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AIRCRAFT FLEXIBLE HOSES WITH RE-USEABLE END FITTINGS

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

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PREFACE

NOTE TO READERS

(1) The specifications and standards applied to equipments detailed in this publication are of American origin and are explained as follows:

AN... United States Army and Navy Standard: AN standards are issued by the United States Aeronautical Standards Board and represent agreement between the United States Air Force and the Department of the Navy Bureau of Aeronautics.

MS, or MIL.... United States Military Specification. MS, or MIL specification are agreed, and issued by joint action of the United States Army, Air Force, and Navy Departments.

(2) To avoid unnecessary complication of the text, reference to part numbers throughout this publication is, in the main, to manufacturers part numbers.

Note...

The extent of the amended material will be indicated thus ► ◄ in the margins.

Chapter 1-0

FLEXIBLE HOSE - GENERAL INFORMATION

CONTENTS

TABLES

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Introduction

1 This chapter contains basic information relating to the construction and identification of flexible hose, hose assembly end fittings and protective sleevings for use in aircraft pipeline systems. Detailed information on the types of hose based on specifications mainly of American origin, with the applicable fittings, protective sleeving, and procedures for the removal, repair and re-installation of hose assemblies are contained in Chapters 2 and 3 respectively. Chapter 4 gives similar information on low pressure hoses used for fuel, oil and pneumatic systems.

2 The majority of pipeline systems utilise flexible hose in the areas which are subject to movement, or vibration which could cause rigid pipes to fracture, and it is available in a greater variety of types and sizes to suit numerous applications.

3 A hose assembly is defined as being a specific length of hose complete with the required end fittings and assembled to form part of a pipeline system, and as such it will have a unique part number. The end fittings of a hose assembly can account for some 80 per cent of its cost, and for this reason many hose assemblies are manufactured with re-useable end fittings. Instructions for the local manufacture of hoses described in Chapter 2 are given in Chapter 3. The simpler procedures used for low pressure hoses of UK origin are included in Chapter 4.

4 A large number of specified standards apply to the manufacture of flexible hose and end fittings. In general terms these refer to application requirements such as flow resistance, operating pressures and temperatures for the hose and additionally to thread forms and mating surfaces for the end fittings. Most of the specifications are of American origin and are known as Military Specifications. Some standards have been nominated by the suitability of existing hose rather than by prerequisites and these are recognised by the application of the manufacturer's specification number, e.g. Aeroquip 617. Various manufacturers produce hose and end fittings which meet the Service standards. Certain end fittings are manufactured for use with particular hose and must not be used with other types. Chapters 2 and 4 of this publication gives details of the hoses that will be found in Service aircraft, together with details of the specific range of end fittings recommended for use with each type of hose.

5 Flexible hose can be divided into two basic categories, rubber and non-rubber, according to the type of material used in forming the tube, and each of the categories is available in a variety of constructions to suit a second division into types dependent on the working pressure requirement as follows:-

5.1 Low pressure hose:- designed for use at pressures from 0 to 17.24 bar (0 to 250 lbf/in^2).

5.2 Medium pressure hose:- designed for use at pressures from 17.24 bar to 103.42 bar (250 to 1500 lbf/in^2).

5.3 High pressure hose:- designed for use at pressures greater than 103.42 bar (1500 lbf/in^2).

Note...

The pressure figures quoted for division of hose into types are chosen for general grouping and must not be regarded as absolute definitions. Reference should be made to the individual hose characteristics to obtain defined working pressures.

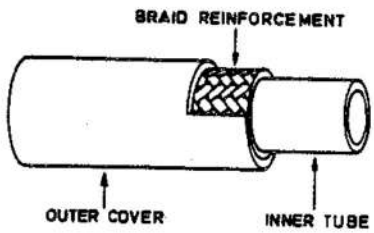

Fig 1 Hose construction

HOSE CONSTRUCTION (fig. 1)

General

6. In general, all hoses are constructed in a similar manner, i.e. an inner tube, which can be of a variety of materials, is reinforced by layers of cotton or metal braid for strength. An outer cover is added for additional protection except where the reinforcement is of stainless steel wire braid.

The inner tube

7. Any material used in manufacture of inner tubes for flexible hose must

meet certain requirements in order to function satisfactorily. Some of these requirements are as follows:-

(1) It must be flexible.

(2) It must be impermeable to the substance to be contained. (Must have negligible porosity.)

(3) It must be chemically compatible with the substance to be contained.

(4) It must be capable of retaining a smooth finish that offers a little or no resistance to flow.

(5) It must retain its characteristics when exposed to specific high and low temperatures.

8. Several different materials are used in the manufacture of inner tubes. In the rubber hose category the most common are Buna-N, Neoprene, and Butyl. Non-rubber hose is generally manufactured with an inner tube of Teflon.

9. Buna-N is a synthetic rubber compound which has excellent resistance to oils and solvents, and is an excellent material for inner tubes to carry these substances.

Note...

Buna-N should not be confused with Buna-S which is a similar material. Buna-S has certain properties which are excellent, but is subject to tearing easily and has poor resistance to oils and solvents.

10. Neoprene is a synthetic rubber compound which has an acetylene base. When chemically compounded for use as an inner tube, it fulfils all of the requirements for use in flexible hose. Its resistance to oils and solvents is not as good as Buna-N, but is has a better resistance to abrasion damage and this is most desirable in certain applications.

11. Butyl rubber compound is manufactured from petroleum products and because of this is not suitable as tube material for hoses to contain petroleum substances. It is however, an excellent material for phosphate ester base hydraulic fluids (Skydrol) and is commonly used in the manufacture of inner tubes for these applications.

12. Teflon is the DuPont trade name for Tetrafluroethylene resin. When compounded and extruded into an inner tube it possesses the following advantageous properties.

(1) It is capable of use over a very wide temperature range; -73.3 to + 232.2°C (-100 to +450°F).

(2) It is compatible with nearly all substances used in Service aircraft pipeline systems.

(3) Its surface is wax-like and thus provides minimum resistance to flow and viscous substances will not cling to it.

(4) It has a lesser coefficient of volumetric expansion than other known tube materials.

(5) Its service, and shelf life are practically unlimited.

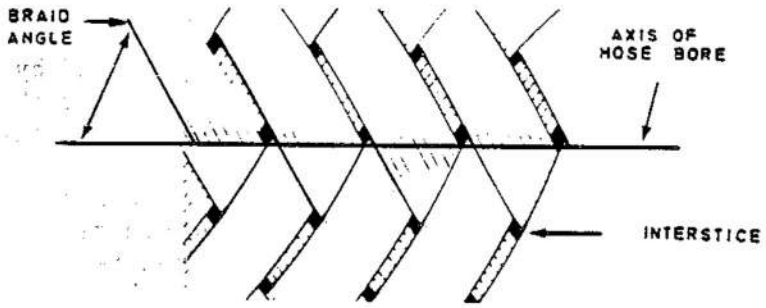

Fig. 2 Braided reinforcement

Reinforcement (fig. 2)

13. The flexible hose inner tube is invariably reinforced; by wrapped or braided coverings; to an extent determined by the required application of the hose. The operating pressure of a flexible hose is dependent on the type and quantity of materials used in reinforcement of the inner tube.

14. The basic materials used for reinforcement coverings are:-

(1) Cotton thread.

(2) High carbon steel wire.

(3) Stainless steel wire.

These materials are wrapped, or braided, over the inner tube in various combinations and numbers of layers according to the design requirement.

15. The reinforcement coverings are applied to the inner tube at a specified angle to the axis of the bore, this angle is sometimes referred to as the 'braid angle'.

16. When an internal pressure is applied to a hose, forces develop which tend to make the hose fatter and shorter, or longer and thinner, depending on the type of reinforcement used. There is a neutral braid angle at which the forces exerted in the hose are balanced by the reinforcement. When this balance exists; pressure in the hose will have no effect on the hose length. If the braid angle of the reinforcement is significantly different from the neutral braid angle, the hose will be continually flexed during use and its service life will be shortened in consequence. The limits to which a hose is permitted to change length under pressure are stated by a quality control clause in the hose specification. This part of the hose specification is important when initially designing a hose assembly as it is the only means of knowing whether a particular hose will get longer or shorter when under pressure.

Hi-Pac reinforcement

17. Hi-Pac is an Aeroquip Corporation trade mark representing densely packed small diameter wires, braided over a minimum thickness Teflon inner tube and bonded by a synthetic compound. This type of reinforcement eliminates the need for multiple layers of complete cover wire braidings in high pressure hoses and results in a weight saving of 40 to 50 per cent together with a reduced overall diameter.

The outer cover

18. Except for Teflon hose, and hose which is reinforced by stainless steel, an outer cover of braided cotton or rubber is fitted over the reinforcement braids. This cover does not add to the pressure capabilities of the hose, but is designed to protect the hose reinforcement against the corrosive effects of moisture in the vicinity and against damage from abrasion. In the case of Teflon hose, the normal stainless steel wire reinforcement is in itself resistant to abrasion damage and is non-corrosive, hi-pac reinforcement is already contained in a rubber compound.

19. Some hoses are fitted with perforated rubber covers, these are generally suited for use in gaseous applications, including air. Most covers are utilized to display the hose identification markings.

HOSE SIZES

20. All hose is measured for size with reference to the internal diameter (I.D.) of the tube. Rigid tubing is measured by the outside diameter (O.D.).

21. Most manufacturers employ a 'dash numbering' system to identify the size of hose in relation to the comparable rigid tubing and the 'dash size' is written after the hose type (or part number) e.g. 302A-6. In general terms, the larger numbers represent the larger sizes and each unit in the dash size range represents one sixteenth (1/16) of an inch in the rigid tubing range. Hose, size-3 matches a tube size 3/16 in (i.e. the internal diameters are comparable); Hose, size-5 matches a tube size 5/16 in; Hose - 10 matches a tube size 5/8 in etc. Table 1 details the rigid tube sizes comparable to all hose sizes used in Service aircraft.

TABLE 1

Comparison of sizes - Flexible hose to rigid tube

FLEXIBLE HOSE SIZE	RIGID TUBE SIZE (O.D.)	
(dash size)	(mm)	(in)
-3	4.76	0.187 (3/16)
-4	6.35	0.250 (1/4)
-5	7.94	0.312 (5/16)
-6	9.53	0.375 (3/8)
-8	12.70	0.500 (1/2)
-10	15.86	0.625 (5/8)
-12	19.05	0.750 (3/4)
-16	25.40	1.000 (1)
-20	31.75	1.250 (1.1/4)
-24	38.10	1.500 (1.1/2)
-32	50.80	2.000 (2)

HOSE IDENTIFICATION

General

22. Service stock numbers are allocated to all the hoses which are used in Service aircraft, but general reference to hose is by the manufacturers part number which is included in all identification markings. Some hose part numbers have the prefix AE, this indicates only that the hose part number was allocated in January 1964.

Identification markings

23. When a hose is fitted with an outer cover, it is common practice to print the hose identification on the outer cover in the form of a lay line. When no outer cover is fitted to the hose, the hose identification is carried on tapes which are attached to the hose. In either case, the identification markings are repeated at intervals of approximately 200 mm (8 inches) along the entire length of the hose. A typical hose identification includes the following information.

(1) Military Specification Number (e.g. MIL-H-8794)

(2) Manufacturers name (e.g. Aeroquip)

(3) Manufacturers Part Number (e.g. 303)

(4) Hose size (e.g. -8)

(5) Date of manufacture (in ¼ year/year) (e.g. 2/74)

Chapter 1-1

LOW, MEDIUM AND HIGH PRESSURE CLASSIFICATION OF HOSE

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ILLUSTRATIONS

General

1. Hoses are normally classified by the amount of pressure they are designed to withstand under normal operating conditions. The recommended operating pressures for any one type of hose will often vary with the size of the hose; larger sizes for lesser pressures and vice versa.

2. Low pressure hose is generally classified as being for any pressure below 17.24 bar (250 lb f/in^2) and will normally be constructed with fabric braid reinforcement.

3. Medium pressure is generally classified as 103.42 bar (1500 lb f/in^2) but will be found operating up to 206.84 bar (3000 lb f/in^2) in the smaller sizes. Medium pressure hose is normally constructed with a single wire braid reinforcement.

4. High pressure hose is generally classified as being designed for pressures in excess of 103.42 bar (1500 lb f/in^2) and is normally constructed with multiple wire braid reinforcements.

5. The following paragraphs provide a brief description of typical hoses selected from each type. Detailed information, for all the hoses used in Service aircraft, appears in Chapter 2 of this publication.

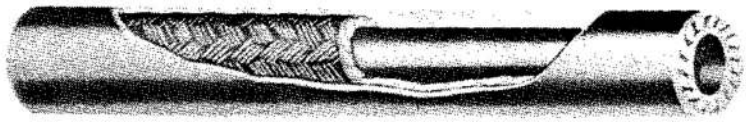


Fig. 1 Hose, Part No. 306

Typical low pressure hose

Hose Part No. 306 (fig. 1)

6. This hose is constructed with a seamless synthetic rubber inner tube which is reinforced by a single layer of cotton braiding. The outer cover is synthetic rubber specially compounded to resist abrasion and to be oil, moisture and mildew resistant.

7. The hose is black in colour and has a yellow lay line consisting of 'L.P., Hose Manufacturers Code, size, date of manufacture'; spaced 180° from this information is a white lay line interspaced with 'Aeroquip 306'.

8. Conforming to the standards of MIL-H-5593, Hose, part number 306 is for use in air or vacuum instrument systems, automatic pilots and lines to pressure gauges as specified in MS33620. Manufactured hose assemblies conform to AN6270. The hose, and fittings are available in sizes -2 to -10.

Fig. 2 Hose, Part No. 617

Hose, Part No. 617 (fig. 2)

9. This hose is fabricated to manufacturers specification (Aeroquip 617) and meets the requirements laid down for the vent and drain lines of low pressure fuel and oil systems and is available in sizes -16 to -32 for use at pressures up to 8.62 bar (125 lb f/in^2).

10. The hose inner tube is of Buna-N compound which is reinforced first with a single layer of cotton braid and then with a single layer of wire braid. The outer cover is of cotton braid which is synthetic rubber impregnated to be oil resistant.

11. Hose, Part No. 617 is grey-black in colour and is identified by a red coloured lay line marking as follows:- 'Aeroquip 617, size, L.P. date of manufacture'.

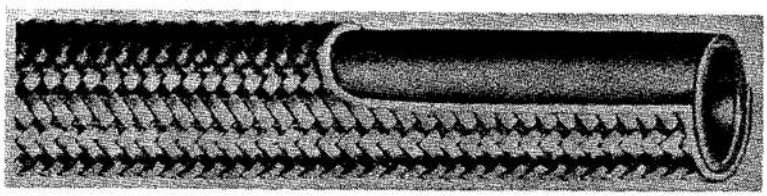


Fig. 3 Hose, Part No. 601

Typical medium pressure hose

Hose Part No. 601 (fig. 3)

12. Hose, Part No. 601 is constructed with a seamless, specially formulated synthetic rubber inner tube over which is placed a partial cover stainless steel wire braid reinforcement. A second, full cover stainless steel wire braid reinforcement doubles as the outer cover.

13. The hose is identified by its bright steel braid outer cover and identification tapes which are attached at regular intervals showing; 'Aeroquip 601 - size, manufacturers code and hose cure date'.

14. Hose Part No. 601 is available in sizes -4 to -32 and is designed for use in fuel or oil lines where flexibility, light weight and fire resistance are prime considerations. It can also be used for hydraulic fluid return lines but should not be used in hydraulic pressure applications.

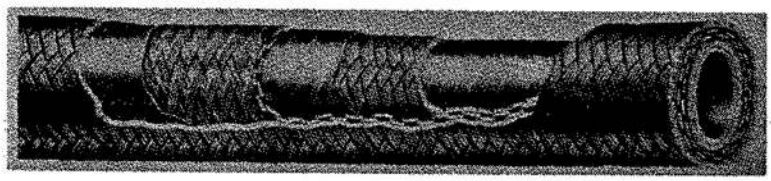


Fig. 4 Hose, Part No. 602

Hose, Part No. 602 (fig. 4)

15. Hose, Part No. 602 is constructed with a seamless, synthetic Butyl rubber inner tube which is reinforced by two separate layers of single wire braid synthetic-impregnated over single cotton braid and covered by a layer of synthetic-impregnated oil resistant cotton braid.

16. The hose is designed for use in medium pressure hydraulic systems and is available in sizes -4 to -20. It is identified by its green coloured outer cover and the white lay line showing 'Manufacturers code, Aeroquip 602 - size, date of manufacture'. Spaced 180° from this lay line is a second white lay line interspersed with 'SKYDROL USE'.

CAUTION...

This hose should never be used with petroleum products or solvents.

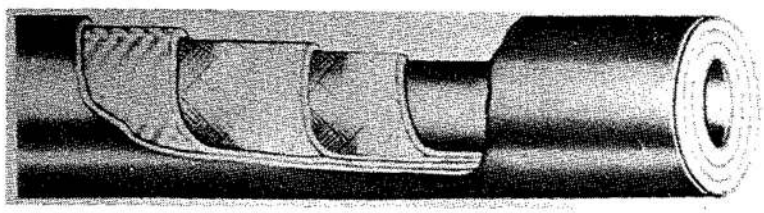


Fig. 5 Hose, Part No. 309

Typical high pressure hose

Hose, Part No. 309 (fig. 5)

17. This hose is constructed to specification MIL-H-8788 and consists of a synthetic compound seamless rubber inner tube which is reinforced with a double layer of high tensile carbon steel wire braid (three layers on the

size -16). The outer cover is a smooth synthetic rubber compound over one layer of fabric braid. The outer cover is specially compounded to resist abrasion, and to be oil, moisture and mildew resistant. The hose is black in colour and is identified by a yellow lay line consisting of '8788 (or 5512), - size, date of manufacture, manufacturers code'. Spaced 180° from this information is a second lay line marked 'Aeroquip 309'.

18. Hose, part No. 309 is available in sizes -4 to -16 and all sizes have a working pressure of 206.84 bar (3000 lb f/in^2) in hydraulic systems specified in MS 33620.

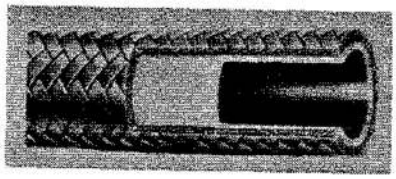


Fig. 6 Hose, Part No. AE246

Hose, Part No. AE246 (fig. 6)

19. Hose, part No. AE246 is manufactured to the specification MIL-H-38360A and is available in sizes -4 to -12. It is a lightweight hose consisting of a Teflon inner tube which is reinforced with Hi-pac braiding, and all sizes are suitable for use at normal operating pressure of 206.84 bar (3000 lb f/in^2) with peak pressures of up to 410.26 bar (4500 lb f/in^2).

20. The hose is identified by tapes which are attached during manufacture and spaced at regular intervals along the entire length. Each tape carries the following information:- 'MIL-H-38360A, manufacturers code, 3000 p.s.i., date of manufacture'.

Chapter 1-2

HOSE ASSEMBLY END FITTINGS

CONTENTS

ILLUSTRATIONS

Introduction

1. Hose assembly end fittings are manufactured in many shapes and sizes to suit the numerous applications and it is important to note that each hose has its own range of recommended end fittings. Detailed information on the end fittings designed for use with particular types of hose is contained in the relevant sections of Chapter 2 of this publication. The following paragraphs provide basic information and describe the different types of fittings that are available.

GENERAL INFORMATION

Threads

2. End fittings are manufactured with a wide variety of thread types but in general only two types are used in Service aircraft. These are tube threads and pipe threads, both of which may be either external (male) or internal (female). Tube threads on a given fitting are uniform in diameter while pipe threads are tapered. Where pipe threads are used, the fitting connection is sealed by the tapering threads and a sealing compound. With tube

threads, the fitting connection is sealed where the flared portion of the fitting butts against a cone seat.

Sealing surfaces

3. The mating surface, or area, of a hose fitting, which butts against a similar surface in, or on, another fitting or adaptor for the purpose of effecting a sealed connection, is called the sealing surface and can be any one of three types described in the following paragraphs.

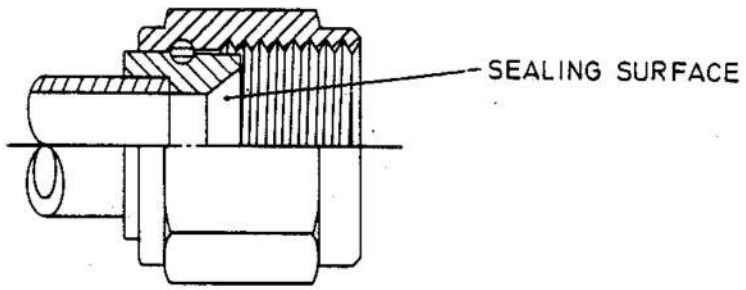


Fig. 1 Flared seal fitting

General types of fittings

Flared seal fittings (fig. 1)

4. The flared type end fitting consists of three parts; a sleeve, a nipple and a nut. The nut is often wired to the nipple in such a way that it is retained but free to rotate. The tapered end of the nipple is pulled into the bore of the hose by the socket which fits over the hose cover and screws onto the nipple thread compressing the hose onto the nipple taper gripping the hose firmly and forming the hose assembly seal.

5. The hose assembly connection (or forward) seal is made by the 37° flare machined in the nipple mating with a similar angled cone in the mated fitting. This type of fitting can be re-used many times provided that the sealing surfaces are not damaged.

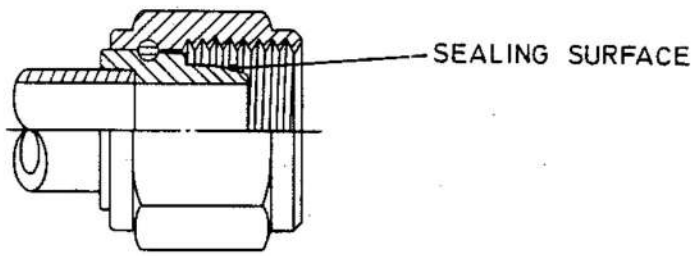


Fig. 2 'Globeseal' flareless seal fitting

'Globeseal' flareless fittings (fig. 2)

6. The Globeseal flareless fitting is similar in construction and is attached to the hose in the same manner as the flared fitting described in para. 4. The forward seal is made by entering the sealing surface of the nipple into the 24° taper tapered bore of the mated connection. The Globseal flareless fitting can be re-used many times provided the sealing surfaces are not damaged.

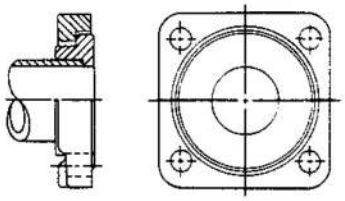


Fig. 3 Flanged seal fitting

Flange fittings (fig. 3)

7. The flanged type fitting is attached to the hose in a similar manner to the flared and flareless fitting already described, and can be re-used many times provided that the sealing surfaces are not damaged. The forward seal is made by positioning a gasket or an 'O' ring between the mating surfaces.

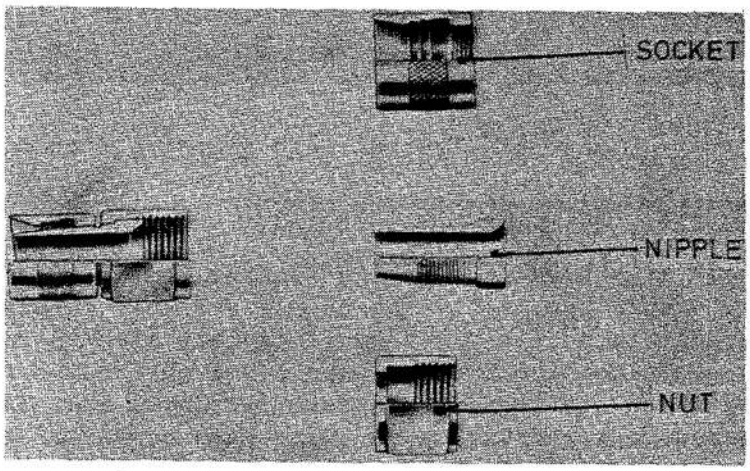


Fig. 4 Typical low pressure fitting

Standard fittings for rubber hose

Low pressure fittings (fig. 4)

8. The basic low pressure hose fitting is supplied in three pieces. These are a socket, nipple and nut. It is a compression type fitting and manufactured only with the flared type forward seal. The standard fitting material is aluminium.

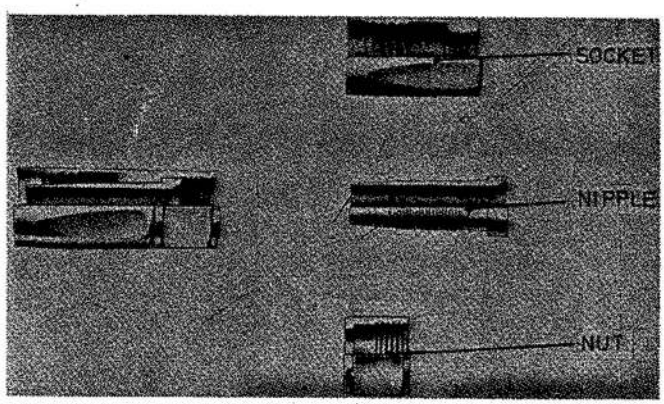


Fig. 5 Typical medium pressure fitting

Medium pressure fittings (fig. 5)

9. Medium pressure fittings for rubber hose are manufactured in three pieces as are the low pressure fittings. Size for size comparison with low pressure fittings will show that the medium pressure sockets and nipples are considerably longer. In the smaller size fittings, i.e. size -3 to size -6, the nipple and the nut are cadmium-plated steel; in all other sizes these parts are aluminium. The sockets for all sizes are aluminium. Flared, flareless, and flange type fittings are provided in the medium pressure range.

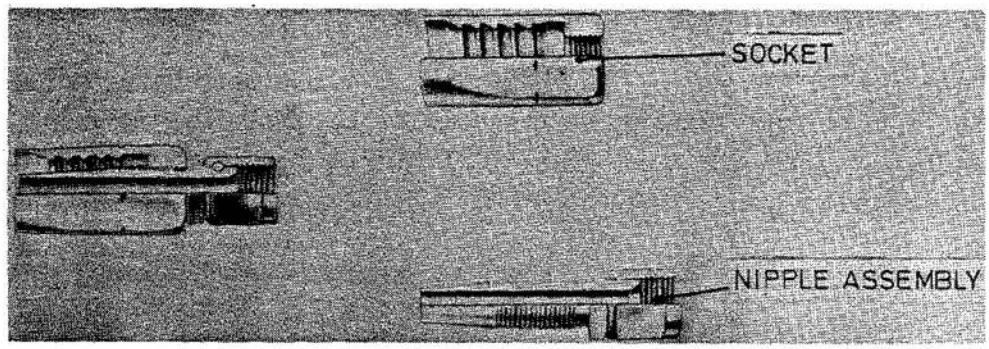


Fig. 6 Typical high pressure fitting

High pressure fittings (fig. 6)

10. The basic high pressure fitting is supplied in two parts; these are a socket and a nipple assembly. The nipple assembly consists of the nipple with the nut wired on in such a way that it is left free to rotate. In all sizes, the sockets are aluminium and the nipple and nut are of cadmium-plated steel. To avoid confusion with medium pressure fittings, the high pressure fitting sockets are manufactured with a notch at each corner of the hexagon. This type of fitting is commonly used in the flared and in the flareless types. Flange type fittings are manufactured but seldom used in Service aircraft systems.

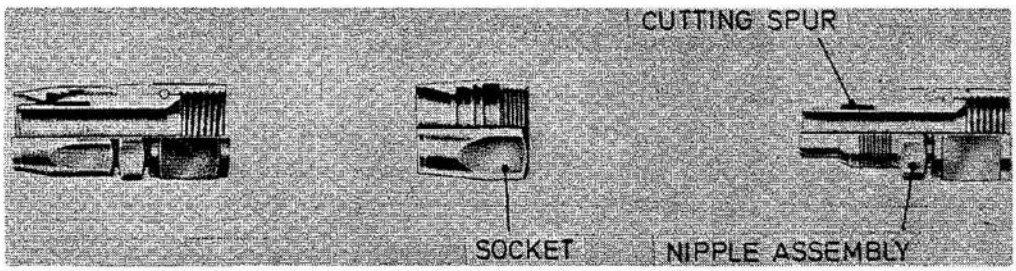


Fig. 7 Typical 'Little Gem' fitting

'Little Gem' fittings (fig. 7)

11. The 'Little Gem' fitting is held to the hose by a 'lip seal' principle rather than by compression of the hose covers, and is specially suitable for hose which relies on its stainless steel braid for protection.

12. During initial assembly, these fittings use a circumferential cutter, or spur, on the nipple (see fig. 7) to cut into the hose between the inner tube and the reinforcements, the inner tube enters the annular space formed by the spur and is driven to form a positive seal when the socket is screwed home. At the same time, the reinforcements are lifted by the outer surface of the

spur and firmly gripped between the socket and the spur when the socket is screwed home.

13. Materials used for these fittings differ according to size and differ again according to the style of fitting; in general, the nut and nipple for the smaller sizes are of cadmium steel while the larger sizes are of aluminium; the sockets for all sizes are aluminium.

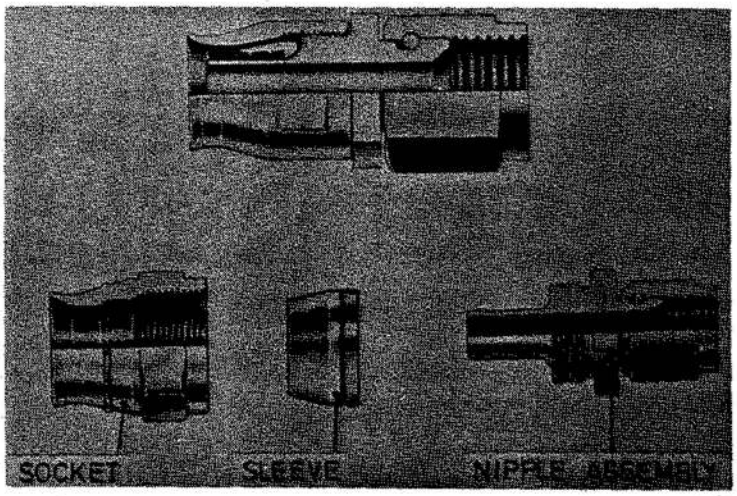


Fig. 8 Typical 'Super Gem' fitting

'Super Gem' fittings for Teflon hose (fig. 8)

14. These fittings are available in the flared and flareless types for use in both medium and high pressure applications. The 'Super Gem' fitting is basically the same as the 'Little Gem' fitting and works on the same principle. The cutting spur of the 'Little Gem' nipple is replaced in the 'Super Gem' by a separate sleeve (see fig. 8).

15. The nipple (and nut) assembly for medium pressure fittings can be either aluminium or stainless steel, and for high pressure fittings is stainless steel. The sleeve is always stainless steel. The sockets, which are always stainless steel, are made with two flat surfaces for medium pressure fittings, and are hexagon shaped for high pressure fittings.

16. During manufacture, some of the threads and sealing surfaces are coated with a film of dry lubricant so that no additional lubricant is needed for assembly. The dry film lubricant is grey-black in colour and is applied to the threads and sealing surfaces of the nipple assemblies, and to the sealing surfaces of the sleeves. On sockets in size -8 and above for medium pressure fittings the lubricant is applied to the threads. All the threads and sealing surfaces are coated with dry film lubricant for high pressure fittings.

17. The major difference between the medium and high pressure fittings is their size. The high pressure fittings being more robust due to the higher working pressure requirement.

Elbow fittings

18. The various fittings available include 45° and 90° elbows. Fig. 9 illustrates the elbows for 'Super Gem' fittings and similar elbows are

available for all types of fitting, including flanged types. The elbow is formed in the nipple of the fitting, sometimes by forging the nipple and machining to finish, and sometimes by manufacturing the nipple from bent tubing and welding to finish. As a general rule, elbows up to size -8 are forged, and those over size -8 are of bent tube. A recently developed process allows the nipple to be machined from bar stock before being bent to the required angle on completion, these elbows are sometimes called 'one-piece, no-weld' elbows and have the advantage of having no high stress areas.

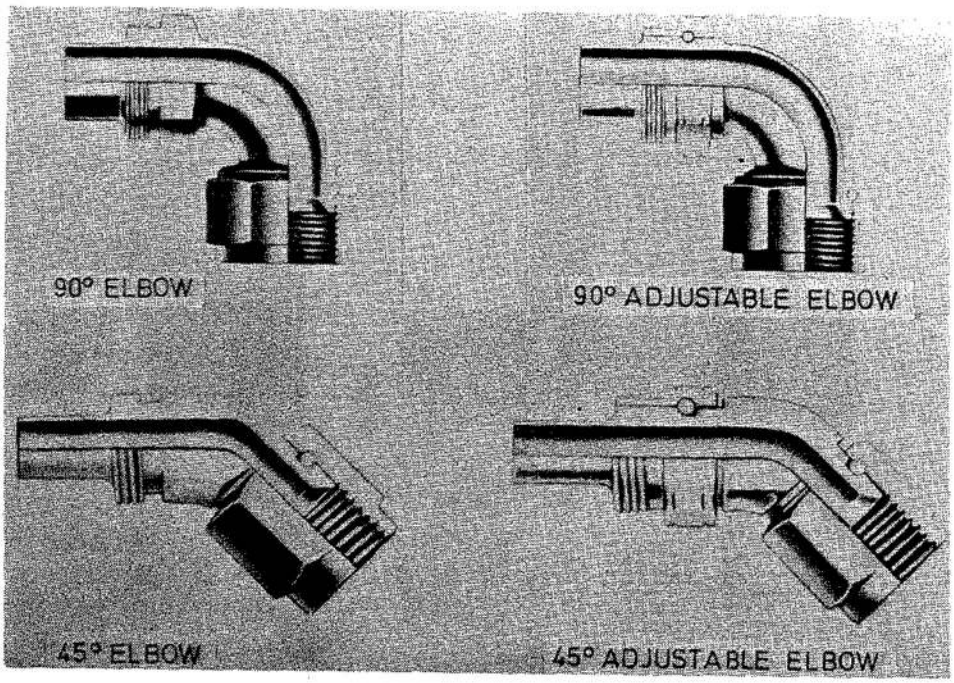


Fig. 9 Typical elbow fittings

19. Elbow fittings can be provided in an adjustable form where the nipple, regardless of manufacturing method, consists of two separate pieces (refer to fig. 9); the nipple hexagon and socket securing thread is machined separately to be a sliding fit on a raised surface of the nipple and is retained on the nipple by a wire insert. This arrangement allows the nipple to be rotated through 360 degrees even when assembled to the hose.

Chapter 1-3

HOSE ASSEMBLIES

CONTENTS

TABLES

ILLUSTRATIONS

General

1. A hose assembly is defined as being a length of flexible hose, complete with the required end fittings, and assembled to form part of a pipeline system. All hose assemblies for use in aircraft are designed for a specific purpose and may be additionally fitted with protective sleeving. To all practical purposes, any sleeving fitting becomes part of the hose assembly specification.

2. Factory manufactured hose assemblies are proof tested to the relevant Military Specification, and are identified with a permanently fixed, non magnetic, metal band before being despatched to the user. The identification band is impression stamped to show the following information and must not be removed from the hose assembly:-

(1) Manufacturers name.

(2) Hose assembly part number (see para. 4).

(3) Service stock number.

(4) Military Specification number.

(5) Normal working pressure.

(6) Date of manufacture (month and year).

(7) Manufacturers code number.

3. Locally manufactured hose must be proof tested to one and a half times the normal working pressure and must also be identified by a permanently fixed, non magnetic, metal band before being placed in service. Detail of

the proof test procedures and the local manufacture identification are contained in Chapter 3 of this publication.

HOSE ASSEMBLY PART NUMBERS

4. Each hose assembly in Service use is allocated a Service stock number and those are listed in the tables contained in Chapter 4 of this publication. The manufacturers part number for a hose assembly is a composite number to show the following information:-

(1) Position angle (i.e. relative angle between the end fittings, sometimes referred to as the 'angle of rotation' or 'elbow angle').

(2) Assembly base number (see para. 6).

(3) Hose size (dash size or letter code, see para. 7).

(4) Assembly length (see para. 9).

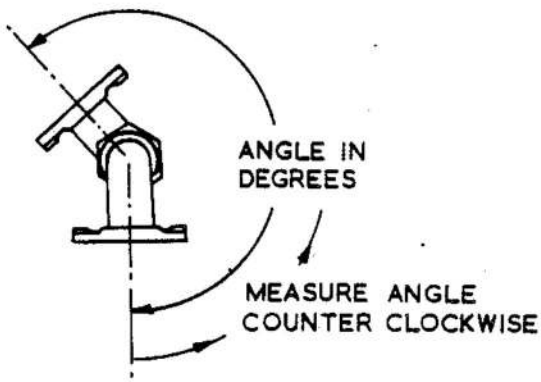


Fig. 1 Measurement of position angle

Position angle (fig. 1)

5. Position angle applies only when a hose assembly is manufactured with elbow fittings at each end and is the angle through which the pipeline system is rotated with respect to the pipeline axis. The position angle is always represented as a three figure number, e.g. 35° is written as 035. If the desired angle is 0° it is written as 000.

Assembly base number

6. The hose assembly base number is a manufacturers catalogue number which defines the hose part number, the end fittings and any additional protective sleeving that is fitted to the assembly. Without reference to the manufacturers catalogues, which detail all the combinations for any one hose, a full understanding of the assembly base number is not possible. The hose assemblies which are used in Service aircraft are detailed in Chapter 4 of this publication and the assembly base number for each is included with the hose assembly part number for each.

Hose assembly size coding

7. Three systems of coding are employed to represent the hose size in a hose assembly, part number as follows:-

(1) The dash numbering system; this system is applied to hose asemblies which have at least one straight fitting and are made with hose which does not have an AE prefix to the part number.

(2) The old (pre 1964) letter coding system; this system is applied to hose assemblies which have an elbow fitting at each end and is made using hose that does not have an AE prefix to the part number.

(3) The new letter coding system; this system is applied to all hose assemblies which are made using hose which has an AE prefix to the part number.

8. In January, 1964, the Aircraft Division of the American Aerospace Industry instituted the AE part numbering system. Since that date, all part numbers assigned have the prefix AE. At the same time the new letter coding system for hose assembly hose size was introduced. Table 1 provides a cross reference between the various hose size coding systems.

TABLE 1

HOSE ASSEMBLY SIZE CODING

HOSE DASH SIZE	OLD LETTER CODE (Pre 1964)	NEW LETTER CODE (for AE part numbers)
2	A	A
3	E	B
4	F	E
5	G	F
6	H	G
8	J	H
10	K	J
12	L	K
16	M	M
20	N	N
24	P	P
32	R	R

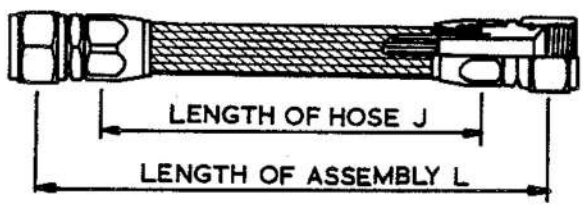


Fig. 2 Measurement of hose assembly length

Hose assembly length (fig. 2)

9. Hose assembly length is measured from sealing surface to sealing surface. With elbow fittings, the measuring point is the intersection of the centre line of the elbow with the face of the sealing surface. Assembly length is written using four digits and the last digit is reserved for fractional lengths in 1/8ths of inches, (e.g. length 21½ inches is written 0214; length 20 inches is written 0200).

