or trademark;
b) the hose type;
c) the nominal bore;

5.2.2 General purpose textile-reinforced collapsible plastic hoses for water

5.2.2.1 These hoses which are not used for fire-fighting, and irrigation, shall be applicable to a maximum temperature of 55°C. These hoses shall consist of:

a) A flexible thermoplastics lining;
b) a reinforcing layer or layers of synthetic textile applied by any suitable technique;
c) a flexible thermoplastics cover which may have a smooth or fluted finish. The color may be different from that of the lining.

The cover and the lining shall be fully gelled and shall be free from visible cracks, porosity, foreign inclusions or other defects causing the hose to be unserviceable.

5.2.2.2 Bore size and the related tolerance shall be as required, which may be selected from Table 2.

5.2.2.3 The tolerances on cut lengths shall be as specified in 5.1.7.

5.2.2.4 The hoses shall withstand the appropriate proof and minimum burst pressures specified in Table 6 compliance shall be verified by method specified in ISO 1402.

TABLE 6 - PROOF AND MINIMUM BURST PRESSURE

NOMINAL BORE mm (inch)	PRESSURE bar (PSI)		
	working	proof	minimum burst
20 (¾)	15.5 (224.8)	24.8 (359.7)	48.9 (709.2)
25 (1)	15.5 (224.8)	24.8 (359.7)	48.9 (709.2)
40	15.5 (224.8)	24.8 (359.7)	48.9 (709.2)
50 (2)	15.5 (224.8)	24.8 (359.7)	48.9 (709.2)
100 (4)	10.0 (145.0)	16.0 (232.0)	31.5 (456.9)
125 (5)	7.0 (102.0)	11.2 (162.5)	22.0 (319.0)
160	7.0 (102.0)	11.2 (162.5)	22.0 (319.0)
200 (8)	4.5 (65.3)	7.2 (104.4)	14.1 (204.5)

5.2.2.5 The adhesion between the lining and between the reinforcement, between the layers of reinforcement and between the reinforcement and the cover, shall not be less than 1.5 kN/m.

5.2.2.6 The hose shall withstand the design working pressure in laboratory temperature at bend radius of 8 times of it's nominal bore and in 0 ±2°C at bend radius of 16 times of it's nominal bore.

5.2.2.7 Hoses shall be marked in accordance with 5.2.1.8.

5.2.3 Plastic hoses for suction and low-pressure discharge petroleum liquids

5.2.3.1 This type of plastic hoses in addition to compliance with 5.1.1, shall consist of a flexible thermoplastics material which its mass should supported by a helix of polymeric material of a similar molecular structure. These hoses shall be electrically bonded between couplings and electrical continuity of hoses are considered.

5.2.3.2 Nominal bore diameters shall be as required which will be selected from the following nominal values in mm: 12.5, 16, 20, 25, 50, 100 and 125 in mm and ½, 1, 1½, 2, 2½, 3, 4 and 5 in inch..

5.2.3.3 The required tolerances for bore diameters shall be as given in Table 2.

5.2.3.4 The length shall be as specified by Company subject to 5.1.7.

5.2.3.5 In respect to the required nominal bore diameter, the pressures of hoses at 20°C shall be as given in Table 7.

TABLE 7 - REQUIRED PRESSURES AT 20°C

NOMINAL BORE mm (inch)		WORKING PRESSURE bar	(PSI)	MINIMUM BURSTING PRESSURE bar	(PSI)	NOMINAL BORE inch
12.5 (½) up to and including	25 (1)	5.5	(79.8)	28	(406.1)	½ up to and including 1
more than 25 (1) up to and including	50 (2)	4	(58.0)	20	(290.0)	1½ up to and including 2
more than 50 (2) up to and including	100 (4)	4	(58.0)	20	(290.0)	2½ up to and including 4

5.2.3.6 The hoses shall show no evidence of leakage, cracking, abrupt distortion or electrical continuity damage at 50% of minimum bursting pressure.

5.2.3.7 The tensile strength of hoses shall be at least 7 MPa and the minimum elongation at break shall be 200%.

5.2.3.8 Hoses shall not exceed the limits given in Table 8, after 48 h immersion in a liquid containing 70% (v/v) trimethylpentane and 30% (v/v) toluene at specified temperature.

TABLE 8 - FUEL RESISTANCE

PROPERTY	LIMIT
Change in tensile strength, % of original value, max.	-30
Change in elongation at break, % of original value, max.	-30
Change in volume, %	-5 to +25

5.2.3.9 Hoses shall be able to pass the tests, stated in ISO 6808.

5.2.4 Plastic hoses, hydraulic type

5.2.4.1 This kind of hoses shall be suitable for use with petroleum, water and synthetic-based hydraulic fluids within a temperature range of -40°C to +100°C. Operating temperature in excess of +100°C may reduce the life of hose but shall not cause sudden effect on hose.

5.2.4.2 The hose shall consist of a seamless thermoplastics lining resistant to hydraulic fluids, with suitable synthetic fibre reinforcement, and a thermoplastics cover resistant to hydraulic fluids and the weather.

5.2.4.3 The bore of the hoses shall meet the requirements of Table 9.

TABLE 9 - NOMINAL BORE AND TOLERANCES

NOMINAL BORE mm inch	PERMITTED RANGE	
	min.	max.
5 ($^3/_{16}$)	4.6	5.3
10 ($^3/_8$)	9.3	10.0
12.5 (½)	12.3	13.2
16 ($^5/_8$)	15.5	16.5
19	18.6	19.8
25 (1)	25.0	26.2

5.2.4.4 The length shall be as specified by Company subject to 5.1.6.2.

5.2.4.5 In respect to the required nominal bore diameter the pressure of hoses at 20°C shall be as given in Table 10.

TABLE 10 - DESIGN WORKING PRESSURE, PROOF TEST PRESSURE AND MINIMUM BURST PRESSURE

NOMINAL BORE mm (inch)	DESIGN WORKING PRESSURE		PROOF TEST PRESSURE		MINIMUM BURST PRESSURE	
	bar	(PSI)	bar	(PSI)	bar	(PSI)
5 ($^3/_{16}$)	345	(5003.9)	690	(10007.8)	1380	(20015.5)
10 ($^3/_8$)	275	(3988.6)	550	(7977.2)	1100	(15954.4)
12.5 (½)	240	(3481.0)	480	(6962.0)	960	(13923.8)
19	155	(2248.1)	310	(4496.2)	620	(8992.5)
25 (1)	138	(2001.6)	275	(3988.6)	550	(7977.9)

1 bar = 10^5 N/m² = 0.1 MPa.

