Ministry of Defence

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RUBBER HOSE AND HOSE ASSEMBLIES FOR HYDRAULIC SYSTEMS (THICK COVER)

This Defence Standard supersedes
INTERIM Def Stan 47-2/Issue 3
dated 20 September 1991

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Revision Note

Issue 4 of this Standard is a revision of Issue 3 to reflect knowledge gained from the Interim. References to type approval have been deleted and test requirements have been amended and clarified.

Historical Record

INTERIM Def Stan 47-2/Issue 3 dated 20 September 1991
Def Stan 47-2/Issue 2 dated 2 June 1980
Def Stan 47-2/Issue 1 dated 1 November 1967
SDM(L) 272/1 dated 1 February 1966
DEF-1421 dated November 1963 and the applicable parts of FVRDE 1039

RUBBER HOSE & HOSE ASSEMBLIES FOR HYDRAULIC SYSTEMS (THICK COVER)

PREFACE

This Defence Standard supersedes
Def Stan 47-2/Issue 3
dated 20 September 1991

i This Defence Standard specifies the requirements for rubber hose assemblies used primarily in hydraulic systems by the Ministry of Defence.

ii This Defence Standard is not applicable for new designs for aerospace use, Def Stan 47–12 is the appropriate document. However it is applicable to designs current prior to 1976.

iii This Standard has been agreed by authorities concerned with its use and shall be incorporated whenever relevant in all future designs, contracts, orders, etc and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, the Directorate of Standardization shall be informed so that a remedy may be sought.

iv Any enquiries regarding this Standard in relation to an invitation to tender or a contract in which it is incorporated are to be addressed to the responsible technical or supervising authority named in the invitation to tender or contract.

v This Standard has been devised for the use of the Crown and its contractors in the execution of contracts for the Crown. The Crown hereby excludes all liability (other than liability for death or personal injury) whatsoever and howsoever arising (including, but without limitation, negligence on the part of the Crown its servants or agents) for any loss or damage however caused where the Standard is used for any other purpose.

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RUBBER HOSE AND HOSE ASSEMBLIES FOR HYDRAULIC SYSTEMS (THICK COVER)

Section One. General

1 Scope

1.1 This Standard specifies the requirements for steel wire reinforced synthetic rubber hose and hose assemblies fitted with end fittings used primarily in hydraulic systems but may be used in pneumatic applications operating at temperatures ranging from -40°C to +100°C for Types 1, 2, 3 & 5 and 120°C for Type 4 where the cover is to be removed before the end fittings are attached.

1.2 It also specifies the conditions for a company applying to be registered as a supplier of hoses, end fittings and assemblies to this Standard and a company applying to be registered as an assembler of certified hose and fittings.

1.3 Where hydraulic hoses of other construction or performance are required then the general provisions of this document shall apply.

NOTE: Attention is drawn to DEF STAN 47–31, to having a thin cover.

2 WARNING

2.1 This Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the designer, the producer, the supplier or the user from statutory and all other legal obligations relating to health and safety at any stage of manufacture or use.

2.2 The hose/hose assembly shall have a total life of 10 years, but this may be seriously reduced by application.

2.3 The hose and hose assemblies are not suitable for use with synthetic hydrocarbon based oils, silicone fluids, phosphate esters or castor oil.

2.4 The 5 mm, 6.3 mm and 8 mm nominal bore hose assemblies may not successfully withstand the standard flame test for 3 minutes. Test times achieved before these hose assemblies fail may be obtained from the Design Authority (see **11.1).** If fire protection is necessary for a time longer than achieved on test, fire sleeving should be specified see **4.8, 8.4,** and annex B.

2.5 The hose end connections of end fittings are designed and toleranced to fit a specific manufacturer’s hose with account having been taken of the hose design and rubber used. It is dangerous to fit end fittings from one manufacturer to another manufacturer’s hose, see clause **7,** NOTE. Before stock end fittings are fitted to a newly procured hose, even from the same manufacturer confirmation must be obtained that they are compatible.

2.6 The explosive nature of pneumatic failure is extremely hazardous and care is necessary to ensure that there is a sufficient safety margin in the operating conditions. The hose and hose assemblies, when used in a pneumatic application shall be chosen so that their minimum burst pressure to maximum working pressure ratio is a factor of 5:1. This practice follows the recommendations given in BS 6596: 1985.

3 Related Documents

3.1 The following documents and publications are referred to in this Standard:

3.1 (Contd)

BS 903			Physical Testing of Rubber
	Part A1		Determination of Density
	Part A2		Method for Determination of Tensile Stress – Strain Properties
	Part A9		Determination of Abrasion Resistance
BS 903	Part A16		Determination of the Effect of Liquids
	Part A19		Heat Resistance and Accelerated Ageing Tests
	Part A25		Determination of Low Temperature Brittleness
	Part A26		Method for Determination of Hardness
	Part A43		Method for Determination of Resistance to Ozone Cracking
BS 2782			Methods of Testing Plastics
	Part 1: Method 141		Determination of Flammability by Oxygen Index
	Part 1: Method 143A and 143B		Determination of Flammability Temperature of Materials
BS 3592	Part 2		Specification for Metallic Coated Steel Wire for the Bonded Reinforcement of Hydraulic Hoses
BS 5173			Methods of Test for Rubber and Plastics Hoses and Hose Assemblies
	Part 101	Sec 101.1	Measurement of Dimensions (Excluding Length)
		Sec 101.2	Measurement Length of Hoses and Hose Assemblies
	Part 102	Sec 102.1	Hydrostatic Tests
		Sec 102.5	Pressure Impulse Test for High Pressure Hydraulic Hoses
	Part 103	Sec 103.9	Determination of Abrasion Resistance of the Outer Cover
	Part 104		
		Sec 104.2	Electrical Tests. Measurement of Electrical Continuity and Discontinuity of Hoses and Hose Assemblies
	Part 106	Sec 106.1	Determination of Low Temperature Flexibility
		Sec 106.3	Determination of Ozone Resistance
BS 5200			Specification for Dimensions of Hydraulic Connectors and Adaptors
BS 3G 100	Part 2	Sec 3	General Requirements for Equipment for Use in Aircraft
BS 5244			Recommendations for Application, Storage and Life Expiry of Hydraulic Rubber Hose and Hose Assemblies
BS 6596 : 1985			Specification for Ratios of Proof and Burst Pressure to Design Working Pressure for Rubber and Plastics Hoses and Hose Assemblies
Def Stan 00–35			Environmental Handbook for Defence Materiel
Def Stan 01-5			Fuels, Lubricants and Associated Products
Def Stan 81-39			Packaging of Rubber Hoses, Plastic Hoses and Hose Assemblies
Def Stan 93-31			Test Procedures and Process Requirements for Fully Compounded Unvulcanized Rubber

3.1 (Contd)

Def Stan 93-50	General Requirements for the Quality Assurance of Rubber Products
NES 711	Determination of Smoke Index of the Products of Combustion from Small Specimens of Materials
NES 713	Determination of the Toxicity Index of the Products of Combustion from Small Specimens of Materials
FED STD 162a	Hose, Visual Inspection Guide

3.2 Reference in this Defence Standard to any related document means in any invitation to tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated.

3.3 The above specifications are obtainable from:

DOCUMENT	SOURCE
British Standards	British Standards Institution Customer Services 389 Chiswick High Road LONDON WA4 4AL
Defence Standards	Ministry of Defence Directorate of Standardization Kentigern House 65 Brown Street GLASGOW G2 8EX
Naval Engineering Standards (NES)	Forms and Publications Mwrwg Road Llangennech LLANELLI Dyfed SA14 8YP
Federal Standards	Air Ltd 5 Elvaston Mews LONDON SW7 5HY ILI Ltd Index House ASCOT Berks SL5 7EU Tel: 0990 23377

3.3 (Contd)

DOCUMENT	SOURCE
Federal Standards (Contd)	Technical Indexes Ltd Willoughby Road BRACKNELL Berks RG12 4DW Tel: 0344 426311 American Technical Publishers Ltd 27–29 Knowl Piece Wilbury Way HITCHIN Herts SG4 0SX Tel: 0462 437933

4 Definitions

For the purposes of this Standard, the following definitions apply:

4.1 Component lot. Shall be defined as given in Def Stan 93-50, taking into account the method of manufacture.

4.2 Dash (Imperial). Represents the number of sixteenth inch increments in the hose nominal bore.

4.3 Design Authority. The Design Authority for this Defence Standard to whom manufacturers of hose and hose assemblies are to submit type testing data is the Ship Support Agency, DME, ME223, Room 31, Block K, Foxhill, Bath.