Chapter 1-4

ACCESSORIES

CONTENTS

TABLES

ILLUSTRATIONS

PROTECTIVE SLEEVING

General

1. Flexible hose is manufactured with an outer cover which is in itself resistant to abrasion. In certain environmental conditions however, additional protection is required. Abrasion damage from adjacent fittings, and fire potential are the more common hazards which call for additional protection and several types of protective sleeving are available. Protective sleeving sizes are matched to the external diameter of the hose assembly and details of the applicable sizes are included with the hose data in Chapter 2 of this publication. The following paragraphs provide a general description of the various types of abrasion resistant and fire resistant sleeves. Some of the part numbers for protective sleeves were re-allocated (with AE prefix) in January, 1964. Obsolescent part numbers (no AE prefix) are still in supply and the applicable number is contained in brackets following the number in current use.

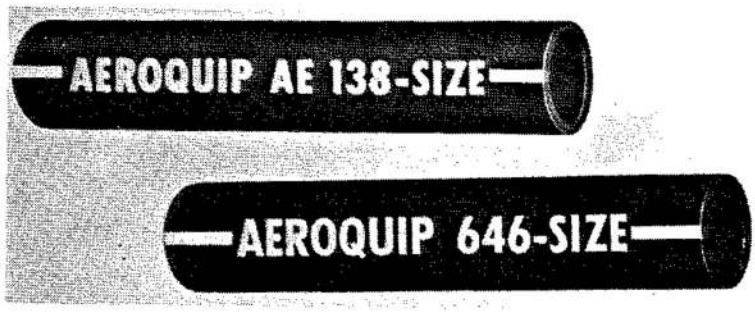


Fig. 1 Abrasion resistant sleeve Part No. AE138(646)

Abrasion resistant sleeves

2. (1) Sleeve Part No. AE138 (formerly part No. 646) (fig. 1), is a tough, synthetic rubber, scuff cover which is fuel, oil and ozone resistant. This sleeve is used in both ground servicing and airborne applications and is satisfactory for use over a temperature range of -54° to +121°C (-65° to +250°F).

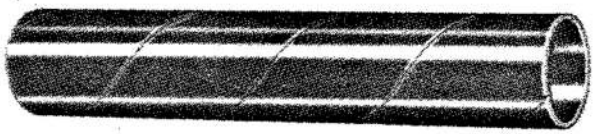


Fig. 2 Abrasion resistant coil Part No. AE208(900005)

(2) Sleeve Part No. AE208 (formerly part No. 900005) (fig. 5) is a lightweight nylon coil designed to afford abrasion resistance at temperatures of -53.8°C to +93.3°C (-65°F to +200°F) but will retain its shape through a temperature range of +93.3°C to +121.1°C (+200°F to +250°F). It is installed by winding or spirally wrapping around the hose. The natural gap between each coil lessens the possibility of entrapped moisture. The coil is recommended for applications where hose assemblies are exposed to moisture. The coil is available in only two sizes, -4 and -10. The -4 size is used with hose of 14.27 mm (0.562 in) and less in diameter.

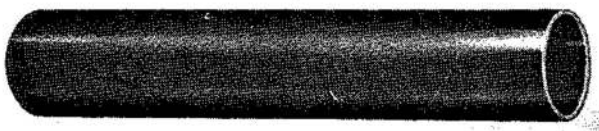


Fig. 3 Abrasion resistant sleeve Part No. AE251(900961)

(3) Sleeve Part No. AE251 (formerly Part No. 900961) (fig. 3). This sleeve is an extruded, translucent, seamless FEP 100 Teflon tube and is used for abrasion protection in high temperature applications of -53.8°C to +204.4°C (-65°F to +400°F). The sleeve is unaffected by fuels, lubricating oils, coolants or solvents used in aircraft service. When supplied in bulk, each length is identified by a tape at each end which shows: Part No., - size, manufacturers code. Additional tapes are attached to lengths in excess of 3.048 m (10 ft).

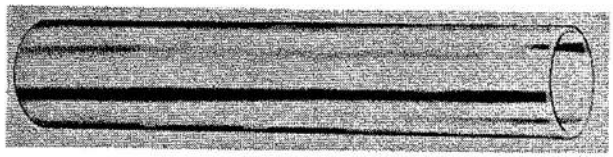


Fig. 4 Abrasion resistant sleeve Part No. 900223

(4) Sleeve Part No. 900223 (fig. 4) is a heat shrinkable polyolefin tubing transparent white in colour and used where a skintight fit is desired. Temperature range of the sleeve is -53.8°C to +135°C (-65°F to +275°F). During installation the sleeve is positioned between the end fittings and shrunk onto the hose by application of heat, either in an oven or with a portable heat gun.

Fire resistant sleeves

3. Firesleeve is an asbestos material with a synthetic rubber compound applied to the outer surface. The asbestos serves to insulate the hose from the intense heat of a fire and the outer cover protects the hose from fluids which it may come in contact with while in service. A firesleeve does not increase the service temperature resistance of a hose line but it protects the hose from direct fire long enough to either extinguish the fire or land the aircraft safely. The following types of fire resistant sleeving are available:-

Fig. 5 Firesleeve, type 624A

(1) Type 624A firesleeve (fig. 5) is a flat strip of elastic knitted asbestos impregnated with a special fuel, lubricating oil and hydraulic oil resistant butyl rubber. The butyl rubber used in the impregnation will not soften, peel, blister or harden even after immersion in distilled water, lubricating oils to MIL-H-6082, hydraulic fluids to MIL-H-5606, MIL-H-7808, or Skydrol 500. The firesleeve is identified by its grey coloured outer surface with a single turquoise lay line consisting of 'Aeroquip 624A-Size-Code' every 254 mm (10 in).

Fig. 6 Firesleeve, type 624

(2) Type 624 firesleeve (fig. 6) is a uniform single layer of braided asbestos tubing impregnated with a flame resistant synthetic rubber com-

pound. The asbestos yarn used in the braid is closely spun to provide maximum protection against fluid wicking. The synthetic rubber used in the impregnation of the outer cover will not blister, peel, soften or harden after contact with distilled water, lubricating oils to MIL-L-7808, MIL-H-5606, MIL-H-7808, MIL-L-6082, hydraulic fluids to MIL-H-5606, MIL-H-7808, or Skydrol 500. The firesleeve is identified by its grey coloured outer surface with a single turquoise layline consisting of 'Aeroquip 624-Size-Code' every 254 mm (10 in).

Fig. 7 Firesleeve type, AE102

(3) Type AE102 firesleeve (fig. 7) comprises a uniform layer of braided asbestos tubing impregnated and overload with flame resistant silicone rubber. The asbestos yarn used in the braid is closely spun to provide maximum protection against fluid wicking. The silicone rubber used in the impregnation and outer cover will not soften, peel, blister or harden after contact with MIL-H-5606, distilled water, MIL-L-7808, MIL-L-6082 or Skydrol 500. It has a continuous operating temperature range of -53.8°C to +260°C (-65°F to 500°F). The firesleeve is identified by its red coloured outer surface with a single black layline consisting of 'Aeroquip AE102-Size-Code' every 254 mm (10 in).

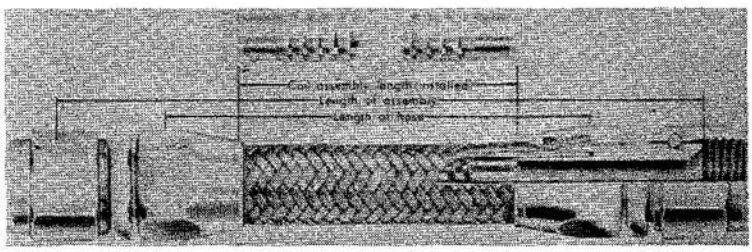


Fig. 8 Internal support coil

INTERNAL SUPPORT COILS (fig. 8)

4. The 900780 internal support coil is a flat helically wound, stainless steel reinforcing coil of 320 Type AMS5516, used to prevent damage to hoses which are subject to mishandling, vacuum applications or tight installations. End ferrules 900800A are used in conjunction with the internal support coil to act as anchor points for the coil and prevent fluids of high viscosity or high flow from forcing the internal support coil out through the end fittings.

5. To determine the coil length (No. of coils) required for a specific hose assembly length.

(1) Obtain length of hose ('J' Factor) in inches for hose assembly being fabricated. This can be obtained from the hose assembly standard drawing or from the assembly being replaced.

(2) Determine applicable formula for size and type of hose from the tables in Chapter 2.

(3) Establish length of coil needed as per example below:

Example: Hose 601-16

Cut length of hose ('J Factor) 20 inches

Formula: 3.3 (J-2.4)
3.3 (20-2.4)
3.3 (17.6)
3.3 x 17.6 = 58.1

Coil length in number of coils = 58.1 coils

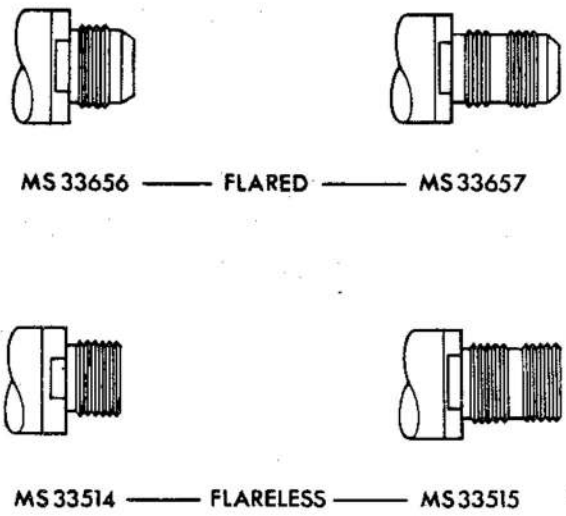


Fig. 9 Couplings - identity of thread forms

COUPLINGS

6. Through bulkhead couplings to suit most applications are available with threads to match flared and flareless hose fittings. Mostly designed for quick release and self sealing properties, these couplings enable the retention of airframe structural integrity whilst allowing the shortest possible fluid lines. Bulkhead mounting is achieved by the use of fixed bosses, flanges, or jam-nuts according to the design requirement. Fig. 9 identifies the thread styles referred to in Table 1 which lists the general data for the various types of coupling available. Coupling halves can be obtained separately or as an assembly. Part numbers are listed in Table 2.

TABLE 1

Couplings - general data

Type	Style	Thread form (see fig.9) Bulkhead half	Thread form (see fig.9) Hose half	Application	Sizes available	Operating pressure
3750 (series)	I	MS 33656	MS 33656	Fuel, Oil, Hydraulics	- 4 to -12	68.95 bar (1000 lbf/in^2)
	II	MS 33657	MS 33656			
	III	MS 33514	MS 33514		-16 to -24	38.37 bar (600 lbf/in^2)
	IV	MS 33515	MS 33514			
155/145 (series)	I	MS 33657	MS 33656	Hydraulics	- 4 to -16	206.85 bar (3000 lbf/in^2)
	II	MS 33656	MS 33656			
	III	MS 33515	MS 33514		-20 to -24	68.95 bar (1000 lbf/in^2)
3200 (series)	III	MS 33657	MS 33656	Hydraulics Skydrol	- 4 to -16	206.85 bar (3000 lbf/in^2)
	IV	MS 33515	MS 33514			
3900 (series)	I	MS 33656	MS 33656	Fuel, Oil, Coolants: ethylene glycol, coolanol 23,35	- 4 to -16	68.95 bar (1000 lbf/in^2)
	II	MS 33657	MS 33656			
	III	MS 33515	MS 33514			
Arc Latch (series)	I	MS 33656	MS 33656	Coolanol 25 (or equivalent)	E to M - 4 to -16	34.47 bar (500 lbf/in^2)

TABLE 2

Couplings and components - part numbers

Note...
(1) Add -size to Part No. listed.

(2) Refer to Table 1 for detail of thread form

Coupling Series	Style	Complete coupling	Bulkhead half	Hose half	Remarks
3750	I	3750	3752	3755	Fuel
		375004	375204	375504	Lube oil
		375007	375207	375506	Hydraulics
3750	II	375001	375201	3755	Fuel
		375000	375200	375504	Lube oil
		375008	375208	375506	Hydraulics

TABLE 2 (cont.)

Coupling Series	Style	Complete coupling	Bulkhead half	Hose half	Remarks
3750	III	375009	375209	375507	Fuel
		375010	375210	375508	Lube Oil
		375011	375211	375503	Hydraulics
3750	IV	375012	375212	375507	Fuel
		375013	375213	375508	Lube Oil
		375014	375214	375503	Hydraulics
155/145	I	155	TB155-S4	155-S5	Sizes -4 to -8
		155	TA155-S4	144-S5	Sizes -10 to -16
		145	B145-S4	145-S5	Sizes -20, -24
155/145	II	015519	TB015519-S4	155-S5	Sizes -4 to -8
		015519	TO15519-S4	155-S5	Sizes -10 to -16
		014519	014519-S4	145-S5	Sizes -20, -24
155/145	III	3065	TB3005-S4	3065-S5	Sizes -4 to -8
		3065	B3005-S4	3065-S5	Sizes -10, 12
		3070	3070-S4	3075-S5	Size -16
		3065	A3005-S4	3065-S5	Size -20
		3065	B3005-S4	3065-S5	Size -24
3200	III	3400	3402	3205	Hydraulics
		340019	340218	320516	Skydrol
	IV	3300	3302	3305	Hydraulics
		330023	330217	330509	Skydrol
3900	I	390008	390210	390509	Fuel
		390055	390206	390505	Oil
		3900	3902	3905	Ethylene glycol
		390059	390261	390544	Coolanol
3900	II	390010	390212	390509	Fuel
		390058	390213	390505	Oil
		390012	390202	3905	Ethylene glycol
		390060	390275	390544	Coolanol
3900	III	390016	390216	390511	Fuel
		390017	390217	390512	Oil
		390061	390204	390503	Ethylene glycol
		390061	390254	390563	Coolanol
Arc Latch	I	AE96626	AE96656	AE96657	Sizes E to M (-4 to -16)

CLAMPS

7. Band clamps, manufactured in stainless steel (Cres) or aluminium alloy (Alum) are used in many applications, from line support clamps to collars, sleeves and covers. Available in numerous sizes, the clamps are weather

and corrosion resistant and vibration proof when properly installed. Details of the more common clamps are as follows:-

(1) Cradle support clamp - A band clamp with integral support cradle for mounting purposes.

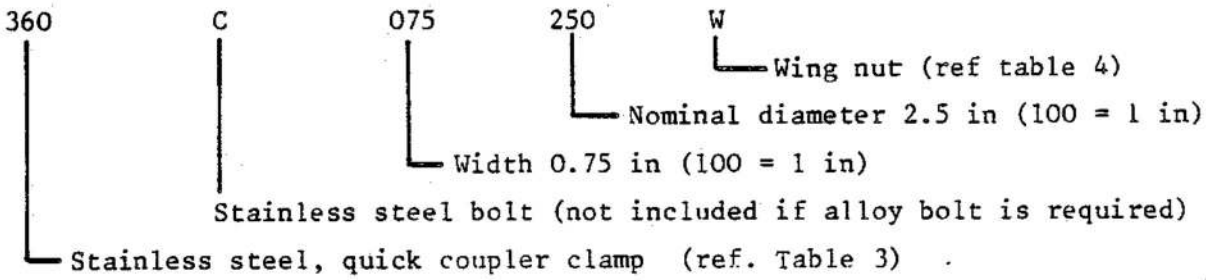
(2) Bracket support clamp - A band clamp which includes clips or lugs for securing to an adjacent structure.

(3) Quick coupler clamp - A clamp which incorporates a snap-on latch to allow instant release.

(4) T-bolt clamp - A clamp in which the band is extended under the take-up bolt to provide for even take-up when tightened.

(5) Multiple take-up clamp - An extra wide clamp, fitted with more than one take-up bolt or latch.

8. The part number of a clamp (except support clamps) is made up of a series of reference numbers as shown in the following example:



9. The part numbers of support clamps must indicate the type of support required and are made up of a series of references as follows:-

(1) Clamp reference number.

(2) Nominal diameter reference number (100 = 1 in).

(3) Reference to show one of the following details:

(a) Number of clips or lugs required.

(b) Letter code to show type of take-up nut required.

10. Table 3 lists reference numbers and required details of the clamps, and Table 4 indicates the letter code applied to the various types of take-up nuts.

TABLE 3

Clamps - reference numbers and details

Note...

(1) All dimensions are quoted in inches.

(2) Diameters quoted are:- Nominal for support clamps
Minimum for other clamps

TABLE 3 (cont.)

Ref.No. Cres	Ref.No. Alum	Diameter	Width	Band Gauge	Remarks
900,901 902,903		As required	.62 .56	0.20	Support clamps:900, 902 with lugs; 901, 903 with clips
914,915, 916,917		1.50-2.50 2.25-4.50 4.50-14.00	1.0	.020 .025	Cradle support clamps 915,917,919 with cork lining
360 365 450 455 550 555	361 366 451 456 551 556	2.00 3.00 4.00 7.00 3.50 6.50	.63-1.00 .75-1.50 .88-3.00	Cres .020 Alum .032 Cres.050 Alum.063	Quick coupler clamps
320 325 420 425 520 535 620 625	321 326 421 426 521 536	1.25 3.00 2.50 7.00 3.00 6.00 4.00 7.00	.63-1.00 .75-1.50 .88-3.00 1.00-2.00	Cres .020 Alum .032 Cres.050 Alum.063 .053	T-bolt clamps
336 338 446 448		2.00 3.00 4.00 7.00	1.38-6.00 2.00-6.00	.020 .025	Quick coupler latch multiple take-up clamps

TABLE 4

Coding of tightening nuts for clamps

Code	Description of nut
B	Plain hexagon, brass, with lockwire hole
D	Plain hexagon, silver plated stainless steel, with lockwire hole
M	Self locking, silver plated stainless steel, 649°C (1200°F)
S	Self locking, cadmium plated steel, 191°C (250°F)
SH	Self locking, cadmium plated steel, 304°C (550°F)
W	Plain wing, cadmium plated steel, with lockwire hole

Chapter 2-O

HOSES AND FITTINGS

Introduction

1 The following sub-chapters describe the types of hose assemblies which have re-usable end fittings giving brief details of their construction and uses. The manufacturers part numbers for the end fittings and the protective sleeves that can be used with each hose are listed in the tables contained in the appropriate sub-chapter.

Notes ...

(1) Hoses which are non-repairable are included in AP101A-0305-1.

(2) Hoses of UK origin used in low pressure systems are described in Chapter 4.

(3) A number of special hoses are also used. These are described in the Manual for the particular aircraft.

▶ (4) **Oxygen hoses are covered by Chapter 3-11 of this publication.** ◀

General

2 The hose cut-off dimension listed in the tables is that length which must be taken off the total length of a complete hose assembly to allow for the end fitting. Fig 1 illustrates the types of end fittings referred to in the sub-chapters and shows the cut-off dimension.

3 The end fitting size corresponds to the hose size for example, a -3 fitting is used on a -3 hose.

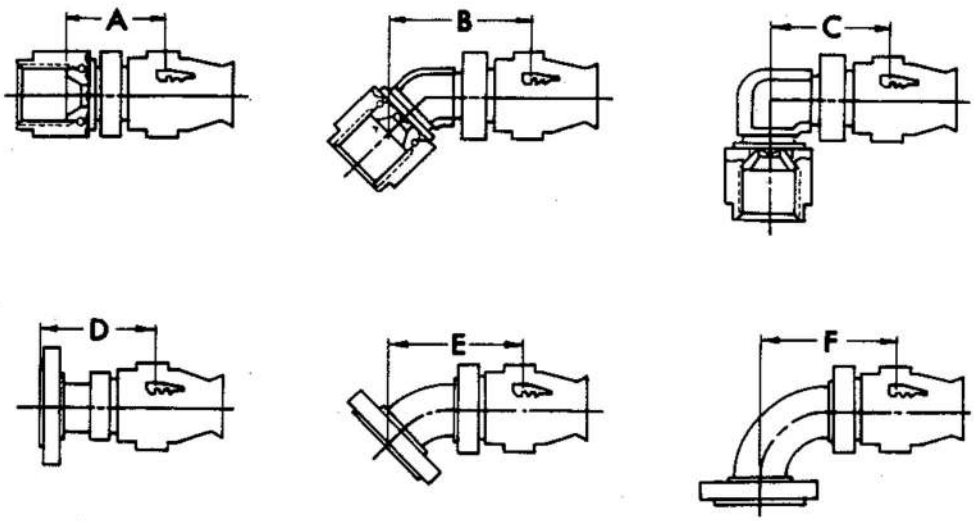


Fig 1 Cut-off dimensions for various fittings

Chapter 2-1

HOSE, PART No. 306/MIL-H-5593

Operating range	Below 17.24 bar (250 lb f/in^2)
Temperature range	53.8 to +71.1°C (–65 to +160°F)
Construction:-	
Inner tube	Seamless synthetic compound
Reinforcement	Single cotton braid
Outer cover	Synthetic rubber
Identification	Black cover with linear yellow stripe interspersed with symbol LP, man's code, size and date of manufacture. Linear white stripe 180° from yellow with marking Aeroquip 306. Markings repeated every 152 mm (6 in).
Application	Air or vacuum instrument lines, auto pilots and pressure gauge lines used with those systems as specified in MS 33620. Hose assemblies conform to AN6270.

TABLE 1

Hose size and general data

Hose	Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lb f/in^2)	mm	(in)
306	-2	8.74	(0.344)	20.68	(300)	50.8	(2.0)
306	-3	10.3	(0.406)	17.24	(250)	50.8	(2.0)
306	-4	11.9	(0.469)	13.79	(200)	101.6	(4.0)
306	-6	15.0	(0.594)	10.34	(150)	101.6	(4.0)
306	-8	19.1	(0.750)	10.34	(150)	152.4	(6.0)
306	-10	22.2	(0.875)	10.34	(150)	152.4	(6.0)

TABLE 2

End fittings

Pt. No. -Size	Cut-off dim.		Components (Pt. No.)			
	mm	(in)	Socket	Nipple	Nut	Thread
Flared, straight						
471-2D (MS27404-2D)	10.16	(0.4)	213-2D	231-2D	290-2D	5/16-24

TABLE 2 (cont.)

Pt. No. -Size	Cut off dim.		Components (Pt. No.)			
	mm	(in)	Socket	Nipple	Nut	Thread
Flared, straight (cont.)						
471-3D (MS27404-3D)	11.18	(0.44)	213-3D	231-3D	290-3D	3/8-24
471-4D (MS27404-4D)	11.93	(0.47)	213-4D	231-4D	290-4D	7/16-20
471-6D (MS27404-6D)	13.72	(0.54)	213-6D	231-6D	290-6D	9/16-18
471-8D (MS27404-8D)	17.02	(0.67)	213-8D	231-8D	290-8D	3/4-16
471-10D (MS27404-10D)	18.29	(0.72)	213-10D	231-10D	290-10D	7/8-14

Note...

MS27404 supersedes AN773

Chapter 2-2

HOSE, PART No. 309/MIL-H-8788

Operating range	Up to 206.84 bar (3000 lb f/in^2)
Temperature range:-	
Size - 4 to -12	-53.8^o to +93.3^{o}C (-65 to + 200^{o}F)
Size -16	-40 to +93.3^{o}C (-40 to +200^{o}F)
Construction:-	
Inner tube	Seamless synthetic compound
Reinforcement	Sizes -4 to -12 high tensile carbon steel double wire braid Size -6 high tensil carbon steel triple wire braid
Outer cover	Synthetic rubber over fabric braid
Identification	Black cover with linear yellow marking consisting of -8788 (or 5512), size, date of manufacture and man's code. Spaced 180^o from this is Aeroquip 309. Marking repeated every 229 mm (9 in).
Application	206.84 bar applications specified in MS33620. Hose may be used in submerged applications. Hose conforms to MIL-H-8788.

TABLE 1

Hose size and general data

Hose size		O.D		Operating pressure		Min.bend radii	
		mm	(in)	bar	(lb f/in ^{2})	mm	(in)
309	-4	15.87	(0.625)	206.84	(3000)	76.2	(3.0)
309	-6	19.45	(0.766)	206.84	(3000)	127.0	(5.0)
309	-8	21.82	(0.859)	206.84	(3000)	146.05	(5.75)
309	-10	26.19	(1.031)	206.84	(3000)	165.1	(6.50)
309	-12	30.96	(1.219)	206.84	(3000)	196.85	(7.75)
309	-16	38.10	(1.50)	206.84	(3000)	244.35	(9.62)

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Flared, swivel nut, straight (MS28760)						
833	-4	20.82	(0.82)	508-4D	543-4	7/16-20
833	-6	24.64	(0.97)	508-6D	543-6	9/16-18
833	-8	27.94	(1.10)	520-8D	543-8	3/4 -16
833	-10	33.27	(1.31)	520-10D	543-10	7/8 -14
833	-12	35.31	(1.39)	520-12D	543-12	1.1/16-12
833	-16	39.62	(1.56)	520-16D	543-16	1.5/16-12
Flared, swivel nut, 45° (MS28780)						
980314	-4	27.94	(1.10)	508-4D	985314-4	7/16-20
980314	-6	32.77	(1.29)	508-6D	985314-6	9/16-18
980314	-8	36.83	(1.45)	520-8D	985314-8	3/4 -16
980314	-10	42.67	(1.68)	520-10D	985314-10	7/8 -14
980314	-12	57.15	(2.25)	520-12D	985314-12	1.1/16-12
980314	-16	62.23	(2.45)	520-16D	985314-16	1.5/16-12
Flared, swivel nut, 90° (MS28781)						
980402	-4	24.64	(0.97)	508-4D	985402-4	7/16-20
980402	-6	28.96	(1.14)	508-6D	985402-6	9/16-18
980402	-8	32.77	(1.29)	520-8D	985402-8	3/4 -16
980402	-10	38.61	(1.52)	520-10D	985402-10	7/8 -14
980402	-12	56.90	(2.24)	520-12D	985402-12	1.1/16-12
980402	-16	64.01	(2.52)	520-16D	985402-16	1.5/16-12
Globeseal, flareless, straight (MS28761)						
882	-4	24.89	(0.98)	508-4D	552-4	7/16-20
882	-6	29.72	(1.17)	508-6D	552-6	9/16-18
882	-8	33.78	(1.33)	520-8D	552-8	3/4 -16
882	-10	40.39	(1.59)	520-10D	552-10	7/8 -14
882	-12	42.42	(1.67)	520-12D	552-12	1.1/16-12
882	-16	46.48	(1.83)	520-16D	552-16	1.5/16-12
Globeseal, flareless, 45°						
980628	-4	30.48	(1.2)	508-4D	985628-4	7/16-20
980628	-6	36.32	(1.43)	508-6D	985628-6	9/16-18
980628	-8	40.89	(1.61)	520-8D	985628-8	3/4 -16

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt.No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Globeseal, flareless, 45° (cont.)						
980628	-10	47.75	(1.88)	520-10D	985628-10	7/8 -14
980628	-12	61.72	(2.43)	520-12D	985628-12	1.1/16-12
980628	-16	67.31	(2.65)	520-16D	985628-16	1.5/16-12
Globeseal, flareless, 90°						
980629	-4	24.64	(0.97)	508-4D	985629-4	7/16-20
980629	-6	28.96	(1.14)	508-6D	985629-6	9/16-18
980629	-8	32.77	(1.29)	520-8D	985629-8	3/4 -16
980629	-10	38.61	(1.52)	520-10D	985629-10	7/8 -14
980629	-12	56.90	(2.24)	520-12D	985629-12	1.1/16-12
980629	-16	64.01	(2.52)	520-16D	985629-16	1.5/16-12

TABLE 3

Protective sleeves

Hose size	-4	-6	-8	-10	-12	-16
Firesleeves 624 and AE102 Clamp 900591B	-12 1C	-14 1C	-16 2C	-18 2C	-20 3C	-26 3C
Protective sleeve 646	-14	-18	-22	-26	-28	-34
Protective coil (ext) 900005	-10	-10	-10	-10	-10	-10
Protective sleeve (shrinkable) 900223	-3	-5	-5	-7	-7	-9

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

Chapter 2-3

HOSES, PART NOS. 303 AND 302A/MIL-H-8794

Operating range:-

303 ... ... 103.42 to 206.84 bar (1500 to 3000 lb f/in^2)

302A ... ... 24.13 to 55.16 bar (350 to 800 lb f/in^2)

Temperature range:-

303 ... ... -54 to +121°C (-65 to +250°F)

302A ... ... -40 to +121°C (-40 to +250°F)

Construction:-

Inner tube ... ... Seamless synthetic rubber compound

Reinforcement ... ... Synthetic impregnated single wire braid over single cotton braid

Outer cover ... ... Synthetic impregnated oil-resistant cotton braid

Identification ... ... Grey-black braided cover with linear yellow marking consisting of 8794, size, date of manufacture and man's code. Spaced 90° from this a yellow stripe interspersed with Aeroquip 303 or Aeroquip 302A. Markings repeated at 229 mm (9 in) intervals.

Application ... ... Medium pressure hydraulic, pneumatic, fuel, oil and coolant systems specified in, MS33620. Hose may be used in submerged applications. Hose 303-3 not to be used in hydraulic systems.

TABLE 1

Hose size and general data

Hose -Size		O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lb f/in^2)	mm	(in)
Flared, swivel nut, straight (MS24587)							
303	-3	11.51	(0.453)	206.84	(3000)	76.2	(3.00)
303	-4	13.11	(0.516)	206.84	(3000)	76.2	(3.00)
303	-5	14.68	(0.578)	206.84	(3000)	85.85	(3.38)
303	-6	17.07	(0.672)	137.89	(2000)	101.60	(4.00)
303	-8	19.46	(0.766)	137.89	(2000)	117.35	(4.62)
303	-10	23.42	(0.922)	120.66	(1750)	139.70	(5.50)
303	-12	27.38	(1.078)	103.42	(1500)	165.10	(6.50)

TABLE 1 (cont.)

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lb f/in^2)	mm	(in)
Flared, swivel nut, straight (MS24587) (cont.)							
302A	16	31.34	(1.234)	55.16	(800)	187.45	(7.38)
302A	20	38.10	(1.500)	41.37	(600)	228.6	(9.00)
302A	24	44.45	(1.750)	34.47	(500)	279.4	(11.00)
302A	32	56.36	(2.219)	24.13	(350)	336.55	(13.25)

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)			
		mm	(in)	Socket	Nipple	Nut	Thread
Flared, swivel nut (MS24587)							
491	-3		(0.65)	210-3D	251-3	290-3	3/8 -24
491	-4		(0.65)	210-4D	251-4	290-4	7/16-20
491	-5		(0.74)	210-5D	251-5	290-5	1/2 -20
491	-6		(0.77)	210-6D	251-6	290-6	9/16-18
491	-8D		(0.94)	215-8D	271-8D	290-8D	3/4 -16
491	-10D		(1.00)	215-10D	271-10D	290-10D	7/8 -14
491	-12D		(1.00)	215-12D	271-12D	290-12D	1.1/16-12
451	-16D		(0.94)	212-16D	251-16D	290-16D	1.5/16-12
451	-20D		(1.00)	212-20D	251-20D	290-20D	1.5/8 -12
451	-24D		(1.09)	212-24D	251-24D	290-24D	1.7/8 -12
451	-32D		(1.24)	212-32D	251-32D	290-32D	2.1/2 -12

				Socket	Nipple assembly	Thread
Flared, swivel nut, 45° (MS27226)						
980006	-4	28.45	(1.12)	210-4D	985006-4	7/16-20
980006	-5	34.04	(1.34)	210-5D	985006-5	1/2 -20
980006	-6	35.05	(1.38)	210-6D	985006-6	9/16-18
980006	-8D	39.37	(1.55)	215-8D	985006-8D	3/4 -16
980006	-10D	43.18	(1.70)	215-10D	985006-10D	7/8 -14
9800136	-12D	48.01	(1.89)	215-12D	985136-12D	1.1/16-12

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim. mm	Cut-off dim. (in)	Components (Pt.No.) Socket	Nipple	Flange
Flared, swivel nut, 45° (MS27226) (cont.)						
980136	-16D	46.74	(1.84)	212-16D	985136-16D	1.5/16-12
980136	-20D	54.86	(2.16)	212-20D	985136-20D	1.5/8 -12
980136	-24D	60.96	(2.40)	212-24D	985136-24D	1.7/8 -12
980136	-32D	72.14	(2.84)	212-32D	985136-32D	2.1/2 -12
Flared, swivel nut, 90° (MS27224)						
980005	-4	25.15	(0.99)	210-4D	985005-4	7/16-20
980005	-5	29.97	(1.18)	210-5D	985005-5	1/2 -20
980005	-6	31.24	(1.23)	210-6D	985005-6	9/16-18
980005	-8D	35.31	(1.39)	215-8D	985005-8D	3/4 -16
980005	-10D	38.61	(1.52)	215-10D	985005-10D	7/8 -14
980137	-12D	44.70	(1.76)	215-12D	985137-12D	1.1/16-12
980137	-16D	44.45	(1.75)	212-16D	995137-16D	1.5/16-12
980137	-20D	53.09	(2.09)	212-20D	985137-20D	1.5/8 -12
980137	-24D	59.44	(2.34)	212-24D	985137-24D	1.7/8 -12
980137	-32D	71.12	(2.80)	212-32D	985137-32D	2.1/2 -12
Swivel flange, straight (MS27232)				Socket	Nipple	Flange
9844	-12D	42.42	(1.67)	215-12D	985592-12D	9664-12D
9844	-16D	38.86	(1.53)	212-16D	985592-16D	9664-16D
9844	-20D	38.86	(1.53)	212-20D	985592-20D	9644-20D
9844	-24D	37.34	(1.47)	212-24D	985592-24D	9644-24D
9844	-32D	42.16	(1.66)	212-32D	985592-32D	9644-32D
Swivel flange, 45° (MS27230)						
9845	-12D	44.20	(1.74)	215-12D	985593-12D	9644-12D
9845	-16D	42.93	(1.69)	212-16D	985593-16D	9644-16D
9845	-20D	49.78	(1.96)	212-20D	985593-20D	9644-20D
9845	-24D	54.86	(2.16)	212-24D	985593-24D	9644-24D
9845	-32D	63.50	(2.50)	212-32D	985593-32D	9644-32D
Swivel flange, 90° (MS27228)						
9890	-12D	44.70	(1.76)	215-12D	985594-12D	9644-12D
9890	-16D	44.45	(1.75)	212-16D	985594-16D	9644-16D
9890	-20D	53.09	(2.09)	212-20D	985594-20D	9644-20D
9890	-24D	59.44	(2.34)	212-24D	985594-24D	9644-24D
9890	-32D	71.12	(2.80)	212-32D	985594-32D	9644-32D

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Flange
Globeseal, flareless, straight						
440	-4	23.88	(0.94)	210-4D	440-3-4	7/16-20
440	-5	26.67	(1.05)	210-5D	440-3-5	1/2 -20
440	-6	28.19	(1.11)	210-6D	440-3-6	9/16-18
440	-8D	33.78	(1.33)	215-8D	440-3-8D	3/4 -16
440	-10D	37.08	(1.46)	215-10D	440-3-10D	7/8 -14
440	-12D	37.34	(1.47)	215-12D	440-3-12D	1.1/16-12
440	-16D	41.15	(1.62)	212-16D	440-3-16D	1.5/16-12
440	-20D	43.69	(1.72)	212-20D	440-3-20D	1.5/8 -12
440	-24D	48.26	(1.94)	212-24D	440-3-24D	1.7/8 -12
Globeseal, flareless, 45°						
980688	-4	30.99	(1.22)	210-4D	985688-4	7/16-20
980688	-5	36.83	(1.45)	210-5D	985688-5	1/2 -20
980688	-6	38.35	(1.51)	210-6D	985688-6	9/16-18
980688	-8D	43.43	(1.71)	215-8D	985688-8D	3/4 -16
980688	-10D	47.75	(1.88)	215-10D	985688-10D	7/8 -14
980688	-12D	59.94	(2.36)	215-12D	985688-12D	1.1/16-12
980688	-16D	61.21	(2.41)	212-16D	985688-16D	1.5/16-12
980688	-20D	65.53	(2.58)	212-20D	985688-20D	1.5/8 -12
Globeseal, flareless, 90°						
980569	-4	25.15	(0.99)	210-4	985569-4	7/16-20
980569	-5	29.97	(1.18)	210-5	985569-5	1/2 -20
980569	-6	31.24	(1.23)	210-6	985569-6	9/16-18
980569	-8D	35.31	(1.39)	215-8D	985569-8D	3/4 -16
980569	-10D	38.61	(1.52)	215-10D	985569-10D	7/8 -14
980569	-12D	55.12	(2.17)	215-12D	985569-12D	1.1/16-12
980569	-16D	57.91	(2.28)	212-16D	985569-16D	1.5/16-12
980569	-20D	60.96	(2.40)	212-20D	985569-20D	1.5/8 -12

TABLE 3

Protective sleeves

Hose size, 303 302A	-3	-4	-5	-6	-8	-10	-12	-16	-20	-24	-32
Firesleeve 624 and AE102 Clamp 900591B	-8 1C	-8 1C	-10 2C	-12 2C	-14 2C	-16 3C	-18 3C	-22 3C	-28 4C	-30 4C	-38 5C
Protective sleeve 646	-	-	-	-	-18	-	-	-	-	-	-
Protective coil (external) 900005	-4	-4	-10	-10	-10	-10	-10	-10	-10	-10	-10
Protective sleeve (shrinkable) 900223	-2	-3	-3	-3	-5	-5	-7	-7	-9	-9	-11

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

Chapter 2-4

HOSE, PART No. AE 116

WARNING...

(1) COMPONENTS WHICH ARE SUPPLIED IN A PRE-LUBRICATED STATE ARE NOT TO BE FITTED TO OXYGEN LINES.

▶ (2) NO LUBRICANT IS TO BE USED WHERE OXYGEN PRESSURES OF 137.89 BAR (2000 LBF/IN^2 MAY BE ENCOUNTERED.

◀

Operating range	Up to 103.44 bar (1500 lb f/in^2)
Temperature range	-54 to +232°C (-65 to +450°F) for hydraulic systems -54 to +71°C (-65 to +160°F) for pneumatic systems
Construction:	
Inner tube	Teflon, non-conductive (no carbon coating on the bore)
Reinforcement	Single layer Type 300 series stainless steel wire braid
Identification	White band giving the following details Aeroquip AE116-3 (or -5), manufacturer's code, MIL-H-27267, operating pressure, lot number.
Application	Gaseous or liquid oxidizing systems and precision clean hydraulic and pneumatic systems

TABLE 1

Hose size and general data

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lb f/in^2)	mm	(in)
AE116	-3	6.35	(0.250)	103.44	(1500)	38.10	(1.5)
AE116	-5	9.53	(0.375)	103.44	(1500)	50.80	(2.0)

WARNING...

THE FITTINGS DETAILED IN TABLE 2 ARE NOT TO BE USED IN OXYGEN SYSTEMS.

Note...

The nipple assemblies listed in Table 2 have UNJF threads. Table 3 gives the part numbers of nipple assemblies with BNAé and ARSAERO metric threads which are available for the size -5.