5.2.4.6 The hoses shall withstand without damage a proof test pressure as shown in Table 10 maintained for a period of 1 min.

5.2.4.7 The hoses shall be able to withstand the minimum bend radius given in Table 11 with change in length not more than 3% at the design working pressure.

5.2.4.8 The hoses shall be oil, electrical, ozone and pulsating pressure resistance. Compliance with shall be checked according to ISO 3949.

5.2.5 Textile-reinforced thermoplastics hoses for compressed air application

5.2.5.1 General requirements of these hoses shall be as specified in 5.1.1.

5.2.5.2 Material and construction of these hoses shall be as specified in 5.2.1.1, plus that the cover and lining shall be fully gelled.

The adhesion between lining and reinforcement and reinforcement and cover, shall be not less than 1.5 kN/m.

The hydrostatic requirements of hoses shall be as specified in Table 11.

TABLE 11 - HYDROSTATIC REQUIREMENTS

Design working pressure	16 bar (232.1 PSI)
Proof pressure	40 bar (580.2 PSI)
Minimum burst pressure	80 bar (1160.3 PSI)

After the proof pressure application, the hoses shall show no evidence of leakage, cracking and abrupt distortion and the change in diameter and length shall not be more than ±10% and ±8% respectively.

Hoses shall be withstand the proof pressure without any crack in cover when bended as Table 12.

TABLE 12 - MINIMUM BEND RADIUS

NOMINAL BORE mm (inch)	BEND RADIUS (mm)
5 ($^{3}/_{16}$)	90
10 ($^{3}/_{8}$)	125
12.5 (½)	180
16 ($^{5}/_{8}$)	205
20 (¾)	240
25 (1)	300
—	500
50 (2)	630

5.2.5.3 Nominal bore diameters shall be as required which will usually be selected from the following nominal values:

5 ($^{3}/_{16}$), 10 ($^{3}/_{8}$), 12.5 (½), 16 ($^{5}/_{8}$), 20 (¾) 25 (1), and 50 (2) mm (inch).

5.2.5.4 Tolerance for required bore shall be as Table 2.

5.2.5.5 The length and tolerance on cut length shall be in accordance with 5.1.6.2.

5.3 Requirements for Rubber Hoses

5.3.1 Rubber hoses used in fuel delivery truck

5.3.1.1 Hoses for the delivery of fuel from delivery truck shall have helix wire reinforcement.

5.3.1.2 The nominal bore diameters will be 25, 50, and 100 mm or 1 1½, 2, 2½, 3, 4 inch. The required tolerance shall comply with Table 2.

5.3.1.3 The length of hose shall be as requisition subject to 1% tolerance.

5.3.1.4 The working pressures for required bore diameters shall comply with Table 13.

TABLE 13 - PRESSURE REQUIREMENTS

NOMINAL BORE mm (inch)	MAXIMUM WORKING PRESSURE		PROOF TEST PRESSURE		MINIMUM BURST PRESSURE	
	bar	(PSI)	bar	(PSI)	bar	(PSI)
25 (1)	9	(130.5)	18	(261.1)	36	(522.1)
40	9	(130.5)	18	(261.1)	36	(522.1)
50 (2)	7	(101.5)	14	(203.0)	28	(406.1)
63 (2½)	6.5	(94.3)	13	(188.6)	26	(377.1)
80	5	(72.5)	10	(145.0)	20	(290.1)
100 (4)	5	(72.5)	10	(145.0)	20	(290.1)

5.3.1.5 The hoses shall be able to withstand the above mentioned proof test pressure for 1 min without any considerable damage.

5.3.1.6 The diameter of the hose under the applied force given in Table 14 shall not be less than 85% of the original outside diameter and after release of the force the diameter shall return to not less than 95% of the original outside diameter.

TABLE 14 - CRUSHING FORCE

NOMINAL BORE	CRUSHING FORCE
mm (inch)	kN
25 (1)	0.9
40	1.0
50 (2)	1.1
63 (2½)	1.45
80	1.45
100 (4)	1.45

5.3.1.7 The minimum tensile strength and elongation at break shall be as given in Table 15.

TABLE 15 - TENSILE STRENGTH AND ELONGATION AT BREAK

TYPES A AND B	TENSILE STRENGTH		ELONGATION AT BREAK
	bar	(PSI)	%
Lining	70.0	(1015.2)	200
Cover	105.0	(1523.0)	200

5.3.1.8 The minimum adhesion between different layers of hose shall be 2.0 kN/m.

5.3.1.9 The cover and lining of the hose, after immersion in standard liquid contains 50%(v/v)* trimethylpentane and 50% (v/v) toluene 72 $^{+2}_{0}$ h at expected work temperature, shall comply with the requirements of Table 16.

Note:

In performing these tests care shall be taken to ensure that only the lining and cover are exposed to the liquid and that there is no possibility of seepage of oil through the cut end of the test piece.

TABLE 16 - REQUIREMENTS AFTER IMMERSION IN TEST LIQUID

	COVER	LINING
Change in tensile strength, % of original	40	40
Elongation at break, % min.	100	100
Adhesion, kN/m min.	1.2	1.2
Volume, % increase max.	100	60

*** Percentage based on the volume of material.**

5.3.2 Hoses for dispensing pumps

Hoses for dispensing pumps shall have smooth bore, and shall be resistant to petroleum products. Hoses shall have woven cotton reinforcement incorporating a double spiral wire for couplings attachment. Hoses shall be able to withstand the test pressure which is at least 20 bar. Hoses shall be equipped with gun metal couplings male full flow, threaded BSPT. Coupling shall be secured to bonding wires embedded in the hose length of at least 360 cm.

5.3.3 Rubber hoses and hose assemblies for oil burners

5.3.3.1 Construction

These hoses shall consist of either:

a) An internally smooth rubber lining and an external corrosion resisting metal braid; or
b) an internally smooth rubber lining, a reinforcement consisting of one or more layers of textile or corrosion-resistant metal braid and a rubber outer cover.