4.4 DN (Metric). Gives the hose nominal bore in millimetres.

4.5 End fitting. A fitting consisting of a hose end connection and a terminating end connection.

4.6 Fire proof hose assemblies. Are those which can successfully withstand for 15 minutes the standard flame test described in BS 3G 100 Part 2 Section 3.

4.7 Fire resistant hose assemblies. Are those which can successfully withstand for 5 minutes the standard flame test described in BS 3G 100 Part 2 Section 3.

4.8 Flame resistant hose assemblies. Are those which can successfully withstand for 3 minutes the standard flame test described in BS 3G 100 Part 2 Section 3.

4.9 Hose. A flexible pipe made of rubber with a metallic wire reinforcement.

4.10 Hose assembly. The hose complete with end fittings and identification bands.

4.11 Hose batch. A batch of hose or hose assemblies shall consist of a quantity to be declared by the manufacturer or as specified in the contract. It shall be identified by an agreed unique code or number on each hose or hose assembly, the packaging and any documentation sent with the batch.

4.12 Hydraulic. Relating to the flow of liquid or operated by the pressure of liquid.

4.13 Lay line. Is a longitudinal straight line on the outside of the hose used to indicate any twist in the hose when fitted. It contains the required information for identifying and dating the hose.

4.14 Maximum fluid temperature. Is the maximum steady temperature at which the hose assembly is intended to operate.

4.15 Maximum hydraulic working pressure. Is the maximum pressure at which the hose/hose assembly is required to operate and includes any surge pressure.

4.16 The minimum bend radius of a hose is the minimum radius (this is the minimum measurement at the inside of the bend) at which the hose/hose assembly may be installed.

4.17 Oxygen index. The minimum concentration of oxygen, expressed as a volume percentage, in a mixture of oxygen and nitrogen that will just support flaming combustion of a material initially at a temperature of 23 ± 2°C under specified conditions.

4.18 Pneumatic. Operated by or relying on air pressure or the force of compressed air.

4.19 Rubber batch. A batch of rubber shall comprise a uniquely identifiable single mix or homogeneous blend of mixes or material produced by a continuous process of fully compounded unvulcanized rubber.

4.20 Service life. The time during which the hose assembly is fitted to a system, portable equipment, or used for transferring fluids regardless of whether it was in use or not.

4.21 Shelf/Storage life. The maximum time commencing from the date of cure of the rubber to when it can be used from storage without testing.

4.22 Smoke Index. The numerical summation of the rates of change in specific optical density of the smoke produced from the start of the test to 70%; 40%; 10% and minimum light transmittance values.

4.23 Temperature index. The temperature at which the oxygen index of a material becomes 21 under the conditions specified.

4.24 Total life. The sum of shelf/storage life and service life.

4.25 Toxicity index. The numerical summation of the toxicity factors of selected gases produced by complete combustion of the material in air under specified conditions.

Section Two. Design Requirements

5 Hose Types (see table A)

5.1 Type 1 - Hose with one layer of wire braid reinforcement -40°C to +100°C (EN 853 1ST).

5.2 Type 2 - Hose with two layers of wire braid reinforcement -40°C to +100°C (EN 853 2ST).

5.3 Type 3 – Hose with four or more spiral wound wire reinforcements -40°C to +100°C (EN856 4SP).

5.4 Type 4 - Hose with four or more spiral wound wire reinforcements for Temperature Range -40°C to 120°C (EN856 R12).

5.5 Type 5 - Hose with four or more spiral wound wire reinforcements extra high pressure -40°C to +100°C (EN856 4SH).

6 Design Requirements of the Hose

6.1 The hose shall conform to all of the requirements listed in tables A and C2.

6.1.1 A hose produced for a pneumatic application shall be designed to meet the pressure ratios given in BS6596 : 1985 and shall have its cover pricked so that any diffusion of the compressed gas into the wall of the hose may be released.

6.1.2 The materials used in the construction of the hose shall, where the specification is not defined in this document, conform to a specification acceptable to the Design Authority.

6.2 The rubber used in the construction of the hose shall have the properties listed in table C1.

6.3 The minimum burst pressure of the hose shall be as specified in table A.

6.4 The minimum bend radius of the hose shall be as specified in table A and there shall be no greater reduction in bore than that stated in annex F.

6.5 The hose shall be suitable for use under the climatic conditions A, B, C0, C1, C2 and M of Def Stan 00-35.

6.6 The hose shall have a minimum total life of 10 years under its specified duty.

6.7 The hose shall, as a minimum, be "Flame Resistant", see **2.4,** and annex B.

6.7.1 The rubber used in the construction of the hose shall meet the Naval requirements for Smoke Index, Toxicity Index, Oxygen Index and Temperature Index, see annex H.

6.8 The hose shall be suitable for operation with the fluids listed below, which are defined in Def Stan 01-5:

OM13, OM15, OM18, OM33, OM65, OM100 and OX30.

Detergent engine oils OMD80, aqueous polyglycol OX40.

6.9 The hose cover shall be resistant to splash contamination by the fluids given in **6.8** and the following:

diesel, petrol, kerosene, sea water and distilled water and OX38, see table C1.

Table A

Hose Type, Bore and Maximum Working Pressure
Types and Hoses shall be Selected from the Range of Sizes Given Below

Type 1 - Hose with One Layer of Wire Braid Reinforcement

NOMINAL BORE		MAXIMUM HYDRAULIC WORKING PRESSURE	PROOF PRESSURE	MINIMUM BURST PRESSURE	MINIMUM BEND RADIUS (SEE **4.16)**	MAXIMUM DIAMETER OVER COVER (OD)
DN	DASH					
mm	1/16 in	BAR	BAR	BAR	mm	mm
5	-3	250	500	1000	90	14
6	-4	225	450	900	100	17
8	-5	215	430	860	115	19
10	-6	180	360	720	130	21
12	-8	160	320	640	180	24
16	-10	130	260	520	200	27
19	-12	105	210	420	240	31
25	-16	88	176	352	300	40
31	-20	63	126	252	420	48
38	-24	50	100	200	500	54
51	-32	40	80	160	630	68

Type 2 – Hose with Two Layers of Wire Braid Reinforcement

NOMINAL BORE		MAXIMUM HYDRAULIC WORKING PRESSURE	PROOF PRESSURE	MINIMUM BURST PRESSURE	MINIMUM BEND RADIUS (SEE **4.16)**	MAXIMUM DIAMETER OVER COVER (OD)
DN	DASH					
mm	1/16 in	BAR	BAR	BAR	mm	mm
5	-3	415	830	1660	90	17
6	-4	400	800	1600	100	19
8	-5	350	700	1400	115	20
10	-6	330	660	1320	130	23
12	-8	275	550	1100	180	26
16	-10	250	500	1000	200	29
19	-12	215	430	860	240	33
25	-16	165	330	660	300	41
31	-20	125	250	500	420	52
38	-24	90	180	360	500	59
51	-32	80	160	320	630	72

NOTE 1: The nominal bores are in DN sizes, the dash sizes are the nearest equivalent, they are not intended to be exact conversions, but are included for comparison only.