TABLE 2

End fittings for use in hydraulic and pneumatic systems

Fitting		Cut-off dim.		Components (Pt. No.)		
				Socket	Nipple assembly	Sleeve
Flared, swivel nut, straight (MS27053)						
F66000	-3	17.8	(.70)	F506-3C	G65000-3C	900767-3C
F66000	-5	19.6	(.77)	F506-5C	G65000-5C	900767-5C
Flared, swivel nut, 45° (forged MS27059) (Bent tube MS27055)						
F663	-3	27.4	(1.08)	F506-3C	G6533-3C	900767-3C
F663	-5	31	(1.22)	F506-5C	G6533-5C	900767-5C
Flared, swivel nut, 90° (forged MS27060) (bent tube MS27057)						
F6605	-3	21.8	(.86)	F506-3C	G6505-3C	900767-3C
F6605	-5	24.6	(.97)	F506-5C	G6505-5C	900767-5C
Flareless, swivel nut, straight (MS27381)						
F66018	-3	23.4	(.92)	F506-3C	G65018-3C	900767-3C
F66018	-5	23.6	(.93)	F506-5C	G65018-5C	900767-3C
Flareless, swivel nut 45° (forged MS27384) (bent tube MS27382)						
F66113	-3	31.2	(1.23)	F506-3C	G65113-3C	900767-3C
F66113	-5	33.5	(1.32)	F506-5C	G65113-5C	900767-5C
Flareless, swivel nut, 90° (forged MS27385) (bent tube MS27383)						
F66104	-3	21.8	(.86)	F506-3C	G65104-3C	900767-3C
F66104	-5	24.6	(.97)	F506-3C	G65104-3C	900767-5C

TABLE 3

Metric thread nipple assemblies

Hose	-Size	Nipple assembly	Cut-off dim.		Nipple assembly	Cut-off dim.	
			mm	(in)		mm	(in)
		BNAé straight			BNAé 45°		
AE116	-5	AE15712F	22.9	(0.90)	AE19187F	33.5	(1.30)
		BNAé 90°			ARSAERO, short, male		
AE116	-5	AE19193F	23.4	(0.92)	AE19317F	22.6	(0.89)

Chapter 2-5

HOSE, PART NO. 617

Operating range	Up to 8.62 bar (125 lb f/in^2)
Temperature range	-40 to +149°C (-40 to +300°F). On approved installations can be used down to -54°C (-65°F)
Construction:-	
Inner tube	Seamless, specially formulated Buna N compound
Reinforcement	Synthetic impregnated single cotton inner braid and single wire braid
Outer cover	Synthetic impregnated oil-resistant cotton braid
Identification	Grey-black braided cover with linear red marking consisting of Aeroquip 617 - size, symbol LP, date of manufacture and man's code. Markings repeated at 229 mm (9 in) intervals
Application	8.62 bar (125 lb f/in^2) aircraft fuel and oil systems and vent the drain line. May be used in airframe or power plant lines and in submerged applications

TABLE 1

Hose size and general data

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lb f/in^2)	mm	(in)
617	-16	29.26	(1.156)	8.62	(125)	187.45	(7.38)
617	-20	36.53	(1.438)	8.62	(125)	228.60	(9.00)
617	-24	42.47	(1.672)	8.62	(125)	279.40	(11.00)
617	-32	53.19	(2.094)	8.62	(125)	431.80	(17.00)

TABLE 2

End fittings

Pt.No.	-Size	Cut-off dim.		Components (Pt. No.)			
		mm	(in)	Socket	Nipple	Nut	Thread
Flared, swivel nut, straight							
817	-16D	20.32	(0.80)	517-16D	527-16D	290-16D	1.5/16-12
817	-20D	23.88	(0.94)	517-20D	527-20D	290-20D	1.5/8 -12
817	-24D	24.64	(0.97)	517-24D	527-24D	290-24D	1.7/8 -12
817	-32D	30.73	(1.21)	517-32D	527-32D	290-32D	2.1/2 -12
Flared, swivel nut, 45°				Socket	Nipple assembly		Thread
8346	-16D	42.42	(1.67)	517-16D	8246-16D		1.5/16-12
8346	-20D	50.29	(1.98)	517-20D	8246-20D		1.5/8 -12
8346	-24D	54.10	(2.13)	517-24D	8246-24D		1.7/8 -12
8346	-32D	66.55	(2.62)	517-32D	8246-32D		2.1/2 -12
Flared, swivel nut, 90°							
8391	-16D	40.13	(1.58)	517-16D	8291-16D		1.5/16-12
8391	-20D	48.51	(1.91)	517-20D	8291-20D		1.5/8 -12
8391	-24D	52.32	(2.06)	517-24D	8291-24D		1.7/8 -12
8391	-32D	65.53	(2.58)	517-32D	8291-32D		2.1/2 -12
Swivel flange, straight				Socket	Nipple		Flange
8344	-16D	28.96	(1.14)	517-16D	220027-16D		9644-16D
8344	-20D	34.29	(1.35)	517-20D	220027-20D		9644-20D
8344	-24D	30.23	(1.19)	517-24D	220027-24D		9644-24D
8344	-32D	36.58	(1.44)	517-32D	220027-32D		9644-32D
Swivel flange, 45°							
8345	-16D	38.61	(1.52)	517-16D	8245-16D		9644-16D
8345	-20D	45.21	(1.78)	517-20D	8245-20D		9644-20D
8345	-24D	47.75	(1.85)	517-24D	8245-24D		9644-24D
8345	-32D	58.17	(2.29)	517-32D	8245-32D		9644-32D
Swivel flange, 90°							
8390	-16D	38.61	(1.52)	517-16D	8290-16D		9644-16D
8390	-20D	46.99	(1.85)	517-20D	8290-20D		9644-20D
8390	-24D	50.80	(2.00)	517-24D	8290-24D		9644-24D
8390	-32D	62.23	(2.45)	517-32D	8290-32D		9644-32D

TABLE 3

Protective sleeves

Hose size	-16	-20	-24	-32
Fire sleeves 624 and AE102 Clamp size	-20 3C	-26 4C	-30 4C	-38 5C
Protective coil (external) 900005	-10	-10	-10	-10

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

TABLE 4

Internal support coil details

Hose size	-16	-20	-24
900800A Ferrule size	14C	15C	17C
900780 Coil size	-14C	-15C	-18C
900591B Clamp size	3C	4C	4C
Coil Formula	3.4(J-1.2)	2.7(J-1.4)	2.0(J-2.0)

Note...

J = length of hose.

Chapter 2-6

HOSE, PART NO. 611

CAUTION...

This hose must never be used with petroleum products or solvents.

Operating range	Up to 206.84 bar (3000 lb f/in^2)
Temperature range	-53.8 to +93.3°C (-65 to +200°F)
Construction:-	
Inner tube	Seamless synthetic Butyl rubber
Reinforcement	High tensile carbon steel double wire braid
Outer cover	Smooth synthetic rubber over cotton braid
Identification	Smooth green cover with white linear markings consisting of: manufacturer's code, Aeroquip 611, size, date of manufacture. Spaced 180° from this is 'SKYDROL USE - 3000 p.s.i.' Markings are repeated every 229 mm (9 in)
Application	Fire-resistant hydraulic fluid systems

TABLE 1

Hose size and general data

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	lb f/in^2	mm	(in)
611	-4	15.88	(0.625)	206.84	(3000)	76.20	(3.00)
611	-6	19.46	(0.766)	206.84	(3000)	127.00	(5.00)
611	-8	21.82	(0.859)	206.84	(3000)	146.05	(5.75)
611	-10	26.19	(1.031)	206.84	(3000)	165.10	(6.50)
611	-12	30.96	(1.219)	206.84	(3000)	196.85	(7.75)

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Flared, swivel nut, straight (MS28760)						
883	-4	20.83	(0.82)	508-4D	543-4	7/16-20
883	-6	24.64	(0.97)	508-6D	543-6	9/16-18
883	-8	27.94	(1.10)	520-8D	543-8	3/4 -16
883	-10	33.27	(1.31)	520-10D	543-10	7/8 -14
883	-12	35.31	(1.39)	520-12D	543-12	1.1/16-12
Globeseal, flareless, straight (MS28761)						
882	-4	24.89	(0.98)	508-4D	552-4	7/16-20
882	-6	29.72	(1.17)	508-6D	552-6	9/16-18
882	-8	33.78	(1.33)	520-8D	552-8	3/4 -16
882	-10	40.39	(1.59)	520-10D	552-10	7/8 -14
882	-12	42.42	(1.67)	520-12D	552-12	1.1/16-12

TABLE 3

Protective sleeves

Hose size	-4	-6	-8	-10	-12
Firesleeves 624 and AE102	-12	-14	-16	-18	-20
Clamp 900591B	2C	2C	2C	3C	3C
Protective coil (external) 900005	-10	-10	-10	-10	-10

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

Chapter 2-7

HOSE, PART No. 602

CAUTION...

This hose must never be used with petroleum products or solvents

Operating range	41.37 to 206.84 bar (600 to 3000 lb f/in^2)
Temperature range	-54 to +121°C (-65 to +250°F)
Construction:-	
Inner tube	Seamless synthetic Butyl rubber
Reinforcement	Synthetic-impregnated single wire braid over single cotton braid
Outer cover	Synthetic impregnated oil-resistant cotton braid
Identification	Braided green cover with linear white indicator stripe interspersed with SKYDROL USE. Spaced 180° from this is manufacturer's code, Aeroquip 602- size, date of manufacture. Markings are repeated every 229 mm (9 in)
Application	Medium pressure, fire-resistant hydraulic systems

TABLE 1

Hose size and general data

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	lb f/in^2	mm	(in)
602	-4	13.12	(0.516)	206.84	(3000)	76.20	(3.00)
602	-5	14.68	(0.578)	206.84	(3000)	85.85	(3.38)
602	-6	17.07	(0.672)	137.89	(2000)	79.25	(3.12)
602	-8	19.46	(0.766)	137.89	(2000)	142.75	(5.62)
602	-10	23.42	(0.922)	120.66	(1750)	155.45	(6.12)
602	-12	27.38	(1.078)	103.42	(1500)	165.10	(6.50)
602	-16	31.34	(1.234)	55.16	(800)	187.45	(7.38)
602	-20	38.10	(1.500)	41.37	(600)	228.60	(9.00)

TABLE 2

End fitting

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)			
		mm	(in)	Socket	Nipple	Nut	Thread
Flared, swivel nut, straight (MS24587)							
491	-4	16.51	(0.65)	210-4D	251-4	290-4	7/16-20
491	-5	18.80	(0.74)	210-5D	251-5	290-5	1/2 -20
491	-6	19.56	(0.77)	210-6D	251-6	290-8D	9/16-18
491	-8D	23.88	(0.94)	215-8D	271-8D	290-10D	3/4 -16
491	-10D	25.40	(1.00)	215-10D	271-10D	290-12D	7/8 -14
491	-12D	25.40	(1.00)	215-12D	271-12D	290-12D	1.1/16-12
451	-16D	23.88	(0.94)	212-16D	251-16D	290-16D	1.5/16-12
451	-20D	25.40	(1.00)	212-20D	251-20D	290-20D	1.5/8 -12
Globeseal, flareless, straight				Socket	Nipple assembly		Thread
440	-4	23.88	(0.94)	210-4D	440-3-4		7/16-20
440	-5	26.67	(1.05)	210-5D	440-3-5		1/2 -20
440	-6	28.19	(1.11)	210-6D	440-3-6		9/16-18
440	-8D	33.78	(1.33)	215-8D	440-3-8D		3/4 -16
440	-10D	37.08	(1.46)	215-10D	440-3-10D		7/8 -14
440	-12D	37.34	(1.47)	215-12D	440-3-12D		1.1/16-12
440	-16D	40.64	(1.60)	212-16D	440-3-16D		1.5/16-12
440	-20D	43.69	(1.72)	212-20D	440-3-20D		1.5/8 -12

Notes ...

(1) MS24587 supersedes MS28740.

▶ (2) Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

TABLE 3

Protective sleeves

Hose size	-4	-5	-6	-8	-10	-12	-16	-20
Firesleeves 624 and AE102 Clamp 900951B	-8 1C	-10 2C	-12 2C	-14 2C	-16 3C	-18 3C	-	-
Protective coil (external) 900005	-4	-4	-4	-10	-10	-10	-10	-10

Chapter 2-8

HOSES, PART NOS. 666 AND 667/MIL-H-27267

Operating range	... 68.95 to 103.42 bar (1000 to 1500 lb/in^2)
Temperature range	... -54 to +232°C (-65 to +450°F)
Construction:-	
Inner tube	... Spiral extruded Teflon resin
Reinforcement:-	
666 ...	... One layer, Type 300 stainless steel wire braid
667 ...	... Two layers, Type 300 stainless steel wire braid
Identification	... A white band giving the following details: Aeroquip 666 (or 667) - size, manufacturer's code, MIL-H-27267, operating pressure and lot number.
Application	... Medium pressure (up to 103.42 bar) hydraulic and pneumatic systems. Hydrocarbon fuel systems up to 41.37 bar (600 lbf/in^2)

TABLE 1

Hose size and general data

Hose	-Size	O.D.		Operating pressure		Min bend radii	
		mm	(in)	bar	(lbf/in^2)	mm	(in)
666	-4	7.92	(0.312)	103.42	(1500)	50.8	(2.00)
666	-5	9.53	(0.375)	103.42	(1500)	50.8	(2.00)
666	-6	11.33	(0.446)	103.42	(1500)	101.6	(4.00)
666	-8	14.27	(0.562)	103.42	(1500)	117.35	(4.62)
666	-10	16.66	(0.656)	103.42	(1500)	139.70	(5.50)
666	-12	20.04	(0.789)	68.95	(1000)	165.10	(6.50)
667	-16	28.17	(1.109)	86.18	(1250)	187.45	(7.38)
667	-20	34.52	(1.359)	68.95	(1000)	279.40	(11.00)
667	-24	42.47	(1.672)	68.95	(1000)	355.60	(14.00)

Note...

(1) There are two basic types of end fitting: ALUM - aluminium; and CRES - corrosion resistant stainless steel. In the following tables the ALUM fittings are listed first and then the CRES.

(2) The nipple assemblies quoted in Table 2 have UNJF threads. Table 3 gives the Pt. No. of nipple assemblies with BNAé and ARSAERO metric threads.

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Sleeve
ALUM, Globeseal, flareless, straight						
F66840	-4	22.61	(0.89)	F506-4C	G65016-4	900767-4C
F66840	-5	23.62	(0.93)	F506-5C	G65016-5	900767-5C
F66840	-6	25.91	(1.02)	F506-6C	G65016-6	900767-6C
F66840	-8	29.46	(1.16)	F506-8C	G65016-8	900767-8C
F66840	-10	33.53	(1.32)	F506-10C	G65016-10	900767-10C
F66840	-12	35.56	(1.40)	F506-12C	G65016-12	900767-12C
F62024	-16	40.13	(1.58)	F756-16C	G67022-16	900867-16C
F62024	-20	43.69	(1.72)	F756-20C	G67022-20	900867-20C
F62024	-24	52.58	(2.07)	F756-24C	G67022-24	900867-24C
CRES, Globeseal, flareless, straight						
F66018	-4	22.61	(0.89)	F506-4C	G65018-4	900767-4C
F66018	-5	23.62	(0.93)	F506-5C	G65018-5	900767-5C
F66018	-6	25.91	(1.02)	F506-6C	G65018-6	900767-6C
F66018	-8	29.46	(1.16)	F506-8C	G65018-8	900707-8C
F66018	-10	33.53	(1.32)	F506-10C	G65018-10	900767-10C
F66018	-12	35.56	(1.40)	F506-12C	G65018-12	900767-12C
F68023	-16	40.13	(1.58)	F756-16C	G67023-16	900867-16C
F68023	-20	43.69	(1.72)	F756-20C	G67023-20	900867-20C
F68023	-24	52.53	(2.07)	F756-24C	G67023-24	900867-24C
ALUM, Globeseal, flareless, 45°						
F62124	-4	32.77	(1.29)	F506-4C	G65114-4	900767-4C
F62124	-5	33.53	(1.32)	F506-5C	G65114-5	900767-5C
F62124	-6	36.32	(1.43)	F506-6C	G65114-6	900767-6C
F62124	-8	49.53	(1.95)	F506-8C	G65114-8	900767-8C
F62148	-10	44.96	(1.77)	F506-10C	G65102-10	900767-10C
F62148	-12	56.64	(2.23)	F506-12C	G65102-12	900767-12C
F62151	-16	59.18	(2.33)	F756-16C	G65396-16	900867-16C
F62151	-20	66.29	(2.61)	F756-20C	G65396-20	900867-20C
F62151	-24	76.96	(3.03)	F756-24C	G65396-24	900867-24C
CRES, Globeseal, flareless, 45°						
F66113	-4	32.77	(1.29)	F506-4C	G65113-4	900767-4C
F66113	-5	33.53	(1.32)	F506-5C	G65113-5	900767-5C

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Sleeve
CRES, Globeseal, flareless, 45° (cont.)						
F66113	-6	36.32	(1.43)	F506-6C	G65113-6	900767-6C
F66113	-8	49.53	(1.95)	F506-8C	G65113-8	900767-8C
F66101	-10	44.96	(1.77)	F506-10C	G65101-10	900767-10C
F66101	-12	56.64	(2.23)	F506-12C	G65101-12	900767-12C
F66421	-16	59.18	(2.33)	F756-16C	G65421-16	900867-16C
F66421	-20	66.29	(2.61)	F756-20C	G65421-20	900867-20C
F66421	-24	76.96	(3.03)	F756-24C	G65421-24	900867-24C
ALUM, Globeseal, flareless, 90°						
F66631	-4	23.11	(0.91)	F506-4C	G65117-4	900767-4C
F66631	-5	24.64	(0.97)	F506-5C	G65117-5	900767-5C
F66631	-6	26.16	(1.03)	F506-6C	G65117-6	900767-6C
F66631	-8	33.27	(1.31)	F506-8C	G65117-8	900767-8C
F66639	-10	35.81	(1.41)	F506-10C	G65116-10	900767-10C
F66639	-12	48.77	(1.92)	F506-12C	G65116-12	900767-12C
F66746	-16	52.07	(2.05)	F756-16C	G65397-16	900867-16C
F66746	-20	59.44	(2.34)	F756-20C	G65397-20	900867-20C
F66746	-24	68.07	(2.68)	F756-24C	G65397-24	900867-24C
CRES, Globeseal, flareless 90°						
F66104	-4	23.11	(0.91)	F506-4C	G65104-4	900767-4C
F66104	-5	24.64	(0.97)	F506-5C	G65104-5	900767-5C
F66104	-6	26.16	(1.03)	F506-6C	G65104-6	900767-6C
F66104	-8	33.27	(1.31)	F506-8C	G65104-8	900767-8C
F66103	-10	35.81	(1.41)	F506-10C	G65103-10	900767-10C
F66103	-12	48.77	(1.92)	F506-12C	G65103-12	900767-12C
F66422	-16	52.07	(2.05)	F756-16C	G65422-16	900867-16C
F66422	-20	59.44	(2.34)	F756-20C	G65422-20	900867-20C
F66422	-24	68.07	(2.68)	F756-24C	G65422-24	900867-24C
ALUM, flared, swivel, straight				Socket	Nipple assembly	Flange
F66826	-4	18.80	(0.74)	F506-4C	G65008-4	900767-4C
F66826	-5	19.56	(0.77)	F506-5C	G65008-5	900767-5C
F66826	-6	20.57	(0.81)	F506-6C	G65008-6	900767-6C
F66826	-8	23.62	(0.93)	F506-8C	G65008-8	900767-8C
F66826	-10	26.67	(1.05)	F506-10C	G65008-10	900767-10C

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Flange
ALUM, flared, swivel, straight (cont.)						
F66826	-12	28.70	(1.13)	F506-12C	G65008-12	900767-12C
F66821	-16	33.02	(1.30)	F756-16C	G65058-16	900867-16C
F66821	-20	36.58	(1.44)	F756-20C	G65058-20	900867-20C
F66821	-24	42.16	(1.66)	F756-24C	G65058-24	900867-24C
CRES, flared, swivel, straight				Socket	Nipple assembly	Sleeve
F66000	-4	18.80	(0.74)	F506-4C	G65000-4	900767-4C
F66000	-5	19.56	(0.77)	F506-5C	G65000-5	900767-5C
F66000	-6	20.57	(0.81)	F506-6C	G65000-6	900767-6C
F66000	-8	23.62	(0.93)	F506-8C	G65000-8	900767-8C
F66000	-10	26.67	(1.05)	F506-10C	G65000-10	900767-10C
F66000	-12	28.70	(1.13)	F506-12C	G65000-12	900767-12C
F66057	-16	33.02	(1.30)	F756-16C	G65057-16	900867-16C
F66057	-20	36.58	(1.44)	F756-20C	G65057-20	900867-20C
F66057	-24	42.16	(1.66)	F756-24C	G65057-24	900867-24C
ALUM, flared, swivel, 45°						
F66555	-4	29.97	(1.18)	F506-4C	G6529-4	900767-4C
F66555	-5	30.99	(1.22)	F506-5C	G6529-5	900767-5C
F66555	-6	32.77	(1.29)	F506-6C	G6529-6	900767-6C
F66555	-8	45.47	(1.79)	F506-8C	G6529-8	900767-8C
F66532	-10	40.13	(1.58)	F506-10C	G6530-10	900767-10C
F66532	-12	52.07	(2.05)	F506-12C	G6530-12	900767-12C
F66533	-16	54.36	(2.14)	F756-16C	G6563-16	900867-16C
F66533	-20	61.47	(2.42)	F756-20C	G6563-20	900867-20C
F66533	-24	69.85	(2.75)	F756-24C	G6563-24	900867-24C
CRES, flared, swivel, 45°						
F6633	-4	29.97	(1.18)	F506-4C	G6533-4	900767-4C
F6633	-5	30.99	(1.22)	F506-5C	G6533-5	900767-5C
F6633	-6	32.77	(1.29)	F506-6C	G6533-6	900767-6C
F6633	-8	45.47	(1.79)	F506-8C	G6533-8	900767-8C
F6634	-10	40.13	(1.58)	F506-10C	G6534-10	900767-10C
F6634	-12	52.07	(2.05)	F506-12C	G6534-12	900767-12C
F6679	-16	54-36	(2.14)	F756-16C	G6562-16	900867-16C
F6679	-20	61.47	(2.42)	F756-20C	G6562-20	900867-20C
F6679	-24	69.85	(2.75)	F756-24C	G6562-24	900867-24C

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Sleeve
ALUM, flared, swivel, 90°						
F6699	-4	23.11	(0.91)	F506-4C	G6531-4	900767-4C
F6699	-5	24.67	(0.97)	F506-5C	G6531-5	900767-5C
F6699	-6	26.16	(1.03)	F506-6C	G6531-6	900767-6C
F6699	-8	33.27	(1.31)	F506-8C	G6531-8	900767-8C
F6653	-10	35.81	(1.41)	F506-10C	G6532-10	900767-10C
F6653	-12	48.77	(1.92)	F506-12C	G6532-12	900767-12C
F66535	-16	52.07	(2.05)	F756-16C	G6561-16	900867-16C
F66535	-20	59.44	(2.34)	F756-20C	G6561-20	900867-20C
F66535	-24	68.07	(2.68)	F756-24C	G6561-24	900867-24C
CRES, flared, swivel 90°						
F6605	-4	23.11	(0.91)	F506-4C	G6505-4	900767-4C
F6605	-5	24.67	(0.97)	F506-5C	G6505-5	900767-5C
F6605	-6	26.16	(1.03)	F506-6C	G6505-6	900767-6C
F6605	-8	33.27	(1.31)	F506-8C	G6505-8	900767-8C
F6606	-10	35.81	(1.41)	F506-10C	G6506-10	900767-10C
F6606	-12	48.77	(1.92)	F506-12C	G6506-12	900767-12C
F6677	-16	52.07	(2.05)	F756-16C	G6560-16	900867-16C
F6677	-20	59.44	(2.34)	F756-20C	G6560-20	900867-20C
F6677	-24	68.07	(2.68)	F756-24C	G6560-24	900867-24C
ALUM, flanged, straight				Socket	Nipple assy.	Sleeve / Flange
F62010	-8	32.26	(1.27)	F506-8C	G61010-8	900767-8C / 9644-8D
F62010	-10	34.29	(1.35)	F506-10C	G61010-10	900767-10C / 9644-10D
F62010	-12	39.37	(1.55)	F506-12C	G61010-12	900767-12C / 9644-12D
F62009	-16	40.89	(1.61)	F756-16C	G61009-16	900867-16C / 9644-16D
F62009	-20	42.93	(1.69)	F756-20C	G61009-20	900867-20C / 9644-20D
F62009	-24	45.97	(1.81)	F756-24C*	G61009-24	900867-24C / 9644-24D
CRES, flanged, straight						
F62008	-8	32.26	(1.27)	F506-8C	G61008-8	900767-8C / 9644-8D
F62008	-10	34.29	(1.35)	F506-10C	G61008-10	900767-10C / 9644-10
F62008	-12	39.37	(1.55)	F506-12C	G61008-12	900767-12C / 9644-12D
F62007	-16	40.89	(1.61)	F756-16C	G61007-16	900867-16C / 8644-16D
F62007	-20	42.93	(1.69)	F756-20C	G61007-20	900867-20C / 9644-20D
F62007	-24	45.97	(1.81)	F756-24C*	G61007-24	900867-24C / 9644-24D

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)			
		mm	(in)	Socket	Nipple assy.	Sleeve	Flange
ALUM, flanged, 45°							
F66722	-8	31.75	(1.25)	F506-8C	G65119-8	900767-8C	9644-8D
F66722	-10	36.07	(1.42)	F506-10C	G65119-10	900767-10C	9644-10D
F66722	-12	48.26	(1.90)	F506-12C	G65119-12	900767-12C	9644-12D
F66713	-16	50.29	(1.98)	F756-16C	G65193-16	900867-16C	9644-16D
F66713	-20	56.39	(2.22)	F756-20C	G65193-20	900867-20C	9644-20D
F66713	-24	63.50	(2.50)	F756-24C*	G65193-24	900867-24C	9644-24D
CRES, flanged, 45°							
F66121	-8	31.75	(1.25)	F506-8C	G65121-8	900767-8C	9644-8D
F66121	-10	36.07	(1.42)	F506-10C	G65121-10	900767-10C	9644-10D
F66121	-12	48.26	(1.90)	F506-12C	G65121-12	900767-12C	9644-12D
F66244	-16	50.29	(1.98)	F756-16C	G65244-16	900867-16C	9644-16D
F66244	-20	56.39	(2.22)	F756-20C	G65244-20	900867-20C	9644-20D
F66244	-24	63.50	(2.50)	F756-24C*	G65244-24	900567-24C	9644-24D
ALUM, flanged, 90°							
F66723	-8	30.73	(1.20)	F506-8C	G65120-8	900767-8C	9644-8D
F66723	-10	35.81	(1.41)	F506-10C	G65120-10	900767-10C	9644-10D
F66723	-12	48.77	(1.92)	F506-12C	G65120-12	900767-12C	9644-12D
F66512	-16	52.07	(2.05)	F756-16C	G65194-16	900867-16C	9644-16D
F66512	-20	59.44	(2.34)	F756-20C	G65194-20	900867-20C	9644-20D
F66512	-24	68.07	(2.68)	F756-24C	*G65194-24	900867-24C	9644-24D
CRES, flanged, 90°							
F66122	-8	30.73	(1.21)	F506-8C	G65122-8	900767-8C	9644-8D
F66122	-10	35.81	(1.41)	F506-10C	G65122-10	900767-10C	9644-10D
F66122	-12	48.77	(1.92)	F506-12C	G65122-12	900767-12C	9644-12D
F66245	-16	52.07	(2.05)	F756-16C	G65245-16	900867-16C	9644-16D
F66245	-20	59.44	(2.34)	F756-20C	G65245-20	900867-20C	9644-20D
F66245	-24	68.07	(2.68)	F756-24C*	G65245-24	900867-24C	9644-24D

* Nipple with removeable flange

TABLE 3

Metric thread nipple assemblies

Hose -Size	Nipple assembly	Cut-off dim. mm	Cut-off dim. (in)	Nipple assembly	Cut-off dim. mm	Cut-off dim. (in)
BNAé straight				BNAé 45°		
666 -4	AE15712E	23.4	(0.92)	AE19187E	33.0	(1.30)
666 -5	AE15712F	22.9	(0.90)	AE19187F	33.5	(1.32)
666 -6	AE12912G	25.6	(1.01)	AE19189G	44.2	(1.74)
666 -8	AE12912H	26.9	(1.06)	AE19189H	49.5	(1.95)
666 -10	AE12912J	29.7	(1.17)	AE19189J	40.4	(1.59)
666 -12	AE12912K	32.8	(1.29)	AE19189K	55.6	(2.19)
667 -16	AE12912M	34.8	(1.37)	AE19189M	56.9	(2.24)
667 -20	AE12912N	38.6	(1.52)	AE19189N	65.8	(2.59)
BNAé 90°				ARSAERO, short, male		
666 -4	AE19193E	22.6	(0.89)	AE19317E	22.6	(0.89)
666 -5	AE19193F	23.4	(0.92)	AE19317F	23.4	(0.92)
666 -6	AE19199G	27.2	(1.07)	AE18156G	27.2	(1.07)
666 -8	AE19199H	28.4	(1.12)	AE18156H	28.4	(1.12)
666 -10	AE19199J	29.7	(1.17)	AE18156J	29.7	(1.17)
666 -12	AE19199K	34.5	(1.36)	AE18156K	34.5	(1.36)
667 -16	AE19199M	36.1	(1.42)	-		
667 -20	AE19199N	37.8	(1.49)	-		

TABLE 4

Protective sleeves

Hose -Size	666 667	-4	-5	-6	-8	-10	-12	-16	-20	-24
Firesleeve 624A		1	2	3	4	5	6	7	8	9
Clamp 900951B		1C	1C	2C	2C	2C	3C	3C	4C	5C
Firesleeves 624 and AE102										
Straight assembly		-8	-8	-11	-13	-14	-18	-24	-28	-38
45° assembly		-11	-12	-12	-13	-22	-26	-28	-32	-
90° assembly		-13	-13	-18	-18	-24	-28	-30	-38	-
Clamp 900951B		1C	1C	2C	2C	2C	3C	3C	4C	5C
Protective sleeve 646 or AE138		-4	-6	-6	-10	-12	-18	-26	-30	-34

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

TABLE 4 (cont.)

Hose -Size	666 667	-4	-5	-6	-8	-10	-12	-16	-20	-24
Protective coil (external) 90005 or AE208		-4	-4	-4	-10	-10	-10	-10	-10	-10
Protective sleeve 900179 or AE506		-8	-9	-10	-13	-14	-16	-19	-20	-21
Protective sleeve (shrinkable) 900223 or AE251		-13	-2	-1	-4	-4	-5	-7	-8	-9

Chapter 2-9

HOSE, PART NO. AE206/MIL-H-83298

Operating range	Up to 206.84 bar (3000 lbf/in^2)
Temperature range	-54 to +204°C (-65 to +400°F)
Construction:-	
Inner tube	Extruded Teflon resin
Reinforcement	Two layers, corrosion-resistant steel wire braid
Identification	Band giving the following details:- Aeroquip AE206 -size, MIL-H-83298, manufacturer's code, operating pressure, assembly date.
Application	High pressure hydraulic and ballistic systems. Fuel and pneumatic installations.

TABLE 1

Hose size and general data

Hose -Size	O.D.		Operating pressure		Min bend radii	
	mm	(in)	bar	(lbf/in^2)	mm	(in)
AE206-4	11.56	(0.455)	206.84	(3000)	76.20	(3.00)
AE206-6	13.97	(0.550)	206.84	(3000)	127.00	(5.00)
AE206-8	18.47	(0.727)	206.84	(3000)	146.05	(5.75)
AE206-10	22.23	(0.875)	206.84	(3000)	165.10	(6.50)

Note...

The nipple assemblies quoted in Table 2 have UNJF threads. Table 3 gives the Pt. No. of nipple assemblies with BNAé and ARSAERO metric threads.

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Sleeve
Flared, straight (MS27616)						
78020	-4	23.37	(0.92)	793-4C	77020-4	900085-4C
78020	-6	26.16	(1.03)	793-6C	77020-6	900085-6C
78020	-8	29.46	(1.16)	793-8C	77020-8	900085-8C
78020	-10	30.73	(1.21)	793-10C	77020-10	900085-10C

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Sleeve
Flared, 45° (MS27617)						
76135	-4	39.12	(1.54)	793-4C	75135-4	900085-4C
76135	-6	46.48	(1.83)	793-6C	75135-6	900085-6C
76135	-8	54.86	(2.16)	793-8C	75135-8	900085-8C
AE14576J	-10	45.21	(1.78)	793-10C	AE14577J	900085-10C
Flared, 90° (MS27618)						
75136	-4	27.43	(1.08)	793-4C	75136-4	900085-4C
75136	-6	30.73	(1.21)	793-6C	75136-6	900085-6C
75136	-8	36.58	(1.55)	793-8C	75136-8	900085-8C
AE14578J	-10	39.88	(1.57)	793-10C	AE14579J	900085-10C
Globeseal, flareless, straight (MS27629)						
78024	-4	27.43	(1.08)	793-4C	77024-4	900085-4C
78024	-6	31.26	(1.23)	793-6C	77024-6	900085-6C
78024	-8	35.31	(1.39)	793-8C	77024-8	900085-8C
78024	-10	37.59	(1.48)	793-10C	77024-10	900085-10C
Globeseal, flareless, 45° (MS27630)						
76144	-4	41.40	(1.63)	793-4C	75144-4	900085-4C
76144	-6	49.78	(1.96)	793-6C	75144-6	900085-6C
76144	-8	56.67	(2.31)	793-8C	75144-8	900085-8C
AE14580J	-10	49.78	(1.96)	793-10C	AE14581J	900085-10C
Globeseal, flareless, 90° (MS27631)						
76145	-4	27.43	(1.08)	793-4C	75145-4	900085-4C
76145	-6	30.73	(1.21)	793-6C	75145-6	900085-6C
76145	-8	36.58	(1.44)	793-8C	75145-8	900085-8C
AE14582J	-10	39.88	(1.57)	793-10C	AE14583J	900085-10C

TABLE 3

Metric nipple assemblies

Hose -Size	Nipple assembly	Cut-off dim. mm	Cut-off dim. (in)	Nipple assembly	Cut-off dim. mm	Cut-off dim. (in)
BNAé, straight				BNAé 90°		
AE206 -4	AE15606E	27.9	(1.10)	AE19244E	27.4	(1.08)
AE206 -6	AE15610G	27.9	(1.10)	AE19900G	36.6	(1.44)
AE206 -6	AE15612G	31.2	(1.23)	AE19246G	36.6	(1.44)
AE206 -8	AE15612H	32.8	(1.29)	AE19246H	36.3	(1.43)
AE206 -10	AE15612J	33.8	(1.33)	AE19246J	39.9	(1.57)
BNAé 45°				ARSAERO, long		
AE206 -4	AE19240E	41.9	(1.65)	AE15598E	36.1	(1.42)
AE206 -6	AE19898G	48.3	(1.90)	AE19902G	37.3	(1.47)
AE206 -6	AE19242G	52.3	(2.06)	AE18742G	41.4	(1.63)
AE206 -8	AE19242H	58.4	(2.30)	AE18742H	43.2	(1.70)
AE206 -10	AE19242J	47.8	(1.88)	-		

TABLE 4

Protective sleeves

Hose size	-4	-6	-8	-10
Firesleeve AE102	-11	-13	-16	-20
Clamp 900951B	1C	2C	2C	2C
Protective sleeve AE138	-8	-10	-14	-22
Protective coil (external) AE208	-4	-4	-10	-10
Protective sleeve AE506	-11	-13	-15	-17
Protective sleeve (shrinkable) AE251	-2	-3	-4	-5

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

Chapter 2-10

HOSE, PART NOS AE246, AE546 and AE566

Operating range, AE246 and AE546	Up to *275.79 bar (4000 lbf/in²)
▶ Operating range, AE566	Up to 103.42 bar (1500 lbf/in²) ◀
Temperature range	-59 to +204°C (-67 to +400°F)
Construction:	
Inner tube	Extruded Teflon
Reinforcement	Densely packed small diameter wire braid
Protection AE246	See Table 5
AE546	Polyester braid wound over the
▶ AE566	wire braid (chafe guard) ◀
Identification	Bands showing specification, manufacturer's code number, operating pressure and date of assembly
Application AE244	High pressure, high temperature
AE546	hydraulic systems
AE566	Medium pressure, high temperature applications

Notes ...

*(1) The manufacturers maximum operating pressure is 206.84 bar (3000 lbf/in²), but the hose is cleared by the Services for ground testing of components to a working pressure of 414 bar (6000 lbf/in²).

(2) AE546 hose is AE246 hose with chafe guard fitted at time of manufacture.

(3) The minimum bend radii and operating pressures for AE546 are the same as for AE246 hose.

(4) AE246 hose is original equipment on Tornado aircraft. Part numbers are listed in the Aircraft Manual.

▶ (5) AE546 hose is used on Harrier GR5 aircraft. Table 6 lists the Aeroquip Pt No of the fittings used and of the sleeves.