The hoses shall be fitted with permanently attached couplings.

Both the couplings and the metal braid shall be provided with suitable corrosion protection. The metals used shall not have any deleterious effects on the rubber components.

5.3.3.2 Hose assemblies for flux and reflux, but not for insertion between the oil burner pump and the atomizing connection shall be suitable for working pressure of 10 MPa (100 bar) and oil temperature of 100°C. The hoses shall have the capability for proof test pressure of 1.6 MPa (16 bar) and minimum burst pressure of 3.15 MPa (31.5 bar).

5.3.3.3 Hose assemblies for insertion between the oil burner pump and the atomizing connection shall be suitable for working pressure of 4.0 MPa (40 bar); proof test pressure of 6.4 MPa (64 bar), minimum burst pressure of 12.6 MPa (126 bar) and maximum oil temperature of 100°C.

5.3.3.4 Nominal diameter and relevant tolerance of bores shall be as required which will be selected from Table 2.

5.3.3.5 The minimum thickness of the lining and cover shall be not less than 1.7 mm and 1.3 mm, respectively.

5.3.3.6 Lining and cover shall comply with requirements given in Table 17.

TABLE 17 - PHYSICAL REQUIREMENTS FOR LINING AND COVER

PROPERTY	REQUIREMENT
Tensile strength (lining and cover)	8.0 MN / m²
Elongation at break (lining and cover)	250% min.
Accelerated aging: Change in tensile strength (lining and cover) Change in elongation at break (lining and cover)	 30% max. after being 3 days at 100 ±1°C 35% max. after being 3 days at 100 ±1°C
Oil resistance: Volume change: - Lining	-5% to +15% after being 70 hours at 70 ±1°C in an oil consisting of closely controlled blend of two lubricating oil fractions obtained by vacuum distillation of selected naphthenic (Gulf Coastal) crudes, with aniline point of 70 ±1°C, kinematic viscosity of 33 ±1 ($X10^{-6}$) m²/s and flash point 160°C min, for hose assemblies relating to 5.3.3.2
- Cover	-5% to +60% after being 70 hours at 125 ±1°C in an oil consisting of closely controlled blend of two lubricating oil fractions obtained by vacuum distillation of selected naphthenic (Gulf Coastal) crudes, with aniline point of 70 ±1°C, kinematic viscosity of 33 ±1 ($X10^{-6}$) m²/s and flash point 160°C min. for hose assemblies relating to 5.3.3.3
Hardness change* - Lining	±10 IRHD

*** No initial hardness is specified, but a limit on hardness change after oil immersion is included to ensure that a lining with adequate oil resistance is employed.**

5.3.3.7 The hoses shall at least consist the marking of items a, b, c, and e of 5.2.1.8 plus the markings stated in requisition.

5.3.4 Rubber hoses for steam

5.3.4.1 Three approved types of these hoses are specified as below:

- **Type 1:** intended for a maximum working steam pressure of 0.6 MPa (6 bar) corresponding to a temperature of 165°C;

- **Type 2:** intended for a maximum working steam pressure of 1.0 MPa (10 bar) corresponding to a temperature of 184°C;

- **Type 3:** intended for a maximum working steam pressure of 1.6 MPa (16 bar) corresponding to a temperature of 204°C.

5.3.4.2 The rubber lining of all three types shall be resistant to aging by pressurized steam.

5.3.4.3 The reinforcement of hoses for type 1 shall consist of either textile fiber or steel wire as required.

5.3.4.4 The reinforcement of hoses for types 2 and 3 shall consist of either high strength steel wire or other material complying with 5.3.4.6 and 5.3.4.7.

5.3.4.5 The rubber cover shall be resistant to ozone. It shall be perforated with a minimum of 280 holes per meter, in four rows radially spaced at 90° around the periphery, to relieve pressure build-up between the inner lining and the cover.

5.3.4.6 The adhesion between the lining and the reinforcement, between layers of reinforcement, and between the cover and the reinforcement, shall be not less than 2.0 kN/m. The method of calculation the adhesion strength shall be that specified in ISO 6133

5.3.4.7 The hoses shall withstand the minimum burst pressure as below:

- Type 1 60 bar (870.2 PSI)
- Type 2 100 bar (1450.4 PSI)
- Type 3 160 bar (2320.6 PSI)

5.3.4.8 The cover immersed in oil consisting of closely controlled blend of two lubricating oil fractions obtained by vacuum distillation of selected naphthenic (Gulf Coastal) crudes, with aniline point of 70 ±1°C, kinematic viscosity of 33 ±1 (X 10^{-6}) m²/s and flash point of 160°C min, for 70 $^{+2}_{0}$ h at a temperature of 100 ±1°C, shall not show a volume change higher than 100%.

5.3.4.9 Bore sizes shall be as required which will be selected from Table 2. Tolerances on bores shall comply with the above mentioned table.

5.3.4.10 Length of the hose shall be as required. Tolerances on cut length shall be %1 required length.

5.3.4.11 The minimum thickness of the lining shall be 2.0 mm and that of the cover shall be 1.5 mm.

5.3.5 Rubber hoses for compressed air

5.3.5.1 Two types of rubber hose for compressed air are specified as follows:

Type A: Air hose for mining and construction work and maximum working pressure of 1.0 MPa (10 bar).

Type B: Air hose for mining and construction work and maximum working pressure of 2.5 MPa (25 bar).

5.3.5.2 For Type A hoses, the ratios of proof and minimum burst pressures to design working pressure shall be in accordance with Service Type No. 3 of Table 1.

5.3.5.3 The ratios of proof and minimum burst pressures to design working pressure shall be in accordance with Service Type No. 4 of Table 1.

5.3.5.4 Bore diameter for any denoted type shall be as required which will be selected from Table 2.

5.3.5.5 Tolerances on bores for any required diameter shall comply with pertinent value given in Table 2.

5.3.5.6 Length of the hose shall be as required. Tolerance on cut length shall be 1% of required length.

5.3.5.7 The rubber used for the lining and cover of the hose shall, when tested in the manner described in ISO 37, have a tensile strength and elongation at break not less than the values given in Table 18.