NOTE 2: Ratios of proof pressures are based on BS 6596 : 1985

NOTE 3: Hoses for pneumatic application (see **2.6** and **6.1.1)**

Type 3 – Hose with Four or More Spiral Wound Wire Reinforcements

NOMINAL BORE		MAXIMUM HYDRAULIC WORKING PRESSURE	PROOF PRESSURE	MINIMUM BURST PRESSURE	MINIMUM BEND RADIUS (SEE **4.16)**	MAXIMUM DIAMETER OVER COVER (OD)
DN	DASH					
mm	1/16 in	BAR	BAR	BAR	mm	mm
6	-4	450	900	1800	150	19
10	-6	445	890	1780	180	23
12	-8	415	830	1660	230	26
16	-10	350	700	1400	250	29
19	-12	350	700	1400	300	33
25	-16	280	560	1120	340	41
31	-20	210	420	840	460	53
38	-24	185	370	740	560	59
51	-32	185	330	660	660	72

Type 4 - Hose with Four or More Spiral Wound Wire Reinforcements

NOMINAL BORE		MAXIMUM HYDRAULIC WORKING PRESSURE	PROOF PRESSURE	MINIMUM BURST PRESSURE	MINIMUM BEND RADIUS (SEE **4.16)**	MAXIMUM DIAMETER OVER COVER (OD)
DN	DASH					
mm	1/16 in	BAR	BAR	BAR	mm	mm
10	-6	276	552	1104	127	21
12	-8	276	552	1104	178	25
16	-10	276	552	1104	200	29
20	-12	276	552	1104	241	32
25	-16	276	552	1104	305	39
31	-20	207	414	828	419	49
40	-24	172	344	688	508	55
50	-32	172	344	688	635	69

Type 5 - Hose with Four or More Spiral Wound Wire Reinforcements
Extra High Pressure

NOMINAL BORE		MAXIMUM HYDRAULIC WORKING PRESSURE	PROOF PRESSURE	MINIMUM BURST PRESSURE	MINIMUM BEND RADIUS (SEE **4.16)**	MAXIMUM DIAMETER OVER COVER (OD)
DN	DASH					
mm	1/16 in	BAR	BAR	BAR	mm	mm
19	-12	420	840	1680	280	33
25	-16	380	760	1520	340	40
31	-20	325	650	1300	460	48
38	-24	290	580	1160	560	55
51	-32	250	500	1000	700	70

NOTE: The maximum diameters over cover were obtained from a range of widely used hoses and are for guidance only in determining the position of fittings so that hose assemblies are not installed with bends less than the minimum bend radius.

7 Design Requirements of Hose Fittings

7.1 For new projects/designs the end fittings shall comply with BS 5200 or as specified in the contract. The end fittings of hose assemblies for use as replacements shall be as specified in the contract.

7.2 If the material is not specified in the contract, end fittings shall be made from carbon steel protected from corrosion by plating.

NOTE: Manufacturers' end connections are designed to suit specific hoses and must not be used on other manufacturers' hoses.

8 Design Requirements of the Hose Assemblies

8.1 The hose assemblies shall conform to the requirements listed in table C3.

8.2 The hose assemblies shall be designed so that if any failure should occur it shall occur in the hose.

8.3 The hose assemblies shall not leak or otherwise fail at Proof Pressure.

8.4 The hose end termination, when connected to the correct hose, shall be as a minimum "Flame Resistant". See **2.4, 4.8,** and annex B.

8.5 The hose assemblies shall be capable of continuous use at 100°C for Types 1 to 4 and 120°C for Type 5.

8.6 The hose assemblies shall be capable of functioning at -40°C.

8.7 The hose assemblies wire braid or spiral wound wire reinforcement shall make electrical contact with the end fitting to give electrical continuity as defined in table C3 No 7.

8.8 The hose end termination shall not reduce the bore of the hose assembly by more than the allowances given in annex C.

8.9 The hose assembly shall be resistant to corrosion when tested in accordance with annex D.

8.10 The hose end fitting and the hose cover shall be in contact at all points of the circumference of the hose so that there can be no possibility of entrapment of corrosive materials.

8.11 All hose assemblies used in existing aircraft designs shall be resistant to the effects of vibration when tested in accordance with BS 3G 100 Part 2 Section 3 Subsection 3.1. The exact requirements shall be supplied by the Design Authority for the aircraft.

9 Hose Construction

The hose shall consist of:

9.1 A seamless oil resistant synthetic rubber lining, smooth in the bore and free from defects. The rubber material shall be resistant to the fluids listed in **6.8** and meet the requirements of table C1.

9.2 The reinforcement shall consist of one or more layers of steel wire to BS 3592 Part 2 or alternative wire standard (see **6.1.1).** The wire shall be either braided or spiral wound depending on the type of hose. Where more than one layer of reinforcement is used, each layer shall be separated by an insulating layer of rubber. The use of fabric as a reinforcement is not allowed.

9.3 A seamless synthetic rubber cover, free from defects and porosity. It shall be resistant to abrasion, weathering, ozone and splash contamination of the fluids listed in **6.8** and **6.9** and meet the requirements of table C1.

9.4 The hose shall conform to the concentricity limits stated in table B when tested in accordance with BS 5173 Sec 101.1.

9.5 The hose lining shall have a minimum thickness of 1.5 mm and the cover a minimum thickness of 2 mm.

Table B

Bore Maximum Variation from Concentricity

NOMINAL BORE SIZE	MAXIMUM VARIATION FROM CONCENTRICITY	
	REINFORCEMENT TO BORE	COVER TO BORE
	mm	mm
Up to and including 6.3 mm	0.4	0.8
Over 6.3 mm, up to and including 19 mm	0.6	1.0
Over 19 mm	0.8	1.3

10 Construction of the Hose Assembly

10.1 End fittings shall be fitted only to the hose they are designed for use with and shall be assembled according to the declared production plan. See clause **7** NOTE and **12.1.**

10.2 End fittings shall be secured to hoses only by the method used for type testing. Clamps or clips are not permitted.

10.3 An anti-corrosion compound may be applied to the metallic reinforcement or to the end fittings where the anti–corrosion treatment has been destroyed during preparation for assembly. This compound shall be acceptable to the Design Authority.

10.4 Hoses to this specification shall have the cover removed and the fittings attached direct to the wire reinforcement.

Section Three. Type Testing of Hose and Hose Assemblies

11 Type Test Requirements

11.1 General. Before any hose or hose assembly is supplied against this Defence Standard the manufacturer shall undertake type testing in respect of each size and design, see **12.2.** The Design Authority for this Defence Standard to whom manufacturers of hose or hose assemblies are to submit type testing data is the Ship Support Agency, DME, ME223, Room 31, Block K, Foxhill, Bath.

11.2 The Design Authority will hold and maintain a register of all type test data for MOD QA and procurement purposes.

11.3 Unless stated otherwise, in the case of failure of one or more samples to meet any of the tests specified, the hose and/or hose assemblies shall be re–sampled and re–tested. Twice the number of specimens designated under the initial test procedure shall be selected from the same batch for such re–test. Failure of any of the re-tested samples shall be cause for rejection of the whole batch.

11.4 Type test results are to be dated and allocated a unique reference number by the manufacturer. Type test results are to be submitted in the proforma at annex J. The responsibility for updating/undertaking further type testing on new/revised product lies solely with the manufacturer. Type test results shall be valid for a maximum period of 5 years.

11.5 The Design Authority reserve the right to request a number of samples at any time for the purpose of verifying type results. The tests shall be undertaken for the Design Authority by a recognised third party.

11.6 Type testing shall be undertaken at the manufacturers or manufacturers representatives cost.

12 Selection of Samples

12.1 The manufacturer should when considering supplying hose or hose assemblies to this Defence Standard propose the samples to be tested to the Design Authority prior to commencing any work. The number and size of samples to be tested shall be as stated in the appropriate test clause. See Table C4.

12.2 Representative sizes of each type and design of hose shall be tested and shall reflect the extremes of sizes of hose the manufacturer intends to supply.

12.3 When the range of samples has been agreed with the Design Authority, the manufacturer is to provide a test programme and identify a suitable opportunity for a representative from the Design Authority to witness all or part of the tests.

12.4 All sample assemblies shall be fitted with straight end fittings which shall be representative of the design used by the manufacturer.

13 Manufacturer's Declaration

13.1 A declaration for submission of Type Test Results to the Design Authority shall be completed for each individual design and each nominal size of hose or hose assembly. The declaration should be in the form of a Test Report with the unique reference number and date (see 11.4) and shall contain the following information:

(a) name and address of manufacturer;

(b) place or places of manufacture of hose and end fittings;

(c) place or places of manufacture of assembly;

(d) type, hose size and declared performance data of hose assembly.