(6) AE566 hose is used only for medium pressure hoses on Harrier GR5 aircraft in size -8. Sleeve Pt No 900767/8C is used for this hose in conjunction with the fittings in Table 6. ◀

TABLE 1 AE246 HOSE SIZE AND GENERAL DATA

Hose - Size	Outside diameter		*Operating pressure		Min bend radii	
	mm	(in.)	bar	lbf/in²	mm	(in.)
AE246-4	10.41	0.41	275.79	4000	38.10	1.50
AE246-6	12.95	0.51	275.79	4000	63.50	2.50
AE246-8	16.26	0.64	275.79	4000	73.15	2.88
AE246-10	18.80	0.74	275.79	4000	82.55	3.25
AE246-12	23.37	0.92	275.79	4000	196.85	7.75

TABLE 2 AE546 AND AE566 HOSE DIAMETER

Hose size	Diameter mm	(in.)	Hose size	Diameter mm	(in.)
AE546-4	12.44	0.49	AE566-4	11.37	0.448
AE546-6	14.35	0.565	AE566-6	14.2	0.559
AE546-8	17.27	0.68	AE566-8	16.89	0.665
AE546-10	20.06	0.79	AE566-10	19.61	0.772

TABLE 3 END FITTINGS, IMPERIAL AND AMERICAN THREADS

Pt No.	Cut-off dim		Components Part No		
	mm	(in)	Socket	Nipple assembly	Sleeve
Flared straight					
AE18806E - 4	23.37	0.92	AE18915E	AE18807E	AE18916E
AE18806G - 6	26.42	1.04	AE18915G	AE18807G	AE18916G
AE18806H - 8	29.46	1.16	AE18915H	AE18807H	AE18916H
AE18806J -10	30.73	1.21	AE18915J	AE18807J	AE18916J
-12					
Flared, 45°					
AE18879E - 4	52.32	2.06	AE18915E	AE18879E	AE18916E
AE18879G - 6	59.69	2.35	AE18915G	AE18879G	AE18916G
AE18879H - 8	66.29	2.61	AE18915H	AE18879H	AE18916H
AE18879J -10	69.60	2.74	AE18915J	AE18879J	AE18916J
-12					
Flared, 90°					
AE18880E - 4	42.93	1.69	AE18915E	AE18881E	AE18916E
AE18880G - 6	48.77	1.92	AE18915G	AE18881G	AE18916G
AE18880H - 8	53.34	2.10	AE18915H	AE18881H	AE18916H
AE18880J -10	52.32	2.06	AE18915J	AE18881J	AE18916J
-12					
Globeseal, flareless, straight					
AE18926E - 4	29.21	1.15	AE18915E	AE18927E	AE18916E
AE18926G - 6	32.00	1.26	AE18915G	AE18927G	AE18916G
AE18926H - 8	37.08	1.46	AE18915H	AE18927H	AE18916H
AE18926J -10	38.10	1.50	AE18915J	AE18927J	AE18916J
-12					

TABLE 3 END FITTINGS, IMPERIAL AND AMERICAN THREADS
(continued)

Pt No	Cut-off dim		Components Part No		
	mm	in	Socket	Nipple assembly	Sleeve
Globeseal, flareless 45°					
AE18882E - 4	55.63	2.19	AE18915E	AE18883E	AE18916E
AE18882G - 6	63.50	2.50	AE18915G	AE18883G	AE18916G
AE18882H - 8	71.37	2.81	AE18915H	AE18883H	AE18916H
AE18882J -10	74.68	2.94	AE18915J	AE18883J	AE18916J
-12					
Globeseal, flareless 90°					
AE18884E - 4	42.93	1.69	AE18915E	AE18885E	AE18916E
AE18884G - 6	48.77	1.92	AE18915G	AE18885G	AE18916G
AE18884H - 8	53.34	2.10	AE18915H	AE18885H	AE18916H
AE18884J -10	52.32	2.06	AE18915J	AE18885J	AE18916J
-12					

▶ TABLE 4 AE546 HOSE PART NUMBERS

Fittings MIL-F 27272	with Super C fittings MIL-H 38360 and AS1339	with Super-Gem fittings MIL-H 38360
Flared 37° Cres		
St to St	AE2463509	AE2463542
St to 45°	AE2463510	AE2463543
St to 90°	AE2463511	AE2463544
45° to 45°	AE4695	AE4715
45° to 90°	AE4696	AE4716
90° to 90°	AE4697	AE4717
Flareless Cres (NAS 1760)		
St to St	AE2463512	AE2463545
St to 45°	AE2463513	AE2463546
St to 90°	AE2643514	AE2463547
45° to 45°	AE4698	AE4718
45° to 90°	AE4699	AE4719
90° to 90°	AE4700	AE4720 ◀

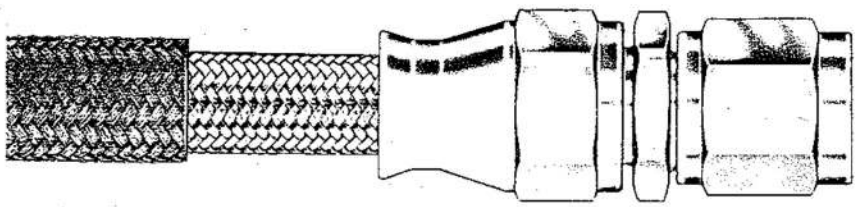


Fig 1 AE546 Hose with Super Gem fitting

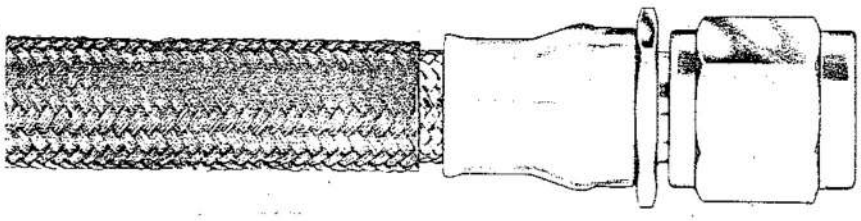


Fig 2 AE546 Hose with Super C fitting

TABLE 5 PROTECTIVE SLEEVES FOR AE246 HOSE

Hose size	-4	-6	-8	-10	-12
Firesleeve AE102 Clamp 900951B	-8 1C	-11 2C	-13 2C	-14 2C	
Protective sleeve AE138	-4	-8	-12	-16	
Protective coil (external) AE208	-4	-4	-10	-10	
Protective sleeve AE506	-9	-10	-13	-14	
Protective sleeve (shrinkable) AE251	-2	-1	-3	-4	

▶ Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance. ◀

TABLE 6 END FITTINGS, LIPSEAL (DYNATUBE)

Dash size	Aeroquip Pt No. Fitting	Sleeve	Description	Cut-off dim. mm (in.)
-4	AE20571E	AE18916E	To be issued later	
-4	AE27544E	AE18916E		
-4	AE27545E	AE18916E		
-4	AE27549E	AE18916E		
-6	AE20571G	AE18916G		
-6	AE20574G	AE18916G		
-6	AE27543G	AE18916G		
-8	AE19663H	AE18916H		
-8	AE20571H	AE18916H		
-8	AE20574H	AE18916H		
-8	AE26540H	AE18916H		
-8		900767/8C	(For use with AE566 hose)	

Note ...
A typical AE546 hose with 'Super Gem' lipseal fittings is illustrated in Fig.3.

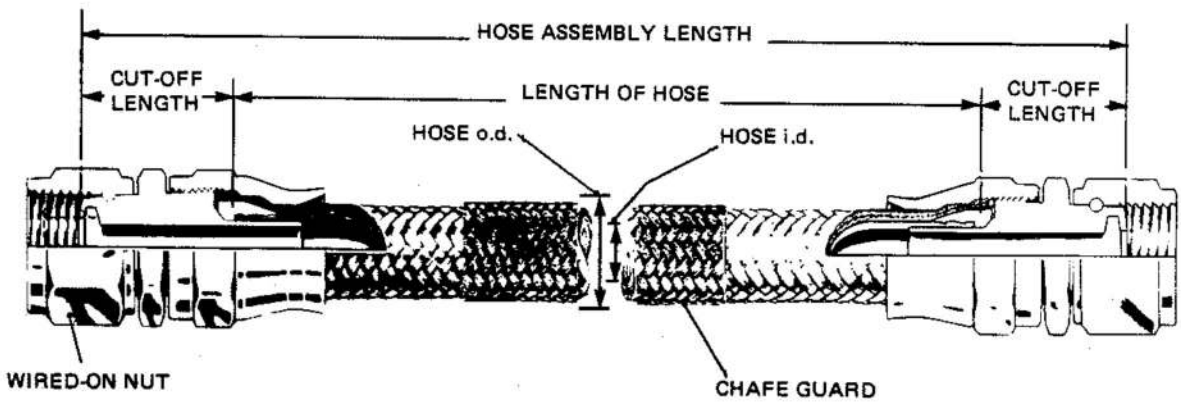


Fig 3 Typical AE546 hose with lipseal fittings

Chapter 2-11

HOSES, PART NOS. 601 AND AE701

Operating range	Up to 68.95 bar (1000 lbf/in^2)
Temperature range	-40 to +149°C (-40 to +300°F)
Construction:-	
Inner tube	Seamless synthetic rubber compound
Reinforcement	Stainless steel wire partial inner braid and full coverage outer braid.
Identification	A tape at regular intervals showing Aeroquip 601 (AE701) -size, manufacture's code and date of manufacture.
Application	Medium pressure a/c power plant and air frame fuel and oil lines.

TABLE 1

Hose size and general data

Hose -Size*	O.D.		Operating pressure		Min bend radii	
	mm	(in)	bar	(lbf/in^2)	mm	(in)
601 -3	9.52	(0.375)	68.95	(1000)	44.45	(1.75)
601 -4	11.12	(0.438)	68.95	(1000)	50.80	(2.00)
601 -5	12.30	(0.484)	68.95	(1000)	57.15	(2.25)
601 -6	13.90	(0.547)	68.95	(1000)	63.50	(2.50)
601 -8	16.28	(0.641)	68.95	(1000)	88.90	(3.50)
601 -10	20.24	(0.797)	68.95	(1000)	101.60	(4.00)
601 -12	23.82	(0.938)	68.95	(1000)	114.30	(4.50)
601 -16	29.36	(1.156)	51.72	(750)	139.70	(5.50)
601 -20	36.50	(1.437)	34.48	(500)	203.20	(8.00)
601 -24	43.28	(1.704)	17.24	(250)	228.60	(9.00)
601 -32	53.19	(2.094)	13.79	(200)	317.50	(12.50)

* The only difference between 601 and AE701 is the O.D. which for AE701 is as follows:-

Size	mm	inches	Size	mm	inches	Size	mm	inches
-3	9.98	(0.393)	-4	11.71	(0.461)	-5	12.88	(0.507),
-6	14.48	(0.570)	-8	17.07	(0.672)	-10	20.83	(0.820),
-12	24.41	(0.961)	-16	29.84	(1.175)	-20	37.29	(1.468),
-24	44.07	(1.735)	-32	54.38	(2.141)			

Note ...

▶ An alternative to Aeroquip fittings for No 601 hose is available in Stratoflex fittings Pt No 25636 (Chap 2-11 fig 3 and Chap 3-6 para 16). ◀

TABLE 2 END FITTINGS

Aeroquip				Stratoflex			
Pt No	Dash size	Cut-off dim mm	(in)	Pt No	Dash size	Cut-off dim mm	(in)
Flared, swivel nut, straight							
816	-3	16.25	(0.64)	676	-3S	18.80	(0.74)
816	-4	16.50	(0.65)	676	-4S	18.80	(0.74)
816	-5	17.78	(0.70)	676	-5S	19.30	(0.76)
816	-6D	19.30	(0.76)	676	-6D	21.34	(0.84)
816	-8D	23.88	(0.94)	676	-8D	24.64	(0.97)
816	-10D	25.15	(0.99)	676	-10D	26.67	(1.05)
816	-12D	25.40	(1.00)	676	-12D	28.19	(1.11)
816	-16D	29.46	(1.16)	676	-16D	34.04	(1.34)
816	-20D	34.04	(1.34)	676	-20D	39.12	(1.54)
816	-24D	36.57	(1.44)	676	-24D	43.18	(1.70)
816	-32D	41.15	(1.62)	676	-32D	51.82	(2.04)
Flared, swivel nut, 45°							
8846	-3	26.67	(1.05)	678	-3S	29.21	(1.15)
8846	-4	25.91	(1.02)	678	-4S	27.18	(1.07)
8846	-5	28.45	(1.12)	678	-5S	28.96	(1.14)
8846	-6D	30.99	(1.22)	678	-6D	30.99	(1.22)
8846	-8D	33.02	(1.30)	678	-8D	33.27	(1.31)
8846	-10D	36.58	(1.44)	678	-10D	36.58	(1.44)
8846	-12D	44.70	(1.76)	678	-12D	43.69	(1.72)
8846	-16D	46.48	(1.83)	678	-16D	51.56	(2.03)
8846	-20D	54.10	(2.13)	678	-20D	58.42	(2.30)
8846	-24D	57.91	(2.28)	678	-24D	64.26	(2.53)
8846	-32D	68.33	(2.69)	678	-32D	73.91	(2.91)
Flared, swivel nut, 90°							
8891	-3	22.60	(0.89)	680	-3S	20.07	(0.79)
8891	-4	22.60	(0.89)	680	-4S	23.88	(0.94)
8891	-5	24.38	(0.96)	680	-5S	24.89	(0.98)
8891	-6D	27.18	(1.07)	680	-6D	27.18	(1.07)
8891	-8D	28.96	(1.14)	680	-8D	29.21	(1.15)
8891	-10D	32.26	(1.27)	680	-10D	32.26	(1.27)
8891	-12D	41.40	(1.63)	680	-12D	40.39	(1.59)
8891	-16D	44.20	(1.74)	680	-16D	49.02	(1.93)
8891	-20D	52.32	(2.06)	680	-20D	56.64	(2.23)
8891	-24D	56.39	(2.22)	680	-24D	62.74	(2.47)
8891	-32D	67.31	(2.65)	680	-32D	72.64	(2.86)
Swivel flange, straight							
8844	-12D	31.75	(1.25)	681	-12D	31.75	(1.25)
8844	-16D	33.02	(1.30)	681	-16D	37.08	(1.46)
8844	-20D	38.10	(1.50)	681	-20D	42.42	(1.67)
8844	-24D	34.04	(1.34)	681	-24D	40.64	(1.60)
8844	-32D	38.61	(1.52)	-	-	-	-

(continued)

TABLE 2 END FITTINGS (continued)

Aeroquip				Stratoflex			
Pt No	Dash size	Cut-off dim mm	(in)	Pt No	Dash size	Cut-off dim mm	(in)
Swivel, flange, 45°							
8845	-12D	40.64	(1.60)	683	-12D	39.88	(1.57)
8845	-16D	42.67	(1.68)	683	-16D	47.50	(1.87)
8845	-20D	49.02	(1.93)	683	-20D	53.59	(2.11)
8845	-24D	51.56	(2.03)	683	-24D	58.17	(2.29)
8845	-32D	59.94	(2.36)	-	-	-	-
Swivel, flange, 90°							
8890	-12D	41.40	(1.63)	685	-12D	40.39	(1.59)
8890	-16D	44.20	(1.74)	685	-16D	49.02	(1.93)
8890	-20D	52.32	(2.06)	685	-20D	56.64	(2.23)
8890	-24D	56.39	(2.22)	685	-24D	62.74	(2.47)
8890	-32D	67.31	(2.65)	-	-	-	-
Globeseal, flareless, straight							
826	-4	20.32	(0.80)	25634	-4 -4S	24.38	(0.96)
826	-6D	24.38	(0.96)	25634	-6 -6D	27.69	(1.09)
826	-8D	29.72	(1.17)	25634	-8 -8D	31.50	(1.24)
826	-10D	32.00	(1.26)	25634	-10 -10D	34.04	(1.34)
826	-12D	32.26	(1.27)	25634	-12 -12D	38.10	(1.50)
826	-16D	36.58	(1.44)	25634	-16 -16D	45.72	(1.80)
826	-20D	41.15	(1.62)	25634	-20 -20D	51.56	(2.03)
826	-24D	46.99	(1.85)	-	-	-	-
Globeseal, flareless, 45°							
880112	-6D	34.54	(1.36)	25636	-6 -6D	36.07	(1.42)
880112	-8D	36.83	(1.45)	25636	-8 -8D	39.62	(1.56)
880112	-10D	41.40	(1.63)	25636	-10 -10D	43.43	(1.71)
880112	-12D	49.02	(1.93)	25636	-12 -12D	48.26	(1.90)
880112	-16D	51.56	(2.03)	25636	-16 -16D	59.44	(2.34)
880112	-20D	59.18	(2.33)	25636	-20 -20D	67.04	(2.64)
Globeseal, flareless, 90°							
880114	-6D	27.18	(1.07)	25638	-6 -6D	27.18	(1.07)
880114	-8D	28.96	(1.14)	25638	-8 -8D	29.21	(1.15)
880114	-10D	32.26	(1.27)	25638	-10 -10D	32.26	(1.27)
880114	-12D	41.40	(1.63)	25638	-12 -12D	40.39	(1.59)
880114	-16D	44.20	(1.74)	25638	-16 -16D	49.02	(1.93)
880114	-20D	52.32	(2.06)	25638	-20 -20D	56.64	(2.23)

TABLE 3 PROTECTIVE SLEEVES

Hose size	-3	-4	-5	-6	-8	-10	-12	-16	-20	-24	-32
Firesleeve AE102 (601)	-	-8	-9	-10	-12	-16	-18	-22	-26	-30	-38
(701)	-8	-8	-9	-12	-14	-16	-20	-24	-30	-38	-50
Clamp 900591B	1C	1C	-2C	-2C	-2C	-2C	-3C	-3C	-4C	-4C	-5C
Protective sleeve AE251 (RN only) shrinkable)	-2	-2	-3	-3	-4	-5	-5	-7	-9	-9	-11
Protective sleeve AE138	-6	-8	-10	-12	-16	-20	-24	-28	-34	-36	-
Protective coil (external) AE208	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10

Note ...

Sizes of firesleeve quoted are nominal; sleeves 2 sizes either side of this figure may be fitted without degradation of performance.

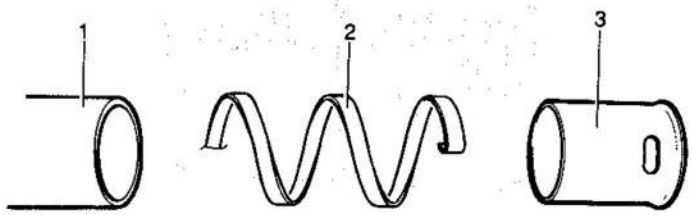
TABLE 4

Internal support coil details

Hose size	-12	-16	-20	-24	-32
900800A Ferrule size	21C	14C	15C	17C	18C
900780 Coil size	13C	14C	15C	15C	18C
900591B Clamp size	3C	3C	4C	4C	5C
Coil Formula	5.1(J-2.2)	3.3(J-2.4)	2.6(J-2.7)	2.7(J-2.9)	2.6(J-3.3)

Note ...

J = length of hose.



1 HOSE
2 STEEL INTERNAL SUPPORT COIL
3 FERRULE

Fig 1 Internal support coil and ferrule

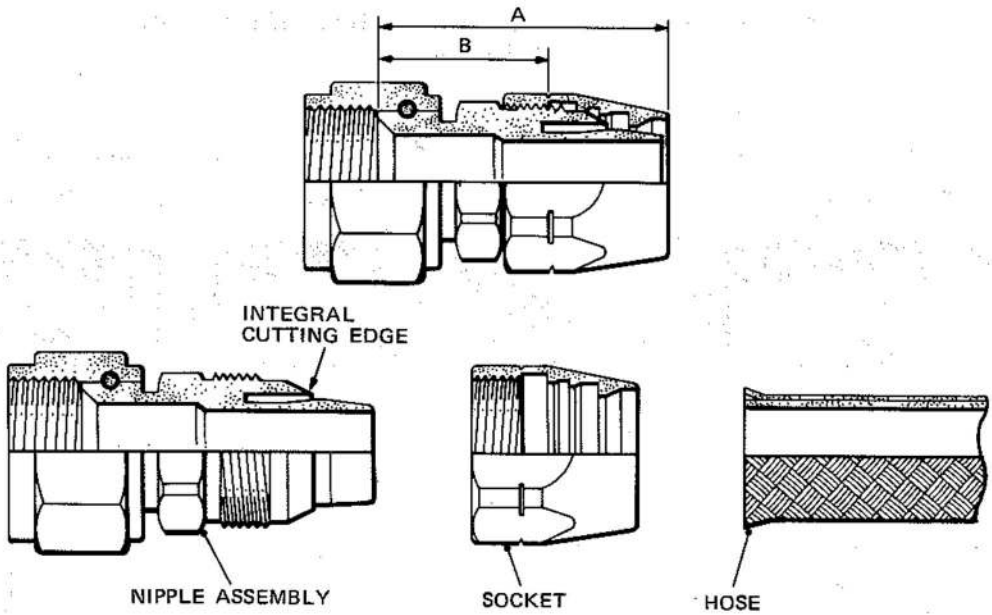


Fig 2 Typical end fitting (Aeroquip) Little Gem for 601 hose

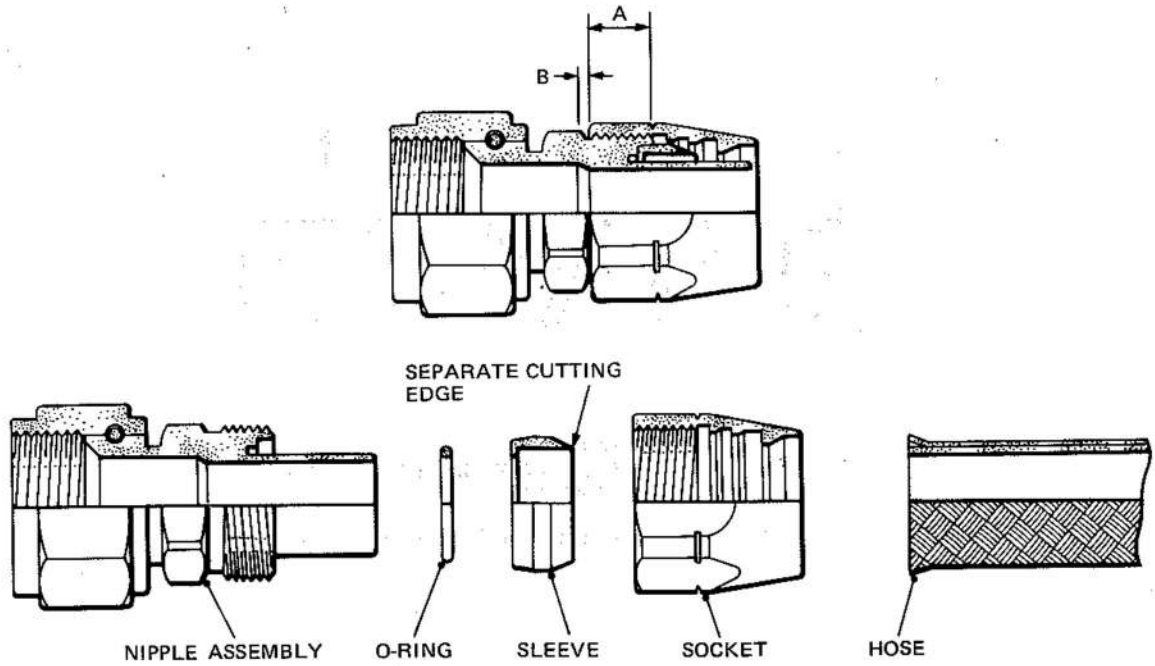


Fig 3 Typical end fitting (Stratoflex) for No 601 hose

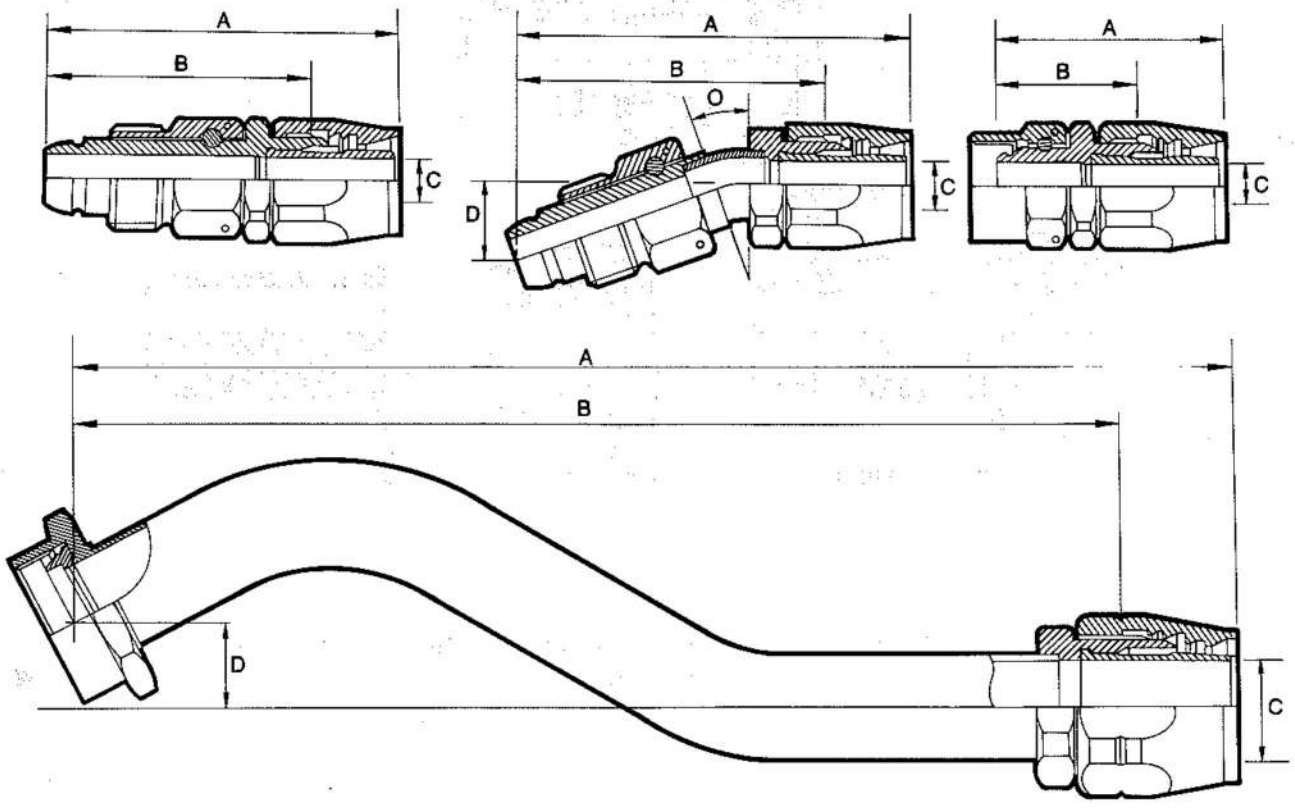


Fig 4 Typical end fittings for AE701 hose

TABLE 5 RE-USEABLE FITTINGS FOR AE701 HOSE

Type	Part No Fitting	Socket	Thread dia x pitch		Dimensions mm A	B	C	D
Straight male	29.E0466.39.20	576.20C	M39x2.0	-	85.72	55.11	26.42	-
20° male	34.E0467.39.20	576.20C	M39x2.0	M20x2.0	108.33	78.10	26.42	17.85
Straight female	29.E0468.25.12	576.12C	M25x2.0	-	55.12	31.75	14.99	-
Straight female	39.20	576.20C	M39x2.0	-	66.67	36.27	27.50	-
Special elbow	34.E0469.39.20	576.20C	M39x2.0	-	342.9	312.23	26.54	23.02

Chapter 3-0

LOCAL MANUFACTURE OF HOSE ASSEMBLIES

Introduction

1. The information contained in the following sub-chapters covers the local manufacture of hose assemblies and includes procedures for removal from installation, inspection, dismantling and testing. Permissible re-work to salvage defective components is described and instructions are contained to show correct installation techniques. Notes are included to promote safe storage and handling of both bulk hose and hose assemblies.

2. It should be noted that reference must be made to the relevant parts of Chapter 2 for selection of the proper end fittings and protective sleeving.

▶ 3 For information on the local manufacture of oxygen hoses refer to Chapter 3-11 of this publication. ◀

Chapter 3-1

TOOLS

Special Tools

1 Workshops or specialist bays are normally equipped with machinery to aid the manufacture of hose assemblies, as well as special tool kits and rubber removal kits. The machinery (Table 1) is hand operated and can be ▶ used for cutting and stripping the hose, assembling end fittings, the ◀ removal of the chafe guard and fixing the protective sleeving clamps. Special tool kits comprise a series of mandrels which can be used to prevent accidental damage to the sealing surfaces of nipple assemblies and and are listed in Table 2. Rubber removal tools (Table 3) are used during the cleaning process to remove rubber from the cutting spur of nipples, and can be used to restore the shape of distorted cutting spurs. Tables 1, 2 and 3 list the special tools provided for the RAF under AFDSEC scale 2142, and identify each by the Service stock number. The only special tools provisioned for the RN workshops are hose cutting machines (see BR320), although other tools and equipment are available as consumable items.

TABLE 1 DETAILS OF MACHINE AND HAND TOOLS

Tool	Part No	Ref No
Hose cut off machine	480/1	3A/4448
Hose cut off machine	-	3A/4665520
▶ Hose fitting assembly machine ◀	RPD/1045/10	TBN
Hand strip machine	RPD/362/1	3A/4665521
Hand clamp machine	F2636	3A/2061383
▶ Chafe guard stripping tool ◀	S1364	3A/7355000

TABLE 2 DETAIL OF ASSEMBLY TOOL KITS

For British fittings			For American fittings		
Part No	Size	Ref No	Part No	Size	Ref No
AT100	-3	3A/4450	583	-3	3A/1223585
AT100	-4	3A/4451	1582	-4	3A/1223591
AT100	-5	3A/4452	1582	-5	3A/1223592
AT100	-6	3A/4453	583	-6	3A/1223586
AT100	-8	3A/4454	1582	-8	3A/1223593
AT100	-10	3A/4455	1582	-10	3A/1223594
AT100	-12	3A/4456	583	-12	3A/1223595
AT100	-16	3A/4457	1563	-16	3A/1223587
AT100	-20	3A/4458	1563	-20	3A/1223588
AT100	-24	3A/4459	1563	-24	3A/1223589
AT100	-32	3A/4460	1563	-32	3A/1223590

TABLE 3

Detail of rubber removal tools

Part No.	-Size	Service stock No.
S1021	-3	3A/2061388
S1021	-4	3A/2061392
S1021	-5	3A/2061406
S1021	-6	3A/2061405
S1021	-8	3A/4526
S1021	-10	3A/2061402
S1021	-12	3A/2061384
S1021	-16	3A/2061397
S1021	-20	3A/2061395
S1021	-24	3A/2061394
S1021	-32	3A/2061393

2. Hose assemblies can be manufactured using only the common range of hand tools. The vice should be fitted with soft pads to avoid damage to the components. Hose can be cut successfully using a fine tooth hacksaw. Spanners used to tighten the end fitting components are to be of the correct size, and of the open ended pattern. Adjustable spanners, if used, may damage the fittings especially in the larger sizes.

3. Proof test adaptors (part No. 2032-6; size required, for flared fittings: and part No. F2373; - size required, for flareless fittings) can be used with complementary items to form a variety of proof test arrangements. The complementary items are AN806 plugs AN815 unions, and AN816 nipples of the -size required.

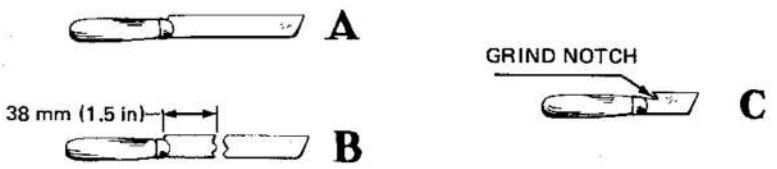


Fig.1 Rubber hose trimming tool

Locally manufactured hose trimming tool

4. Rubber hose can be cut and the layers peeled easily and accurately by use of a standard leather knife adapted to suit the purpose as shown in fig. 1. Obtain a leather knife (A), break off the blades as in (B). Grind the end smooth and grind a notch where the blade joins the handle (C). Sharpen the rear edge of the notch and keep the blade sharp for easy stripping.

Chapter 3-2

REMOVAL OF HOSE ASSEMBLIES FROM INSTALLATION

General

WARNING...

DO NOT STAND ON HOSE LINES, OR USE AS HANDLES.

CAUTION...

Do not bend, or attempt to straighten hose assemblies.

1. Hose assemblies are removed from installation for inspection at the specified maintenance or overhaul periods for the aircraft or engine, or whenever leakage, abrasion of the cover, kinks or other mutilation is evident. As soon as any hose assembly is disconnected, the open bores of the installation must be protected by the fitting of plugs or caps as appropriate.

2. Fitted hose, especially when in hot fluid lines, tend to take a set in the installed shape. Some hose assemblies are pre-formed during manufacture. Any disturbance of the set, or pre-formed shape will cause damage to the hose and for this reason great care must be taken to retain the set shape. Fig. 1 illustrates a method of tying to protect a set hose during routine inspection.

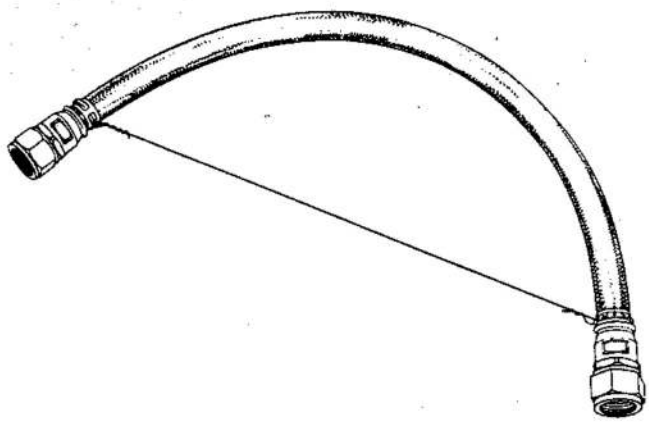


Fig.1 Method of tying hose to retain set shape

Disconnecting swivel nut fittings

CAUTION

Do not place a spanner on the hose assembly end fitting socket (fig. 2) when loosening connections.

3. When disconnecting a swivel nut fitting it is necessary to hold the nipple assembly with a spanner placed on the hexagon section (fig. 3). Loosen the nut by turning with a second spanner, then open the connection by unscrewing the nut by hand.

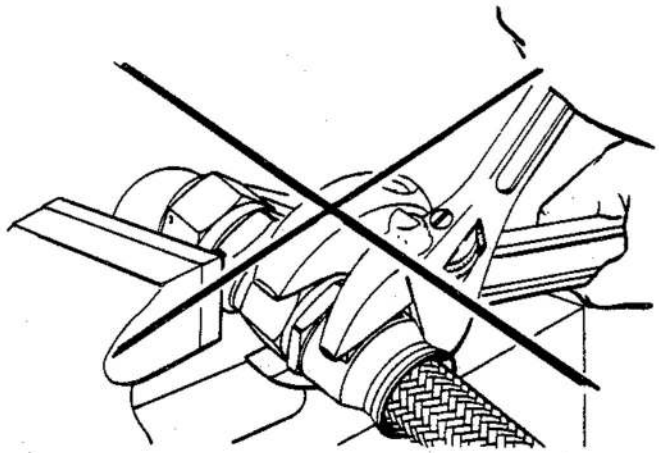


Fig.2 Incorrect method of loosening swivel nut connections

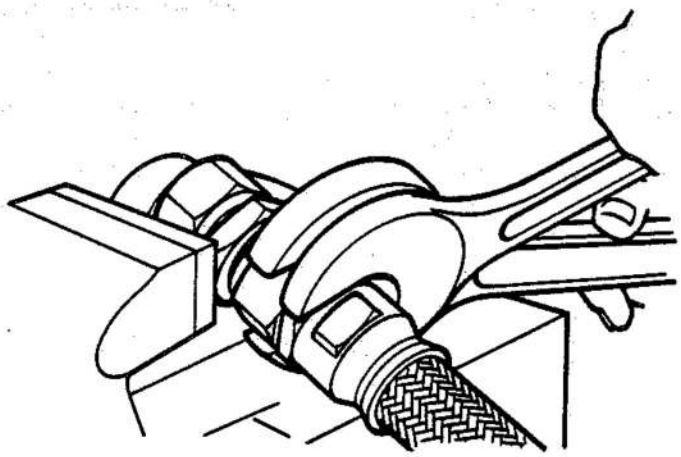


Fig.3 Correct method of loosening swivel nut connections

Disconnecting flange fittings

CAUTION...

Care must be taken when handling flange fittings so as not to damage the flange ring, gasket or sealing face of the pad or fitting.

4. When disconnecting flange fittings, first remove the nuts, or bolts, and washers, then pull the flange clear of the pad. Do not use wedges to prise off difficult fittings.

Chapter 3-3

INSPECTION PROCEDURES

CONTENTS

TABLES

ILLUSTRATIONS

INSPECTION OF HOSE ASSEMBLIES

General

1. Hose assemblies removed from installation because of expiration of service life are to be dismantled and the fittings salvaged for possible re-use. All other hose assemblies are to be inspected to determine if the assembly can be returned to service, repaired or if it must be replaced. The end fittings of any rejected hose assembly are to be salvaged for possible re-use.

2. Before any inspection, the hose assembly is to be thoroughly cleaned in accordance with instructions in sub-chapter 3-7. Firesleeving should be removed for cleaning the hose and should not be replaced until after the hose assembly has been proof tested prior to installation.

Inspection of firesleeved hose assemblies

3. Firesleeve should be removed before the hose assembly itself is cleaned for inspection. Fuel or oil soaked firesleeve must be scrapped. Severely abraded or otherwise mutilated firesleeve must be scrapped. Slight abrasion damage or frayed ends may be repaired and re-used. Instructions for the repair of firesleeve are contained in sub-chapter 3-5.

External inspection

4. Examine the hose externally for evidence of twisting, kinking, abrasion and broken wires. Any hose assembly showing evidence of twisting or kinking must be rejected. Hydraulic pressure lines which are found to have any broken wires are to be rejected. Crossed over reinforcement wires are not cause for rejecting a hose assembly.

5. Abrasion damage and broken wires are acceptable to a certain degree in fuel, oil and other low pressure systems, however, if excessive wire breakage, either general or localised as the result of abrasion damage, etc., is found the hose assembly must be scrapped.

6. The amount of permissible damage to a low pressure system hose can be assessed as follows:- If two or more broken wires per plait; or if more than six broken wires per 300 mm (12 inches) length are found; or if any broken wire is found in a position where kinking is suspected; the hose assembly should be scrapped.

Internal inspection

7. All hose assemblies should be examined internally for signs of restriction, tube collapse or other damage that might affect the satisfactory performance. Visual inspection is possible by applying the following techniques:-

(1) Straight hose assemblies. The hose bore can be examined by looking through the hose at a convenient light source.

(2) Elbow fitting at one end. Insert a flexible inspection light into the elbow fitting and examine the hose bore by looking through from the straight fitting end.

(3) Elbow fitting at each end. Insert a flexible inspection light into one end fitting and examine the hose bore from the opposite end with the aid of a dental type mirror.

8. In addition to the visual examination, the hose bore should be checked for restrictions by the passage of a steel ball. The ball should be of the size which will just pass through the end fitting and can be selected by reference to Table 4. Should a suitable ball not be available, hose assemblies which contain at least one straight fitting can be checked using a locally manufactured steel bobbin as illustrated in fig. 1.

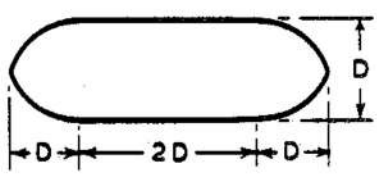


Fig.1 Bobbin for hose bore test

TABLE 1

Ball size chart for bore obstruction checks

Hose -size	Ball size		Hose -size	Ball size	
	mm	in		mm	in
-4	2.38	3/32	-12	12.70	1/2
-5	3.97	5/32	-16	19.05	3/4
-6	5.56	7/32	-20	25.40	1
-8	7.14	9/32	-24	30.16	1 3/16
-10	9.53	3/8	-32	31.75	1 1/4

Inspection of assembled end fittings

9. In general, assembled end fittings should be examined for damage to the threads and sealing surfaces, distortion of the socket or any other damage which would impair the sealing or hose retention characteristics of the fitting. Elbow fittings should also be examined for dents or abrasions in the bent tube region. If any signs of damage are apparent the hose assembly must be dismantled and the sound components salvaged for re-use. The following paragraphs detail special requirements for inspection of end fitting connections.

Swivel nut connections

10. (1) Check the nut for mutilated threads and evidence of overtightening, the latter may be indicated by a belled condition of the flared seal or by a seized, or tight, swivel nut. Damaged wired-on type swivel nuts may be replaced (see sub-chapter 3-5).

(2) Examine for backed out retaining wire on the swivel nut. Drive the wire back into the nut if necessary (see sub-chapter 3-5).

(3) Examine the sealing surfaces of the nipple for nicks, spiral or longitudinal scratches or scoring which could create an escape passage for fluids under pressure. Check for flare out or distortion of cone seats resulting from overtightening. All swivel fittings with damaged sealing surfaces must be scrapped.

Flanged connections

11. Check the flange surface for warping and the sealing surfaces for scoring or other damage. All flange fitting nipples with damaged sealing surfaces must be scrapped.

INSPECTION OF END FITTING COMPONENTS

General

12. All fitting components with an anodized or plated finish must be examined for corrosion damage and discarded if corrosion damage is evident.

CAUTION...

Under no circumstances should a fitting component be stripped and re-anodised.

13. The components of fittings removed from hose assemblies must be thoroughly cleaned and all traces of rubber removed before inspection. Instructions for cleaning and removal of rubber residue are contained in sub-chapter 3-7. Minor scratches are not cause for rejection, however, parts which exhibit wrench, vice jaw or similar marks should be replaced. A certain amount of re-work is permissible to salvage some damaged components. Permissible re-work is detailed in sub-chapter 3-5 and indicated in the following inspection procedures where applicable.