TABLE 18 - TENSILE STRENGTH AND ELONGATION AT BREAK

TYPE	COMPONENT	TENSILE STRENGTH bar	(PSI)	ELONGATION AT BREAK %
A B	Lining	70	(1015.2)	250
	Cover	100	(1450.4)	300

5.3.5.8 After aging for 168 h at a temperature of 70°C as described in ISO 188 the tensile strength and elongation at break of the lining and cover shall not vary by more than ±25% and +10% to -30% respectively from the initial values.

5.3.5.9 The minimum adhesion between rubber lining and reinforcement, between layers of reinforcement, and between reinforcement and cover, shall be not less than 2.0 kN/m.

5.3.5.10 Hoses after immersion in a low volume increase oil consisting of a closely controlled blend of mineral oils comprising a solvent extracted, chemically treated dewaxed paraffinic residuum and neutral oil with Aniline Point of 124 ±1°C, kinematic viscosity of 20 ±1 ($X10^{-6}$) m²/s and flash point of 240°C min, at 70 ±1°C for 72^{0}_{-2} h specimens of the lining shall show no shrinkage and the increase in volume shall not exceed 15%.

5.3.5.11 Hoses after immersion in oil consisting of closely controlled blend of two lubricating oil fractions obtained by vacuum distillation of selected naphthenic (Golf Coastal) crudes, with aniline point of 70 ±1°C , kinematic viscosity of 33 ±1 ($X10^{-6}$) m²/s and flash point of 160°C min, at 70 ±1°C for 72^{0}_{-2} h specimens of the lining and cover shall shown no shrinkage and the increase in volume shall not exceed 30% for the lining and 75% for the cover.

5.3.6 Rubber hoses and hose assemblies for hydraulic purposes

5.3.6.1 These hoses and hose assemblies shall be suitable for use with common hydraulic fluids, such as mineral oils, soluble oils, oil and water emulsions, aqueous glycol solution, and water, at temperatures ranging from -40 to +100°C. These hoses are distinguished by their design working pressure and minimum bend radius, as well as their reinforcement construction.

5.3.6.2 The hose shall consist of a seamless oil and water resistant synthetic rubber tube, one or more layers of high tensile steel wire or suitable textile yarn and an oil and weather-resistant synthetic rubber cover.

5.3.6.3 Hose assemblies shall consist of a length of hose complying with the requisition together with suitable couplings at each end.

5.3.6.4 The bore of hose shall meet the requirements of Table 19.

TABLE 19 - NOMINAL BORES

Dimensions in Millimeters

NOMINAL BORE mm (inch)	PERMITTED RANGE	
	minimum	maximum
5 ($^3/_{16}$)	4.5	5.4
10 ($^3/_8$)	9.3	10.1
12.5 (½)	12.3	13.5
16 ($^5/_8$)	15.4	16.7
—	18.6	19.8
25 (1)	25.0	26.4
50 (2)	37.7	39.3
	42.5	51.0

*** Wire reinforced only.**

5.3.6.5 Pressure requirements

5.3.6.5.1 The design working pressure of the hoses and the minimum bursting pressure of textile reinforcement shall comply with the requirements of Table 20.

TABLE 20 - DESIGN WORKING PRESSURE AND MINIMUM BURSTING PRESSURE

NOMINAL BORE mm (inch)	DESIGN WORKING PRESSURE bar (PSI)				MINIMUM BURSTING PRESSURE bar (PSI)			
	Type I	Type II	Type III	Type IV	Type I	Type II	Type III	Type IV
5 ($^3/_{16}$)	34 (493.1)	80 (1160.3)	103 (1160.3)	160 (4320.6)	136 (1972.5)	320 (4641.2)	412 (5975.6)	640 (9282.5)
10 ($^3/_8$)	28 (406.1)	63 (913.8)	78 (1131.3)	100 (1450.4)	112 (1624.4)	252 (3655.0)	312 (4525.2)	400 (5801.6)
12.5 (½)	28 (406.1)	50 (725.2)	69 (1000.8)	80 (1160.3)	112 (1624.4)	200 (2900.8)	276 (4003.1)	320 (4641.3)
16 ($^5/_8$)	24 (348.1)	50 (725.2)	60 (870.2)	80 (1160.3)	96 (1392.4)	200 (2900.8)	240 (3481.0)	320 (4641.3)
19 (¾)	—	40 (580.2)	52 (754.2)	63 (913.8)	—	160 (2320.6)	208 (3016.8)	252 (3655.0)
25 (1)	—	40 (580.2)	39 (565.6)	50 (725.2)	—	160 (2320.6)	156 (2262.6)	200 (2900.8)

Type determination is based on design working pressure.

5.3.6.5.2 The design working pressure of hoses with wire reinforcement shall comply with the requirements of Table 21.

TABLE 21 - DESIGN WORKING PRESSURE OF HOSES WITH WIRE REINFORCEMENT

NOMINAL BORE SIZE	DESIGN WORKING PRESSURE			
	Type 1		Type 2	
mm (inch)	bar	(PSI)	bar	(PSI)
5 ($^3/_{16}$)	210	(3045.8)	350	(3045)
10 ($^3/_8$)	160	(2320.6)	280	(4061.1)
12.5 (½)	140	(2030.6)	250	(3626)
16 ($^5/_8$)	105	(1523.0)	200	(2200.8)
19 (¾)	90	(1305.4)	160	(2320.6)
25 (1)	70	(1015.2)	140	(2030.6)
38 (1½)	35	(507.6)	90	(1305.4)
50 (2)	26	(377.1)	80	(1160.3)

Type determination is based on working pressure.

5.3.6.6 The hose shall withstand without damage a proof test pressure of twice the design working pressure.

5.3.6.7 Minimum bend radius

The hoses shall be capable of performing at design working pressure when curved to the radius given in Table 22 as measured to the inside of the bend. Should any portion of the hose be curved to a radius smaller than the specified bend radius, performance capability of the hose is reduced.

TABLE 22 - BEND RADIUS

Values in millimeters

NOMINAL BORE	BEND RADIUS FOR HOSES WITH REINFORCEMENT	BEND RADIUS FOR HOSES WITH REINFORCEMENT			
mm (inch)	mm	Type I	Type II	Type III	Type IV
5 ($^3/_{16}$)	90	51	35	76	40
10 ($^3/_8$)	130	76	60	102	70
12.5 (½)	180	102	70	127	85
16 ($^5/_8$)	205	127	90	140	105
19 (¾)	240	—	110	152	130
25 (1)	300	—	130	203	150
38 (1½)	500	—	—	as specified	
50 (2)	630	—	—		

5.3.6.8 The hose shall be supplied in lengths as specified by the purchaser, subject to a tolerance on the specified lengths ±1% or ±3 mm, whichever is the greater.