(e) test report shall be in accordance with Def Stan 93-50, see Annex G.

13.2 The declaration shall be signed by the person named in the manufacturer's production plan.

14 Tender And Quality Requirements

14.1 Tenders for the supply of flexible hose assemblies to this Defence Standard shall quote the unique reference and date of the type test data submission to the Design Authority. A statement shall be included that the assemblies conform in every detail to the sample(s) tested and that the place of manufacture is the same.

14.2 Type Test procedures and results are to be prepared and retained in accordance with the relevant Quality Management System.

15 Production Plan

15.1 A production plan shall be produced to cover all hose sizes and types submitted for approval. It shall cover processes involved in the production of the hose, the rubber and the production of hose assemblies.

15.2 The production plan shall be submitted to and agreed by the Design Authority before Type Testing can proceed.

16 Repeat Type Tests

16.1 Full details of any change contemplated in the design, construction, manufacturing process or materials used in the manufacture of any hose assembly which has been type tested shall be brought to the notice of the Design Authority for agreement who may, at its discretion, call for samples embodying the proposed changes for type testing.

16.2 Hose or hose assemblies to a design already approved, but from a new source or place of manufacture, shall be re–tested.

16.3 Should the result of a repeat type test be unsatisfactory, the hose or hose assembly shall be deemed not to meet this Defence Standard.

16.4 The test specified in tables C1, C2 and C3 shall be met and the information required at Annex G supplied.

16.5 Material test samples shall be in accordance with the requirements of Def Stan 93–31 and Def Stan 93-50 for tests 1 to 8 in Table C1.

Table C1

Rubber Properties

NO	TEST	METHOD	REQUIREMENT
1	Specific Gravity	BS 903 Part A1	Nominal ± 0.02
2	Low Temperature Brittle Point	BS 903 Part A25	No cracks at –40°C
3	Resistance to Accelerated Ageing	BS 903 Part A19 Method A or B for 168 hours	Cover material at 100°C Lining material at 70°C
	a. Change in Hardness	BS 903 Part A26 and Def Stan 93–31	+8 IRHD for both –2 Cover and lining material
	b. Change in Tensile Strength	BS 903 Part A2	Cover material -25% Lining material -20%
	c. Change in Elongation at Break	BS 903 Part A2	Cover material –35% Lining material -25%
4	Resistance to Fluids	BS 903 Part A16	
	a. Lining Material	168 hours at 100°C in standard oil No 3	
	Volume Change Hardness Change		+25% max +0 IRHD -15
	Tensile Strength Elongation at Break		-35% of original value -35% of original value

NO	TEST	METHOD	REQUIREMENT
4	b. Cover Material Volume Change	168 hours at 70°C in standard oil No 3	+100% max
5	Ozone Resistance Cover a. Material as received b. After immersion in standard oil No 3 168 hours at 70°C	BS 903 A43 72 hours at 40°C, 50 pphm, 20% elongation	No cracks when examined at X2 magnification
6	Abrasion Resistance Cover Material	BS 903 Part A9 Method A1, Relative Volume Loss 10 N Force	250 mm^3 maximum
7	Resistance to Operating Fluids listed in Para 6.8 for Liner and 6.8 and 6.9 for Cover a. Lining Material Volume Change Tensile strength Elongation at break b. Cover Material Volume Change Tensile Strength Elongation at break	Immersion at 50°C for 28 days BS 903 A16	 +20% -5% (No disintegration shall occur) ±15% +10% -20% +30% (Note: this figure may rise to +40% in OX38, this is acceptable. No disintegration shall occur) ±20% +10% -20%

8	Fire Test (Combustion Characteristics)	Annex H	
	(a) Smoke Index	NES 711 Sample size 75 x 75 x 1.5	<50
	(b) Toxicity Index	NES 713 Sample size 75 x 75 x 1.5	<5
	(c) Oxygen Index	BS 2782 Pt 1 method 141 Sample size 150 x 10±0.5 x 1.5	>30
	(d) Temperature Index	BS 2782 Pt 1 methods 141 a&b Sample size 150x6.5±0.5x1.5	>250

Table C2

Hose Properties

NO	TEST	METHOD	REQUIREMENT
1	Low Temperature Bend Test	BS 5173 Part 106 Section 106.1 Method B -40°C	No cracks and survival of Proof Test
2	Abrasion Resistance	BS 5173 Part 103 Sec 103.9 50 N Load	Max weight loss 1 gm after 2000 cycles. No exposure of the reinforcement
3	Adhesion Cover/ Reinforcement Between Plies Reinforcement/ Lining	BS 5173 Part 103 Sec 103.9 Type 6 Test Piece Type 5 Test Piece	2.5 N/mm There shall be adhesion to the metal
4	Ozone Resistance	BS 5173 Part 106 Sec 106.3 72 hours at 40°C, 50 pphm, Method 1	No cracks when examined at X2 magnification
5	Resistance to Operating Fluids. Type Approval. It may be required that the compatibility of the compounds forming the cover and lining of the hose be determined. This shall be carried out as given in Table C1, Test No 7.		
6	Impulse Test	BS 5173 Part 102 Sec 102.5 See Annex E	Type Cycles 1 150,000 2 200,000 3 & 4 400,000 5 500,000
7	Fire Resistance Test	BS 3G 100 Part 2 Section 3 Subsection 3.13 See Annex B	All sizes to be a minimum of 3 Minutes Flame Resistant. No leakage and a maximum 5 seconds afterburn on removal of flame. See **2.4** and **16.3**
8	Proof Test	BS 5173 Part 102 Section 102.1, table A See annex A	No leaks when fluorescein dye tested

Table C2 – Concluded

NO	TEST	METHOD	REQUIREMENT
9	Burst Test	BS 5173 Part 102 Section 102.1 See annex A	Table A
10	Hydrostatic Stability Test	BS 5173 Part 102 Section 102.1 See annex A	Change in length +2% -4% No failure of Assembly, Twist 5°/metre max
11	Dimensions	BS 5173 Part 101 Section 101.1	Declare Nominal ± Declared Tolerance
12	Bore Check at Min Bend Radius	Annex F	Free passage of ball 95% of nominal bore

Table C3

Hose Assembly Properties

NO	TEST	METHOD	REQUIREMENT
1	Low Temperature Bend Test	BS 5173 Part 106 Sec 106.1 Method B -40°C	No cracks and survival of Proof Test
2	Impulse Test	BS 5173 Part 102 Sec 102.5 Method 7.2 See annex E	Type Cycles 1 150,000 2 200,000 3 & 4 400,000 5 500,000
3	Fire Resistance Test	BS 3G 100 Part 2 Section 3 Subsection 3.13 See annex B	All sizes to be a minimum of 3 minutes Flame Resistant. No leakage and a maximum 5 seconds afterburn on removal of flame. See **2.4.**
4	Proof Test	BS 5173 Part 102 Section 102.1, table A See annex A, A-1	No leaks

Table C3 – Concluded

NO	TEST	METHOD	REQUIREMENT
5	Burst Test	BS 5173 Part 102 Section 102.1	Table A
6	Hydrostatic Stability Test	BS 5173 Part 102 Section 102.1 See annex A, A-2	Change in Length +2% -4% No failure of Assembly Twist 5°/metre max
7	Electrical Continuity	BS 5173 Part 104 Section 104.1	Each assembly shall have a maximum resistance of 0.05 ohms
8	Bore Check	See annex C and table E	Free passage
9	Dimensions	BS 5173 Part 101 Section 101.1 BS 5173 Part 101 Section 101.2	Drawing requirement
10	Corrosion Resistance	See annex D	No base metal shall be apparent

17 Type Test Sequence

17.1 Twelve samples of each size of hose assemblies selected, one metre in length, or as specified in individual tests shall be provided. They shall be tested in the following sequence listed in table C4. Failure of any sample shall cause rejection of that type and size.