Sockets

14. Visually check for distortion or 'egging' of the socket barrel. Test for damaged threads by screwing a new nipple of the correct size into the socket threads. No re-work is permissible to salvage sockets. Damaged sockets must be scrapped.

Nipples and nipple assemblies

15. (1) With standard flared and flareless type nipples, examine the tapered surface for distortion, dents, scores or any other damage which might create an escape route for fluids under pressure. Examine the nipple to socket thread for general condition and test for damaged threads by screwing into a new socket of the correct size. No re-work is permissible to salvage these types of nipple. If any damage is evident the nipple must be discarded.

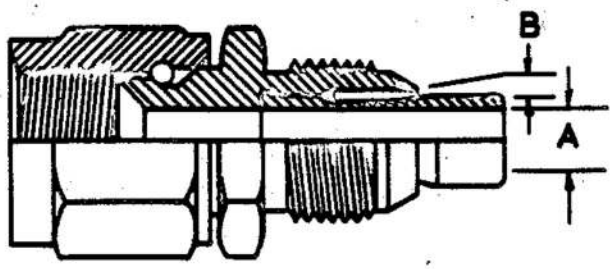


Fig.2 Cutting spur and nipple shank clearances

(2) Where the nipple has a fixed cutting spur ('Little Gem' fittings) examine as described in (1) and in addition examine the edge and general condition of the cutting spur. Any rubber remaining lodged under the spur should be removed by using a rubber removal tool (see sub-chapter 3-5). The cutting edge should be in good condition and the spur should be smooth and concentric within the limits given in Table 2. Provided that the nipple is otherwise in good condition, re-work of the cutting spur is permissible to obtain the limits of Table 2 and salvage the nipple.

(3) When the nipple cutting spur is replaced by a sleeve (i.e.'Super Gem'fittings). Visually inspect the sealing surface (fig. 3) for damage or galling and general condition of the dry film lubricant. Test the nipple to socket thread by screwing into a new socket of the correct size. Using a new sleeve of the correct size check for overtightening damage by checking for even all round clearance (fig. 4) between the sleeve and nipple faces.

TABLE 2

Cutting spur and nipple shank tolerances

Note...

Refer to Fig. 2

Nipple -Size	A max.		A min.		B min	
	mm	in	mm	in	mm	in
-3	6.1	.240	5.5	.217	0.8	.031
-4	7.7	.303	7.2	.283	0.7	.029
-5	9.1	.358	8.6	.337	0.7	.029
-6	10.5	.415	10.1	.398	0.6	.025
-8	13.6	.534	13.0	.511	0.9	.035
-10	17.0	.669	16.3	.642	1.0	.041
-12	20.1	.791	19.5	.767	0.9	.037
-16	25.0	.986	24.3	.957	1.1	.043
-20	32.0	1.261	31.2	1.229	1.2	.048
-24	37.7	1.486	37.1	1.460	0.9	.038
-32	49.9	1.961	48.9	1.927	1.2	.049

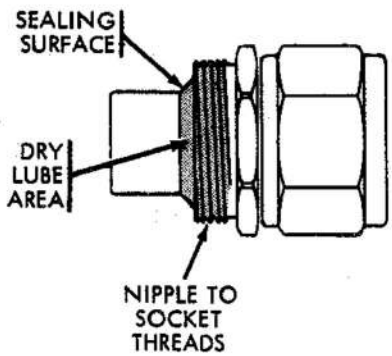


Fig.3 Hose sealing surface of 'Super Gem' fittings

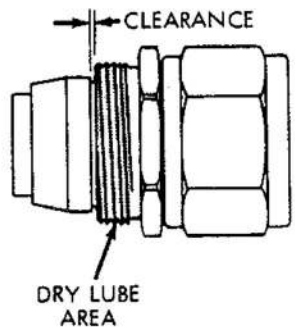


Fig.4 Nipple/sleeve clearance

Connection seal (forward sealing surface)

16. Examine the forward sealing surface for scores, scratches, nicks, distortion (either belling or flattening) or any other damage which might affect the sealing properties and create an escape route for fluids under pressure. Dry lubrication which is worn may be replaced by a coating of Rocol (see sub-chapter 3-5) otherwise any nipple which is damaged in the forward sealing area must be scrapped.

Elbow fitting nipples

17. Examine the angled part of the nipple for scores, denting or kinking, with forged type nipples examine the flats for distortion. Any nipple that shows signs of damage in the angled portion must be scrapped.

Nipple sleeve

18. The nipple sleeve is to be renewed each time end fittings are dismantled for hose replacement.

Swivel nuts and male connectors

19. Examine the nut for general condition, especially at the connection sealing end where it should not show any signs of distortion such as belling out or flattening of the rim. Swivel nuts damaged in this way must be discarded.

20. Test the threads of nuts and male connectors for distortion by screwing into a suitable fitting of the correct size. The threads should then be examined in accordance with the following qualifications:

(1) All threads must fall within the pitch diameter tolerances of Class 2, Military Specification MIL-S-8879.

(2) Provided that the leading thread is not defective, damage to the balance of threads must not exceed 25% of one thread.

(3) Provided that the balance of threads is not defective, damage to the leading thread must not exceed 50%.

Except as described, all damaged threaded components must be scrapped.

Wired on type swivel nuts

21. Inspect the location of the retaining wire of wired on swivel nuts, it should be located just below the surface of the hexagon face of the nut and may be driven home with a pin punch if necessary. Test the nut for freedom to rotate on the nipple. Provided that the nipple itself is in good condition a tight nut may be removed and replaced using new wire; and a defective nut may be removed and replaced by a new nut (see sub-chapter 3-5).

Chapter 3-4

DISMANTLING THE HOSE ASSEMBLY

General

1. A new hose assembly may be partly dismantled in order to shorten the overall length (see sub-chapter 3-5) and this is the only occasion on which the hose may be returned to service. The end fittings of defective hose assemblies should be dismantled and each component examined in accordance with the inspection procedures (sub-chapter 3-3) before being stored for subsequent re-use or scrapped. The following paragraphs outline the procedures that should be adopted, when dismantling a hose assembly, in order to avoid unnecessary damage to components.

Note...

If the hose assembly is to be replaced by local manufacture, and is fitted with two elbow fittings; the local manufacture may be aided by noting the angular relationship (see sub-chapter 3-5) of the two fittings before the assembly is dismantled.

Removing the protective sleeving

2. Spiral coil type protective sleeving can be removed by unwrapping. Other types of abrasion resistant sleeving may be torn from the hose assembly after a short cut has been made with a sharp knife. To remove firesleeve, first release the band clamps at each end of the assembly, then using a suitably improvised tool(fig. 1) lift out the staples along the entire length.

Fig.1 Removing firesleeve

Removing the nipple assembly (fig. 2)

3. Grip the socket, without overtightening, in a soft jawed vice and unscrew the nipple assembly by use of a suitable spanner.

Removing the socket

4. The method of removing the socket differs according to the type of fitting. The socket of standard flared and flareless fittings can be pulled directly off the hose once the nipple assembly is removed. This task is made easier if the pulling is associated with a clockwise twisting motion.

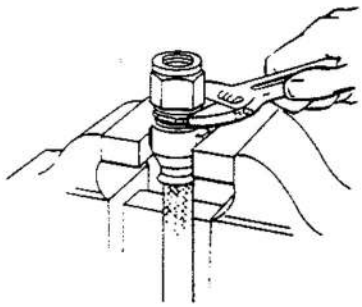


Fig.2 Removing the nipple assembly

5. The socket of a 'Super Gem' fitting cannot be removed until the nipple sleeve has been extracted from the hose end. After removing the nipple assembly the procedure is as follows:-

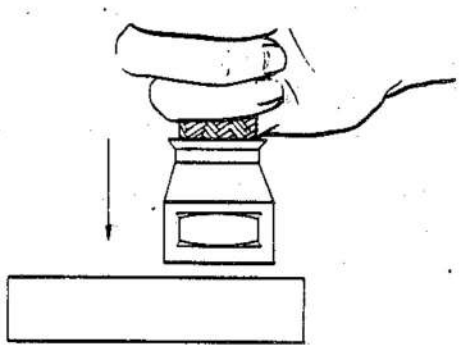


Fig.3 Loosening the 'SuperGem' socket

(1) Loosen the socket (see fig. 3). Hold the hose firmly and tap the socket sharply on a flat wooden surface. Ease the socket back along the hose to expose the hose end and nipple sleeve.

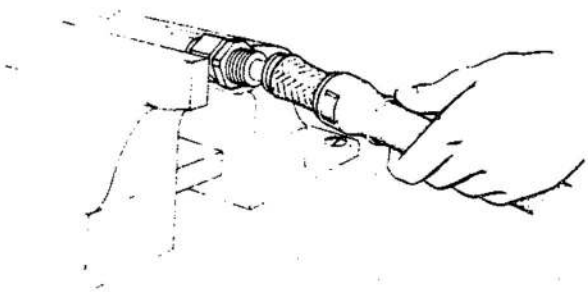


Fig.4 Removing the sleeve

(2) Remove the nipple sleeve (see fig. 4). Grip the previously removed nipple assembly in a vice and place the hose end and sleeve over the nipple taper. Using the nipple taper as a lever gently pry the sleeve from the hose.

(3) Slide the socket from the hose.

Chapter 3-5

PERMISSIBLE RE-WORK TO SALVAGE HOSE ASSEMBLY COMPONENTS

Hose assemblies

1. New hose assemblies may be shortened if necessary to suit a particular application. No re-work is permissible on hose assemblies which have been removed from installation. Except for the spiral type, all abrasion protective sleeving will be spoiled during removal. Spiral type sleeving, and fire-sleeve, may be shortened to suit the new length and replaced. It is emphasised that all work must be carried out in accordance with the relevant instructions and the following procedure is recommended:-

(1) Remove the protective sleeving, if fitted (sub-chapter 3-4).

(2) Dismantle and remove one end fitting (sub-chapter 3-4).

(3) Cut the hose to the new length required (sub-chapter 3-6).

(4) Re-assemble the end fitting dismantled at step (2) (sub-chapter 3-6).

(5) Examine the completed hose assembly (sub-chapter 3-3).

(6) Proof test the complete hose assembly (sub-chapter 3-8).

(7) Fit a properly marked up identification tag (para. 5).

(8) Refit the protective sleeving if required.

Hose

2. Except for cutting to the required length, no re-work is permissible. All defective hose must be scrapped.

Swivel nut fittings

3. Provided that the nipple sealing surfaces are in satisfactory condition, re-work is permissible to the following tasks:-

(1) To lubricate the threads and sealing surfaces where the original dry film lubrication is worn.

(2) To replace a defective swivel nut.

(3) To re-shape the cutting spur of the nipple.

Re-lubrication of the threads and sealing surfaces

4. If undue wear of the original dry film lubrication is observed, or bare metal is revealed, the entire thread and/or the sealing surface must be evenly lubricated with ROCOL MT/LM (ZX-38, NATO Code No. S-722). The lubricant should be applied, after cleaning and immediately prior to assembly, with a soft brush of suitable size and should not be thinned.

▶ WARNING...

FOR LUBRICATING FITTINGS FOR USE IN OXYGEN SYSTEMS, REFER TO CHAPTER 3-11 OF THIS PUBLICATION. ◀

Replacing a defective wired on type swivel nut

5. The basic part number for a swivel nut is 029001 and is completed by addition of the 'dash size' required (e.g. 029001-6). Retaining wire is part number 900303-1 for all sizes of fitting. Before attempting to replace a wired on type swivel nut, the nipple must be thoroughly cleaned and examined for unacceptable damage. Provided that the nipple condition is satisfactory, the following procedure may be used to exchange the swivel nut:-

(1) Place the nut in a vice, with the retaining wire hole at the top.

(2) Using a fine tooth hacksaw (fig. 1), cut the nut down to the retaining wire and all the way round. The front section of the nut should now fall off.

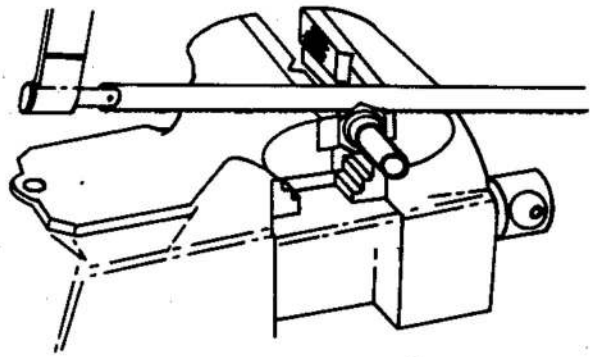


Fig.1 Removing the wired on nut

(3) Using a pair of pliers, grip the exposed retaining wire and pull out from the groove. Remove the remainder of the nut from the nipple.

(4) Clean off the nipple and check that the wire groove and sealing areas of the nipple are still suitable for re-use. If so, place a new nut in the vice with the wire hole at the top, place the nipple through the nut and push a suitable length of retaining wire into the hole (fig. 2).

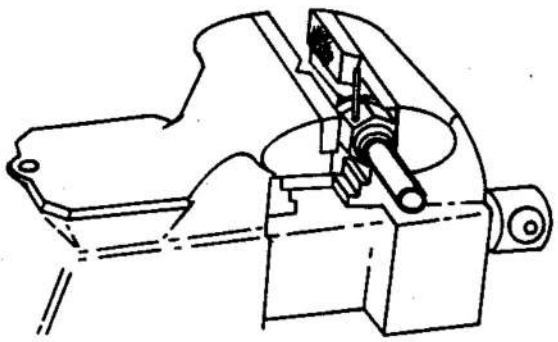


Fig.2 Locating the new retaining wire

(5) Drive the wire into the nut by tapping with a small hammer and finally by using a flat punch to set the wire end below the hexagon surface (fig 3).

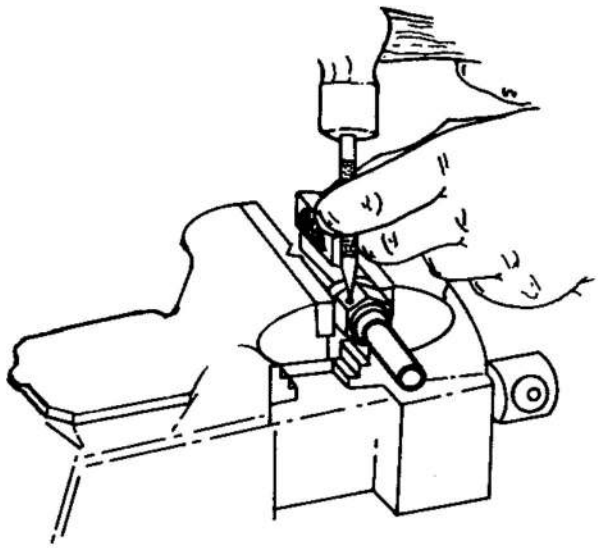


Fig 3 Setting the retaining wire

Note ...

(1) Backed out retaining wires may be driven back into place and set with a punch as indicated in step (5).

(2) If the nut does not turn easily after setting the retaining wire, it may be freed by tapping lightly with a hammer on the hexagon surfaces, or by tightening onto an AN 815 adaptor.

Re-shaping the nipple cutting spur

6 A nipple spur that is dented, or collapsed may be re-shaped provided that it will accept the knife edge of the rubber removing tool. It should be noted that if the nipple spur is rolled down, or torn during this operation, the nipple is to be scrapped. On completion of re-shaping the nipple must be re-examined to the specification of the inspection procedures.

Repairs to firesleeve

7 Two types of synthetic sealer (see Table 1) are available for the repair of minor damage to firesleeves. Slight abrasions and scuffing damage should be sealed by a brush application of the sealer. Frayed ends should first be trimmed and then sealed, either by a brush application, or by dipping to a depth of at least 12 mm ($\frac{1}{2}$ in).

▶ Note ...

(1) The details of protective sleeves are included in the Chapter for the particular type of hose.

(2) Fitting and repair procedure for AE 272 Flexwrap sleeving is included in Chap 3-6.

(3) Table 1 is transferred to Chap 3-6 Table 7. ◀

Chapter 3-6

MAKING UP THE HOSE ASSEMBLY BY LOCAL MANUFACTURE

CONTENTS

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Introduction

1. The instructions contained in the following paragraphs apply to the local manufacture of hose assemblies from new hose and new or salvaged end fitting components. When protective sleeving is specified for a hose assembly it is sometimes necessary to place the sleeve over the hose before assembling the second end fitting. This is often the case when a hose assembly contains two elbow fittings and should be considered at the appropriate stage.

CAUTION...

Do not salvage hose which has been removed from a previously installed hose assembly.

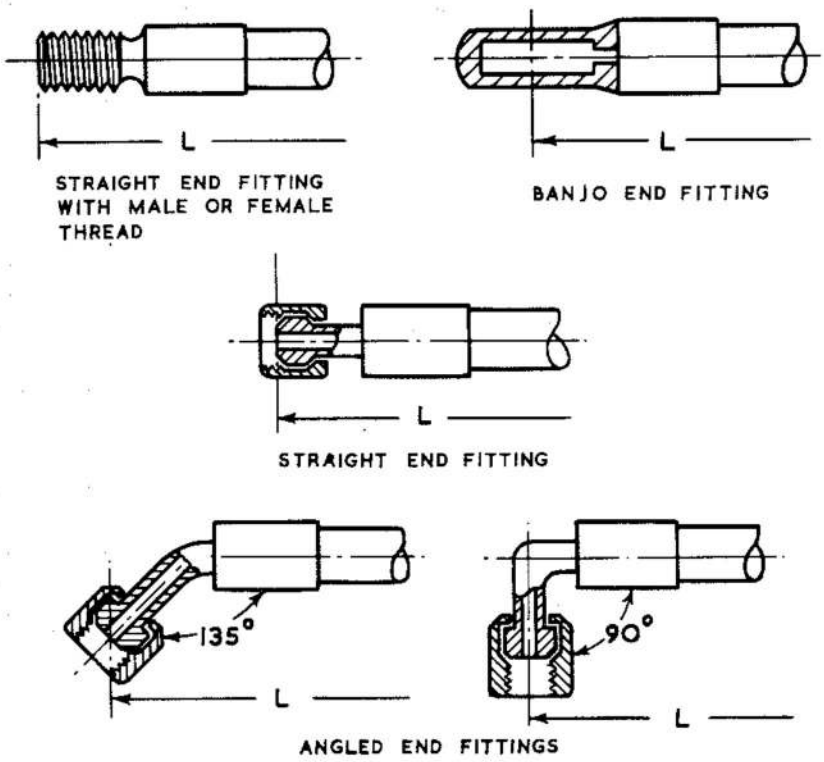


Fig.1 Measurement of hose assembly length

GENERAL INFORMATION

Measurements

2. The length of a hose assembly is measured between the two points at which the connection sealing surface intersect the centre line of the bore (fig. 1).

3. The length of hose in a hose assembly (fig. 2) is determined by subtracting the cut off factor for each end fitting from the length of the hose assembly. The cut off factor is an important consideration when manufacturing a hose assembly if the hose assembly length tolerances are to be met. Each size of each type of fitting has a unique cut off factor and these are listed in the Chapter describing the hose type. The tolerances for length are given in Table 1.

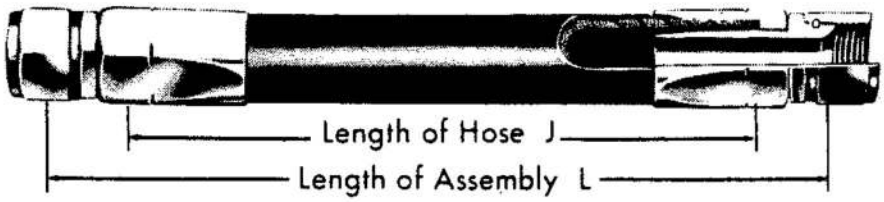


Fig.2 Length of hose in a hose assembly

Length tolerances

4. Table 1 lists the tolerances applicable to the various lengths of hose assemblies according to the type of hose used.

TABLE 1

Hose assembly length tolerances

Hose type (Part Number)	Length of assembly	Tolerance (plus or minus)
302A) 303) 306)	457 mm (18 in)	3.2 mm ($\frac{1}{8}$ in)
602) 611) 617)	457 to 914 mm (18 to 36 in) 914 mm (36 in) or longer	6.4 mm ($\frac{1}{4}$ in) 1%
309	Up to 610 mm (24 in) 610 to 914 mm (24 to 36 in) 914 to 1270 mm (36 to 50 in) 1270 mm (50 in) or longer	3.2 mm ($\frac{1}{8}$ in) 6.4 mm ($\frac{1}{4}$ in) 12.7 mm ($\frac{1}{2}$ in) 1%
601 AE701	Up to 203 mm (8 in) 203 to 406 mm (8 to 16 in) 406 to 610 mm (16 to 24 in) 610 to 914 mm (24 to 36 in) 914 mm (36 in) or longer	3.2 mm ($\frac{1}{8}$ in) 4.8 mm (3/16 in) 6.4 mm ($\frac{1}{4}$ in) 7.9 mm (5/16 in) 1%
666,667 676,AE116, AE206,AE246, AE546	Up to 457 mm (18 in) 457 to 914 mm (18 to 36 in) 914 to 1270 mm (36 to 50 in) 1270 mm (50 in) or longer	3.2 mm (1/8 in) 6.4 mm ($\frac{1}{4}$ in) 12.7 mm ($\frac{1}{2}$ in) 1%

Identification of the completed assembly

Identification band

5. Hose assemblies which have been made up locally are to be marked for identification purposes in accordance with AP 101A-0300-1A, Chap. 1 (formerly AP 1464D, Vol. 1, Part 2, Sect. 3, Chap. 2), using the approved methods of

application for international markings. The assemblies are also to be identified by the permanent fixing of a metal band Part No. 23036 impression stamped or etched with the following information:-

Hose part No. and Service reference No.

Unit serial number

Hose batch number

Date of manufacture

The correct band size for the hose is selected from Table 2 by reference to the hose circumference (i.e. dimension B in fig. 3).

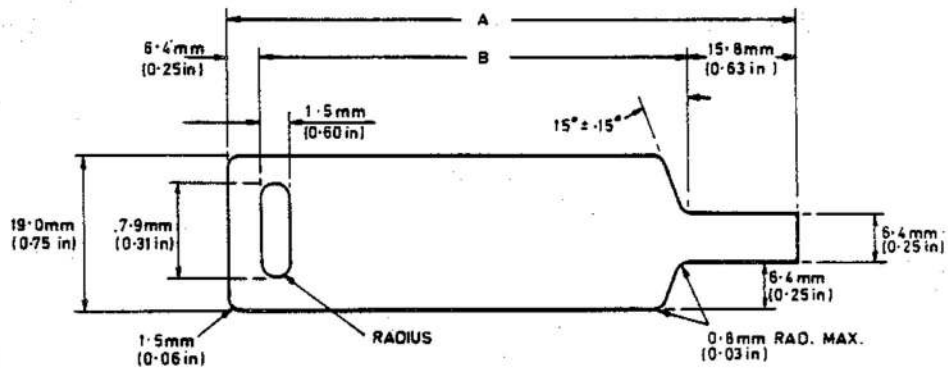


Fig.3 Identification band, Part No. 23036

Securing the identification band

6. The identification band is to be fitted securely so that it will not slide when the hose assembly is held vertical by the band. The proper fitting procedure is as follows:

(1) Remove burrs and sharp edges from the band.

(2) Bend the end to approximately 90° at the slot.

(3) Wrap the band around the hose, insert the tab through the slot, pull up snug and bend the tab perpendicular to the hose.

(4) Fold the tab end through 180° over the slotted end of the band (see fig. 4).

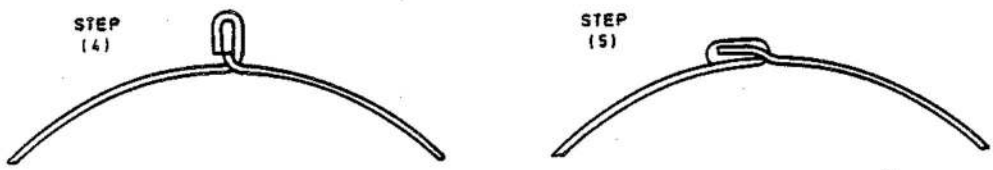


Fig.4 Securing the identification band

(5) Bend the folded tab down flat against the band so that the tab end is trapped (see fig. 4).

TABLE 2

Sizes of the identification band, part No. 23036

'Dash size' of band	Dimension A		Dimension B		'Dash size' of band	Dimension A		Dimension B	
	mm	in	mm	in		mm	in	mm	in
-1	37.31	1.469	18.26	0.719	-26	89.69	3.531	70.64	2.781
-2	42.06	1.656	23.01	0.906	-27	90.47	3.562	71.42	2.812
-3	42.87	1.688	23.82	0.938	-28	92.86	3.656	73.81	2.906
-4	46.02	1.812	26.97	1.062	-29	98.42	3.875	79.37	3.125
-5	47.62	1.875	28.57	1.125	-30	100.00	3.937	80.97	3.188
-6	49.19	1.937	30.17	1.188	-31	102.39	4.031	83.34	3.281
-7	51.59	2.031	32.54	1.281	-32	106.37	4.188	87.32	3.438
-8	52.37	2.062	33.32	1.312	-33	107.95	4.250	88.90	3.500
-9	53.19	2.094	34.14	1.344	-34	110.33	4.344	91.29	3.594
-10	53.97	2.125	34.92	1.375	-35	114.30	4.500	95.25	3.750
-11	55.57	2.188	36.52	1.438	-36	117.47	4.625	98.42	3.875
-12	57.94	2.281	38.89	1.531	-37	119.86	4.719	100.81	3.969
-13	58.72	2.312	39.67	1.562	-38	126.21	4.969	107.16	4.219
-14	59.54	2.344	40.49	1.594	-39	127.78	5.031	108.74	4.281
-15	61.11	2.406	42.06	1.656	-40	128.57	5.062	109.52	4.312
-16	62.71	2.469	43.66	1.719	-41	133.35	5.250	114.30	4.500
-17	63.50	2.500	44.45	1.750	-42	135.74	5.344	116.69	4.594
-18	67.46	2.656	48.41	1.906	-43	138.10	5.437	119.07	4.688
-19	68.27	2.688	49.22	1.938	-44	147.62	5.812	128.57	5.062
-20	69.06	2.719	50.00	1.969	-45	149.22	5.875	130.17	5.125
-21	70.64	2.781	51.59	2.031	-46	155.57	6.125	136.52	5.375
-22	73.02	2.875	53.97	2.125	-47	157.96	6.219	138.91	5.469
-23	77.77	3.062	58.72	2.312	-48	167.48	6.594	148.44	5.844
-24	79.37	3.125	60.32	2.375	-49	188.92	7.438	169.87	6.688
-25	88.11	3.469	69.06	2.719	-50	191.29	7.531	172.24	6.781

Measuring angular relationship (fig. 5 to 9)

7. Sometimes known as the position angle, the angular relationship of elbow fittings is measured in a counter-clockwise direction between the centre lines of the two end fittings while the nearest end fitting is held with its centre line vertical (fig. 5).

8. Required angles may be obtained either from the pipeline system drawings or by comparison with a known good (and identical) hose assembly or with an assembly mocked up on the installation. For preference, the hose assembly

being replaced should be set up on a flat surface and its angles measured with universal measuring vices and parallels before it is dismantled. The required angular relationship tolerance on assembly is plus or minus 2 degrees.

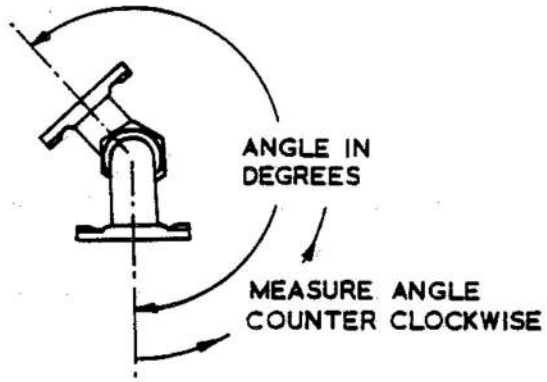


Fig. 5 End view of angular relationship

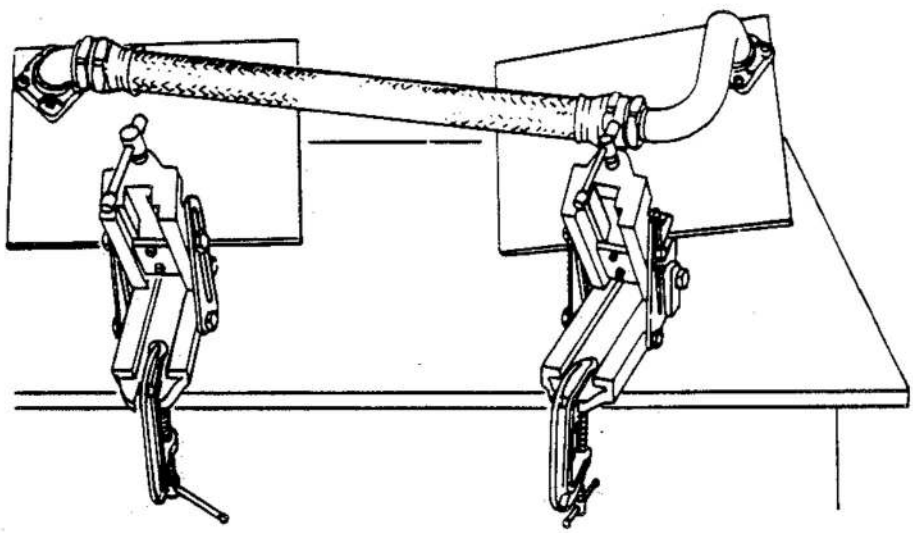


Fig. 6 Setting up to measure the angles

ASSEMBLY PROCEDURES

Basic procedure and cutting the hose

9. The manufacture of all hose assemblies follows a basic procedure in that the hose is cut to length before the end fittings are assembled in turn. The method of assembly of end fittings varies according to the type of hose assembly and the various procedures are detailed in the following paragraphs

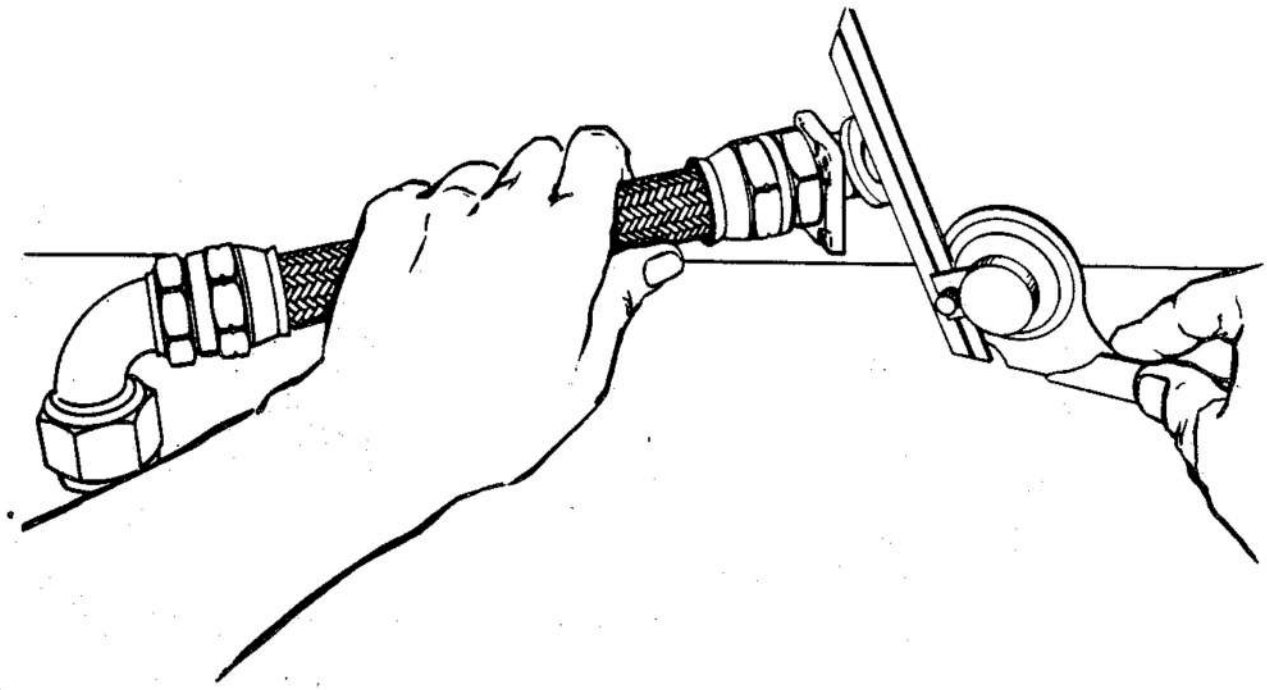


Fig.7 Simple check for proper angular relationship

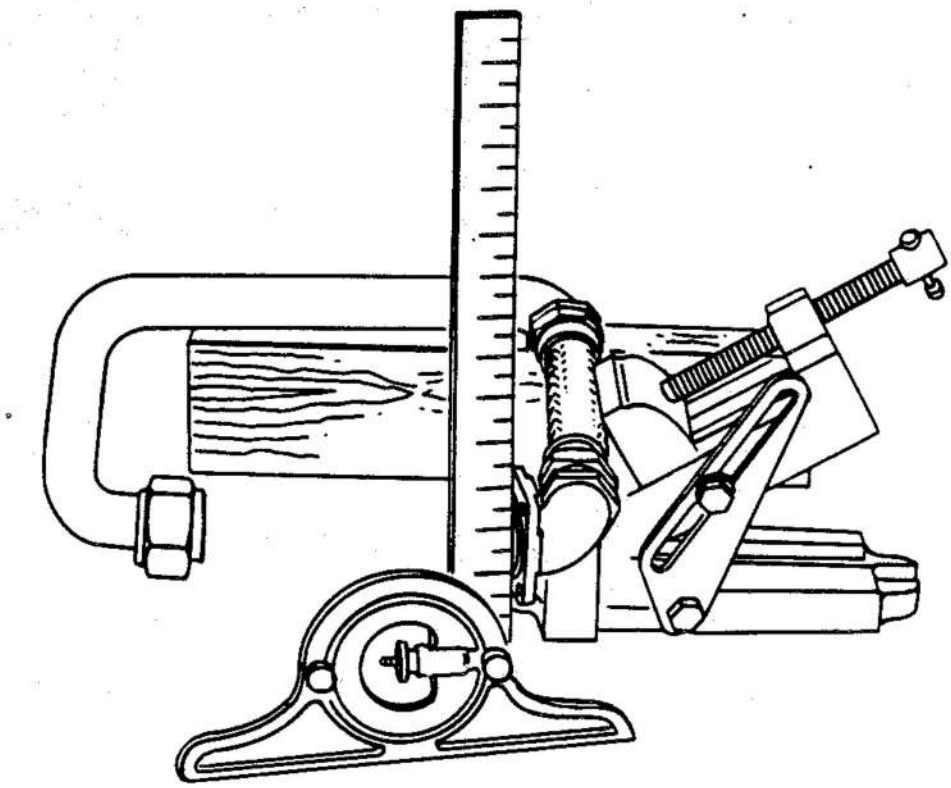


Fig.8 Checking flange face for angular relationship

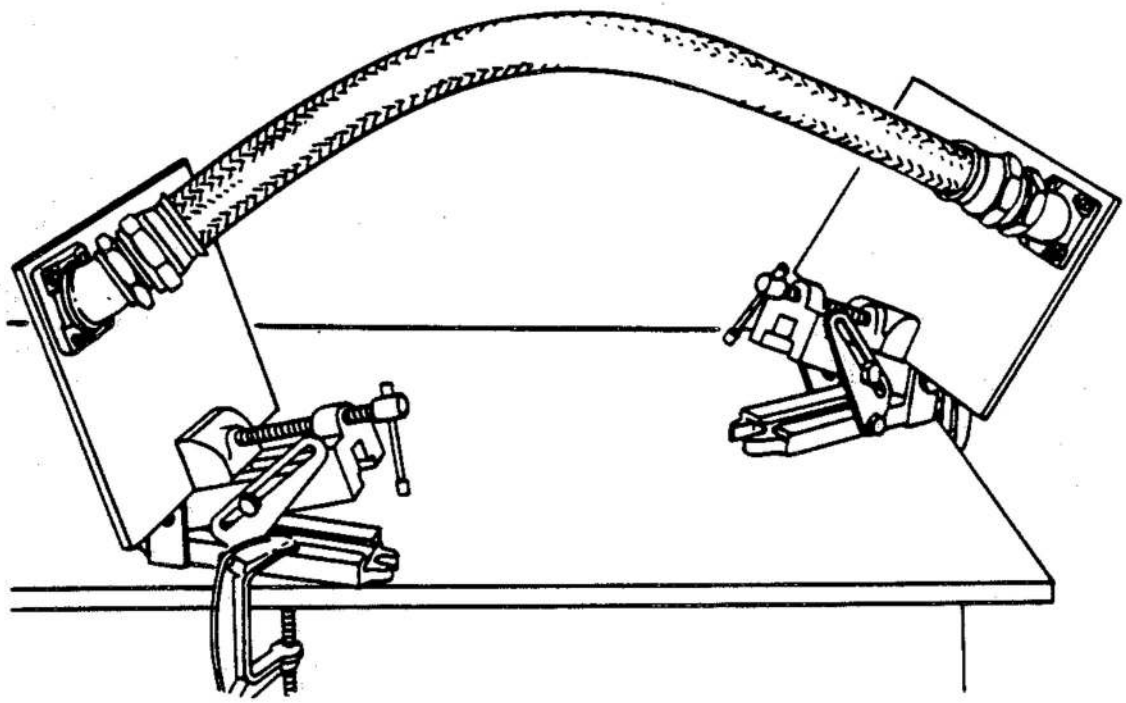


Fig.9 Method of setting angular relationship

10. Determine the hose length required by direct reference to the hose assembly drawings, by measurement of the hose to be replaced, or by subtraction of the cut off factor for each end fitting from the hose assembly length. The cut off factors are listed in the relevant tables of chapter 2.

11. Having determined the length of hose required, cut the hose squarely using a hose cut off machine, or a fine tooth hacksaw. To avoid ragged ends and minimise wire braid flare out the hose should be wrapped with masking tape at the cut off point (fig. 10).

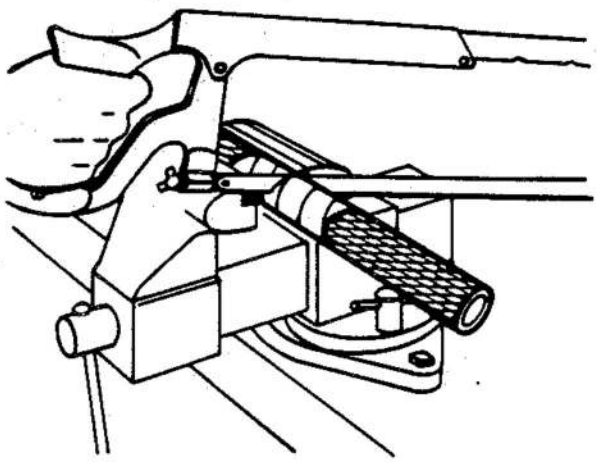


Fig.10 Cutting the hose

12. After the hose is cut, and before proceeding to assemble the end fittings, the tape must be removed and the hose end cleaned of any cutting residue. Snip any loose wires flush with the tube stock, and trim the bore of the hose with a sharp knife. Finally clean the hose by blowing through with a jet of clean, dry compressed air.

