

Cover Sheeted DEF STAN

No. TSC47-012™

POLYTETRAFLUOROETHYLENE (PTFE) HOSE ASSEMBLIES (WIRE REINFORCED) FOR MEDIUM AND HIGH PRESSURE FLUID SYSTEMS IN AIRCRAFT



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FOREWORD

REVISION NOTE

Issue 4 of this Standard takes account of developments in hose technology, both nationally and internationally, and introduces requirements for lightweight hose assemblies for 21 000 kPa systems. "Wire reinforced" has been added to the title and the applicability of the Standard clarified. The Standard has also been rewritten in the latest format.

HISTORICAL RECORD

Issue 1 was published as an INTERIM Standard and replaced Def Stan 47-6, Issue 1, dated 20 December 1968 for aircraft use, and superseded DTD(RDI)3612, Issue 1, dated February 1962.

Issue 2 of the INTERIM Standard replaced Specification UK/AID/959 for aircraft use, incorporated requirements for the basic PTFE hose and included amendments to the test requirements. Hose assemblies for use in aircraft oxygen systems were excluded from the applicability.

Issue 3 of the Standard removed the INTERIM status and superseded SDM(A)247-4 dated 1 July 1960. In addition, the Standard was completely metricated and included amendments and additions to bring it more into line with related international requirements.

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This Defence Standard supersedes Def Stan 47-12,
Issue 3, dated 3 July 1978

i This Defence Standard specifies, for Ministry of Defence use, the requirements for smooth bore, wire reinforced, polytetrafluoroethylene (PTFE) hose assemblies for use in medium and high pressure fluid systems (except oxygen) in aircraft. It does not apply to convoluted PTFE hose assemblies.

ii This Standard has been revised to take account of developments, particularly in the international field, that have taken place since the previous issue. In this respect, it is technically equivalent to certain draft ISO Standards which are being prepared in ISO Committee TC20/SC10 - Aircraft Fluid Systems and Components.

iii This Standard has been agreed by authorities concerned. It is to be implemented, whenever practicable, in all designs, contracts, orders, etc, commencing after its date of publication. 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 invoked 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 of its contractors in the execution of contracts for the Crown and, subject to the Unfair Contract Terms Act 1977, the Crown will not be liable in any way whatever (including but without limitation negligence on the part of the Crown its servants or agents) where the Standard is used for other purposes.

1 Scope

1.1 This Standard covers the basic requirements for the design, construction, and testing of smooth bore, wire reinforced, polytetrafluoroethylene (PTFE) hose assemblies for use in medium and high pressure fluid systems (except oxygen) in aircraft throughout a temperature range of -55°C to 232°C for medium pressure (Type 1) hoses, and of -55°C to 204°C for high pressure (Types 2 and 3) hoses.

1.2 The hose assemblies are classified according to their pressure range and/or weight characteristics as follows:

Type 1A - Medium pressure up to 8750 kPa (87.5 bar) depending on hose size

Type 1B - Medium pressure up to 10 500 kPa (105 bar)

Type 2A - High pressure up to 21 000 kPa (210 bar), standard weight

Type 2B - High pressure up to 21 000 kPa (210 bar), lightweight

Type 3 - High pressure up to 28 000 kPa (280 bar)

(NOTE: Types 2A and 2B hose assemblies are described for convenience in terms of relative weight. However, it is possible to have hose assemblies conforming to Type 2A dimensions yet as light as equivalent sizes conforming to Type 2B dimensions.)

1.3 This Standard also includes the requirements for those hose assemblies which are required to satisfy a specified minimum grade of resistance to fire.

1.4 In addition, this Standard includes in annex C the basic requirements for the design, construction, and testing of reinforced PTFE hose (without end fittings) for use in the manufacture of PTFE hose assemblies. Annex C may, therefore, be used as a separate specification to facilitate the supply of hose (inner liner plus reinforcement) from a hose manufacturer to a hose assembly manufacturer or other user.

2 Warning

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 supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

3 Definitions

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

3.1 Hose. That product comprising a length of PTFE inner liner (tube) complete with reinforcement but without end fittings.

3.2 Hose assembly. An assembly comprising a length of hose equipped at each end with a pipe fitting.

3.3 Minimum bend radius. The minimum bend radius, measured to the inside bend of the hose, at which the hose assembly can be used.