5.3.7 Rubber hoses for gas welding

5.3.7.1 These hoses shall have the capability of working pressure of 2000 kPa (20 bar) over the temperature of -25°C to +70°C.

5.3.7.2 Class A of these hoses "when required" will be used for acetylene, oxygen and non-combustible gases such as argon. Class B of these hoses "If Required" will be used for gas cutting and welding applications using LPG.

5.3.7.3 Materials and construction

The hose shall consist of:

a) A rubber lining of minimum thickness 1.5 mm;
b) reinforcement applied by any suitable technique;
c) a rubber cover of minimum thickness 1 mm.

The lining and cover shall be of uniform thickness, free from air holes, porosity and other defects.

The hose shall be mandrel or non-mandrel made and the finish shall be smooth, fluted or fabric marked.

5.3.7.4 Color identification

In order to identify the gas for which the hose is to be used, the hose cover shall be colored as given in Table 23.

TABLE 23 - COLOR OF HOSE COVER

CLASS	GAS	COLOR OF COVER
A	Acetylene and other fuel gases (excluding LPG)	Red
A	Oxygen	Blue
A	Non-combustible gases (e.g. argon)	Black
B	Liquefied petroleum gas (LPG) (e.g. propane or butane)	Orange

5.3.7.5 Nominal bore diameters shall be as required, which will be either 5.0, 10.0, 12.5, 16.0, mm or ¾ inch. Tolerances on bore diameters for any size shall comply with values given in Table 2.

Concentricity for bore sizes of 5.0 hose mm shall be maximum 1.00 mm.

Concentricity for bore sizes of 10.0, 12.5 and 16.0 mm shall be maximum 1.25 mm.

Concentricity for bore sizes of ½ inch shall be maximum 1.50 mm.

Hoses shall be supplied in lengths as specified by the Company subject to a tolerance on cut lengths of ±1% or ±3 mm whichever is greater.

5.3.7.6 The rubber used in the lining and cover of the hose shall have a tensile strength of 5.0 MPa and 7.0 MPa and elongation at break 200% and 250% respectively.

5.3.7.7 When aged for 96 h at a temperature of 70°C in accordance with BS 903: Part A 19, the tensile strength and elongation at break of the lining and cover shall not decrease by more than 25% and 50% from the unaged values, respectively.

5.3.7.8 Three samples of the lining shall remain in the apparatus at a temperature of 360°C to 365°C for 2 min without ignition. If more than one of the sample shows evidence of in less than 2 min, the hose shall be deemed not to comply with this Standard. If only one sample shows evidence of ignition in less than 2 min, three further samples shall be prepared and tested. If any of the three samples in this second series shows evidence of ignition in less than 2 min, the hose shall be deemed not to comply with this Standard.

5.3.7.9 Resistance to acetone (Class A only). A sample of the hose lining when immersed in boiling acetone for 8 h shall not increase in mass by more than 8%.

5.3.7.10 Resistance to n-pentane (Class B only). A sample of the hose lining shall show an absorption of pentane not exceeding 15% and pentane extractable matter not exceeding 10%. Test procedure and calculation of results shall be as below:

a) Procedure

Weigh a portion of the hose lining and immerse it in n-pentane at standard temperature (see BS 903: Part A35) for $72\ ^{0}_{-2}$ h. Ensure that the volume of the pentane is at least 50 times the volume of the test piece.

Following immersion, reweigh the test piece after 5 min conditioning in air at room temperature and reweigh again after 24 h further conditioning under the same conditions.

b) Calculation of results

Calculate the pentane absorbed and the pentane-extractable matter using the following expressions:

- Percentage pentane absorbed $\frac{(M_1 - M_2)}{M_0} \times 100$

- percentage extractable matter $\frac{(M_0 - M_2)}{M_0} \times 100$

Where:

$\mathbf{M_0}$ is the initial mass of the test piece;
$\mathbf{M_1}$ is the mass of the piece after immersion and 5 min conditioning;
$\mathbf{M_2}$ is the mass of the test piece after 24 h further conditioning.

5.3.7.11 Hydrostatic pressure requirements hoses shall comply with the appropriate rating given in Table 24 and shall show no cracks or leaks at proof pressure.

TABLE 24 - HYDROSTATIC PRESSURE RATING

MAXIMUM WORKING PRESSURE		PROOF PRESSURE		MINIMUM BURST PRESSURE		MAXIMUM CHANGE IN LENGTH AT WORKING PRESSURE
bar	(PSI)	bar	(PSI)	bar	(PSI)	%
20	(290.1)	40	(580.2)	60	(870.2)	±7

5.3.7.12 Adhesion

The adhesion between adjacent components shall be not less than 2.0 kN/m.

5.3.7.13 Low temperature flexibility

At -25°C, using a diameter of curvature of 10 times the nominal bore (with a minimum of 80 mm), the hose shall show no signs of cracking or breaking and shall show no signs of leaks when subjected at ambient temperature to the proof pressure given in Table 24.

5.3.7.14 Resistance to hot surfaces

When tested in accordance with procedure given below, the reinforcement of the hose shall not be exposed through the cover in the area under the heated bar after 60 ±1 s at 360 ±5°C .

Cut a length of hose 100 ±10 mm in length.

Place the hose at right angles to a heated bar of 8 mm diameter maintained at 360 ±5°C. Ensure that the total mass on the hose is 1 kg.

After 60 ±1 s remove the hose and examine for any exposure of the reinforcement.

5.3.7.15 Resistance to crushing

When tested in accordance with procedure given below the flow rate shall not drop to less than 0.07 m^3/h and the hose shall show no signs of leaks during the final pressure tests.

Connect the hose to a supply of air maintained at a constant pressure of 30.0 mbar at the inlet to the hose. Fit a variable control at the outlet end and adjust it to give a flow rate of 0.30 m^3/h. Apply a force of 340 N evenly over a length of 25 mm of the hose and after 30 s, while the force is still maintained on the hose, record the flow rate. Following this test subject the hose to the proof pressure in Table 24 and examine the hose for leaks.