Procedure using hose Part Nos. 309 and 611

(High pressure rubber hose assemblies)

13. After cutting the hose to length proceed as follows:-

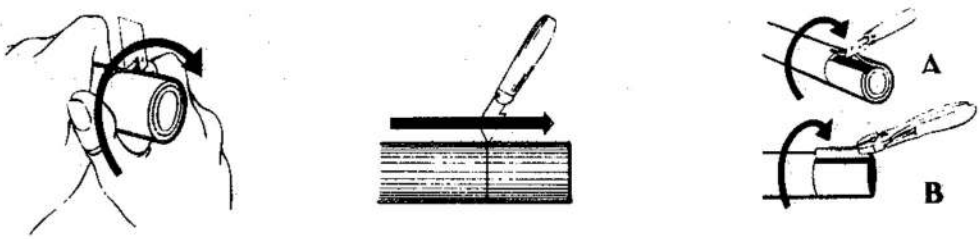


Fig.11 Outer cover removal

(1) Prepare the hose (fig. 11) by stripping part of the outer cover. Using the notch on the socket as a guide to the amount to be stripped cut the outer cover and prise off as shown in fig. 11. The cover removal is eased by ensuring that the cuts are made down to the wire braid.

(2) Clean the end of the outer cover and the exposed wire braid to remove any adhering particles of rubber. A soft wire brush may be used but care must be taken so that the braid is not loosened, flared or frayed. Finally clean using trichloroethane.

(3) Apply a uniform layer of sealant to the end of the outer cover, to the exposed wire braid and to the hose end of the socket. Sealant type PRC 1422BT2 is used on hoses Pt No 309 and 611.

Note...

Excessive amounts of sealant should be avoided. Methlethyl Keytone can be used as thinners for the sealant at not more than 5 parts thinners to 1 part sealant.

(4) Place the socket in a vice. Do not overtighten. Screw the hose, in a counter-clockwise direction, into the socket until it bottoms.

(5) Lubricate the bore of the hose and the nipple taper and threads liberally.

CAUTION...

With hose 611 use only liquid vegetable soap or castor oil; lubricating oil, petroleum jelly or light grease may be used with Pt. No. 309.

Note...

Step 6 applies to tightening of straight fittings: see para. 15 for adjustment of elbowed fittings.

▶ (6) Screw the nipple into the socket and hose using a spanner on the nipple hexagon. The gap between socket and nipple hexagon surface may vary from 0.13 to 1.6 mm (0.005 to 0.063 in). ◀

Procedure using hose Pt. Nos. 303, 302A, 602, 617 and 306

(Medium and low pressure rubber hose assemblies)

14. The following procedure is written for straight fittings. Assembly of elbowed fittings differs only slightly and those details are listed in para. 15.

(1) Cut the hose squarely to length, clean off the cutting residue. Do not remove any of the outer cover. With hose Pt. No. 602 (Skydrol hose) additionally clean the hose ends and the end fitting components with trichloroethane.

(2) Place the socket in a vice (do not overtighten). Screw the hose into the socket, in a counter-clockwise direction until it bottoms then back off one quarter turn.

(3) Tighten nipple and nut on a mandrel, or in the case of flanged fittings, place the flange on the nipple, ensuring that the nipple shoulder fits neatly into the flange counterbore.

(4) Lubricate the inside of the hose and nipple threads liberally. With Skydrol hose use only liquid vegetable soap or castor oil; otherwise use oil or light grease.

▶ (5) Screw the nipple into the socket and hose, using a spanner on the assembly tool (fig. 12). Check that the nut swivels freely when the assembly tool is removed, and that the gap between nut and socket is between 0.13 and 1.6 mm (0.005 to 0.063 in). With flange fittings the spanner may be used on the nipple hexagon. ◀

Fig.12 Assembly mandrel in use

Note...

With hose size -32 it will be necessary to remove the nipple and re-lubricate the fittings when assembly during operation (5) becomes difficult.

Differences in procedure (for assembly of elbow fittings to rubber hose)

15. (1) There is no requirement to tighten the nipple and nut on a mandrel (step (3) para. 14) as with elbow fittings the nut is wired on to the nipple and provided as a nipple assembly.

(2) All elbow fitting nipple assemblies are manufactured with a hexagon cross section and this can be used for tightening the nipple in the socket.

(3) Adjustments may be necessary, on completion of the basic assembly, to obtain the desired position angle between two elbow fittings; and in order to minimise backing off movements the following method should be used to supplement basic procedure when tightening the nipple and socket.

(a) Tighten both elbows to obtain acceptable gap between hexagon and socket ie 0.13 to 0.8 mm (0.005 to 0.031 in) for 617 hose, 0.13 to 1.6 mm (0.005 to 0.063 in) for 303 and 302A hose.

(b) Adjust elbows to the correct relative angle primarily by tightening the nipple assemblies. Backing off movements should be avoided and, if found necessary, must not exceed one quarter turn.

▶ Note ...

Both Aeroquip (2 part) and Stratoflex (3 part) fittings are available for use with No 601 hose.

Procedure for using Aeroquip 'Little Gem' fittings on hose No 601 and AE701 hose (Lightweight rubber hose assemblies) ◀

16 After cutting the hose to the length required and cleaning off all cutting residue proceed as follows:

Note ...

The procedure is written for assembly of straight fittings. When two elbowed fittings are used, the procedure differs only slightly. Those details are listed in para 17.

16.1 Place the socket of one end fitting in a vice and insert the hose with a twisting and pushing motion until the hose end is in line with the back of the socket threads.

16.2 Mark the hose with tape, or a painted or grease pencil line, at the point where the socket end sits after being properly installed (fig 13). This marking is important as it is used to check the hose for push out while fitting the nipple.

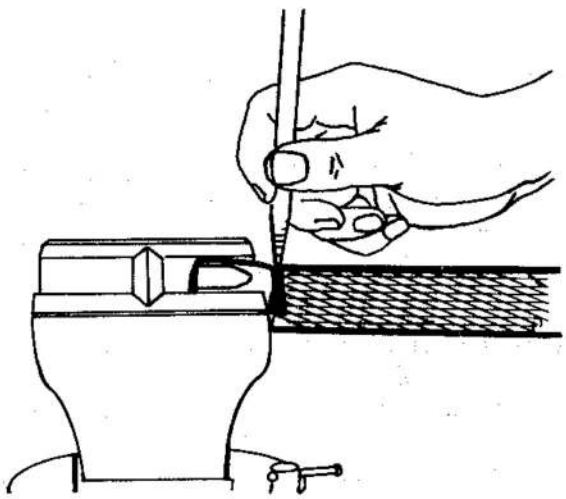


Fig 13 Marking the hose for check of push out

▶ Note ...

Step 16.3 is applicable only to fittings where the nut is not wired on to the nipple to form a nipple assembly.

16.3 Place the swivel nut over the threads of the nipple and screw the nut on to an assembly mandrel of the correct size, or on to an AN815 adaptor.

16.4 Lubricate the bore of the hose and the nipple threads liberally. Use oil, OMD-75, Ref No 34D/2246769.

CAUTION ...

On no account must the oil be allowed to enter the cutting spur of the nipple.

16.5 Carefully insert the tapered end of the nipple assembly through the socket and into the bore of the hose. Engage the nipple and socket threads while holding the hose in position by hand (fig 14).

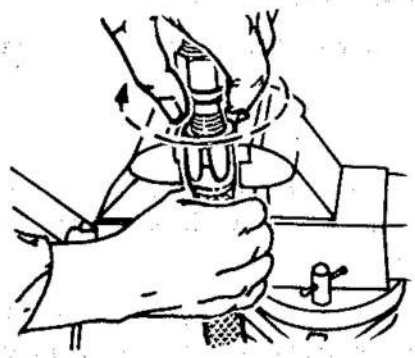


Fig 14 Engaging the nipple/socket threads

16.6 Check the hose for push out from the socket by reference to the marking made at step 16.2.

Note ...

If push out has occurred; remove the nipple assembly and repeat the procedure from step 16.1.

16.7 While continuing the hold the hose against push out, complete the assembly using a spanner on the driving hexagon of the nipple assembly (fig 15). The allowable gaps between the adjacent surfaces of the nipple and socket are: 0.13 to 1.0 mm (0.005 to 0.04 in) for sizes -3, -4 and -5; and 0.13 to 0.8 mm (0.005 to 0.031 in) for sizes -6 upwards.

16.8 Finally check for hose push out by reference to the mark made at step 16.2. No push out is permissible. If push out has occurred, dismantle the fitting and repeat the entire procedure. ◀

Differences in procedure (for assembly of elbow fittings to lightweight rubber hose)

17 Adjustments may be necessary, before completion of the hose assembly, to obtain the desired angular relationship between two elbow fittings (fig 5).

The angular relationship must be accurate to within ±2°. In order to minimise backing off movements during final tightening of the nipple assemblies, the following method should be adopted to supplement the basic assembly procedure for tightening the nipple to socket.

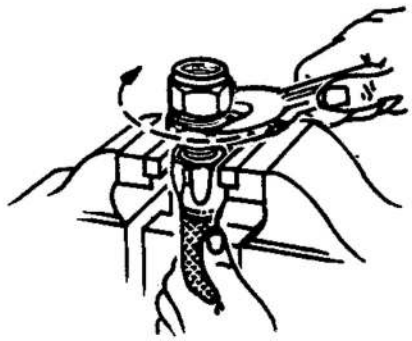


Fig 15 Tightening the nipple assembly

▶ 17.1 Tighten both elbows to the maximum permissible gap between nipple and socket.

17.2 Adjust the elbows to the correct relative angle primarily by tightening the nipple assemblies. Backing off movements should be avoided and, if found necessary, must not exceed one quarter turn.

Procedure for using Stratoflex fittings on No 601 hose (Chap 2-11 fig 3)

18 This type of fitting includes a sleeve with a cutting edge which grips the exterior of the hose. The material of sizes -3, -4 and -5 fittings is cadmium plated steel, and of sizes -6 and up, the material is anodised aluminium. The assembly procedure for all sizes of fitting is as follows:

18.1 Wrap the hose with a double layer of masking tape over the area to be cut. Place the hose in a vice and cut to length using the allowances given in Chap 2-11 Table 2.

18.2 Fit 'O' ring into recess of nipple and fit sleeve to hose.

18.3 Place the socket of one end fitting in a vice and insert the hose with a twisting and pushing motion until the hose end is in line with the back of the socket threads. Check position to dimension A.

18.4 Mark the hose with tape, or a painted or grease pencil line, at the point where the socket end sits after being properly installed. This marking is important since it is used to check the hose for push-out while fitting the nipple.

18.5 Clean hose bore with a nylon bristle brush and air blast hose to remove all residue.

18.6 Do not lubricate nipple, but lubricate hose bore and socket thread with oil OMD75.

18.7 Place the nipple assembly in the socket and engage the threads by pressing firmly and turning clockwise. During nipple assembly, hold the hose firmly in the socket.

18.8 Use a set spanner engaging the hexagon of the nipple to continue screwing the nipple into the socket until the gap between the socket and nut, or socket and nipple hexagon, is not less than 0.38 mm (0.015 in) or more than the maximum given in Table 3. ◀

TABLE 3 ALLOWABLE GAP, SOCKET/NIPPLE/HEXAGON

Hose dash size	Minimum gap mm	(in)	Maximum gap mm	(in)
-3	0.38	0.015	1.27	0.050
-4	0.38	0.015	1.27	0.050
-5	0.38	0.015	1.40	0.055
-6	0.38	0.015	1.40	0.055
-8	0.38	0.015	1.65	0.065
-10	0.38	0.015	1.65	0.065
-12	0.38	0.015	1.78	0.070
-16	0.38	0.015	1.78	0.070
-20	0.38	0.015	1.78	0.070
-24	0.38	0.015	2.03	0.080
-32	0.38	0.015	2.03	0.080

Note ...

Straight fittings with hexless nipples sizes -3, -4 and -5 should have 0.76 to 1.52 mm (0.03 to 0.06 in) gap.

18.9 Check the position of the mark made at para 18.3 for hose push-out. Allowable push-out for -3 to -10 sizes is 0.76 mm (0.03 in) and for -12 and above maximum allowable push-out is 1.27 mm (0.05 in). If push-out has occurred in excess of these figures; remove the nipple and repeat the assembly procedure.

Procedure using hose Pt Nos 666, 667, 676, AE116, AE206, AE546 and AE566 (Medium and high pressure Teflon hose assemblies)

WARNINGS ...

(1) STANDARD FITTINGS, OR STANDARD FITTING COMPONENTS ARE NOT TO BE USED FOR OXYGEN SYSTEM HOSE ASSEMBLIES (CHAPTER 3-11).

(2) THE ONLY ASSEMBLY LUBRICANT WHICH IS ALLOWED FOR USE WITH OXYGEN HOSE ASSEMBLIES IS FLUOROLUBE LG 160 GREASE (REF No. 34B/NIV)

Note ...

The chafe guard of AE546 and AE566 hose must be stripped at the ends before assembly of the fittings as detailed in paras 20 to 22.

19 After cutting the hose to the length required, and cleaning off all cutting residue, proceed as follows:

19.1 Slip two sockets, skirt to skirt, over the 'necked down' end of the hose.

19.2 Place the nipple in a vice and work the hose end over the nipple in a circular motion to size the tube and aid in separating the braid prior to fitting the sleeve.

AIRCRAFT FLEXIBLE HOSES WITH RE-USABLE END FITTINGS

ADVANCE INFORMATION LEAFLET No 1/87

Insert this leaflet to face Chap 3-6 Page 14
*Record its receipt in the AIL record

After para 18:

NOTE ...

When assembling new fittings no lubrication is generally needed as component parts should have been dryfilm lubricated at the time of manufacture. However where dryfilm lubrication has been omitted or if undue wearing of the dryfilm coating has occured the fittings should be lubricated with Molycote GN (NSN 9150-99-2249733 or 9150-99-2248896)

NOTE ...

(1) The information contained in this leaflet will be incorporated by normal amendment list action in due course.

(2) If, after receipt of this leaflet, an amendment list with a prior date and conflicting information is received, the information in the leaflet is to take precedence.

▶ 19.3 Carefully insert the sleeve (over the end of the inner tube and under the wire braid). Press the sleeve home, by pushing against a flat surface, until the hose tube bottoms against the shoulder in the sleeve.

19.4 Inspect the hose end to see that the tube stock butts against the shoulder in the sleeve, and that there are no wires trapped under the sleeve.

19.5 Push the hose and sleeve into place on the nipple using a twisting motion until the sleeve seats against the nipple chamfer.

19.6 Bring up the socket and hand-start the threads.

19.7 Place the socket hexagon in the vice and using a spanner tighten the nipple hexagon tighter to a gap of 0.8 mm (0.031 in) nominal for all sizes (Gap may vary from 0.6 to 1.2 mm (0.023 to 0.047 in). ◀

Chafe guard thermal stripping tool, S1364

20 The chafe guard thermal stripping tool is used to remove the integral polyester chafe guard of AE546 hose prior to assembling the end fittings, thus avoiding damage to the braiding by sharp edged tools. The tool is designed to operate from 110V ac supply.

Description

21 The equipment comprises a power unit housed in a steel case containing a low voltage transformer and output selector switch. The LV output is led to two screw terminals. The stripping head includes a hot wire movable by hand pressure towards an interchangeable mandrel. The size of mandrel required is dictated by the bore of the hose (Table 3). The twin cable of the stripper head is terminated by spade lug connectors.

Operating instructions

22 To strip the chafe guard from a hose proceed as follows:

22.1 Connect the two spade lugs of the cable to the terminals on the power unit. Ensure that the switch is on the 'off' position and connect the power unit to a power supply (110V ac).

22.2 Select the correct mandrel (Table 3) and fit it to the stripping head (fig 17).

22.3 Set the stop on the mandrel so that the distance from the hot wire to the stop gives the stripping length (SL) in Table 3.

CAUTION ...

Before switching on power to the hot wire from the stripping head ensure that it is in a safe position and away from flammable liquids or materials.

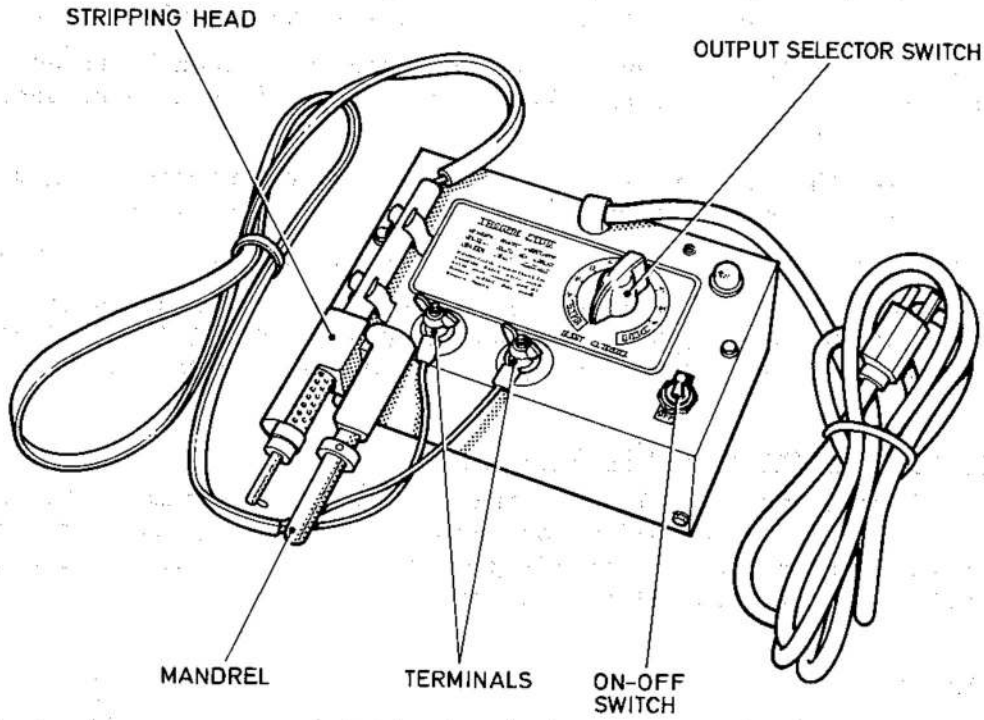


Fig 16 Chafe guard thermal stripping tool, S1364

TABLE 4 CHAFE GUARD STRIPPING LENGTH, AE546 HOSE

Dash size	Mandrel Part No	Stripping length (SL) Super Gem fitting mm	in	Super C fitting mm	in
-4	S1364-1-1	29.5	1.16	16.0	0.63
-6	S1364-1-1	29.7	1.17	17.0	0.67
-8	S1364-1-1	34.0	1.34	19.3	0.76
-10	S1364-1-2	36.6	1.44	25.4	1.00
-12	S1364-1-2	43.7	1.72	29.7	1.17

Notes ...

(1) Tolerance on stripping length ± 0.5 mm (0.02 in).

(2) Stripping is to be done using Thermal stripping tool, Pt No S1354.

▶ 22.4 Set the selector switch on the power unit to '4'. This is a nominal setting. Turn the switch to 'on' and the hot wire will heat up.

22.5 With the hose end pushed onto the mandrel up to the preset stop, squeeze the tool body to bring the hose in contact with the hot wire to melt the chafe guard.

Note ...

The wire should melt the chafe guard, if it fails to do so increase the selector switch setting. The appearance of an open flame indicates too high a setting.

22.6 As the hot wire melts through the chafe guard rotate the hose slowly through 360° (fig 18).

22.7 Remove the tool from the hose, position the tool at right angles to the mandrel (fig 19) and draw it slowly across the hose cover to split the polyester covering.

22.8 Using pliers or other suitable gripping device (without sharp edges), pull the cover from the end of the hose.

22.9 While the worked area is still quite warm, roll the melted edge of the polyester cover to flatten out the rough heated area.

22.10 Check that the stripped length is in accordance with Table 3.

23 The hose end is now ready to accept the end fitting. ◀

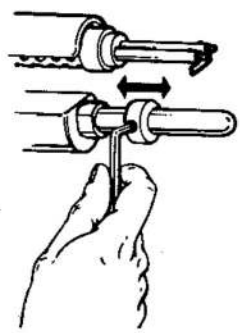


Fig. 17
Select the correct mandrel and set the stop (Table 3)

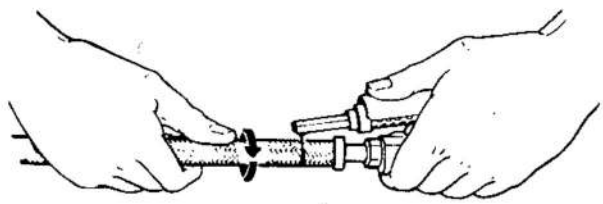


Fig. 18
As the hot wire melts through the chafe guard rotate the hose slowly through 360°

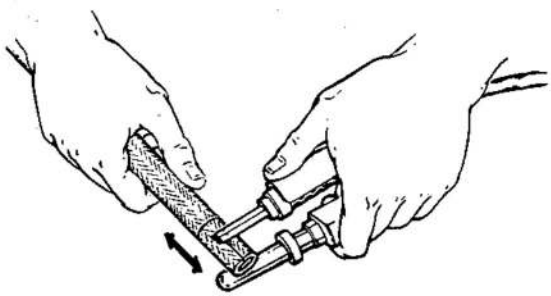


Fig. 19
Position the tool at right angles to the mandrel and draw it slowly across to split the covering

Notes ...

(1) Some of the molten guard material may stick to the hot wire element causing uneven heating. If this occurs, turn the heat selector switch to maximum for a few seconds to burn off the residue.

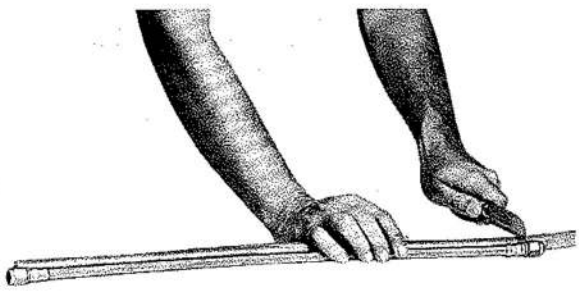
(2) The setscrews securing the heating element must be tight to ensure good electrical contact. Periodically remove the setscrews and brush off any corrosion deposits in the threaded areas.

▶ Fitting AE272 Flexwrap firesleeves

24 AE272 Flexwrap firesleeve is a double layer firesleeve and is wrapped around the hose to be protected as distinct from sliding the sleeve onto the hose endwise. Dimensions are given in Table 6.

Assembly procedure

25 The sleeve is secured into position by RTV adhesive/sealant, Aeroquip Part No AE15965-005, Ref No 33C/2245722. The procedure is illustrated in figs 20 to 27 as follows:



25.1 Cut sleeve to length. Length should be from nipple hexagon to nipple hexagon. (para 28).

Fig 20 Cut sleeve to length

25.2 For ease of assembly to the hose, roll the sleeve inside out. This will expose the inner edge.

Fig 21 Roll inside out

◀

Fig 22 Notch inner ends

25.3 The firesleeve is sized to wrap around the hose assembly twice. Notch the inner layer on both ends. This will put the first layer of sleeve on the hose only, and the second layer on the hose and fitting. (fig 22 and 23).

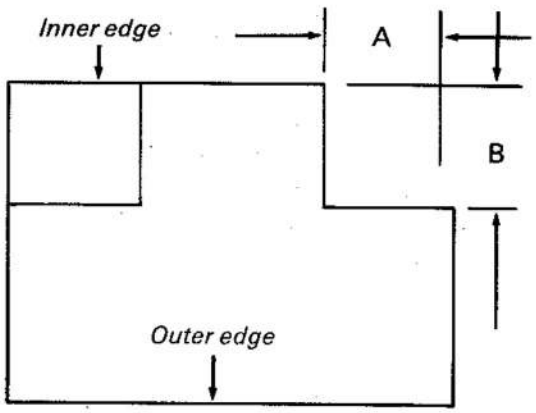


Fig 23 Notching dimensions

25.4 Notch the sleeve using dimensions A and B:

25.4.1 Dimension A: Socket length.
25.4.2 Dimension B: Hose circumference.
Note ...
Cutting length is given in para 28.

25.5 Wrap the sleeve onto the hose assembly with the inner edge of the sleeve next to the hose od. When completed, this puts the sleeve into its original coiled shape.

Fig 24 Wrap sleeve onto hose

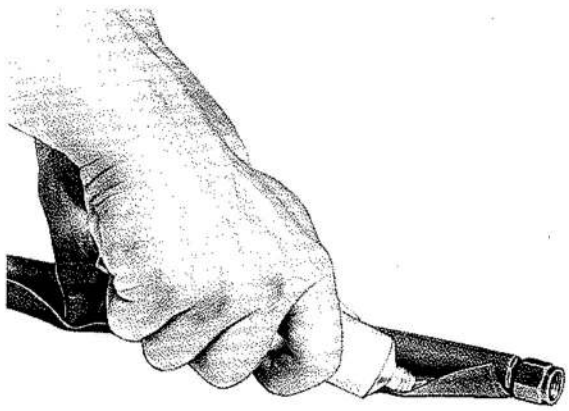


Fig 25 Apply adhesive

25.6 Apply adhesive under the outer edge of the sleeve approximately 6.4 mm ($\frac{1}{4}$ in) from the edge on the full length of the assembly.

25.7 Apply hand pressure at the sleeve edge to work out the excess sealant. When completed wipe off the excess with paper tissue or cloth.

Fig. 26 Work out excess adhesive

25.8 Fit band clamps to each end of the sleeve as described in para 10.

25.9 After attachment of the band clamps apply a bead of adhesive at each end of the sleeve to prevent moisture entrapment.

Fig 27 Sealing ends

Sleeve length

26 Determine the sleeve length A from the hose assembly drawing or ensure that the old hose is straight and measure from nipple hexagon to nipple hexagon (fig 28).

Fig 28 Sleeve length

Hand operated band clamp tool

27 This tool, Ref No 3A/2061383, may be held in a vice or bench mounted. It is suitable for band sizes up to -5C (Table 5).

TABLE 5 AE272 SLEEVE, HOSE AND CLAMP SIZES

AE272 sleeve size	AE666/667 Crimped fitting	AE666/667 Reusable fitting	Clamp size S00591B
-3	-3,-4,-5	-3,-4,-5	-1C
-4	-6	-6	-1C
	-8	-8	-2C
-6	-10,-12	-10,-12	-2C
-9	-16	-	-3C
-11	-20	-16	-3C
			-4C
-13	-24	-20	-4C
		-24	-5C

Operating instructions

28 The firesleeve is to be cut to length and in accordance with para 24 after which, the procedure is as follows:

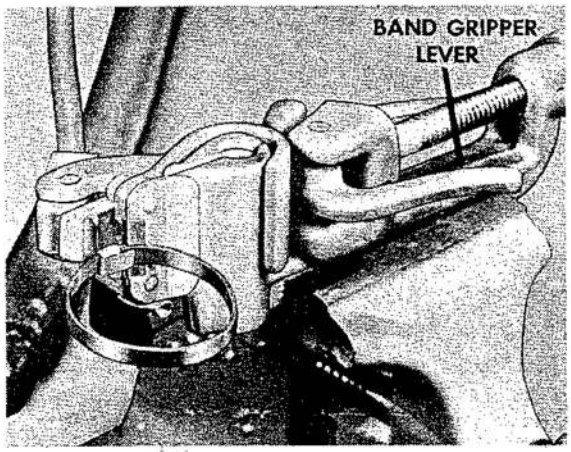


Fig 29 Inserting clamp band

28.1 Insert the clamp band and grip the end of the band by tightening the band gripper lever.

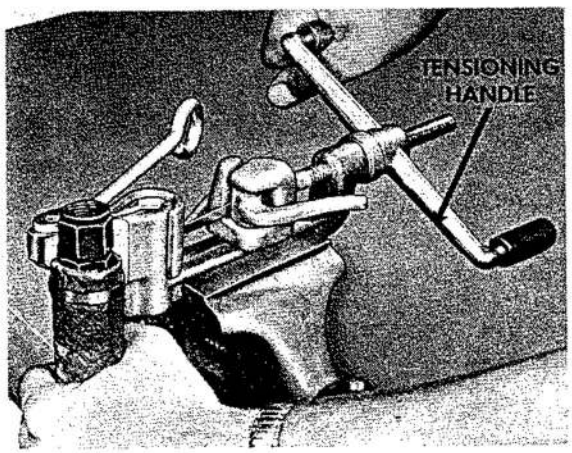


Fig 30 Tighten clamp onto hose

28.2 Position the hose assembly in the clamp and tighten the clamp onto the hose assembly by turning the handle of the tool in a clockwise direction. To feel movement of the band, place one finger on the band clamp at the buckle edge while tensioning with the tool handle. Maximum pressure is exerted when movement can no longer be felt.

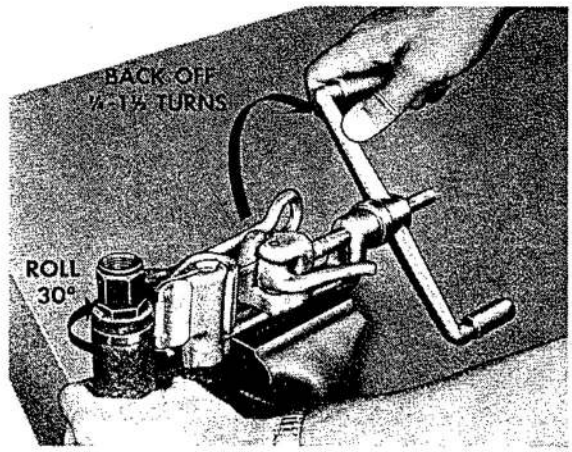


Fig 31 Roll hose 30°

28.3 Roll hose over by approximately 30° and it the same time rotate the tension handle counter-clockwise by approximately ¼ to 1½ turns.

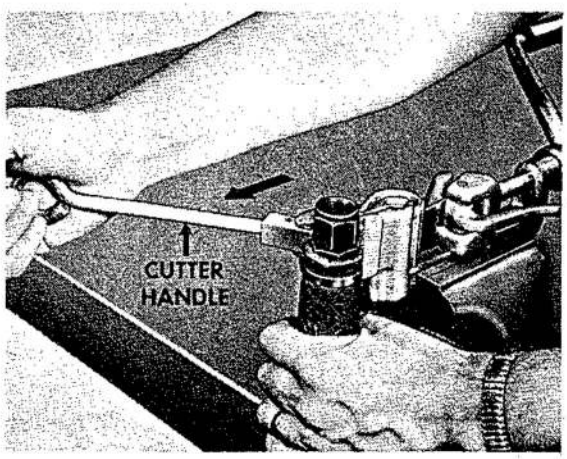


Fig 32 Cut off the band

28.4 Grip the back of the buckle with the nose of the band clamp cut-off tool. Continue to push the cut-off tool to cut the band.

28.5 Cutting off the band will separate the hose assembly from the tool.

28.6 Fit a similar band clamp to the other end of the hose assembly.

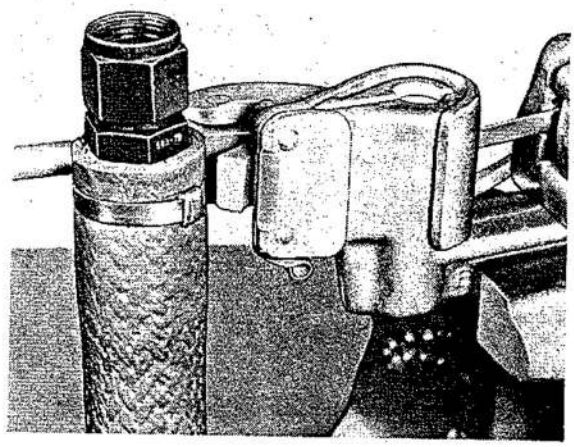


Fig 33 Removal from tool

Note ...

It is recommended that the finished assembly is allowed to dry for four hours for the adhesive to set before installation in an aircraft.

TABLE 6 AE272 SLEEVE DIMENSIONS

Sleeve dash size	Inside diameter inch	Wall thickness inch	Weight lb/ft
-3	4.5	0.125	0.1512
-4	5.5	0.125	0.1520
-6	7.0	0.125	0.2412
-9	9.0	0.125	0.3096
-11	10.0	0.125	0.3516
-13	12.75	0.125	0.4044
-14	16.5	0.125	0.5233
-15	21.5	0.125	0.6819

Note ...
Inside diameter is given as for unwrapped sleeve.

Removal of clamp band

29 To remove the clamp band use a fine tooth saw to cut through the buckle.

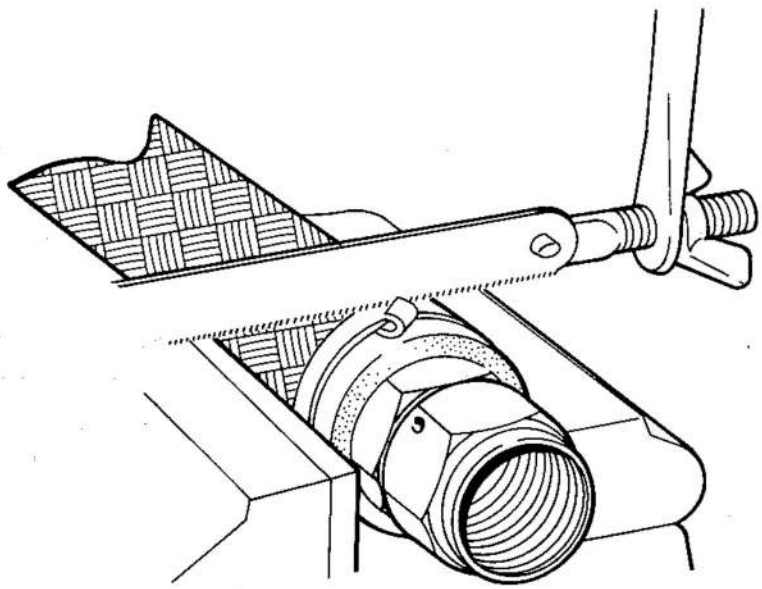


Fig 34 Cutting off a clamp

Repairing minor damage to firesleeves

30 Two types of synthetic sealer are available for the repair of minor damage to firesleeves. Slight abrasions and scuffing damage should be sealed by a brush application of the sealer. Frayed ends should first be trimmed and then sealed, either by a brush application, or by dipping to a depth of at least 12 mm ($\frac{1}{2}$ in).

▶ 31 Part No AE15965-005 is a combined adhesive/sealant for use only with AE272 Flexwrap.

TABLE 7 FIRESLEEVE SEALING COMPOUNDS

Firesleeve type (Aeroquip)	Sleeve and dip compound Aeroquip Part No	Ref No
624A (grey)	AE10187-001	
AE198 (red)	AE13702-001	
AE272	AE15965-005	33C/224722

Hose cutting-off machine

32 To facilitate manufacture of hose-assemblies a hose cutting-off machine Type 480/1 is provided to cut single and multiple wire braided hose. See Chap 3-1.

WARNING

EYE AND EAR PROTECTION IS TO BE WORN DURING ALL CUTTING OPERATIONS. CHECK THAT BLADE IS STATIONARY BEFORE INSERTING HOSE.

Operating procedure

33 The basic operating procedure is as follows:

33.1 Ensure that the cut-off point is clearly marked on the hose, see note (2).

33.2 Adjust the hose guide pins to suit the size of hose to be cut.

Note ...

(1) It is essential to position the guide pins correctly to ensure a square cut and to prevent the hose from binding on the blade.

(2) To prevent flare-out of the wire end during the cut-off operation wrap tape around the hose at the cut-off point. Mark with a grease marker.

33.3 Position hose on cutting table to make the cut at the marked point.

33.4 Start machine and feed hose onto the blade: do not force the cut.

33.5 Switch off machine.

Hose fitting assembly machine (fig 35)

34 The RPD 1045B-10 assembly machine with power assemble all standard straight and elbow end fittings up to -24 (1½ in) size. The machine needs a power supply of 415V ac 3-phase 50 Hz for the 1.5 kW motor.

Description

35 The equipment comprises a twin channel section base on which are mounted a reversible power unit with reduction gearbox, a chuck with interchangeable jaws, a vice and a feeding handle. The electric motor is controlled by ◀

▶ ON/OFF buttons, which also operate a brake. A reversing switch on the front of the motor is operated by a small hand lever. Two pairs of jaws for the vice and three pairs of chuck jaws cover the range of fitting sizes and are easily changed. Opening the safety guard operates the brake to stop the motor.

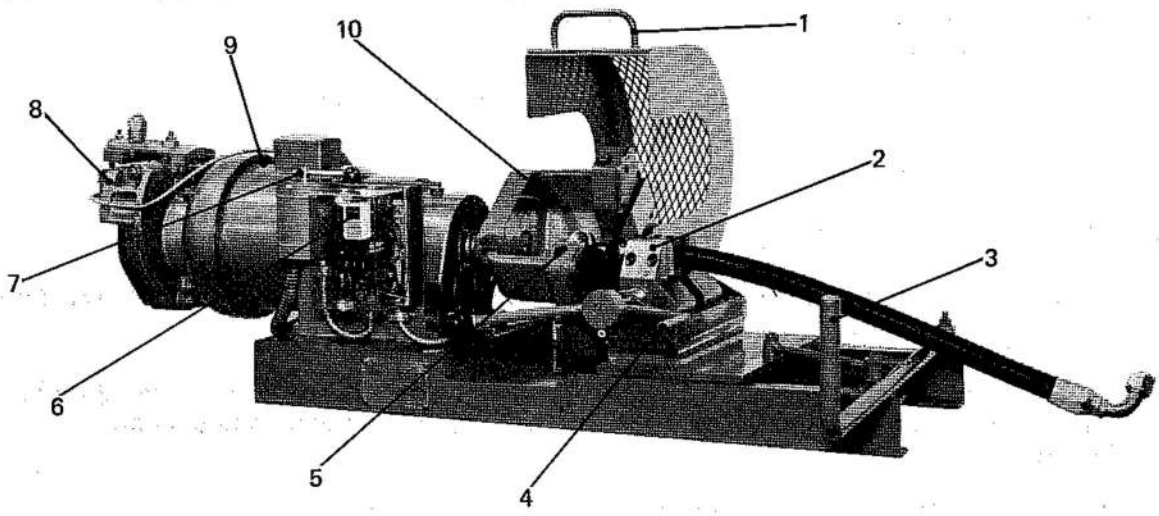


Fig 35 Hose fitting assembly machine, RPD 1045B-10

Key to fig 35

1	Guard	6	Start/Stop buttons
2	Vice	7	Forward/Reverse switch
3	Feeding handle	8	Brake
4	Vice handle	9	Motor
5	Chuck	10	Chuck jaws

Operating instructions (figures in paranthesis refer to fig 35)

CAUTION

Ensure that the correct speed is selected for the size of hose fitting; - 20 hose and over select low speed.

Assembly of socket to hose

36 The procedure to assemble a socket to hose is as follows:

36.1 Select the correct size of chuck and vice jaws to suit the hose size, and fit these to the machine.

Note ...

The chuck has only a limited opening undue strain on the chuck key will stretch the locking chain and make it stiff. ◀

▶ 36.2 Lift guard (1) grip socket in chuck jaws (10) and lower guard.

36.3 Grip hose in vice (2) without crushing the hose.

36.4 Select switch (7) to REVERSE, press START button (6) and gently push hose into socket using feed handle (3), stop motor when hose bottoms.

36.5 Release hose from vice and manually back hose a quarter turn; this allows the hose to flare when the nipple is assembled.

36.6 Mark the hose with tape or grease pencil at the point where the socket end sits after being properly installed (fig 13). This marking is important as it is used to check the hose for push-out while fitting the nipple.