3.4 Batch. A batch of hose or hose assemblies shall consist of a quantity to be declared by the manufacturer, and agreed by the Quality Assurance Authority, as substantially uniform in quality. It is to be identified by means of an agreed code or number on each length of hose and on each hose assembly.

3.5 Nominal working pressure. The maximum steady pressure at which the hose assembly is intended to operate. The hose assembly is liable to be subjected to surge pressures up to 50% in excess of the nominal working pressure.

3.6 Fire-resistant (FR). Hose assemblies which are capable of withstanding for at least 5 minutes the application of heat by a standard flame without malfunction such as to jeopardise the safety of the aircraft or failure such as to aggravate an existing hazard. (Ref - BS G100: Part 2: Section 3: Subsection 3.13: Clause 3.1.)

3.7 Fireproof (FP). Hose assemblies which are capable of withstanding for at least 15 minutes the application of heat by a standard flame without malfunction such as to jeopardise the safety of the aircraft or failure such as to aggravate an existing hazard. (Ref - BS G100: Part 2: Section 3: Subsection 3.13: Clause 3.2.)

3.8 The length. The appropriate dimension 'L' shown in fig 1.

3.9 Hose size (nominal diameter). A size designation (abbreviation DN) applied to hose dimensioned in millimetres which corresponds to the nominal outside diameter of an associated rigid tube such that the internal diameters of the hose and the rigid tube are approximately equal. In abbreviated form, it is expressed as a non-dimensional reference by using the prefix DN followed by the nominal outside diameter of the associated rigid tube but omitting the metric units, eg DN10 signifies a hose having an internal diameter approximately equal to the internal diameter of a rigid tube of 10 mm nominal outside diameter.

NOTE: For information, a conversion table for relating the previously used inch "dash number" size to the metric "DN number" is given below:

DN number	06	08	10	12	16	20	25	32	40
Dash number	-4	-5	-6	-8	-10	-12	-16	-20	-25

4 Related Documents

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

BS 245	White Spirit
BS 410	Test Sieves
BS 1595	Isopropyl Alcohol
BS 1610	Methods for the Load Verification of Testing Machines
BS 6001	Sampling Procedures and Tables for Inspection by Attributes
BS G100: Part 2:	General Requirements for Equipment for use in Aircraft:
Section 3:	Environmental Conditions:
Subsection 3.13	Resistance to Fire in Designated Fire Zones
BS M52	Impulse Testing of Hydraulic Hose, Tubing and Fitting Assemblies for Aerospace Fluid Systems
BS M56	Determination of Density and Relative Density of PTFE Tubing for Aerospace Applications
Def Stan 00-970	Design and Airworthiness Requirements for Service Aircraft
Def Stan 47-22	End Fittings for Flexible Hose Assemblies for Aircraft-Metric
Def Stan 91-48	Hydraulic Fluid, Petroleum
D Eng RD 2454	Turbine Fuel, Aviation, Wide Cut Type +FSII, AVTAG/FSII, NATO Code F-40
ASTM D1457	TFE-Fluorocarbon Resin Moulding and Extrusion Materials
TT-S-735	Standard Test Fluids: Hydrocarbon

4.2 Reference in this 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.

4.3 Copies of the related documents referred to in this Standard are obtainable from:

DOCUMENT	SOURCE
British Standards (BS)	The Sales Department British Standards Institution Linford Wood MILTON KEYNES MK14 6LE
Defence Standards (Def Stan)	Ministry of Defence Directorate of Standardization Kentigern House 65 Brown Street GLASGOW G2 8EX

4.3 (Contd)

DOCUMENT	SOURCE
D Eng RD	Ministry of Defence Directorate of Standardization Kentigern House 65 Brown Street GLASGOW G2 8EX
ASTM TT	https://www.astm.org/

5 Design and Construction

5.1 Minimum operating requirements. All hose assemblies shall be capable of operating satisfactorily in the appropriate temperature range quoted in 1.1 and at the respective nominal working pressure, as appropriate to type and hose size, specified in table A.

5.2 Dimensions. Unless otherwise specified, the hose assembly dimensions, except for length, shall conform to the dimensions, as appropriate to type and hose size, specified in table B.

5.3 Hose. All hose used in the manufacture of hose assemblies to this Standard shall comply with the requirements of annex C.