5.3.7.16 Permeability to gas (Class B only)

Using a test gas of 95% propylene at cylinder pressure (approximately 6 bar) and standard temperature 20°C, the gas permeance for all bore sizes shall not exceed 25 cm^3/m per hour.

5.3.8 Flexible rubber hoses for use in LPG vapor phase and LPG/air installation

5.3.8.1 These hoses shall be used for installations not exceeding 17.5 bar.

5.3.8.2 These hoses are not suitable for gas cutting and welding applications.

5.3.8.3 The hose shall be capable of functioning satisfactorily when bent to the minimum installed bend radius specified in Table 25.

TABLE 25 - MINIMUM INSTALLED BEND RADIUS

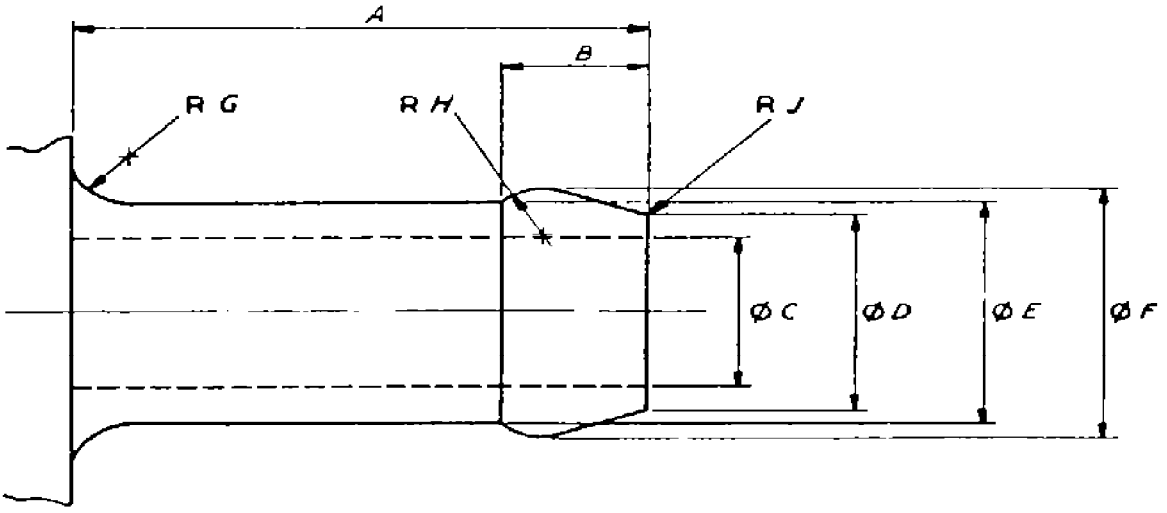
NOMINAL BORE		MINIMUM BEND RADIUS
mm	(in.)	mm
5	($^3/_{16}$)	60
	(¼)	75
10	($^3/_8$)	120
12.5	(½)	150

5.3.8.4 The hose shall be of self extinguished and ozone resistant type. The material used in the manufacture of the hose shall be substantially free from odor. The hose lining shall be seamless and free from all visible defects and the hose shall contain a suitable reinforcement. Pricking of the hose cover shall not constitute a defect. The bore of the hose shall be clean and free from loose particles which might be carried forward by the gas. Hose shall be secured to end fittings by means of swaging, crimping or the use of suitable clips.

5.3.8.5 Tolerance

The bore diameter shall not vary by more than 10% or ±0.8 mm ($^1/_{32}$ in), whichever is the smaller, from the declared nominal bore.

5.3.8.6 The adhesion between cover and reinforcement and between lining and reinforcement shall be not less than 35 N.



NOMINAL BORE	A	B	DIA. C	DIA. D	DIA. E	DIA. F	RAD. G	RAD. H	RAD. J
5 ($^{3}/_{16}$)	25.0 (1.0)	6.4 (¼)	3.2 ($^{1}/_{8}$)	4.5 (0.177)	5.0 ($^{3}/_{16}$)	5.94 (0.234)	1.0 (0.04)	1.0 (0.04)	0.4 ($^{1}/_{64}$)
(¼)	25.0 (1.0)	8.0 ($^{5}/_{16}$)	4.8 ($^{3}/_{16}$)	6.2 (0.244)	6.3 (¼)	7.95 (0.313)	1.3 (0.05)	1.3 (0.05)	0.4 ($^{1}/_{64}$)
10 ($^{3}/_{8}$)	38.0 (1.5)	8.7 ($^{11}/_{32}$)	7.9 ($^{5}/_{16}$)	8.6 (0.338)	9.5 ($^{3}/_{8}$)	11.1 (0.438)	2.0 (0.08)	2.0 (0.08)	0.4 ($^{1}/_{64}$)
12.5 (½)	38.0 (1.5)	12.0 ($^{15}/_{32}$)	8.7 ($^{11}/_{32}$)	11.6 (0.458)	12.5 (½)	14.3 (0.568)	2.5 (0.10)	2.5 (0.10)	0.4 ($^{1}/_{64}$)

Note:

Tolerance on all dimensions: ±0.125 mm (0.005 in.). Dimensions in millimeters (inches in parentheses).

STANDARD NOZZLES
Fig. 1

5.3.8.7 Strength and stretch

The hose shall fit over the appropriate standard nozzle shown in Fig. 1 and shall show no fractures, cracks or leakage when tested in accordance with the method described in below.

5.3.8.7.1 Strength and stretch test for hose and assemblies

a) Four specimens of hose (or hose assembly), each at least 150 mm long, shall be tested;

b) suspend each test piece vertically with a mass of 22.5 kg attached to its lower end and leave the assembly to stand for 30 min. Examine the test pieces and reject those which show signs of fractures or cracks.

c) Test for leakage the test pieces which were not rejected, by immersing them in water for 5 min with an internal air pressure of 17.5 bar. After immersion reject those test pieces which show signs of leakage.

d) Then place the test pieces which were not rejected in b or c in an aging oven for 168 h at 70°C and after cooling to room temperature again immerse them in water for 5 min with an internal air pressure of 17.5 bar. Re-examine the test pieces for leakage.