Table C4

Type Test Sequence

TEST	SAMPLE NUMBERS	REFERENCE
Low Temperature Bend	1, 2 and 3	Table C3 No 1
Proof Test	1, 2 and 3	Table C3 No 4
Electrical Continuity	1, 2 and 3	Table C3 No 7

Table C4 – Concluded

TEST	SAMPLE NUMBERS	REFERENCE
Hydrostatic Stability	1, 2 and 3	Table C3 No 6 and annex A
Burst Test	1, 2 and 3	Table C3 No 5
Bore Check	4, 5 and 6	Table C3 No 8 and annex C
Impulse Test	4, 5, 6 and 7	Table C3 No 2 and annex E
Sectioning for Examination	4	See **17.2**
Corrosion Resistance	8	Table C3 No 10 annex D
Fire Resistance	9, 10, 11 and 12	Table C3 No 3 and annex B

17.2 Sectioning for examination. The sample 4 is to be sectioned longitudinally and examined for signs of internal collapse or other indications of failure. The sample is to be retained for inspection by the Design Authority.

Section Four. Approval of Hose Assembly Companies

18. Type Test Requirements for Hose Assembly Companies

Before a hose assembly company can be considered for the supply of hoses, it shall provide type test and supporting data to the Design Authority as required at **20** for each size to be supplied. The submission shall be identified with the assemblers unique reference number, and the date of the tests as required under **21.**

19. Arrangements for Type Testing

When the range of samples has been agreed with the Design Authority, the assembler is to provide a test programme and identify a suitable opportunity for a representative from the Design Authority to witness all or part of the tests.

20. Assembly Type Test Submission

Assembly type test submissions shall comprise the following:

(a) A written statement or certificate from the manufacturer of the hose and fittings that the assembly company is an official distributor and qualified/approved assembler of product which satisfies the requirement of and has undergone type testing to this Standard.

(b) Type and hose sizes to be assembled, using manufacturers identification numbers to enable cross reference with manufacturers type test data.

(c) Results of the hose assembly type tests as specified at **21** are to be submitted on the proforma at annex J.

(d) Copy of assemblers Quality Approval Certificate.

(e) Name, Address place/places of assembly.

(f) Company assembly/production plan.

21. Assembly Type Test Requirements

21.1 The following additional type tests shall be undertaken by any company assembling hose assemblies using hose and fittings type tested by the original manufacturer. These are to prove the integrity and acceptability of the finished product from the specified assembly facility. The additional tests are specified by table C3 Nos. 4, 5, 7 and 9.

21.2 The type test results shall be prepared and submitted in accordance with **13** and **14.2.**

22. Tendering Conditions

22.1 Before a hose assembly company may tender for the supply of hose assemblies to this Standard the company shall have satisfied the requirements of **18.**

22.2 Hose assemblers tendering for the supply of hose assemblies to this Standard shall quote the unique reference number and date the tests required at **21** were undertaken.

22.3 A statement shall be included that the assemblies conform in every detail to the samples type tested and that the place/places of assembly is/are as stated on the certificate.

Section Five. Manufacture

23 Tolerances

23.1 Length. The tolerances permitted on the length of hose assemblies are given in table D:

Table D

Tolerances on Lengths of Hose Assemblies

LENGTH UP TO AND INCLUDING (M)	TOLERANCE	
	MINUS	PLUS
0.5	0	6 mm
1	0	12 mm
5	0	20 mm
10	0	50 mm
Over 10	0	150 mm

24 Angle Fittings

The tolerance on angle fittings shall be within ±3°, see figure 1.

25 Angular Relationship Between End Fittings

Where the two end fittings have a specified angular relationship about the axis of the hose, the tolerance shall be within ±3°, see figure 1.

26 Hose Life - Age of Rubber

26.1 Because of the shelf/storage life, service life and total life limitations related to items wholly or partially composed of rubber, the age of the hose or hose element of the hose assembly on delivery from the supplier to the MOD shall not exceed one year, measured from the date of cure of the rubber.

26.2 Where hoses are supplied as components in equipment/vehicle/vessel then the cure date of the rubber shall still be taken as datum. However the total life left on delivery of equipment/vehicle/vessel will be subject to contractual agreement between the Authority responsible for the technical aspects of the contract and the manufacturer/supplier of the complete equipment/vehicle/vessel.

27 Defects

27.1 The hose shall be free from all major class B defects as described by Federal Standard No 162a.

27.2 Minor class B defects shall be subject to concession action with the Design Authority through the Quality Assurance Representative.

27.3 Any damage caused to the surface of the couplings during the manufacture of the assembly shall be made good and the assembly cleaned after repair.

28 Production Tests

28.1 All batches of rubber material shall be tested in accordance with table C1 (excluding Test No 7 Resistance to Operating Fluids) as required by Def Stan 93-50.

28.2 Hose. All batches of hose shall be tested to table C2 test Nos 8 and 11.

28.3 Hose Assemblies. Each hose assembly shall be tested to table C3 test No 7 and annex A, clause A.5 and any specific test quoted on the drawing.

28.4 The quality assurance authority named in the contract or/and the Design Authority may request that any of the other tests listed in this Defence Standard be performed at any time.

29 Flushing and Cleaning of Hoses

Every hose bore should be cleaned and dried. This should be done in accordance with the requirements of the specification to which the assembly is manufactured. In the absence of any additional instructions and where the fluid medium of the base is not known the base should be cleaned out with soap and water, rinsed with clean water and then dried.

30 Hose Markings

The following minimum information shall be applied legibly and indelibly to the hose cover of each assembly.

Def Stan 47–2 and Type (1, 2, 3, 4 or 5)

The manufacturer’s identification and name.

Date of cure of the rubber by quarter and year.

A lay line or lines parallel to the hose longitudinal axis. Except where other markings are present, the line(s) shall be continuous.

EXAMPLE OF MARKING

Def Stan 47-2 _____ Type 1 _____ Smith & Co _____ Q2 - 94 _____

31 Hose Assembly Markings

31.1 A metal band or bands shall be secured around each hose assembly and carry the following minimum information. Alternatively, the information may be marked on the connection ferrule:

31.1 (Contd)

Def Stan 47-2

Assemblers identification and name (when manufacturer's hose and fittings have been assembled by another company)

NATO Stock Number/Management Code

Batch Number

Maximum Hydraulic Working Pressure

Test Pressure and Test Date

Maximum Pneumatic Working Pressure (should the hose assembly have been produced for that service).

31.2 Hose assemblies less than 600 mm long, which, if manufactured from bulk hose stock on which cure date markings are 600 mm apart, would not show any cure date marking. Therefore, some additional marking shall be required, ie a metal band around the circumference of the hose assembly with the cure date marked on it and any additional marking required by the drawing.

32 Packaging and Protection

Packaging of hose and hose assemblies shall be in accordance with Def Stan 81-39 except that the polythene used shall be black. The end coupling shall be protected by mouldable wrap. The outside of packaging shall clearly indicate NSN, designation, cure date of hose, date of hose assembly and of test. Where hose is supplied in bulk, hose shall be held in sealed tri–wall containers or in pallets which are edged with black polyethylene to restrict light.

NOTE: Or as specified in the contract.

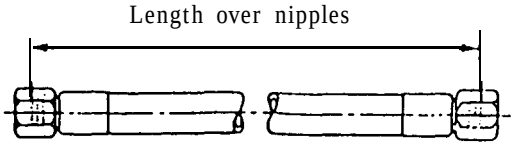
33 Commercial Storage and Retesting

Hose manufacturers, hose assemblers and equipment manufacturers shall comply with BS 5244.

34 Approved Manufacturers' and Assemblers' List

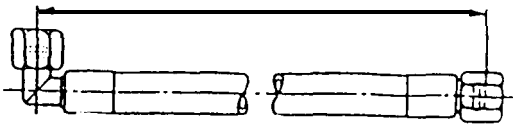
A current list of approved manufacturers and assemblers can be obtained from the Design Authority, see **11.1** for address.