5.4 End Fittings

5.4.1 Unless otherwise specified by the purchaser, the end fittings shall conform to the requirements of Def Stan 47-22.

5.4.2 The end fittings shall be so designed as to facilitate tightening on installation without subjecting the hose assembly to any appreciable twist. They shall, in addition, provide a positive lock on to the wire reinforcement. The design of the end fittings shall be such as to obviate a sudden change in the cross-section of the bore at the junction with the hose.

5.5 Assembly

5.5.1 Hose clips or clamps shall not be used as a method of securing the end fittings to the hose.

5.5.2 No adhesive shall be used when attaching the end fittings to the hose.

5.5.3 An approved anti-corrosive compound may be applied to the end fittings where any anti-corrosion treatment has been destroyed during preparation for attachment of end fittings.

5.5.4 The assembly shall be of the lightest possible weight and shall fall within the smallest possible envelope dimensions, consistent with meeting the requirements of this Standard.

5.6 Electrical bonding. The electrical resistance between an end fitting of a hose assembly and the pipe fitting to which it is connected in the aircraft shall not exceed 0.05 ohm.

5.7 Fire protection. In the case of hose assemblies which are required to withstand a specified minimum grade of resistance to fire, protection may be provided by a sheath suitably treated to prevent wick action by the sheath material and absorption of fluids through the ends and surface. The protection provided shall not affect adversely the ease of installation of the complete hose assembly.

Table A

Physical Requirements of Hose Assemblies

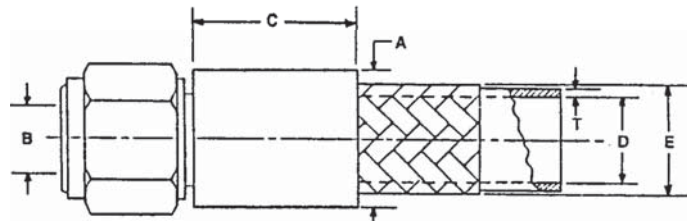
HOSE TYPE	HOSE SIZE (DN)	NOMINAL WORKING PRESSURE kPa	PROOF PRESSURE MINIMUM kPa	ROOM TEMP BURST PRESSURE MINIMUM kPa	HIGH TEMP BURST PRESSURE MINIMUM (1) kPa	MIN BEND RADIUS mm	VOLU-METRIC EXPANSION MAXIMUM mL/m	EFFUSION AFTER STRESS DEGRADATION MAXIMUM (2) mL/m per min	PNEUMATIC EFFUSION MAXIMUM (3) mL/m
Type 1A	20	7 000	14 000	34 000	24 000	165	N/A	78	19.7
	25	8 750	17 500	34 000	24 000	190			26
	32	7 000	14 000	28 000	21 000	280			26
	40	7 000	14 000	28 000	21 000	360			26
Type 1B	06	10 500	21 000	83 000	48 000	50	1.1	315	13.1
	08			69 000	45 000	50	1.6	315	16.4
	10			62 000	45 000	100	N/A	315	16.4
	12			56 000	41 000	120	N/A	157	16.4
	16			48 000	38 000	140	N/A	78	16.4
Type 2A	06	21 000	42 000	84 000	63 000	76	2.6	78	26
	10					127	3.3		
	12					146	5.3		
	16					165	8.7		
	20					197	11.8		
	25					245	29.5		
	32					305	39.4		
Type 2B	06	21 000	42 000	84 000	63 000	38	2.6	78	26
	10					63	3.3		
	12					73	5.3		
	16					82	8.7		
	20					101	11.8		
	25					127	29.5		
Type 3	06	28 000	56 000	112 000	84 000	76	3.2	78	26
	10					127	4.7		
	12					146	6.7		
	16					165	10.8		
	20					197	14.8		
	25					245	37.0		

(1) Nominal test temperature: 232°C for Type 1 (see clause B.19)
204°C for Types 2 and 3 (see clause B.7)