36.7 Lift guard and release socket from chuck jaws.

Disassembly of socket from hose

37 The procedure to disassemble a socket from hose is as follows:

37.1 Lift guard (1), grip nipple assembly in jaws (10), and lower guard.

37.2 Grip hose in vice (2) without crushing hose.

37.3 Select switch (7) to FORWARD, press START button (6) and gently pull the hose off socket using handle (3), stop motor when hose becomes free.

37.4 Release hose from vice.

37.5 Lift guard and release socket from chuck jaws.

Assembly of nipple assembly to socket and hose

38 The procedure to assemble a nipple assembly to socket and hose is as follows:

38.1 Lift guard (1), grip nipple assembly in jaws (10) and lower guard.

38.2 Lubricate taper and threads in nipple with heavy lubricating oil, Nato Code OMD-75, Ref No 34D/2246769.

38.3 Grip socket and hose in vice (2).

38.4 Select switch (7) to FORWARD, press START button (6) and engage socket to nipple with handle (3). Stop motor when distance between nipple and socket is 0.8 to 1.6 mm, (0.031 to 0.062 in).

Note ...

Refer to the relevant paragraph for the appropriate dimensions for manufacture of specific hose type and size.

38.5 Lift guard, release nipple from vice jaws, and socket from vice.

38.6 Check the hose for push-out from the socket by reference to the marking made on it (para 36.6). ◀

Note ...

If push-out has occurred, remove the nipple assembly and repeat the procedure from para 36.

Removal of nipple assembly from socket and hose

39 The procedure to remove a nipple assembly from socket and hose is as follows:

39.1 Lift guard (1) grip nipple assembly in chuck jaws (10) and lower guard.

39.2 Grip socket and hose in vice.

39.3 Select switch (7) to REVERSE, press START button, and ease socket and hose off nipple using handle (3). Stop motor when socket is disengaged.

39.4 Lift guard, release nipple assembly from chuck jaws and release socket and hose from vice.

Replacement of firesleeve (other than AE272)

40 The procedure for replacing a firesleeve is as follows:

40.1 Determine the sleeve size and length: refer to Table 8 and hose assembly drawing of the sleeve to be replaced. Length may also be determined by measuring nipple to nipple (fig 28).

40.2 Cut sleeve to length using knife, shears or cut off machine.

40.3 Apply adhesive Ref No 33C/8030-99-2245772 on both ends of firesleeve for a distance of 0.75 $\pm$ 0.25 in and allow to dry at room temperature.

40.4 Assemble adhesive coated sleeve to hose. Sleeve shall be assembled prior to assembling the second end fitting.

Note ...

When assembling firesleeve on a short hose assembly, it may be necessary to roll one or both ends of the firesleeve to facilitate assembly of the second fitting.

40.5 After assembling the firesleeves, all fractures of the rubberized exterior surface and adhesive coating is to be recoated with adhesive.

40.6 Fit clamps as instructed in para 28.

TABLE 8 AEROQUIP FIRESLEEVE AND CLAMP SELECTION
(AE 601 HOSE)

Hose dash size	Sleeve Part No	Clamp Part No
-3	624-7	900591B1C
-4	624-8	900591B1C
-5	624-9	900591B2C
-6	624-10	900591B2C
-8	624-12	900591B2C
-10	624-16	900591B2C
-12	624-18	900591B3C
-16	624-22	900591B3C
-20	624-26	900591B4C
-24	624-30	900591B4C
-32	624-38	900591B5C

Chapter 3-7

CLEANING OF FLEXIBLE HOSE ASSEMBLIES

Introduction

1 It is important to remove all contamination from both the inside and outside of hoses in readiness for fitting to the aircraft. Cleaning, degreasing and protective materials are of great importance to proper maintenance of equipment. These materials must be handled carefully when used, personnel should be aware of the particular purpose for which the material is intended. In some instances there is danger to health of personnel and risk to equipment.

CAUTIONS ...

(1) Carry out safety precautions as laid down by AP 3158 Vol 2 Lft/H24.

(2) It is important that cleaning procedures laid down in AP107D-0001-1 Chap 4 be strictly adhered to when cleaning liquid and gaseous oxygen system parts.

All flexible hose assemblies are to be cleaned prior to storage, testing and post testing.

General procedure, hydraulic/pneumatic system

2 The procedure to be used for cleaning all hydraulic/pneumatic flexible hose assemblies varies according to material used for the hose construction. The cleaning fluid to be used for each hose material is listed in Table 1.

3 To clean a hose assembly select the correct cleaning fluid from Table 1 and proceed as follows:

3.1 Clean the exterior of the hose assembly and end fittings using a lint free cloth, cleaning fluid, and a bristle brush, if necessary, to remove all dirt.

CAUTION ...

Do not use the brush to clean the interior surfaces, otherwise damage to hose liner wire or convolutions may occur when the brush is pushed into the internal diameter of the hose assembly.

3.2 Flush through and completely fill the bore of the hose with cleaning fluid at a pressure not exceeding 0.7 bar (10 lbf/in^2); flush pipe until bore is clean.

3.3 Pass clean dry warm nitrogen or air through the bore of the hose to evaporate all traces of cleaning fluid.

3.4 Examine the bore of the hose to ensure it is clean. Ensure that all traces of cleaning fluid have evaporated.

WARNING ...

THE MIXTURE OF WARM AIR AND WHITE SPIRIT MAY FORM A FLAMMABLE MIXTURE.

CAUTION ...

No trace of trichloroethane or white spirit shall remain on the hose on completion of the procedure. Masking tape, rags or similar shall not be used for blanking. The trichloroethane used for flushing shall be replaced when a drop evaporated on clean white paper leaves a perceptible dirt mark.

TABLE 1 CLEANING FLUIDS FOR HOSE ASSEMBLIES

Hose material	Authorised cleaning fluids	
	Hydraulic/pneumatic interior/exterior	Fuel system interior flushing
Teflon	White spirit	White spirit
Rubber	Trichloroethane	N/A
Synthetic rubber	Trichloroethane	White spirit
Metallic	Trichloroethane	White spirit

Note ...

Metallic hose assemblies used in fuel systems are to be cleaned in accordance with the instructions in para 4.

Procedure, fuel system

4 The procedure to be used for cleaning all fuel system flexible hose assemblies is as follows:

4.1 Clean the exterior of the hose assembly and end fittings using a lint free cloth, trichloroethane, and a bristle brush, if necessary, to remove all dirt.

CAUTIONS ...

(1) Do not use the brush to clean the interior surface, otherwise damage to the liner wire or convolutions may occur when the brush is pushed into the internal diameter of the hose assembly.

(2) Do not use white spirit for cleaning rubber hose.

(3) Do not use trichloroethane for cleaning Teflon hose.

4.2 Flush through and completely fill the bore of the hose with clean white spirit at a pressure not exceeding 0.7 bar (10 lbf/in^2). Flush hose until bore is clean.

Notes ...

(1) Particular care is necessary with fuel hoses containing an internal wire helix, such as Superflexit.

(2) If a fuel hose assembly is to be stored, the procedure given at 3.2 and 3.3 should be followed, but where a pressure test follows proceed to para 4.3.

4.3 Clean the end fittings using a lint free cloth and trichloroethane to remove any dirt arising from 4.2.

4.4 Pass clean dry warm nitrogen or air through the bore of the pipe; this will evaporate excess white spirit and also trichloroethane on the exterior.

WARNING ...

THE MIXTURE OF WARM AIR AND WHITE SPIRIT MAY FORM A FLAMMABLE MIXTURE.

4.5 Examine the bore of the hose to ensure that it is clean.

CAUTION ...

No trace of trichloroethane shall remain on the hose on completion of the procedure. Masking tape, rags or similar shall not be used for blanking.

Chapter 3-8

PRESSURE TESTING OF LOCALLY MANUFACTURED FLEXIBLE HOSES

CONTENTS

General

1 This test procedure covers the range of locally manufactured hoses and is to be used in conjunction with the relevant sub-chapter of this publication to determine the correct system pressure and proof pressure for testing purposes.

2 Absolute standards of cleanliness are to be observed at all times and care must be exercised to prevent the ingress of foreign matter into hose assemblies.

WARNING ...

ASSEMBLIES UNDER TEST MAY BURST, ESPECIALLY AT MEDIUM AND HIGH PRESSURE, AND MUST BE GUARDED SO THAT THERE IS NO HAZARD TO THE OPERATOR.

CAUTION ...

These procedures are not to be used for liquid or gaseous oxygen system pipes and hoses for which the procedures laid down in Chap 3-11 of this publication must be strictly adhered to. ◄

Test equipment

3 The following equipment is required for complete examination and testing of all assemblies:

3.1 Regulated pressure supply (for example, hand pump) with gauge, using a particular fluid as a pressurizing medium (para 6).

3.2 Electrical probe illuminator and dental mirror, for internal examination of assemblies.

3.3 Where practicable, facilities for drying with a continuous blast of hot air over external surfaces and through internal diameter of assembly at a temperature of between 160 and 180 degrees C for a period of 30 minutes should be used.

4 Assemblies which convey a gas under pressure require, in addition:

4.1 Regulated clean, dry compressed air supply with gauge, together with a water container of sufficient depth to enable the assembly to be submerged. The water container must have a heating facility for raising the the temperature of water to approximately 27 degrees C to assist dispersion of air trapped in pockets on assembly.

Pressure testing

5 Where a hose assembly is considered to be serviceable, either after local assembly, or after removal from an aircraft and examination, it must be pressure tested to the applicable test pressure for its type, size and ► system. The data is given in the sub-chapter relevant to the particular ◄ hose assembly to be tested.

Test medium

6 The test medium to be selected, in the first instance, is the fluid which normally passes through the hose, however, fuel hoses are to be tested using ► OM15, then cleaned (Chap 3-7). Additionally, hoses used in gaseous systems are to be tested with nitrogen, the assembly being immersed in water, then ◄ cleaned (Chap 3-7).

Test procedure

7 Lay the assembly on a bench in an unrestricted position. Blank off one end of the hose and connect the other end to a regulated pressure supply as specified in the installation tables.

WARNING ...

ASSEMBLIES UNDER TEST MAY BURST, ESPECIALLY AT MEDIUM AND HIGH PRESSURE, AND MUT BE GUARDED SO THAT THERE IS NO HAZARD TO THE OPERTOR.

CAUTION ...

► The prevention of leaks during testing by overtightening is prohibited. ◄

8 Refer to the installation data table for the hose assembly to be tested and note correct test pressure for the size and type, then proceed as follows:

► 8.1 Disconnect the assembly from the fluid test equipment and clean.

8.2 Connect assembly to a regulated, clean and dry supply of air or nitrogen. Lay assembly in an unrestricted position in a tank of water.

8.3 Agitate hose assembly to remove air trapped in the braiding and slowly apply the correct test pressure and maintain for five minutes. ◄

► 8.4 Check for deformation of hose, movement of the braid in the vicinity of the attachment to the coupling and for any signs of leakage. Leaks will be apparent either as a thin trickle or stream of bubbles. Locate exact emanation of bubble stream as leaks from test adaptors, connections etc, can be mistaken for hose or coupling failures. ◄

Post testing

9 After completion of testing, disconnect the hose assembly from the test equipment and clean the assembly as detailed in Chap 3-7.

Blanking plugs

10 After tests have been completed, all threaded end couplings and any other threaded connections are to be fitted with the correct protective caps or plugs. Use polythene bags placed over the open ends to seal 'V' flanges and other orifices for which caps or plugs are not available.

CAUTION ...

Do not use any type of blanking plug or cap which can fragment as particles could pass into the bore of the assembly.

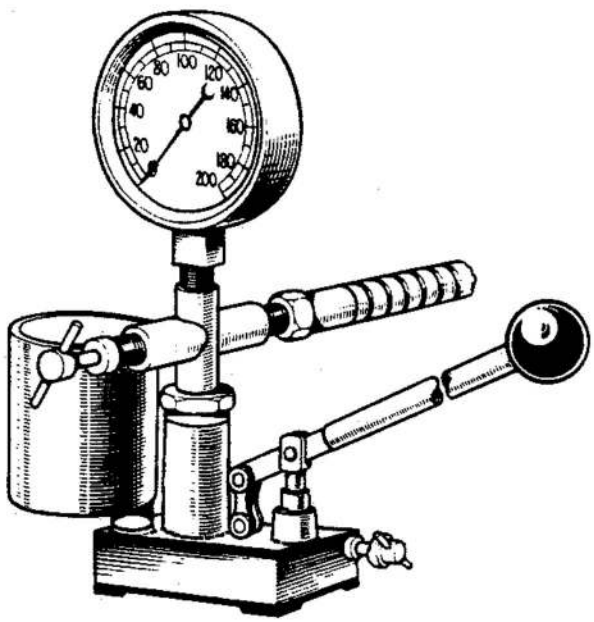


Fig. 1 Hose assembly test rig

Chapter 3-9

STORAGE AND HANDLING

General

1. Rubber hose equipment is to be stored in a dry, well ventilated and shaded place away from other equipment. Ideal storage conditions consist of self-contained accommodation where the maximum temperature does not exceed 18.3°C (65°F) and the relative humidity does not exceed 65 per cent. Where such accommodation is not available the area selected is to be curtained off to keep out light.

2. To minimise obsolencence or deterioration of hose in storage release of stock should be by the 'first in - first out' principle. The open ends of bulk hose held in storage should; after being cut; have the ends taped to prevent wire flare out, and sealed using firesleeve end dip and sealant (Part No. AE0187-001) to prevent the ingress of moisture between the layers of the hose. Plastic or metal blanking caps should be placed on the end fittings of stored hose assemblies.

Advice and precautions

3. The following advice should be noted and the relevant precautions observed during storage of hose and hose assemblies.

(1) Direct sunlight has a deleterious effect on rubber; so too, has ultra-violet light and for this reason, rubber hose is never to be stored in the direct rays of the sun or where mercury vapour lighting is installed.

(2) Where rubber hose is stored in metal containers, it is to be prevented from actual contact with the metal. Copper containers are on no account to be used for the storage of rubber.

(3) When storing rubber articles in conjunction with fabric, care is to be taken to ensure that the fabric does not become damp, as this causes rapid deterioration.

(4) Ozone may be increased by electrical discharge of generators or motors in use and as this has a degrading effect on rubber, rubber hose should not be stored in the immediate vicinity of electrical plant in operation.

(5) Rubber hose must be stored in a relaxed condition free from strain in the form of tension, compression or deformation. Rubber tubing or narrow bore hose is to be packed into lay-flat polythene tubing suitably sealed at both ends.

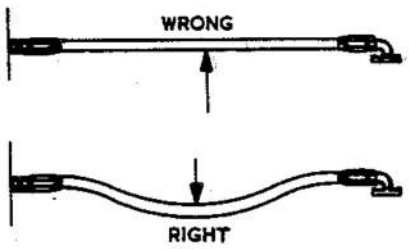
(6) As far as possible, rubber hose is to be stored in straight lengths on shelves. When rubber hose is coiled, the outside of each turn of the coil is in slight tension and this can lead to 'exposure cracking' due to ozone attack, with consequent unserviceability.

Chapter 3-10

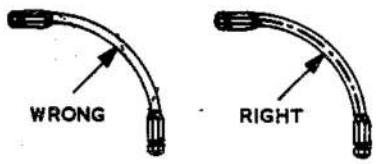
INSTALLATION OF HOSE ASSEMBLIES

Rubber hose assemblies

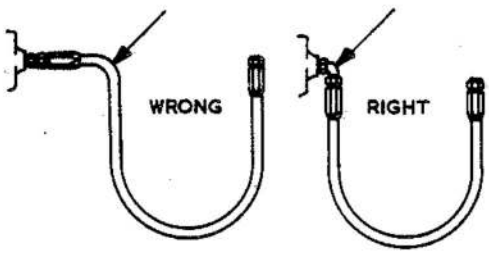
1. Fig. 1 details the installation techniques that should be adopted when placing rubber hose assemblies in service.



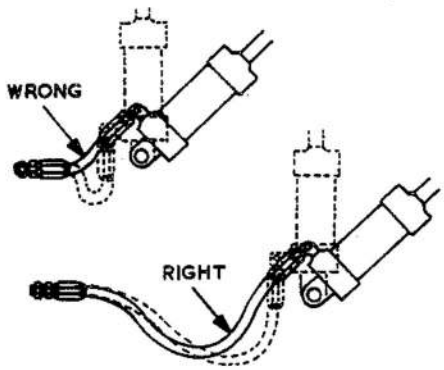
(1) Provide slack or bend in the hose line to provide for changes in length that will occur when pressure is applied.



(2) Observe linear stripe. The hose must not be twisted. High pressures applied to a twisted hose may cause failure or loosen the nut.



(3) Relieve sharp bends, avoid strain or hose collapse and make cleaner installations by using Aeroquip elbows or other adapter fittings. Provide as large a bend radius as possible. Never use less than the recommended minimum bend radius specified for the hose.



(4) Provide additional bend radius when lines are subject to flexing and remember that the metal end fittings are not flexible. Place line support clamps so as not to restrict hose flexing.

Fig.1 Rubber hose installation techniques

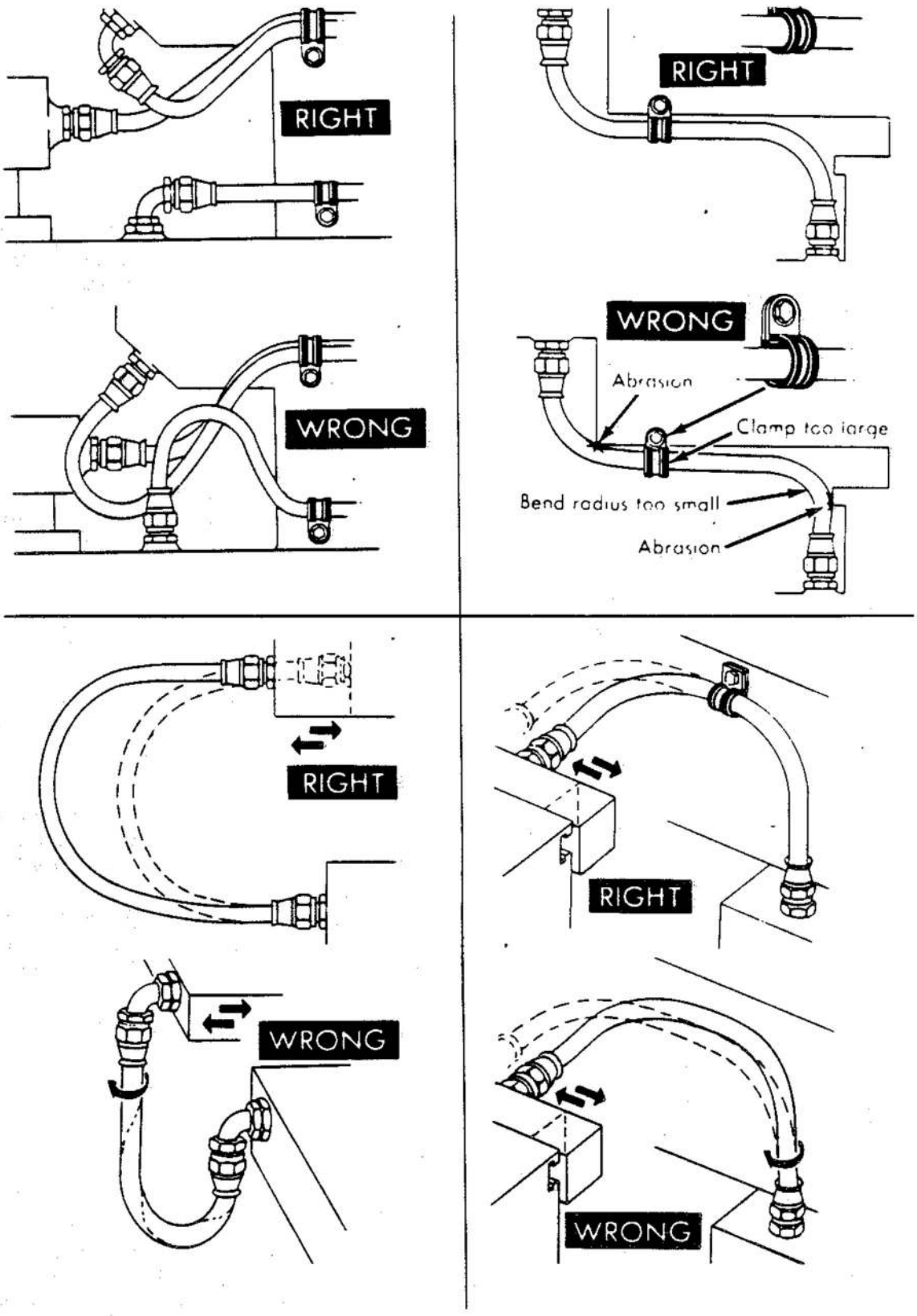


Fig.2 Teflon hose installation techniques

▶ Hose assemblies, including Teflon hose assemblies

2 Fig 2 illustrates the installation techniques that should be adopted when placing Teflon hose assemblies into service. This information is also applicable to other hoses, particularly braided hoses which are more prone to damage by twisting than unbraided hoses. Additional points to be noted are as follows: ◀

2.1 Abrasion against adjacent structure, moving parts or other lines should be avoided. Lines should be securely clamped. If this is not possible, a suitable protective sleeve should be specified.

2.2 Flexing - provide sufficient free hose to allow for movement. Hose should not be subjected to tension, torsion, compression or shear stress during flexing cycles. Support clamps should not restrict travel.

▶ 2.3 Kinking - extra care should be exercised to avoid kinking Teflon hose lines on installation or removal. Kinking will reduce or even cut off the flow of fluid and is generally caused by the following conditions:

2.3.1 Tight bends. Re-route line if possible. Otherwise, use integral tube assembly or Aeroquip Internal Support Coil.

2.3.2 Removed lines. Teflon and some other types of hose tend to preform themselves in hot service conditions. On no account should Teflon hose be straightened on removal from installation. ◀

2.3.3 Twisting. Flexing twisted installations may cause kinking. The hose should be bent in the same plane as the movement to avoid twisting. Flexing hose bent in two planes requires a clamp at the point where the hose changes plane. This has the effect of dividing the hose into two sections.

Avoiding tension and twisting

3 Hose must not be installed in a state of tension in any part of its length. It is essential that the hose is supported in such a manner that the end fittings are relieved of the weight of the hose and of its contents.

4 The greatest care must be taken to avoid twisting hoses when installing them in aircraft and when making and breaking a joint as otherwise the linings may become damaged or distorted. These defects may not become apparent until the fluid seeps between the layers of the hose, disintegrating the cement and causing leakage or a restriction in the flow of the liquid. In any instance where there is doubt as to the condition of the lining, whatever may have been the cause, a new hose assembly must be fitted. This is all the more important if facilities are not available to make adequate tests of suspect hose assemblies.

5 No difficulty will be experienced in avoiding twists when installing or removing hose assemblies if three important principles are observed. These are:

▶ 5.1 That the hose is held firmly when the union nut of the end fitting is being tightened or loosened.

5.2 That no abnormal effort is applied with spanners.

5.3 That the identification line marking, which is on most hose assemblies, is straight throughout its length (fig 1). ◀

Chapter 3-11

MANUFACTURE OF OXYGEN HOSES

CONTENTS

Introduction

1 This chapter is designed to give guidance in the manufacture of hose assemblies for use in oxygen systems. All instructions in this chapter should be carried out in conjunction with the information contained in the relevant sections of AP 107D-0001-1 and previous chapters of this publication.

Flexible hoses

2 The majority of oxygen pipelines utilises flexible hoses in areas which are subject to movement or vibration, and could cause rigid pipes to fracture. A hose assembly is defined as being a specific length of hose complete with end fittings and will have a unique part number. However, a number of types and sizes of flexible hose are available to suit different applications, each of which has its own range of end fittings. General information on flexible hoses is included in Chapter 1-0 of this publication. Detailed information on the construction of low, medium and high pressure hoses is contained in Chapter 2-0 of this publication.

Hose assembly end fittings

3 Hose assembly end fittings are manufactured in many shapes and sizes to suit specific applications and each type of hose has its own range of recommended end fittings. General information on end fittings and their application is contained in Chapters 1 and 2 of this publication.

Safety precautions

4 Before work is carried out on any item of an oxygen system the safety precautions for oxygen systems contained in Chapter 2 of AP 107D-0001-1 should be complied with. The most suitable hose for use with oxygen is Aeroquip AE 116, with Super Gem end fittings. Although these fittings are re-usable,

always use new items on hoses for use in oxygen systems (see Fig. 1).

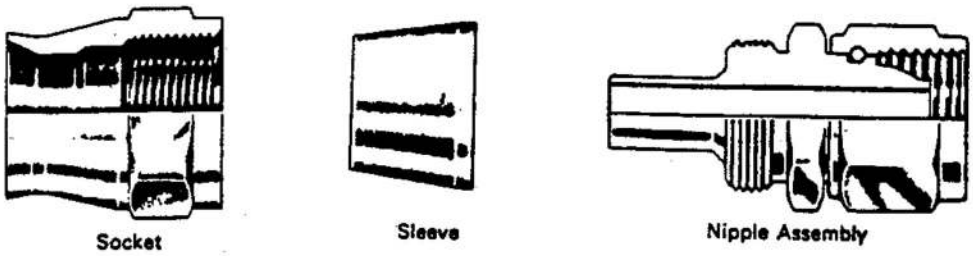


Fig. 1 Nipple assembly components

WARNING...

(1) END FITTINGS WHICH ARE SUPPLIED BY THE MANUFACTURER IN A PRE-LUBRICATED CONDITION MUST NOT BE USED TO MANUFACTURE HOSE ASSEMBLIES FOR USE IN OXYGEN SYSTEMS. SPECIAL FITTINGS OF PLAIN METAL ARE PROVIDED FOR THIS PURPOSE.

(2) WHEN CLEANING WITH TRICHLOROETHANE THE SAFETY PRECAUTIONS LAID DOWN IN AP 119A-1512-1 CHAPTER 2 PAGE 1 MUST BE COMPLIED WITH.

Manufacturing procedure

5 To make up an oxygen hose proceed as follows:

5.1 Cut the hose to length squarely using a hose cut-off wheel if available, although a fine tooth hacksaw may also be used. To prevent flare out of the wire end during cutting, wrap tape around the hose at the cut-off point. After the hose is cut, and just prior to installing the sockets, the tape must be removed. Clean the hose after cutting, be sure all cutting residue is dislodged.

5.2 All end fittings are to be cleaned in trichloroethane prior to installation. Place 2 sockets skirt to skirt in a vice and work hose through sockets with a twisting, pushing motion. Inserting sockets over "neck down" end of hose, as shown in Fig. 2, will facilitate assembly.

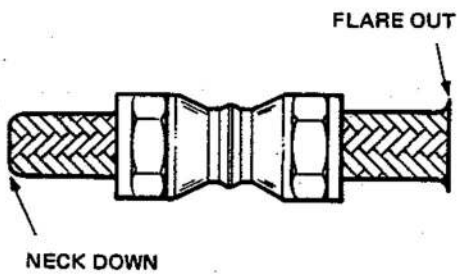


Fig. 2 Hose neck-down flare out

5.3 Size tube and flare braid by placing the nipple hexagon in a vice. Push one end of the hose onto the nipple and work gently in a circular motion as shown in Fig. 3 to aid in separating the wire braid from the tube; remove the hose from the nipple.

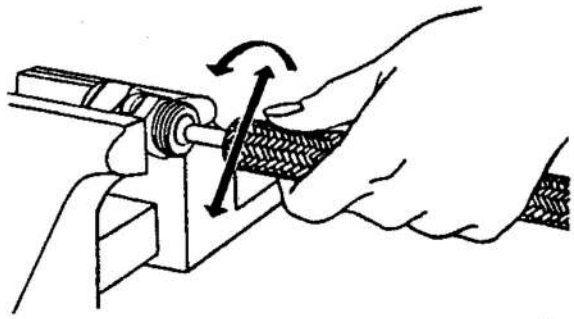


Fig. 3 Pushing the hose onto the nipple

5.4 Install the sleeve by carefully inserting the sleeve between the braid and the outer part of the tube, taking care that no wires are trapped between the sleeve and the tube. Complete positioning by pushing the end of the sleeve against a flat surface until the tube bottoms against the shoulder in the sleeve as shown in Fig. 4. Visually inspect the sleeve to ensure the tube end is bottomed against the sleeve shoulder and that no wires are trapped in the sleeve.

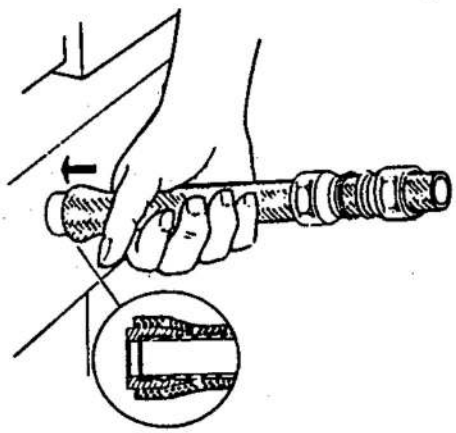


Fig. 4 Bottoming the sleeve

5.5 Size the tube to the sleeve by pushing the hose onto the nipple until the sleeve bottoms against the nipple chamfer. Remove and ensure that the sleeve is properly positioned.

5.6 Lubricate the nipple on both the threaded and chamfer areas shown in Fig. 5 with Fluolube grade LG 160.

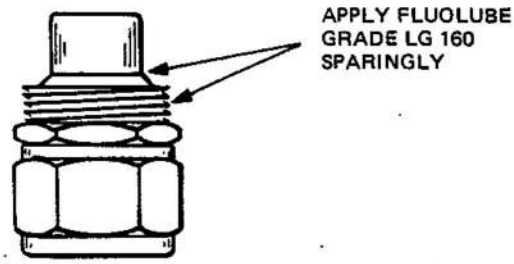


Fig. 5 Lubrication

WARNING...

ONLY FLUOLUBE LG 160 IS TO BE USED ON HOSES WITH A WORKING PRESSURE BELOW 138 BAR (2000 LBF/IN^2). NO LUBRICANT OF ANY TYPE IS TO BE USED ON HOSES WITH A WORKING PRESSURE ABOVE 138 BAR (2000 LBF/IN^2).

5.7 With the nipple held in a vice push the hose onto the nipple until the sleeve is bottomed against the nipple chamfer. Slide the sockets forward and thread onto the nipple by hand. Remove the assembly, place the socket in the vice and, as shown in Fig. 6, use a wrench on the nipple hexagon to tighten the nipple to a nominal gap of 0.8 mm (0.031 in.) as shown in Fig. 7.

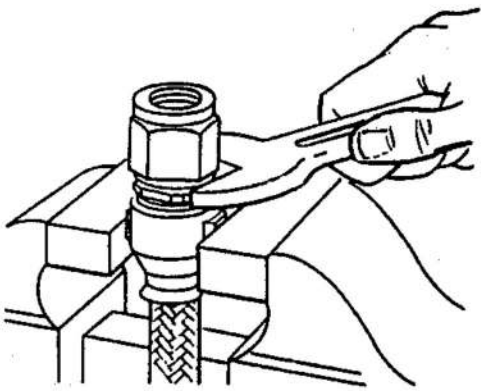


Fig. 6 Tightening up the nipple

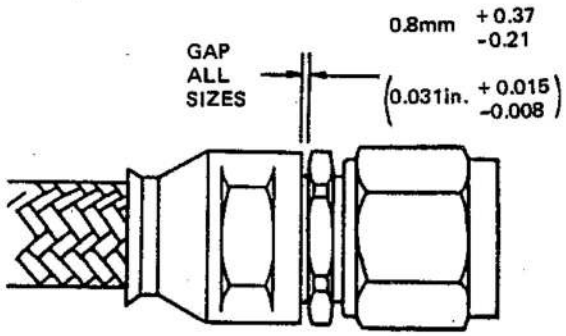


Fig. 7 Nipple gap

Cleaning

6 Hoses should be cleaned both before and after testing in accordance with Chapter 4-2 of this publication and AP 107D-0001-1 Chapter 4.

Testing

7 Pressure test all hoses after assembly with dry nitrogen to the proof pressure recommended by the hose manufacturer. Hoses are to be immersed in a water bath during test and covered with a guard. Once pressurised, the hose assembly should be allowed to stabilise for five minutes, after which no leaks are acceptable. For test procedure refer to Chapter 3-8 of this publication.

WARNING...

ASSEMBLIES UNDER TEST MAY BURST, ESPECIALLY AT MEDIUM AND HIGH PRESSURE, AND MUST BE GUARDED SO THAT THERE IS NO HAZARD TO THE OPERATOR.

Purging and bagging

8 After testing, clean the hose again in accordance with AP 107D-0001-1 Chapter 4, then purge with dry nitrogen for at least 3 minutes. Fit clean blanking caps to each end of the hose, label and seal in a clean polythene bag.

WARNING...

DO NOT USE ANY TYPE OF BLANKING PLUG OR CAP WHICH CAN FRAGMENT AS PARTICLES COULD PASS INTO THE BORE OF THE HOSE ASSEMBLY.

Chapter 4-O

LOW PRESSURE HOSES OF UK ORIGIN

CONTENTS

Introduction

1 The following sub-chapters describe the main types of low pressure hoses with re-useable end fittings, which are of UK origin. The end fittings are normally AGS types for which simple assembly tools are used. Replacement hoses can be made up by Service personnel. The use of low pressure hoses is normally confined to aircraft fuel, oil and pneumatic systems.

Note ...

The pressure categories of hoses are given in Chap 1-O, para 5.

2 The specific type of hose to be used in a particular aircraft is indicated in the relevant aircraft servicing manual. Where the substitute of existing metal tubing by hoses is authorized, instruction is given in the topic 2 leaflet of the relevant aircraft air publication.

3 Different types of hose are designed for specific purposes; the lining is impervious to the liquid which the hose is intended to carry. Hose must also be capable of withstanding internal pressure and heat in accordance with the relevant specification.

4 Hose construction varies according to whether it is intended for use foward or to the rear of the fireproof bulkhead. Hose used forward of the fireproof bulkhead has an outer covering of fireproof material; hose for use to the rear of the bulkhead is, usually, non fire-resisting. The main reason for not using fire-resisting hose throughout is that the increased weight factor would not justify the possible advantages.

5 When any type of hose is supplied in a defined length with end fittings attached it is known as a 'hose assembly'. Material held in bulk without end fittings is termed 'hose'. Hose assemblies facilitate replacement but, in certain circumstances, it may be necessary to make up hose assemblies to specified lengths, locally. Hose and end fittings must then be obtained from bulk supply and the assembly made up by Service personnel.

Service life of hose

▶ 6 Provided the instructions in Chap 3-9 have been complied with, hose held ◀ in Stores is not generally subject to any life limitation. This also applies to hose assemblies installed in stored aircraft, where the hose is in its normal position with no open ends. Special instructions may, however, be issued to cover specific types of hose and hose assemblies.

Markings on hose

7 The date of manufacture is indicated in various ways according to the type or construction of the hose. The date is either printed on the exterior ▶ surface or stamped on a metal tab secured to the hose. (Chap 1-0, para 22 and 23). ◀

8 In some instances the maximum working pressure is also indicated on the exterior of the hose; the test pressure is generally taken to be one-and-a-half times that of the maximum working pressure.

9 Hose assemblies bear an additional marking which denotes the maker's drawing number for that particular item. This number may be incorporated on the tab bearing the date stamp, printed on the hose or on adhesive tape affixed to the hose. Stores demands for new assemblies must quote this number.

10 Some hoses have a continuous white or coloured marking along their length, which in addition to being an identification marking, serves to indicate that the hose is not twisted during installation.

▶ CAUTION ...

Hose which has taken a permanent set due to high temperature conditions or other cause, must not be straightened but renewed. The renewal is to be in accordance with any location instructions (Chap 3-2, para 2).

Installation of hose assemblies

11 A hose assembly is defined as being of a specific length (fig 1) measured over the end fittings and designed for a specific part of a pipeline system, and as such it will have a unique part number (Chap 1, para 3).

12 Hose assemblies made by local manufacture must be of the same effective length as those they replace.

Installation data ◀

13 When hose assemblies are to be renewed, the layout of the particular system must be studied and followed, and the hose protected and supported as detailed in the approved drawing for the type of aircraft. If a layout drawing is not available, the assembly must follow the same run and be supported in the same manner as the hose that has been removed.

▶ 14 The minimum bend radius for the size of hose, and relating to either 'flexing' or 'vibrating' positions in the system, must not be less than that given in the appropriate installation data table. The precautions to be taken when installing a hose assembly are detailed in Chap 3-10.

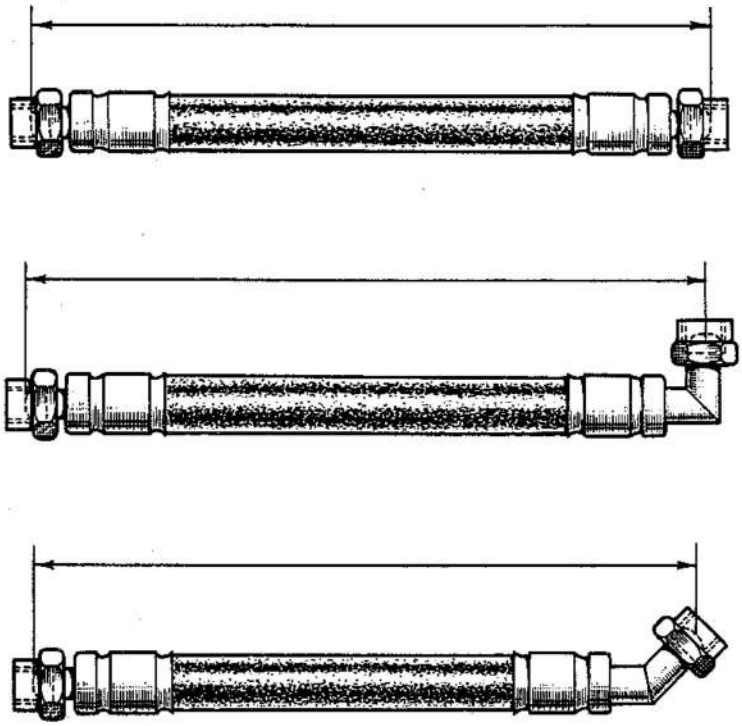


Fig 1 Effective lengths of hose assemblies

► Testing

15 All hoses must be tested before installation as detailed in Chap 3-8. Reference should be made to the engine/aircraft manual to check for any special requirements, and to the appropriate sub-chapter for working and test pressures. The test pressure is normally, working pressure x 1.5. ◄

Chapter 4-1

FLYLITE No 4 HOSE

CONTENTS

Description (fig 1)

1 Flylite No 4 hose is a non-fireproof type, suitable for use in fuel and oil systems aft of the fireproof bulkhead. The hose is designed to withstand a maximum internal pressure of 3.48 bar (50 lbf/in²).

2 This hose is spirally grooved externally. The bore is smooth. The hose is reinforced with fabric around which is wound a spiral thread made of regenerated cellulose which is embedded in the synthetic rubber to give additional resistance to external pressures. The use of non-metallic reinforcement avoids the necessity for electrical bonding.

Installation data

3 Installation data for Flylite No 4 hose, AGS (Flylink) end fittings and assembly tool Ref No is given in Table 1.

Identification

4 This hose is easily identified since it is spirally grooved externally and has a smooth bore.

End fittings

5 This hose is normally fitted with AGS (Flylink) anodised aluminium fittings consisting of a ferrule, union nut and nipple. The ends can be fitted to, and if necessary removed by Service personnel using a tool (fig 2) and a standard spanner.

6 Flylite No 4 hose may be used as a direct replacement for Lockheed Avery Type 11 or Flexatex hose, making use of the original AGS fittings.