Length over nipples



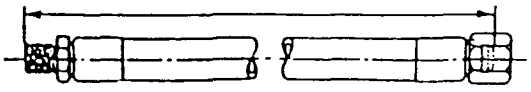
Swivel female union each end

Length between centre line of angle and over nipple



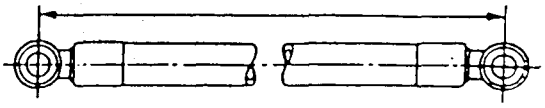
Swivel female straight and 90° angle unions

Overall length over nipple



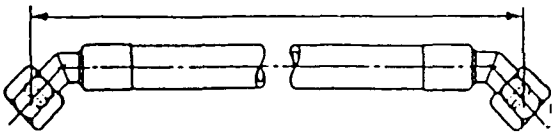
Male and swivel female unions

Length between centre line of banjos



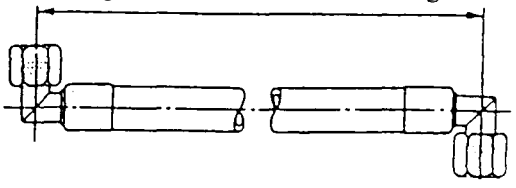
Banjo couplings

Length between centre line of nipples



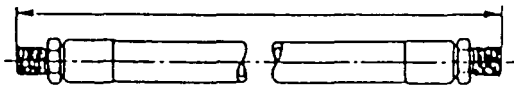
Swivel female 135° angle unions each end

Length between centre line of angles



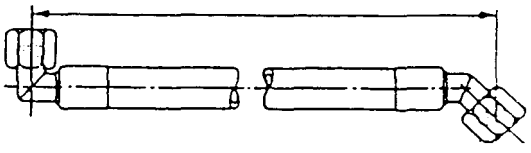
Swivel female 90° angle unions each end

Overall length



Male ends

Length between centre line of angle and centre line of nipple



Swivel female 90° and 135° angle unions

Angle settings

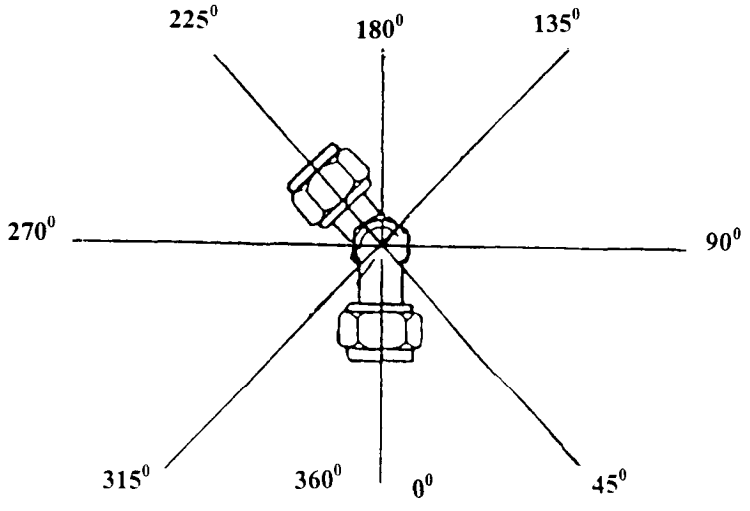


Fig 1 Method of Dimensioning Flexible Hose Assemblies

Collation Page

Hydrostatic Tests

A.1 The Proof Test

Shall be conducted in accordance with BS 5173 Part 102 Sec 102.1.

A.2 The Hydrostatic Stability Test shall be carried out at the maximium working pressure defined in table A and the change in length and degree of twist determined in accordance with BS 5173 Part 102 Sec 102.1 but with the following amendments.

A.2.1 The pressure shall then be released, reapplied to the Proof Pressure given in table A and held for one minute. The pressure shall then be raised to three times the maximum working pressure given in table A and held for one minute. At both of the pressure holds the assembly shall be examined for leakage and any signs of incipient failure, using a fluorescein dye in the test fluid. The pressure shall then be reduced to zero and the test terminated if there are any signs of failure.

A.3 Burst Test

The pressure shall be raised in accordance with BS 5173 Part 102 Sec 102.1 until the hose assembly fails. The pressure at failure shall be recorded.

A.4 Type Testing Sequence

A.4.1 At Type Testing the tests shall be conducted consecutively, the hose assembly being allowed to return to zero pressure between each test. Three samples shall be tested.

A.4.2 The test fluid shall be ZX 9 containing fluorescein dye.

A.5 Production Testing

A.5.1 Raise to the appropriate proof pressure for the hose, hold for one minute. Check for any signs of failure (see clause **28)** .

A.5.2 Flush and dry assembly.

NOTE: Reference is made to this annex in table C2 Nos 6, 8, 9 and 10, also in table C3 Nos 4 and 6.

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Resistance to Fire (Loss of Function)

B.1 This method of test is based on BS 3G 100 Part 2 Section 3 Subsection 3.13 and applies to all hose and hose assemblies and to all bore sizes. The chosen options of Subsection 3.13 are as given in the following text.

B.2 The Standard Burner shall be that specified in BS 3G 100 Appendix A of Subsection 3.13.

B.3 Procedure

The hose assembly to be tested shall be blanked at one end, mounted so that it is bent at the minimum bend radius given in table A. The blanked end shall be vibrated throughout the test. The amplitude of the vibration shall be ±1.25 mm and the frequency 50 Hz. It shall be filled with the test fluid OM 13, or a suitable alternative approved by the Design Authority, and subjected to a constant pressure equal to the maximum working pressure given in table A. The tests shall be continued until failure occurs and the time to fail recorded. The test may be discontinued after a period of 15 minutes.

B.4 Hose Test

The nozzle of the torch shall be positioned 50 mm from the surface of the hose, approximately equidistant from each end, with the flame directed radially onto the outer periphery of the hose.

B.5 End Fitting Tests

The nozzle of the torch shall be positioned 50 mm from the surface of the hose with the flame directed radially on the outside of the bend and onto the junction of the hose and vibrated end termination.

Collation Page

Bore Check

C.1 Three samples shall be tested to ensure that no excessive reduction of the bore of the hose has occurred when attaching the end fittings. A solid rigid sphere or plug of dimensions given in table E shall pass freely through the complete length of the assembly.

Table E

Test Sphere or Plug Dimensions

HOSE NOM BORE		MINIMUM BORE DIA OF INSERT (mm)	MINIMUM BORE DIA AFTER SWAGING (mm)	TEST SPHERE OR PLUG DIA TOLERANCE -0 (mm)
DN	Dash			
5	-3	3	2.7	2.5
6	-4	4	3.6	3.4
8	-5	5.8	5.2	5
10	-6	7	6.3	6
12	-8	9	8.1	7.6
16	-10	12	10.8	10.2
19	-12	14	12.6	12
25	-16	19	17.1	16
31	-20	26	23.4	22
38	-24	32	28.8	27
51	-32	42	37.8	36

C.2 The test shall be performed using straight end fittings only. These shall be representative of all coupling types.

NOTE: Reference is made to this annex at table C3 No 8.

Collation Page

Method of Test for Corrosion Resistance

D.1 Apparatus

D.1.1 A salt spray chamber, of internal capacity at least 0.8 m^3, with collecting ducts.

D.1.2 A salt solution reservoir.

D.1.3 A supply of compressed, air, free from grease and dirt and maintained at a pressure of between 0.7 and 1.75 bar.

D.1.4 A spray nozzle or nozzles, adjusted so that the collecting ducts collect between 1 and 2 ml of salt solution per hour for each 80 cm^2 of horizontal collecting area.

D.1.5 Test assembly supports

D.1.6 A means of maintaining the temperature of the chamber at 35 ± 1°C.

D.2 Construction of Apparatus

The apparatus shall be constructed so that:

D.2.1 The construction material does not affect the corrosiveness of the salt spray;

D.2.2 The test assembly is supported or suspended 30° from the vertical and parallel to the principal direction of the horizontal flow of salt spray through the chamber;

D.2.3 The test assembly shall not contact any metallic material or any material capable of acting as a wick;

D.2.4 Condensation which falls from the test assembly shall not return to the salt solution reservoir for spraying;

D.2.5 Condensation from any source does not fall on the test assembly or the collecting ducts.

D.2.6 Spray from the nozzle or nozzles shall not be directed onto the test assembly.