(2) See B.11.8

(3) See clause B.13

Table B
Hose and Fitting Dimensions



Dimensions in mm

HOSE TYPE	HOSE SIZE (DN)	FITTING O/D A	FITTING I/D B	SOCKET LENGTH C	HOSE I/D D		HOSE O/D E		INNER WALL THICKNESS T	
					Min	Max	Min	Max	Min	Max
Type 1A	20	Optional	13.92	Optional	15.62	16.38	19.46	20.62	1.07	1.37
	25		19.76		21.62	23.01	27.38	28.96	1.07	1.37
	32		25.4		27.96	29.36	33.73	35.3	1.14	1.45
	40		31.75		34.14	35.71	41.58	43.36	1.65	1.96
Type 1B	06	Optional	3.35	Optional	4.39	5.16	7.72	8.71	0.89	1.19
	08		4.9		5.97	6.73	9.32	10.31	0.89	1.19
	10		6.5		7.57	8.33	10.92	11.91	0.89	1.19
	12		8.64		9.93	10.69	13.87	14.86	0.96	1.27
	16		10.92		12.32	13.08	16.28	17.45	1.07	1.37
Type 2A	06	23	3.3	58	5.3	-	10.2	11.8	0.89	-
	10	26	6.1	64	7.5	-	13.6	15.1	0.89	-
	12	31	8.6	70	9.9	-	17.1	18.6	1.14	-
	16	36	10.4	76	12.3	-	22.2	23.7	1.14	-
	20	43	12.9	83	15.2	-	26.1	27.7	1.14	-
	25	51	19.3	96	21.6	-	34.2	35.8	1.27	-
	32	54	23.5	99	27.9	-	39.6	41.9	1.27	-
Type 2B	06	18	3.6	25.6	5.4	5.9	9.1	9.9	0.9	1.2
	10	20.3	6.4	28	7.6	8.1	11.6	12.5	0.9	1.2
	12	25	9.1	34	9.9	10.4	14.9	15.6	1.0	1.3
	16	28	11.6	35	12.3	12.8	17.5	18.5	1.1	1.4
	20	35	14.4	36	15.3	16.0	24.1	25.2	1.1	1.4
	25	42.2	19.3	41	21.6	22.4	31.2	32.3	1.1	1.4
Type 3	06	22.23	3.43	57.15	5.38	-	10.1	12.6	0.89	-
	10	25.4	6.1	63.5	7.57	-	14.0	15.8	0.89	-
	12	30.48	8.64	69.85	9.93	-	17.0	20.9	1.02	-
	16	35.71	10.41	76.2	12.32	-	19.8	24.6	1.14	-
	20	42.85	12.95	82.55	15.29	-	25.1	30.5	1.14	-
	25	50.8	19.3	95.25	21.64	-	30.73	38.1	1.14	-

5.8 Tolerances

5.8.1 Length. The tolerances permitted on the lengths of hose assemblies are given in table C:

Table C

Tolerances on Lengths of Hose Assemblies

NOMINAL LENGTH OF HOSE ASSEMBLY	TOLERANCE	
	MINUS	PLUS
460 mm or less	0	6.5 mm
461 mm to 1000 mm	0	13 mm
1001 mm to 1300 mm	0	25 mm
1301 mm or longer	0	2% of length

5.8.2 Angle fittings. The tolerance permitted on angle fittings is $\pm 2^\circ$.

5.8.3 Angular relationship between end fittings. Where the two end fittings have a specified angular relationship about the axis of the hose, the tolerance permitted is $\pm 3^\circ$.

5.9 Any additional material (eg sleeving) used in the hose assembly shall be compatible with the operating fluid specified by the purchaser.

6 Markings

6.1 Hose markings. The following markings shall be applied clearly and indelibly to an approved band* fixed around each length of hose:

- (a) The number of this Standard, and hose type.
- (b) A code or number indicating the manufacturer and batch number of the hose.

6.2 Assembly markings

6.2.1 An approved band, or bands*, shall be secured around each hose assembly and shall carry the following markings:

- (a) A code number indicating the manufacturer of the hose and the batch from which it was cut.
- (b) Date of assembly.
- (c) Assembly drawing and issue number.

*NOTE: (as note on page 10)

6.2.1 (Contd)

(d) The number of this Standard, and hose assembly type.

(e) NATO Stock Number (if required).

(f) Final inspection stamp.

6.2.2 Where assemblies are fire protected, the following letters, as appropriate, shall be marked clearly and indelibly at intervals along the hose outer cover or on an identity band* attached to the hose assembly:

(a) Fire-resistant assemblies - FR.

(b) Fireproof assemblies - FP.

6.2.3 In addition, when practicable, the hose assembly shall be suitably marked to provide a means of indicating that twisting has not occurred during installation.