5.3.8.7.2 Three samples of hose each with 60 cm in length when immersed in water shall show no crack or leakage if tested for internal pressure of 3.5 kg/cm². The induced pressure shall be supplied by air or nitrogen or carbon oxide. This test shall be replicated after the test given in 5.3.8.10.

5.3.8.8 The samples which have already passed from the test given in 5.3.8.7 shall be verified for resistance to burst, for this purpose the samples shall be subjected to a hydraulic pressure built up at a rate of 7 kN/cm² to 15 kN/cm² until the hoses burst. The test medium shall be water and the hose shall not burst at a pressure below 350 kN/cm².

5.3.8.9 The hose shall show no crack after remaining in -20°C for 48 hour and being turned around a cylinder of diameter equal to 3 times of the hose diameter.

5.3.8.10 Tensile strength and elongation of the hose when remaining in 70°C for 7 days, shall not be less than the 75% of tensile strength and elongation of the hose in normal ambient temperature.

5.3.8.11 Resistance to pentane

When an assembly is tested in accordance with the method described in 5.3.7.10 a and 5.3.7.10 b the pentane absorbed shall not exceed 15% of the initial mass of the hose lining and the amount of pentane-extractable matter shall not exceed 10% of the initial mass of the hose lining.

5.3.9 Textile-reinforced rubber, hoses for water

5.3.9.1 General requirements of textile-reinforced rubber hoses for water shall conform with subclause 5.1.1 and shall consist of :

a) A flexible rubber lining;
b) a reinforcing layer(s) of synthetic textile for hoses;
c) a flexible rubber cover for rubber hoses the color of rubber cover may be different from that of the lining.

5.3.9.2 Nominal bore size shall be as required which will be selected from the following sizes 10 mm, 12.5 mm, 16 mm, 20 mm, 25 mm, 50 mm and 100 mm.

5.3.9.3 Cut length of hoses shall be as denoted lengths in requisition and the tolerance on cut lengths shall be as specified in Table 4.

5.3.9.4 Pressure rating

The design working pressure of the hoses shall comply with the requirements of Table 5. During and after tests, hoses shall show no evidence of leakage, cracking and abrupt distortion indication irregularity in materials or manufacture or other signs of failure.

TABLE 26 - PRESSURES AT STANDARD LABORATORY TEMPERATURE

MATERIAL	TYPE	DESIGN WORKING PRESSURE		PROOF PRESSURE		MINIMUM BURST PRESSURE	
		bar	(PSI)	bar	(PSI)	bar	(PSI)
rubber	1*	6.0	(780.2)	9.6	(139.2)	1.9	(275.5)
	2	25.0	(362.6)	40.0	(580)	7.9	(1145.6)

*** The required rubber hoses shall have the requirements of Type 1 if it is declared that to be used for water suction only.**

5.3.9.5 When the hose tested by the method specified in ISO 1746, using a minimum radius of curvature of five times the nominal bore size, shall show no signs of collapse.

5.3.9.6 The hose outside diameter of water suction hoses shall not show appreciable collapse, nor shall the lining show evidence of separation from the reinforcement. However, hoses with textile reinforcement without helix-wire support may show collapse of not more than 20% if tested in vacuum.

5.3.9.7 The adhesion between the various elements shall be not less than 1, 4 kN/m compliance shall be verified according to ISO/R 36.

5.3.9.8 Marking

The packages of hoses shall be marked using a contrasting indelible ink with the following information or as specified by company:

a) The manufacturer's name or trademark:
b) the hose type;
c) the nominal bore;
d) the statement "Non-Potable Water"
e) production date, "Year and Month"

5.4 Requirements of Metal Hoses

5.4.1 Single overlap flexible metal hoses

These hoses shall be made from protected carbon steel.

These hoses shall have a circular or polygonal section as required.

Fig. 2 shows the unpacked, no tightness type. The special requirements of this type shall be as given in Table 28.

Fig. 2

Fig. 3 shows the limited tightness type which is to be packed with rubber or asbestos as required the special requirements of rubber and asbestos packing shall be in accordance with Tables 27 and 28 respectively.

Fig. 3

TABLE 27 - REQUIREMENTS OF SINGLE OVERLAP FLEXIBLE METAL HOSES (UNPACKED, NO TIGHTNESS, CIRCULAR OR POLYGONAL SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH
	mm	mm	mm	N	N
8 (¼)	7	10.2	35	300	4000
10 ($^3/_8$)	9.5	13.5	40	400	4000
12 (½)	13	21	50	600	4000
20 (¾)	18	26	65	800	4000
25 (1)	23	32	75	1000	4000
40 (1½)	37	49	115	1600	4000
50 (2)	48	59	135	2000	4000
65 (2½)	62	76	170	2500	4000
80 (3)	75	89	200	3400	4000
100 (4)	97	111	255	4200	4000

TABLE 28 - REQUIREMENTS OF SINGLE OVERLAP FLEXIBLE METAL HOSES (RUBBER PACKING, LIMITED TIGHTNESS, CIRCULAR OR POLYGONAL SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE[1)] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH
	mm	mm	mm	N	N
8 (¼)	7	10.2	65	150	3000
10 ($^3/_8$)	9.5	13.5	75	200	3000
12 (½)	13	21	100	300	3000
20 (¾)	18	26	135	400	3000
25 (1)	23	32	155	500	3000
40 (1½)	37	49	210	800	3000
50 (2)	48	59	240	1000	3000
65 (2½)	62	76	290	1300	3000
80 (3)	75	89	325	1700	3000
100 (4)	97	111	395	2200	3000

TABLE 29 - SINGLE OVERLAP FLEXIBLE METAL HOSES (ASBESTOS PACKING, LIMITED TIGHTNESS, CIRCULAR OR POLYGONAL SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE[1] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH
	mm	mm	mm	N	N
8 (¼)	7	10.2	65	300	3500
10 ($^3/_8$)	9.5	13.5	85	400	3500
12 (½)	13	21	110	600	3500
20 (¾)	18	26	150	800	3500
25 (1)	23	32	175	1000	3500
40 (1½)	37	49	240	1600	3500
50 (2)	48	59	270	2000	3500
65 (2½)	62	76	330	2600	3500
80 (3)	75	89	390	3400	3500
100 (4)	97	111	475	4200	3500

5.4.2 Double overlap flexible metal hoses

5.4.2.1 Unpacked type

These hoses shall have circular or polygonal section which shall present a limited tightness and shall be made from protected carbon Fig 4 shows the unpacked, limited tightness circular section double overlap flexible metal hoses. Table 30 gives the special requirements of these hoses.