D.3 Reagent

A salt solution, five parts by mass of sodium chloride to 95 parts of distilled water, using sodium chloride substantially free of nickel and copper, and containing on a dry basis not more than 0.1 percent of sodium iodide and not more than 0.3 percent of total impurities. Ensure that the solution is free of suspended solids before the solution is atomized.

D.4 Test assembly

The hose assembly to be tested shall be new and unused and shall not be tested until at least 25 hours after manufacture.

D.5 Procedure

D.5.1 Plug each end of the test assembly and place in the salt spray chamber.

D.5.2 Subject the test assembly to atomized reagent at 35°C ensuring that the collected solution is in the pH range 6.5 to 7.2; pH measurements shall be made at a temperature of 25°C.

D.5.3 Maintain a compressed air supply to the nozzle or nozzles free of oil and dirt and at a pressure of between 0.7. to 1.75 bar.

D.5.4 Subject the test assembly to the salt spray continuously for 168 h.

D.5.5 After exposure, remove the salt deposit from the surface of the test assembly by washing gently or dipping in clean running water at a temperature not exceeding 40°C and then drying immediately.

D.5.6 Examine the base metal of the end fittings for evidence of corrosion.

D.6 Report

The report shall include the following information:

(a) A reference to this Standard;

(b) The identification of the hose assembly;

(c) The date of test;

(d) The condition of the end fittings after test.

NOTE: Reference is made to this annex at table C3 No 10.

Impulse Test

E.1 The test shall be conducted substantially in accordance with BS 5173 Part 102 Sec 102.5 but with the following exceptions.

E.1.1 The fluid shall be as specified in BS 5173, Part 102.5.

E.1.2 The temperature shall be 100°C for types 1, 2, 3 & 4 and for type 5, 120°C.

E.1.3 When hoses are tested the hose assembly shall be formed using the hose couplings approved for use with that hose type. At Type Testing the hose shall be fitted with the couplings proposed for approval.

E.1.4 It will be permissible for specific hose assemblies to be tested at different temperatures and using different fluids when required by a particular equipment manager. A satisfactory performance to this requirement will form a separate Approval and be noted as such.

E.1.5 Any failure of the hose or hose assembly before the expiry of the required number of impulse cycles shall be recorded as a failure of the assembly, and a duplicate assembly tested. The failed assembly shall be sectioned to determine the cause of failure.

E.1.6 On completion of the required number of impulse cycles the Design Authority may request that the test be continued to failure and/or that the sample hose assemblies be subjected to the other hose tests listed in tables C2 and C3.

NOTE: Reference is made to this annex in tables C2 No 6 and C3 No 2.

Table F

Impulse Test Pressure

HOSE TYPE	BORE SIZE	PERCENTAGE OF MAXIMUM WORKING PRESSURE
1	Up to and including 25 mm	125
1	Over 25 mm	100
2, 3, 4 & 5	All	133

Collation Page

Bore Check at the Minimum Bend Radius

F.1 A length of hose not less than πx r where r equals the minimum bend radius shall be bent through 180° around a mandrel. The diameter of the mandrel shall be equal to twice the minimum bend radius of the hose to be tested. A sphere, diameter 95% of the nominal bore, shall pass freely through the hose, see table C2 No 12.

Collation Page

Test Report Requirements (for Manufacturer's Declaration)

G.1 The following information shall be included in the Test Report.

G.1.1 Reference No for the rubber used for the lining.

G.1.2 Reference No for the rubber used for the cover.

G.1.3 The rubber mixes used for the lining and cover shall be declared.

G.1.4 Thickness of cover.

G.1.5 Thickness of lining.

G.1.6 Wall thickness.

G.1.7 Inner diameter.

G.1.8 Outer diameter.

G.1.9 Material used for the end fittings (see clause **7).**

G.1.10 Concentricity (table B).

G.1.11 Anti-corrosion compound used (see **10.3).**

G.1.12 Reference No for Production Plan (see clause **15).**

G.1.13 Marking check (see clause **30** and **31).**

G.1.14 Reports of all the tests specified in tables C1, C2 and C3.

G.1.15 Report of annex H.

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H.1 Fire Test (Combustion Characteristics)

These tests are intended to specify the combustion characteristics of the hose cover for the purposes of production control. They are not suitable for the assessment of a fire hazard; however, they are used as a means of preventing the use of material with a high potential for exacerbating a hazard resulting from combustion.

H.2 Design Authorities specify acceptance levels in terms of numerical test indices for particular applications. The standards that are desirable to be achieved for the various fire tests should be as follows:

(a) the Smoke Index - values of 100 or less, determined in accordance with NES 711;

(b) the Toxicity Index – values of 5 or less, determined in accordance with NES 713:

(c) the Oxygen Index – value of 30 or more, determined in accordance with BS 2782: Part 1: Method 141;

(d) the Temperature Index – the numerical value should be as high as possible - value of 250 or more determined in accordance with BS 2782: Part 1: Methods 141A and 141B.

The thickness of the test piece for each test shall be 1.5 mm.

NOTE: The stated index values may not all be obtained for a particular material. Acceptance will depend upon factors such as the degree or variance for each test; the availability of an alternative material; or a unique physical property which meets a specified requirement.

H.3 Requirements for combustion characteristics indices shall be specified in the enquiry/invitation to tender and the acceptance levels given in any subsequent contract. The indices shall be re–established by retest whenever a change in material specification is made.

Collation Page

Hose and Hose Assembly Type Test Results Proforma

MANUFACTURER ..... HOSE ..... UNIQUE REF .....

Table C1

COVER MATERIALS - RUBBER PROPERTIES

Test	Requirement	Cover Type	Cover Type
1. Specific Gravity	Nominal 0.02		
2. Low temperature brittle point	No cracks at -40 degrees C		
3. Resistance to accelerated ageing	at 100 degrees C		
a. Change in hardness	-2 to +8 IRHD		
b. Change in tensile strength	-25%		
c. Change in elongation at break	-35%		
4. Resistance to Fluid			
a. Volume change	+100% max		
5. Abrasion resistance	250 cu.mm		
6. Ozone resistance	No crack at X2 magnification		

RESISTANCE TO OPERATING FLUIDS

OM18 - Hydraulic Fluid		
Change in volume	0 to +30%	
Change in tensile strength	+20% to -20%	
Change in elongation at break	–20% to +10%	
OM15 - Hydraulic Fluid		
Change in volume	0 to +30%	
Change in tensile strength	+20% to –20%	
Change in elongation at break	-20% to +10%	
OX40 - Aqueous Polyglycol		
Change in volume	0 to +30%	
Change in tensile strength	+20% to -20%	
Change in elongation at break	–20% to +10%	
OX38 – Aviation engine oil		
Change in volume	0 to +30%	
Change in tensile strength	+20% to –20%	
Change in elongation at break	–20% to +10%	
OM13 - Lubricating Oil		
Change in volume	0 to +30%	
Change in tensile strength	+20% to -20%	
Change in elongation at break	-20% to +10%	
OM100 - Lubricating Oil		
Change in volume	0 to +30%	
Change in tensile strength	+20% to -20%	
Change in elongation at break	-20% to +10%	
OM33 - Hydraulic Fluid		
Change in volume	0 to +30%	
Change in tensile strength	+20% to -20%	
Change in elongation at break	-20% to +10%	

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RESISTANCE TO OPERATING FLUIDS (Contd)

OX30 - Hydraulic Fluid		
Change in volume –5 to +20%		
Change in tensile strength +20% to –20%		
Change in elongation at break –20% to +10%		
OMD80 – Lubricating Fluid		
Change in volume -5 to +20%		
Change in tensile strength +20% to -20%		
Change in elongation at break –20% to +10%		
OM65 – Hydraulic Fluid		
Change in volume -5 to +20%		
Change in tensile strength +20% to -20%		
Change in elongation at break -20% to +10%		

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Table C1

LINING MATERIALS - RUBBER PROPERTIES

Test	Requirement	Lining Type	Lining Type
1. Specific Gravity	Nominal 0.02		
2. Low temperature brittle point	No cracks at -40 degrees C		
3. Resistance to accelerated ageing	at 100 degrees C		
a. Change in hardness -2 to +8 IRHD			
b. Change in tensile strength -25%			
c. Change in elongation at break -35%			
4. Resistance to fluid			
a. Volume change	+100% max		
b. Hardness change	+0 to –15 IRHD		
c. Tensile strength	-35% of original		
d. Elongation at strength	–35% of original		