6.3 Private marks. The manufacturer may impose any private marks considered necessary to facilitate assembly; all such markings shall be indicated on the drawing submitted to the purchaser (see **A.2.1(b)**). Other markings shall only be applied when specified in the tender or contract, or where permission has been obtained from the Qualifying Activity.

7 Qualification Approval

7.1 Before any hose assembly is supplied against this Standard, the manufacturer must, in the first instance, have obtained qualification approval in respect of the appropriate type, hose size, and method of end fitting attachment, under the conditions set out in annex A.

7.2 Tenders for the supply of hose assemblies to this Standard shall quote the appropriate qualification approval details and shall be accompanied by a statement that the articles offered conform in every detail to the samples qualified and that the place of manufacture is the same.

7.3 Before accepting any hose assembly ordered to this Standard, the purchaser (eg equipment manufacturer, user, etc) is responsible for satisfying himself regarding Qualification Approval for the item concerned, eg the purchaser may grant Qualification Approval under his own authority or, at his own discretion, he may accept a Qualification Approval granted previously by another purchaser.

8 Test Equipment

8.1 Before tests are commenced, the manufacturer shall satisfy the Quality Assurance Authority that all test equipment is accurate, reliable, suitable for the purpose of the tests, and adapted to the particular requirements of the unit to be tested.

* NOTE: See Def Stan 00-970, Chapter 404, paragraph 8.4.2 for requirements relating to metal identification bands (labels).

8.2 In addition, provision shall be made on the impulse test equipment for oscillograph readings and/or recordings of the pressure-time curve to be taken. The position of the tapping shall be as close as possible to the outlet side of the last hose assembly on the rig.

9 Production Tests

9.1 Hose. Before assembly, each cut length of hose shall be examined visually and shall be free from visible flaws or defects.

9.2 End fittings. Before assembly, all end fittings shall be examined by an approved method to ensure freedom from cracks. After assembly, the end fittings shall be examined visually to ensure that no cracks or other damage have resulted from the assembling operations.

9.3 Hose assemblies. All hose assemblies shall be examined visually to ensure conformance with the design drawings and shall be subjected to the following tests in the sequence given:

TEST	ANNEX B
	CLAUSE
Bore check	B.2
Production air pressure test (except assemblies fitted with fire- or abrasion-resistant sleeves)	B.1*
Proof pressure test	B.3

* See NOTE to clause **B.1**.

9.4 Cleaning. Unless special cleaning conditions are specified, hose assemblies must, immediately following the production tests, be cleaned and dried by a method acceptable to the Quality Assurance Authority and the purchaser.

10 Production Quality Tests

10.1 In order to confirm that the standard of quality and reliability of production hose assemblies is satisfactory and equal to that established by the qualification tests, sample hose assemblies shall be selected in accordance with BS 6001 and subjected to production quality tests (PQ tests) as follows:

- (a) Sampling tests (see 10.2).
- (b) Periodic control tests (see 10.3).

10.2 Sampling tests. The following inspections or tests shall be performed in the order indicated on eight hose assemblies selected at random from each batch. The batch shall consist of no more than 3000 hose assemblies, all of one size, manufactured under essentially the same conditions. One hose assembly tested from each batch of 375 hose assemblies is also permitted:

- (a) Internal cleanliness (see **9.4**).
- (b) Leakage test (see clause **B.6**).
- (c) Room temperature burst test (see clause **B.14**).
- (d) Density and relative density tests (see **G.1.3** and **G.1.4**).

10.3 Periodic control tests. The following inspections and tests shall be performed as indicated on 10 hose assemblies manufactured from bulk hose lengths selected at random from each batch. The batch shall consist of not more than 6000 m of hose, all of one size, manufactured under essentially the same conditions. Two hose assemblies manufactured and tested from each batch of 1200 m of hose is also permitted.

10.3.1 Six hose assemblies (or one hose assembly from a batch of 1200 m) shall be subjected to the following tests in the order indicated:

- (a) Elongation and contraction test (see clause **B.4**).
- (b) Impulse test (see clause **B.8**).

10.3.2 Four hose assemblies (or one hose assembly from a batch of 1200 m) shall be subjected to the following tests in the order indicated:

- (a) Stress degradation test (see clause **B.11**).
- (b) Electrical conductivity test (see clause **B.15**).