Fig. 4

TABLE 30 - DOUBLE OVERLAP FLEXIBLE METAL HOSES (UNPACKED, LIMITED TIGHTNESS, CIRCULAR OR POLYGONAL SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE[1] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH
	mm	mm	mm	N	N
8 (¼)	7	10.2	80	800	3000
10 ($^3/_8$)	9.5	13.5	90	1100	2600
12 (½)	13	21	130	1700	1800
20 (¾)	18	26	150	2300	2600
25 (1)	23	32	175	2800	1600
40 (1½)	37	49	250	4000	1800
50 (2)	48	59	305	5000	1000
65 (2½)	62	76	365	6000	1500
80 (3)	75	89	395	7500	1500
100 (4)	97	111	460	9000	900

5.4.2.2 Packed type

These hoses shall be of asbestos or copper packing type, as required.

5.4.2.2.1 Copper packing type shall be made from protected carbon steel and shall have a circular section which presents limited tightness (see Fig. 5).

Special requirements of these hoses are given in Table 31.

Fig. 5

TABLE 31 - DOUBLE OVERLAP FLEXIBLE METAL HOSES (COPPER PACKING, LIMITED TIGHTNESS, CIRCULAR SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE[1] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH
	mm	mm	mm	N	N
12 (½)	13	21	180	1500	9400
20 (¾)	18	26	205	2300	9000
25 (1)	23	32	235	3200	8700
40 (1½)	37	49	320	6000	8100
50 (2)	48	59	370	8000	7800
65 (2½)	62	76	460	12000	7500
80 (3)	75	89	570	16000	7300
100 (4)	97	111	700	21000	7100

5.4.2.2.2 Asbestos packing type

These hoses shall have a circular section (see Fig. 4), and be leak proof and shall be made from either austenitic stainless steel or protected carbon steel as required. The special requirements of hoses made from austenitic stainless steel or protected carbon steel shall comply with Tables 32 and 33 respectively.

TABLE 32 - SPECIAL REQUIREMENTS OF DOUBLE OVERLAP FLEXIBLE METAL HOSES (ASBESTOS PACKING, LEAK PROOF, CIRCULAR SECTION, IN AUSTENITIC STAINLESS STEEL)

NOMINAL SIZE[1] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH	MAXIMUM PERMISSIBLE WORKING PRESSURE min.
	mm	mm	mm	N	N	N
12 (½)	13	21	185	5000	11000	32
20 (¾)	18	26	205	5800	10500	32
25 (1)	23	32	235	7500	10000	32
40 (1½)	37	49	350	13000	9300	31
50 (2)	48	59	420	17000	9000	26
65 (2½)	62	76	550	23000	8700	20.5
80 (3)	75	89	670	29000	8400	17
100 (4)	97	111	840	38000	8100	14

TABLE 33 - SPECIAL REQUIREMENTS OF DOUBLE OVERLAP FLEXIBLE METAL HOSES (ASBESTOS PACKING, LEAK PROOF, CIRCULAR SECTION, IN PROTECTED CARBON STEEL)

NOMINAL SIZE[1] DN mm (inch)	MINIMUM INTERNAL DIAMETER d	MAXIMUM OUTSIDE DIAMETER D	BEND RADIUS max.	TENSILE STRENGTH min.	CRUSH STRENGTH	MAXIMUM PERMISSIBLE WORKING PRESSURE min.
	mm	mm	mm	N	N	N
12 (½)	13	21	185	1500	7500	30
20 (¾)	18	26	210	2300	7200	25
25 (1)	23	32	240	3200	6900	21
40 (1½)	37	49	340	6000	6400	15
50 (2)	48	59	410	8000	6200	13
65 (2½)	62	76	540	12000	6000	11
80 (3)	75	89	650	16000	5800	9.5
100 (4)	97	111	820	21000	5600	8

6. TESTS

Tests shall be made at the manufacturer's work.

The supplier/manufacturer shall maintain appropriate inspection and test records to substantiate conformance with specified requirements.

Test and calibration records shall be legible and relevant to product involved. Supplier/Manufacturer shall submit to purchaser the test and calibration records (in ..... copies) on completion of tests.

7. DOCUMENTS

7.1 At Quotation Stage

Documents to be submitted by manufacturer/supplier shall give the following as complete:

- Report of experience;
- drawings and documents which define the technical data of required commodity(ies);

- list of tests and calibrations which may be made on his work;
- complaint and compensation policies;
- declaration of any certificate from any impartial laboratory "if any".

7.2 At Ordering Stage

- A copy of test certificate;
- quality assurance certificate.

Note:

All documents shall be in English language.

8. CONFLICTING REQUIREMENTS

In case of conflict between documents relating to the inquiry or purchase order following priority of documents shall apply:

- First priority Purchaser order (including attachments) and variations thereon,

- Second priority Data-Requisition sheet and drawings,

- Third priority This Standard specification.

9. PACKING

9.1 Hoses shall be packaged in away to avoid damage in transit.

9.2 Packages shall display the quantity of commodities and trade mark (identification mark) of manufacturer.

9.3 Packages shall have the Company name and full address of Company.

10. INSURANCE

The insurance shall be carried out exactly as Company purchaser order.

11. SHIPMENT

11.1 The greatest care must be taken to ensure that shipping and associated documents with exact description for customs release are accompanied with the shipment.

APPENDICES

APPENDIX A
HOSE DATA SHEET

Name of required commodity

Bore diameter ..... mm
..... inch

Nominal size (for metal hoses) ..... mm
..... inch

Required quantity..... m in ..... m cut lengths

cover .....

Material reinforcement .....

lining .....

Anticipated working pressure ..... MPa

Type of service:

- General service.
- Irregular heavy service (with shock loads).
- For use with gaseous media.
- For use with media which at working pressure change into the gaseous state.
- For use with steam.
- Details of any other types of services.

Hoses with couplings be electrically bonded between couplings Yes b
No b