RESISTANCE TO OPERATING FLUIDS

OM18 - Hydraulic Fluid Change in volume -5 to +20% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		
OM15 – Hydraulic Fluid Change in volume -5 to +20% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		
OX40 - Aqueous Polyglycol Change in volume –5 to +20% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		
OX38 – Aviation engine oil Change in volume –5 to +20% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		
OM13 - Lubricating Oil Change in volume -5 to +20% Change in tensile strength +20% to –20% Change in elongation at break –20% to +10%		
OM100 – Lubricating Oil Change in volume –5 to +20% Change in tensile strength +20% to -20% Change in elongation at break –20% to +10%		
OM33 - Hydraullc Fluid Change in volume -5 to +20% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		
OX30 - Hydraulic Fluid Change in volume 0 to +30% Change in tensile strength +20% to -20% Change in elongation at break -20% to +10%		

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RESISTANCE TO OPERATING FLUIDS (Contd)

OMD80 – Lubricating Fluid		
Change in volume 0 to +30%		
Change in tensile strength +20% to –20%		
Change in elongation at break –20% to +10%		
OM65 - Hydraulic Fluid		
Change in volume 0 to +30%		
Change in tensile strength +20% to -20%		
Change in elongation at break -20% to +10%		

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TABLE C1

RUBBER PROPERTIES
FIRE TESTS - COMBUSTION CHARACTERISTICS

	Material Type	Material Type	Material Type
TEST REQUIREMENT			
a . The Smoke Index<100			
b. The Toxicity Index<5 per 100 g			
c. The Oxygen Index>30%			
d. The Temperature Index >250 degrees C			

HBr-Hydrogen Bromide
HCl–Hydrogen Chloride

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TABLE C2

HOSE PROPERTIES

TEST	REQUIREMENT	SAMPLE NO	HOSE TYPE AND SIZE	HOSE TYPE AND SIZE
1. Low temperature bend test	No cracks @ -40 degrees C	1		
	No cracks @ –40 degrees C	2		
	No cracks @ -40 degrees C	3		
	Proof test, pressure in brackets	1		
	Proof test, pressure in brackets	2		
	Proof test, pressure in brackets	3		
2. Abrasion test	Max wt loss 1g after 1000 cycles			
	Exposure of the reinforcement			
3. Adhesion				
Cover/reinforcement	>2.2 N/mm, adhesion to the metal			
Between plies (ply/ply)	>2.2 N/mm, adhesion to the metal			
Reinforcement/Lining	>2.2 N/mm, adhesion to the metal			
4. Ozone Resistance	No cracks @ 2X magnification			
5. Resistance to Operating Fluids, see table C1				
6. Impulse Test Type 1	150,000 100°C <25mm 125% WP	4		
Type 1	150,000 100°C >25mm 100% WP	5		
Type 2	200,000 100°C All 133% WP	6		
Type 3 & 4	400,000 100°C All 133% WP	7		
Type 5	500,000 120°C All 133% WP			
7. Fire Resistance Test	3 minutes,no leakage,no afterburn	9		
		10		
8. Proof Pressure Test	Pressures in brackets for 1 minute each	1		
		2		
		3		
9. Burst Test	See figure in brackets for min	1		
		2		
		3		
10. Hydrostatic Stability Test	+2% to –4% elongation	1		
		2		
		3		
	Maximum twist 5 degrees	1		
	Maximum twist 5 degrees	2		
	Maximum twist 5 degrees	3		
11. Dimensions	As declared nominal/tolerance dims			
12. Bore Check @ min Bend Rad				
	Free passage of ball 95% of NB	4		
	Reduction in mm, bore size in brackets	5		
		6		
	HOSE WORKING PRESSURE (bar)			
	TUBE MATERIALS			

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TABLE C3

HOSE ASSEMBLY PROPERTIES

TEST	REQUIREMENT	SAMPLE NO		
1. Low temperature bend test	No cracks @ -40 degrees C	1		
	No cracks @ -40 degrees C	2		
	No cracks @ -40 degrees C	3		
	Proof test, pressure in brackets	1		
	Proof test, pressure in brackets	2		
	Proof test, pressure in brackets	3		
2. Impulse Test	Type / Cycles / Temp / Ø / Test Pressure	4		
	1 / 150,000 / 100°C / <25mm / 125% WP	5		
	1 / 150,000 / 100°C / >25mm / 100% WP	6		
	2 / 200,000 / 100°C / All / 133% WP	7		
	3 & 4 / 400,000 / 100°C / All / 133% WP			
	5 / 500,000 / 120°C / All / 133% WP			
3. Fire Resistance Test	3 minutes,no leakage,no afterburn	9		
		10		
4. Proof Pressure Test	Pressures in brackets for 1 minute each	1		
		2		
		3		
5. Burst Test	See figure in brackets for min	1		
		2		
		3		
6. Hydrostatic Stability Test		1		
	+2% to –4% elongation @ pressure shown in brackets	1		
		2		
		3		
	Maximum twist 5 degrees	1		
	Maximum twist 5 degrees	2		
	Maximum twist 5 degrees	3		
7. Electrical Continuity	Maximum resistance 0.05 ohms			
8. Bore Check @ min bend Rad	Free passage of ball 95% of NB, reduction in mm, bore size in brackets	4		
		5		
		6		
9. Dimensions	As declared nominal/tolerance dims			
10. Corrosion Resistance	No base metal should be apparent			

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TABLE C3

HOSE ASSEMBLY COMPANIES

TEST	REQUIREMENT	SAMPLE NO	HOSE TYPE AND SIZE	HOSE TYPE AND SIZE
4. Proof Pressure Test	Pressures in brackets for 1 minute each	1		
		2		
		3		
5. Burst Test	See figure in brackets for min	1		
		2		
		3		
7. Electrical Continuity	Maximum resistance 0.05 ohms			
9. Dimensions	As declared nominal/tolerance dims			

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Contract Requirements

When Defence Standards are incorporated into the contract users are responsible for their correct application and for complying with contract requirements.

Revision of Defence Standard

Defence Standards are revised when necessary by the issue either of amendments or of revised editions. It is important that users of Defence Standards should ascertain that they are in possession of the latest amendments or editions. Information on all Defence Standards is contained in Def Stan 00–00 (Part 3) Section 4, Index of Standards for Defence Procurement - Index of Defence Standards and Specifications published annually and supplemented periodically by Standards in Defence News. Any person who, when making use of a Defence Standard encounters an inaccuracy or ambiguity is requested to notify the Directorate of Standardization without delay in order that the matter may be investigated and appropriate action taken.

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Date : 9 November 1998

Removal of Product Qualification Approval

IMPORTANT ANNOUNCEMENT

1. This Standard contains a Product Qualification Approval (PQA) scheme. [i]MOD policy requires that all PQA schemes are removed from Defence Standards called up in contracts placed after 1st January 1998.

2. Users of this Standard are to contact the Project Manager (PM), Equipment Support Manager (ESM) or Technical Service Authority (TSA) named in the contract or order, to identify whether there is a continuing need for an approvals scheme.

3. [ii]Product Conformity Certification (PCC) is a risk based process that replaces PQA. Once a risk has been identified PCC can be included as a contract clause. In exceptional circumstances agreement can be sought from AD/Stan for PCC to be included in a Defence Standard.

4. At the next revision of this Standard the PQA scheme will be removed.

T R Leaver
Head of Standards Programme Management
Tel: 0141 224 2595 FAX: 0141 224 2503

[i] Defence Council Instruction (General) 197/97; Quality Temporary Memorandum 5/98; Chief of Defence Procurement Instruction CDPI/TECH/250 (draft)

[ii] PCC is certification that a product meets its specification. When PC is required by the contract, the contractor is responsible for obtaining the necessary PCC. Certification shall be provided from a NAMAS accredited laboratory when appropriate. PCC shall apply where a Risk Assessment has been identified by the PM; ESM or TSA.