10.4 Rejection and retest. In the event of a failure of a hose assembly during PQ tests, or any defects being revealed during subsequent inspection, the representative of the Quality Assurance Authority may, at his discretion, select a further sample representative of the same batch for submission to the full test. Pending the results of this further test, no deliveries of hose assemblies of the suspect type and size will be made and, if tests result in another failure, the assemblies will continue to be suspect until the cause of the failure has been determined and action taken to the satisfaction of the Quality Assurance Authority.

10.5 Reports. Reports on the tests, detailing the results and any remedial action taken and stating the period or quantity of production represented, shall be made available to the Quality Assurance Authority and/or purchaser.

10.6 Changing inspection procedures. Changing inspection severity levels (eg from normal to tightened inspection) shall be in accordance with BS 6001. All inspection plans shall be single sample plans with an AQL of 1.0% at special inspection level S-2.

10.7 Destructive test samples. Prior to testing, a letter "D" shall be impression-stamped on each end fitting of those assemblies used for destructive tests (see 10.2 and 10.3).

11 Protection and Packaging

11.1 Immediately after cleaning (see 9.4), hose assemblies shall have an approved blanking cap or plug fitted to each end fitting. The cap or plug shall be so designed that no end float of the end fitting nut is possible.

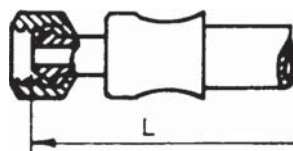
11.2 Hose assemblies which are packed by coiling shall be suitably supported and shall not be bent to less than the minimum bend radius specified in table A.

11.3 Packaging (preservation, identification, and packing) and the level of protection shall be as required by the terms of the contract or order.

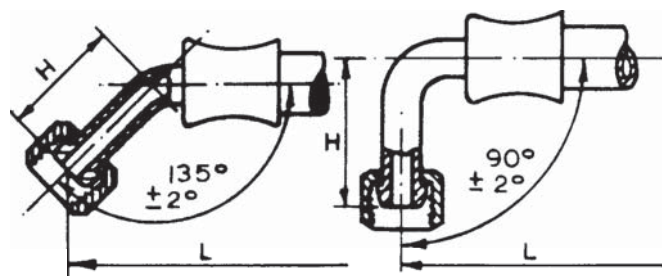
12 Information to be Specified by the Purchaser

12.1 The following information shall be specified by the purchaser in the procurement documents:

- (a) Type, size and length of parts required.
- (b) Details of end fittings if different from 5.4.1.
- (c) Data requirements, if applicable (see A.2.1).
- (d) If applicable, level of fire resistance and system fluid for fire testing (see 3.6, 3.7 and B.20.1(c)).
- (e) For Type 2 assemblies, any fuel resistance qualification/production test requirements (see clause B.9 and clause G.2) .
- (f) Any production air pressure test requirement (see 9.3 and clause B.1).
- (g) Packaging requirements (see 11.3).

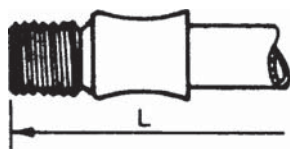


STRAIGHT END-FITTING

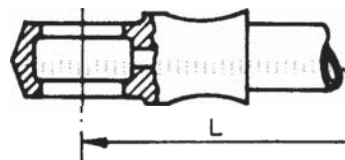


ANGLE AND RIGHT-ANGLE END FITTINGS

NOTE: THE DIMENSIONS H AND L ARE TO BE QUOTED IN BOTH CASES

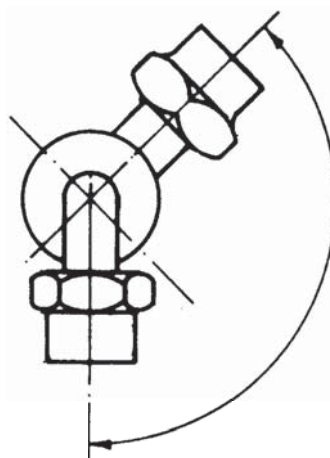


STRAIGHT END - FITTING WITH
MALE OR FEMALE THREAD



BANJO END - FITTINGS

VIEW THE HOSE ASSEMBLY
END ON THEN IN AN ANTI-
CLOCKWISE DIRECTION
MEASURE THE ANGULAR
RELATIONSHIP OF THE
FAR END TO THE NEAR
END AS SHOWN.



ANGULAR SETTING
STD TOLERANCE
 $\pm 3^\circ$

ANGLE OF OFFSET
INTERPRETATION.

Fig 1 Method of Dimensioning Flexible Hose Assemblies

Qualification Approval Conditions

A.1 Responsibility for Qualification Testing

Unless otherwise specified in the contract or purchase order, the supplier is responsible for carrying out all qualification testing specified herein. Unless otherwise specified, the supplier may utilise his own facilities or any commercial laboratory or test house acceptable to the purchaser. The purchaser may reserve the right to carry out any of the tests specified where such tests are deemed necessary to assure the supplies and services conform to the prescribed requirements.

A.2 Test Reports, Samples, and Data for the Purchaser

A.2.1 When the qualification tests are conducted at a location other than the laboratory of the purchaser, the following shall be made available to the purchaser, if requested:

- (a) Three copies of the test report which shall include a report of all tests and an outline description of the tests and conditions.
- (b) Three sets of engineering data in the form of assembly drawings. These shall have a cut-away section showing all details in their normal assembly position and shall carry the necessary design reference data, including materials and weights, for the hose and end fittings.
- (c) List of sources of hose or hose components, including source's name and product identification for inner liner, hose and assembly.
- (d) When requested by the purchaser, a sample of the hose assembly which was tested (see also **A.3.2.2.1**).

NOTE: Log sheets, containing required test data, shall remain on file at the source test facility and should not be sent to the qualifying activity unless specifically requested.

A.3 Qualification Approval Tests

A.3.1 Inner liner. Sufficient samples shall be selected and subjected to all the inner liner tests listed in clause **G.1**. Each of the tests shall be carried out on two separate samples.

NOTE: Production lot records may be used to verify conformance to these tests when the inner liner being used is an established production item.

A.3.2 Hose assemblies

A.3.2.1 Samples

A.3.2.1.1 The number of sample assemblies of any one type and hose size shall be as follows:

(a) For all hose assemblies: 16 assemblies which shall be identified as numbers 1 to 16 respectively.

(b) Additionally, for hose assemblies which are required to satisfy a specified minimum level of resistance to fire, a further two assemblies complete with protection sleeves, where required, which shall be identified as numbers 17 and 18 respectively.

A.3.2.1.2 Sample assembly numbers 10 to 15 shall be fitted at one end with a 90° elbow fitting, and at the other end with a straight type end fitting. If approval is being sought for both the bent-tube and forged-elbow configurations, then three samples shall be fitted with 90° bent elbows and three samples fitted with 90° forged elbows.

All other sample assemblies shall be fitted with straight end fittings at both ends (except sample number 16 which shall have a straight fitting at one end only).

All end fittings shall be representative of the design used by the hose assembly manufacturer.

A.3.2.1.3 The lengths of the sample hose assemblies, including end fittings, shall be in accordance with table D.

Table D

Lengths of Sample Hose Assemblies

SAMPLE NO	LENGTH (INCLUDING END FITTINGS)
1	300 mm minimum
2 and 3	Approximately 3.5 times the appropriate minimum bend radius specified in table A plus 200 mm plus the length of the end fittings, or 460 mm whichever is the greater.
4 to 9	460 mm minimum
10 to 15	As for samples 2 and 3
16	330 mm of hose plus one straight end fitting (see figure 5).
17 and 18	Sizes DN 06 to DN 25 - 600 mm minimum Size DN 32 - 700 mm minimum Size DN 40 - 760 mm minimum

A.3.2.2 Test requirements

A.3.2.2.1 Sample assembly number 1 shall be subject to examination, in the untested state, in respect of materials and construction. On satisfactory completion of qualification testing, the sample shall be permanently identified and retained by the manufacturer as a control sample.

A.3.2.2.2 Sample assemblies numbers 2 to 16 (or 2 to 18) shall respectively be subjected to the appropriate tests listed in annex B in accordance with the schedule contained in table E and in the sequence given therein.

A.3.2.3 Repeat qualification tests

A.3.2.3.1 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 qualified shall be brought to the notice of the qualifying activity who may, at its discretion, call for samples embodying the proposed changes for repeat qualification testing.

A.3.2.3.2 Change from prototype to production is regarded as a change of method and may, at the discretion of the qualifying activity, require partial or complete retesting.

A.3.2.3.3 Hose assemblies to a design already approved, but from a new source of manufacture, shall be resubmitted for repeat qualification testing.