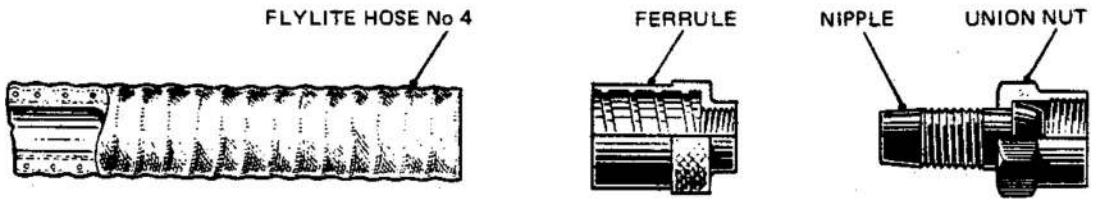


Fig 1 Flylite No 4 hose and AGS (Flylink) end fitting

Attachment of end fittings

7 The attachment of AGS (Flylink) end fittings is carried out by using the end fitting assembly tool (fig 2). The procedure is as follows:

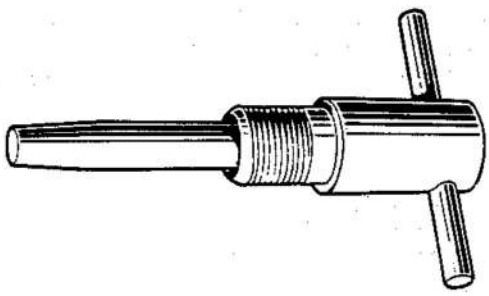


Fig 2 AGS (Flylink) end fitting assembly tool

8.1 Select the size of assembly tool and end fittings to suit the bore of the hose, from Table 1.

8.2 Cut the end of the hose, at right-angles to its centre line, with a sharp knife lubricated with water.

8.3 Apply lubricating oil to the outer surface of the hose to the depth of the ferrule and to the inner surface of the ferrule.

8.4 Screw the ferrule on to the end of the hose with a left-hand thread action (fig 3A) until the end of the hose butts against the inner shoulder of the ferrule.

8.5 Apply lubricating oil to the bore of the hose to a distance equal to the length of the nipple, and also to the thread in the neck of the ferrule.

8.6 Slide the nipple on to the tool (fig 3B) followed up by the nut (fig 3C) and screw the nut up tightly.

8.7 Grip the knurled portion of the ferrule firmly and insert the tool in the bore of the hose, as far as it will go, with gentle pressure. Engage the thread of the nipple with that of the ferrule, and screw home tightly (fig 3D).

Note ...

The risk of a cross-thread will be minimised if, before the thread is engaged, the nipple is turned counter-clockwise until a faint click is felt.

8.8 Unlock the tool by slackening the union nut and unscrew the tool out of the tube (fig 3E).

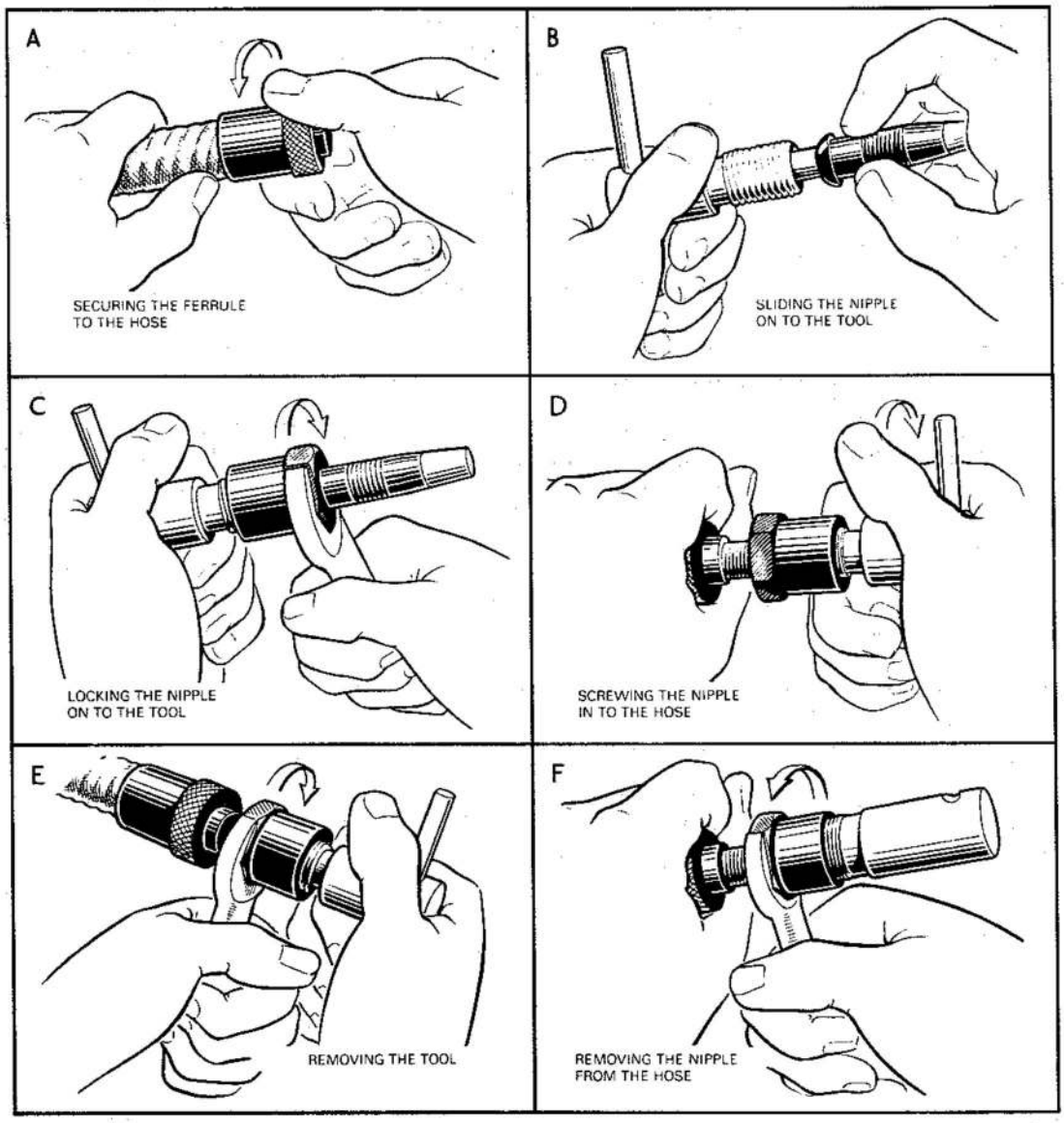


Fig 3 Attachment and removal of AGS (Flylink) end fitting

Precautions

9 It is essential that lubricating oil is applied as specified in the previous paragraph, otherwise difficulty will be experienced in the removal of the end fitting.

10 If a vice is used to grip the knurled portion of the ferrule, only moderate pressure must be applied and fibre, wood or similar material must be used as vice clamps.

Use of standard AGS end fittings

11 When Flylite No 4 hose is used as a direct replacement for Lockheed Avery Type 11 or Flexatex hose already installed with AGS clips, it may be used with the standard AGS end fittings and AGS 605 hose clips. The hose must be a good push fit over the end of the fitting. A split ring of aluminium alloy of suitable gauge must be placed over the corrugated surface of the hose to form a foundation for the clip. The gap in the split ring must be wide enough to prevent the ends from meeting when the clip is tightened.

Note ..

The procedure for attaching AGS end fittings is given in Chap 4-2.

Removal of end fittings

12 To remove an end fitting proceed as follows:

12.1 Insert the tool into the end fitting and bore of the hose and screw tightly into the union nut.

12.2 Grip the ferrule firmly (in a vice if necessary) and unscrew the tool and union nut with a spanner on the nut (fig 3F). This will remove the nipple from the hose and free the nut.

Note ...

Do not attempt to turn the tool and union nut by the tommy bar in the tool.

12.3 Unscrew the ferrule from the hose with a left-hand thread action.

Pipe testing

► 13 After local manufacture of pipelines they must be tested in accordance with Chap 3-8. Special reference must be made to the limitations of Para 1.◄

TABLE 1 INSTALLATION DATA FOR FLYLITE NO 4 HOSE AND AGS (FLYLINK) END FITTINGS

Bore diameter		System	Maximum working pressure		Minimum bend radius (in to centre line of hose)				End fitting AGS No			Assembly tool Stores Ref
					Flexing		Vibrating		Union	Tail piece	Ferrule	
in	mm		lbf/in²	bar	in	mm	in	mm				
1/4	6	Fuel	50	3.48	5	127	2½	64	1231B	1232B	1233B	1C/6185 No 1
3/8	10	Fuel	50	3.48	5½	140	2¾	70	1231C	1232C	1233C	1C/6186 No 2
1/2	12	Fuel	50	3.48	6	152	3	76	1231D	1232D	1233D	1C/6187 No 3
5/8	16	Fuel	50	3.48	6½	165	3¼	83	1231E	1232E	1233E	1C/6188 No 4
3/4	20	Fuel	50	3.48	7	178	3½	89	1231F	1232F	1233F	1C/6189 No 5
1	25	Fuel	50	3.48	8	203	4	102	1231H	1232H	1233H	1C/6190 No 6
1	32	Fuel	50	3.48	10	254	5	127	1231J	1232J	1233J	1C/6191 No 7
1½	40	Fuel	50	3.48	12	305	6	152	1231K	1232K	1233K	1C/6192 No 8
2	50	Fuel	50	3.48	16	406	8	203	1231M	1232M	1233M	1C/6193 No 9

Chapter 4-2

AVERY (LOCKHEED) No 11 HOSE

CONTENTS

Description

1 Avery Type 11 hose is a non-fire resistant hose suitable for use to the rear of the fireproof bulkhead and is designed to withstand a maximum internal pressure of 3.48 bar (50 lbf/in²).

2 The hose is of synthetic rubber with successive plies of braided cotton. The 12 mm (½ in) to 32 mm (1¼ in) sizes have three plies and the 40 mm (1½ in) bore hose has four plies of cotton braid. The hose is tropicalised.

Alternatives

3 If the Type 11 hose is not available Flylite No 4 hose (Chap 4-1) or Superflexit VP hose (Chap 4-3), may be used in its place.

Installation data

4 Installation data for Avery (Lockheed) Type 11 hose is given in Table 1.

Identification

5 The Avery Type 11 is fitted with bands of Lassolatic tape marked AVA 342 LP fuel - NOT FIRE RESISTING.

Attachment of end fittings

6 Standard AGS end fittings must be used with Avery Type 11 hose and assemblies can be made up as required by Service personnel, using standard AGS end fittings and AGS 605 hose clips.

Notes ...

(1) The maximum length supplied is 4.27 m (14 ft).

(2) The method of attaching end connections shown in Chap 4-4 fig 3, for Flexatex Type C6 is applicable to Avery Type 11 hose.

7 The procedure to be used for attaching end fittings is as follows:

7.1 Cut the hose squarely to the length required with a sharp knife lubricated with water. No other tool must be used for this purpose.

7.2 Thread the union nut on to the nipple portion of the assembly, thenscrew the nut on to an adapter so that the union nut and nipple are held securely.

7.3 Grip the adapter lightly in a vice. Ensure that the end of the nipple shank is radiused to not less than 0.5 mm (0.02 in) and remove any burrs that may be on the shank.

7.4 Clean the surface on the nipple shank and the end of the hose bore. Engage the hose on to the shank and with a slight rotary motion, force the hose on the shank until the shoulder of the shank lightly compresses the end of the hose. When an unshouldered connection is used, the hose insert length must be as specified in Chap 4-4 fig 3. Lubricating oil smeared on the shank will facilitate the fitting operation.

7.5 Secure the hose in position with an AGS 605 hose clip having previously fitted a wrapping of tape (Ref No 5F/454 or similar) around the hose under the clip. The position at which the clip must be fitted is shown in Chap 4-4 fig 1. Care must be taken not to over-tighten the clip.

Pipe testing

► 8 After local manufacture of pipelines they must be tested in accordance with Chap 3-8. Special reference mest be made to the limitations of para 1. ◄

TABLE 1 INSTALLATION DATA FOR AVERY TYPE 11 HOSE

Diameters				System	Maximum working pressure		Forward or rear of fireproof bulkhead	Minimum bend radius (in to centre line of hose)			
Bore		Outside						Flexing		Vibrating	
in	mm	in	mm		lbf/in²	bar		in	mm	in	mm
1/4	6	0.53	13.46	Fuel	75	5.17	Rear	5	127	2½	63.5
3/8	10	0.71	18.03	Fuel	75	5.17	Rear	5½	140	2¾	70
1/2	12	0.99	25.15	Fuel	75	5.17	Rear	7	178	3½	90
5/8	16	1.13	28.70	Fuel	75	5.17	Rear	8	203	4	102
3/4	20	1.28	32.51	Fuel	75	5.17	Rear	9	229	4½	114
7/16	22	1.38	35.05	Fuel	75	5.17	Rear	11½	292	5¾	146
1	25	1.54	39.12	Fuel	75	5.17	Rear	13½	343	6¾	172
1¼	32	1.77	44.96	Fuel	75	5.17	Rear	16	406	8	203
1½	40	2.09	53.08	Fuel	75	5.17	Rear	25	635	12½	318

Chapter 4-3

SUPERFLEXIT TYPES VP, VM AND FIREPROOF HOSES

CONTENTS

Description

1 These three types of hose use the same types of end fitting and are of basically the same construction. The hoses are supplied in bulk lengths and assemblies can be made up by Service personnel. The hoses are for use in aircraft fuel or oil systems. Types VP and VM are for use aft of the fireproof bulkhead, but the Fireproof type may be used forward of the fireproof bulkhead. They will withstand a maximum working pressure of 6.9 bar (100 lbf/in²) and a maximum temperature of 100°C. Type VP and VM hoses are supplied coloured either red or black so that a distinction can be made between the hose used in oil systems (red) and fuel systems (black).

Alternative types

2 Should type VP hose not be available, Flylite No 4 hose described in Chap 4-1 can be used as a substitute provided the system pressure is not more than 3.48 bar (50 lbf/in²).

Installation data

3 Installation data for Superflexit Type VM, VP and Fireproof hoses is given in Table 1.

Note ...

Metal braided hose should not be used where flexing may also incur twisting, as the braid resists any twisting action which, if continually applied, would ultimately fracture the braid.

CONSTRUCTION OF SUPERFLEXIT HOSES

Superflexit Type VP hose (fig 1A)

4 This hose comprises a helix of tinned copper wire covered with a longitudinal wrapping of specially treated thin cellulose sheet, two layers of calico, and a layer of thin synthetic rubber sheet. An external covering of oil-dressed canvas (red or black) is wrapped on, followed by a bonding wire wound in a spiral of wide pitch. Lastly, an external reinforcing wire is wound over the canvas covering and bonding wire. Type VP is the manufacturer's code marking. The letter 'V' denotes 'aircraft', and the letter 'P' denotes 'Paulin', which is a closely woven canvas used as an outer covering for the hose.

Superflexit Type VM hose (fig 1B)

5 Superflexit Type VM hose is similar to Type VP except that instead of an outer covering of oil-dressed canvas and a spirally wound outer reinforcing wire, a further layer of aero fabric is wrapped over the layer of synthetic rubber. On this is wound a strand of soft string. Lastly, an outer covering of fine tinned copper wire is braided over the fabric to give the hose extra strength and protection. The code letters VM denote 'aircraft - metal braided'. The metal braiding makes this type of hose especially useful for installation in congested areas where contact with other components is possible.

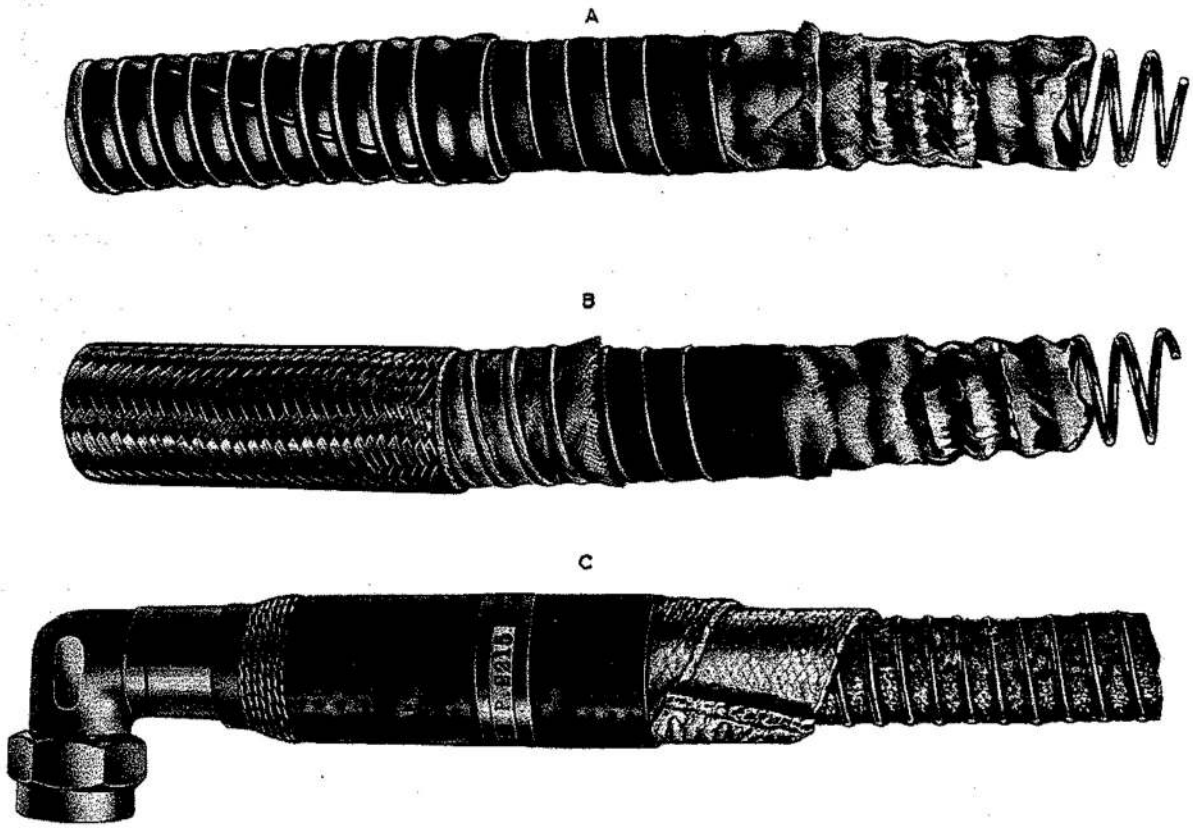


Fig 1 Superflexit hoses

Superflexit Fireproof hose (fig 1C)

6 Superflexit fireproof hose, sometimes referred to as 'lagged' Superflexit, is similar in construction to Type VP hose except that over the outer helix of reinforcing wire there are two separate coverings of 25 mm (1in) wide asbestos tape, the top tape covering the butt joints of the under wrapping. The ends of the tape are bound with varnished asbestos string. The external covering is a maroon-coloured seamless PVC sheathing which provides a smooth glossy fireproof finish.

Identification

7 All asseemblies of hose and end fittings have bands of Lassolastic tape showing month and year of issue, together with part number. The types of hose can be identified by their external appearance (fig 1) and other features as follows:

7.1 VP hose, coloured red or black, with external wire helix.

7.2 VM hose is braided with fine tinned copper wire.

7.3 Fireproof hose has a maroon coloured external sheath of seamless PVC which is smooth and glossy.

End fittings

8 AGS unions are used with Superflexit hose. These can either be Series 808 (brass) or Series 770 (light-alloy) according to the requirements of the system.

Attachment of end fittings

9 The sequence of operations for the attachment of end fitting is as follows:

9.1 Measure the length of hose required, making an allowance for the length of the body of the union.

9.2 Cut through the outer reinforcing wire with wire cutters.

9.3 Cut the hose squarely with a sharp knife lubricated with water.

9.4 Bend the hose and cut the inner reinforcing wire with wire cutters.

9.5 Cut both the inner and outer wires back a quarter of a turn.

9.6 Trim the ragged ends of the hose with scissors.

9.7 Screw the union nut on to an adapter so that the nipple is held rigidly, then grip the adapter in a vice.

9.8 Fit the sleeve, supplied with the AGS union, on to the end of the hose. Make sure that the hose butts against the sleeve shoulder.

9.9 Screw the hose end on to the body of the union 1½ turns, making sure that the inner reinforcing wire engages in the body spiral groove.

9.10 Coat the exposed portion of the union body with engine jointing compound (Ref No 33C/523). No compound must enter the bore of the hose that extends beyond the end of the union body.

9.11 Grip the hose by hand and screw the hose on to the union body as far as possible. Then wrap a leather strap spanner, similar to that illustrated in fig 2, around the sleeve and hose and screw the hose in a clockwise direction until the sleeve butts against the shoulder of the union. It is important that the sleeve on the hose remains in close contact with the end of the hose while the hose is being rotated on to the body of the union.

9.12 When the end of the tube and the sleeve have reached the shoulder of the union, about one turn more must be given to ensure tight contact with the union. The amount of this last turn can be judged by experience, but it is better to under-turn the hose than the reverse.

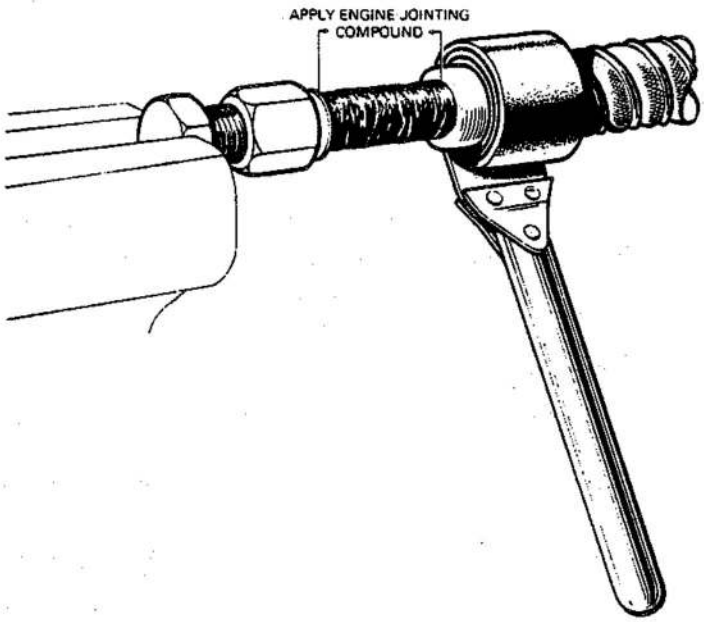


Fig 2 Screwing hose on to a nipple

TABLE 1 INSTALLATION DATA FOR SUPERFLEXIT VP, VM AND FIREPROOF HOSES

Diameter				System	Maximum working pressure		Forward or rear of fireproof bulkhead	Minimum bend radius (in to centre line of hose)			
bore		outside						Flexing		Vibrating	
in	mm	in	mm		lbf/in²	bar		in	mm	in	mm
1/8	3	0.48	12.2	Fuel and oil	100	6.9	Rear	2	50	1	25
1/4	6	0.62	15.8	Fuel and oil	100	6.9	Rear	$2\frac{3}{4}$	70	$1\frac{3}{8}$	35
3/8	10	0.78	19.8	Fuel and oil	100	6.9	Rear	4	102	2	50
1/2	12	0.90	22.9	Fuel and oil	100	6.9	Rear	$4\frac{1}{4}$	108	$2\frac{1}{8}$	54
5/8	16	1.02	25.9	Fuel and oil	100	6.9	Rear	$4\frac{3}{4}$	121	2	60
3/4	20	1.14	28.9	Fuel and oil	100	6.9	Rear	$5\frac{1}{2}$	140	$2\frac{3}{4}$	70
7/8	22	1.33	33.8	Fuel and oil	100	6.9	Rear	$6\frac{1}{4}$	159	3	79
1	25	1.41	35.8	Fuel and oil	100	6.9	Rear	$7\frac{1}{4}$	184	$3\frac{5}{8}$	92
$1\frac{1}{4}$	32	1.81	46.0	Fuel and oil	100	6.9	Rear	$10\frac{1}{4}$	260	5	130
$1\frac{1}{2}$	38	1.92	48.8	Fuel and oil	100	6.9	Rear	11	279	$5\frac{1}{2}$	140

Note ...

Superflexit Fireproof hose can be used forward of the fireproof bulkhead.

Chapter 4-4

FLEXATEX TYPE C6 HOSE

CONTENTS

Description

1 Flexatex C6 hose is used in aircraft systems to the rear of the fireproof bulkhead. It is designed to withstand a maximum working pressure of 2.07 bar (30 lbf/in²) at ambient temperatures up to 85°C, and may be installed on either the pressure or the suction side of the fuel pump.

Alternative types

2 If Flexatex C6 hose is not available, Flylite No 4, or Superflexit VP hose may be used in its place.

Installation data

3 Installation data for Flexatex C6 hose is given in Table 1.

Installation notes

4 The hose is supplied in various lengths, up to 4.4 m (14 ft 6 in) for the larger bore sizes, and in 2.9 m (9 ft 6 in) lengths for the 6.35 and 8 mm ($\frac{1}{4}$in and $\frac{5}{16}$in) sizes. Lengths of the hose are joined by standard AGS end connections but in emergency rigid metal pipes may be connected with short lengths of Flexatex C6 hose provided the ends of the pipes are radiused.

Note ...

The installation precautions given in Chap 4-0 are to be adhered to.

Construction

5 The construction of the hose varies according to its bore size, and fig 1 illustrates the construction for bore size upwards of 11 mm ($\frac{7}{16}$ in). The inner layer of hose is an extended tube of polyvinylchloride around which is wound a strand of regenerated cellulose monofilament and a 113 gm (4 oz) fabric. A strand of string is wound over the fabric in the space between the turns of the monofilament. The outer layer is a thinner extruded tube of polyvinylchloride. The exterior surface has a helical groove.

6 The construction of the smaller sizes 6.35 to 9.52 mm ($\frac{1}{4}$ to $\frac{3}{8}$ in) is illustrated in fig 2. The hose consists of a thick extruded tube of polyvinylchloride corrugated to allow bending without kinking.

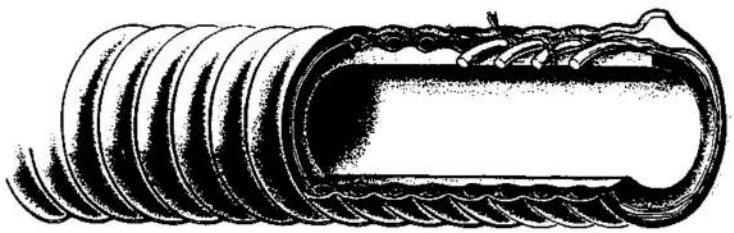


Fig 1 Flexatex C6 hose, 11.1 to 38.1 mm ($\frac{7}{16}$ to $1\frac{1}{2}$ in) bore sizes

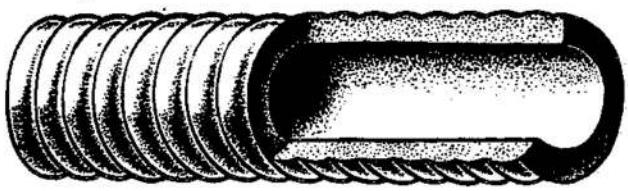


Fig 2 Flexatex C6 hose, 6.35 to 9.52 mm ($\frac{1}{4}$ to $\frac{3}{8}$ in) bore sizes

Identification

7 Type C6 hose can be identified by its maroon colour and by figures indicating the month and year of manufacture followed by the continuous marking FLEXATEX C6.

End fittings

8 Only AGS end fittings may be used with Flexatex C6 hose (fig 3). The AGS series numbers to suit the various sizes of this hose are tabulated in Table 1.

Attachment of end fittings

Note ...

To obviate the effects of hose shrinkage due to temperature changes and the action of fuel on the hose material, an allowance of 5 per cent over the length of the hose between its two end connections must always be added to the actual required length when making hose replacements. This will prevent tensioning of the hose and any tendency to pull away from the end connections due to shrinkage.

9 The sequence of operations for attaching the end fittings to the hose is as follows:

9.1 Measure the length of hose required, plus 5 per cent allowance for shrinkage. Cut the hose straight across with a sharp knife lubricated with water. No other tool is to be used for this purpose.

9.2 Thread the union nut on to the nipple and screw the union nut on to an adapter so as to hold the nut and nipple firmly in position.

9.3 Grip the adapter lightly in a vice. Ensure that the shank of the nipple is radiused to not less than 0.5 mm (0.02 in) and remove any burrs that may be on the shank.

9.4 Clean the shank of the nipple portion and the end of the hose bore. Engage the hose bore on to about 6 mm ($\frac{1}{4}$ in) of the shank.

9.5 Smear the exposed portion of the shank with Linatex No 4 Cement (Ref No 33C/302). It is essential that the entering end of the shank be left uncemented so that no trace of the cement can enter the free portion of the hose bore.

9.6 Immediately force the hose on to the shank with a rotary movement until the shoulder of the shank lightly compresses the end of the hose or, where an unshouldered connection is used, to the length specified in fig 3 in conjunction with Table 2.

9.7 Secure the hose in position with an AGS 605 hose clip, having previously fitted a wrapping of tape (Ref No 5F/454 or similar) around the hose under the clip. The position at which the clip is to be fitted is shown in fig 3. Care must be taken not to overtighten the clip, as otherwise the hose material will tend to 'flow' from under the clip. The hose may be installed not less than five minutes after the joint has been made.

TABLE 1 INSTALLATION DATA FOR FLEXATEX C6 HOSE AND AGS END FITTINGS

Diameter				End fitting used (complete)				Minimum bend radius to centre line of hose			
bore		outside						Flexing		Vibrating	
in	mm	in	mm	AGS 1163/	AGS 1165/	AGS 1166/	AGS 1172/	in	mm	in	mm
1/4	6	0.65	16.5	B	B	B	B	2.6	66	1.3	33
5/16	8	0.713	18.1	-	BB	BB	BB	3.2	81.3	1.6	40.6
3/8	10	0.775	19.7	C	C	C	C	3.8	96.5	1.9	45.3
7/16	11	0.938	23.8	-	CC	CC	CC	4.4	111.7	2.2	56
1/2	12	1.0	25.4	D	D	D	D	5	127	2.5	63.5
5/8	16	1.125	28.6	E	E	E	E	6	152	3	76.2
3/4	20	1.25	31.7	F	F	F	F	7.2	183	3.6	91.5
7/8	22	1.375	34.9	G	G	G	G	8.2	208	4.1	104
1	25	1.5	38.1	H	H	H	H	9.4	239	4.7	119
$1\frac{1}{8}$	28	1.625	41.3	-	-	-	-	12.8	325	6.4	163
$1\frac{1}{4}$	32	1.75	44.5	J	J	J	J	14	356	7	178
$1\frac{1}{2}$	38	2.0	50.8	K	K	K	K	20	508	10	254

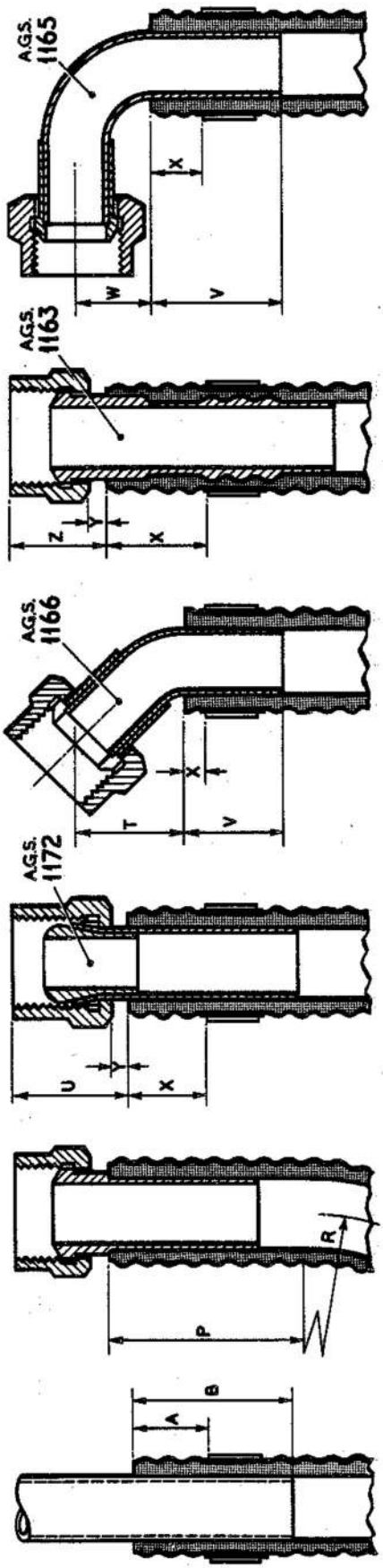


Fig 3 AGS end fittings for Flexatex C6 and other hoses

TABLE 2 DIMENSIONS OF AGS END FITTINGS

AGS end fitting size		P		T		U		V		W		X		Y		Z		A		B	
in	letter	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/4	B	2	50.8	0.406	10.3	0.797	20.2	1.25	31.8	0.25	6.3	0.812	20.6	0.15	3.8	0.44	11.2	0.37	9.4	1	25.4
5/16	BB	2	50.8	0.562	14.3	0.797	20.2	1.5	38.1	0.406	10.3	0.812	20.6	0.15	3.8	–	–	–	–	–	–
3/8	C	2	50.8	0.718	18.2	0.812	20.6	1.75	44.5	0.406	10.3	0.812	20.6	0.15	3.8	0.484	12.3	0.37	9.4	1	25.4
7/16	CC	2	50.8	0.812	20.6	0.828	21.0	1.75	44.5	0.531	13.5	0.812	20.6	0.15	3.8	–	–	–	–	–	–
1/2	D	2	57.1	1.032	26.2	0.844	21.4	1.75	44.5	0.656	16.7	0.812	20.6	0.15	3.8	0.531	13.5	0.5	12.7	1	31.7
5/8	E	2	57.1	1.125	28.6	0.937	23.8	1.75	44.5	0.656	16.7	0.812	20.6	0.20	5.1	0.609	15.5	0.5	12.7	1	31.7
3/4	F	2	57.1	1.25	31.8	0.953	24.2	1.75	44.5	0.656	16.7	0.812	20.6	0.20	5.1	0.625	15.9	0.62	15.9	1	38.1
7/8	G	2½	63.5	1.875	47.6	0.968	24.6	1.75	44.5	1.25	31.8	0.812	20.6	0.20	5.1	0.625	15.9	0.62	15.9	1	38.1
1	H	2½	63.5	2.0	50.8	1.032	26.2	1.75	44.5	1.25	31.8	0.812	20.6	0.25	6.4	0.75	19.0	0.62	15.9	1	38.1
1 1/8	–	–	–	–	–	–	–	–	–	–	–	1.0	25.4	–	–	–	–	–	–	–	–
1 1/4	J	3	76.2	2.25	57.1	1.094	27.8	2.0	50.8	1.25	31.8	1.09	27.7	0.25	6.4	0.812	20.6	0.75	19.0	2	50.8
1 1/2	K	3	76.2	2.375	60.3	1.156	29.4	2.0	50.8	1.5	38.1	1.25	31.8	0.25	6.4	0.812	20.6	0.75	19.0	2	50.8

Note ...

This table is to be read in conjunction with Table 1.

Chapter 4-5

AVIOFLEXUS HOSE

CONTENTS

Description

1 Avioflexus is a non-fireproof hose, suitable for use in pneumatic and oil systems to the rear of the fireproof bulkhead. The hose is designed to withstand internal pressures of 6.90 bar (100 lbf/in²) in the largest size, up to 18.96 bar (275 lbf/in²) for the 4.7 mm ($\frac{3}{16}$ in) size hose. The hose will withstand temperatures up to 140°C.

2 The hose consists of a flexible metal tube covered by layers of thin cellulose material; a helical winding of string presses the cellulose covering on to the metallic tube. This is followed by a covering of synthetic rubber, and the outer covering comprises a fine metal wire braiding. Some of the larger diameter hose sizes are reinforced with a cotton braiding underneath the outer metallic braid covering (fig 1).

Fig 1 Avioflexus hose construction

Alternative types

3 If Avioflexus hose is not available for replacement purposes, Flylite No 4 hose (Chap 4-1) or Superflexit VP hose may be used instead.

CAUTION ...

Check system pressure before choosing an alternative hose.

Installation data

4 Installation data for Avioflexus hose is given in Table 1.

Note ...

This hose can be damaged by twisting. When screwing up or unscrewing the union nuts of the end fittings, it is most important to prevent the hose from turning with the union nut. The union nut must be held firm with a spanner whilst the adapter is loosened or tightened with another spanner.

Identification

5 This hose carries no unique identification marking but the flexible metal inner tube is easily visible. A metal band marked with Manufacturers name, part number and date of manufacture is fitted to hose assemblies supplied as a component.

TABLE 1 INSTALLATION DATA FOR AVIOFLEXUS HOSE

Bore		System	Maximum working pressure		Forward or rear of fireproof bulkhead	Minimum bend radius (to centre line of hose)			
						Flexing		Vibrating	
in	mm		lbf/in²	bar		in	mm	in	mm
3/16	4.7	Oil and pneumatic	275	18.96	Rear	5	127	2	64
1/4	6		250	17.24	Rear	6	152	3	76
5/16	8		220	15.17	Rear	7½	191	3¾	95
3/8	10		200	13.79	Rear	8	203	4	102
1/2	12		175	12.07	Rear	10½	267	5¼	133
5/8	16		160	11.03	Rear	13	330	6½	165
3/4	20		150	10.34	Rear	14	356	7	178
7/16	22		130	8.94	Rear	14½	368	7¼	184
1	25		125	8.62	Rear	16	406	8	203
1¼	32		110	7.58	Rear	18	457	9	229
1½	38		100	6.90	Rear	20	508	10	254

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Chapter 5

HOSE CLIPS AND JOINTS

CONTENTS

ILLUSTRATIONS

Introduction

1 This chapter describes the standard hose clips which are used when joining the ends of two metal pipes with a length of rubber hose and gives detailed instructions for making a flexible joint. This type of flexible joint is only used to the rear of the fireproof bulkhead or outside the power unit envelope firewall. Normally the joint is made by assembling a suitable length of hose over the beaded ends of metal pipes and compressing the ends of the hose with adjustable clips. Stores Reference Numbers (Section 28E) for various types and sizes of clip are to be found in AP 1086.

AGS 605 and 1000, TYPE J

Description

2 The AGS 605 hose clip (fig 1) is similar to and interchangeable with AGS 1000. It is standard for use with all pipes except light-gauge low-pressure pipes, and is available in a range of sizes to fit pipes of 12.7 to 127 mm (0.5 to 5 in) diameter.

3 The clip is of the single band type and is fitted with an adjusting screw mounted in a housing welded to one end of the head. The other end of the band has a series of evenly-spaced slots or serrations which engage with the screw thread. By turning the screw the clip can be adjusted and tightened.

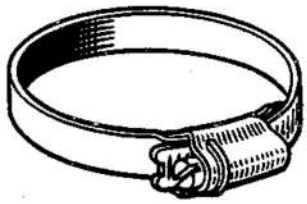


Fig 1 AGS 605, Type J hose clip

Fitting

4 The clip must be positioned on the rubber tubing before the tubing is fitted over the pipe ends. The clip must then be screwed up tightly, taking care not to strip the screw thread or to damage the housing or the slots in the band.

LINOLITE CC

Description

5 The Linolite CC hose clip (fig 2) is standard for use only with light-gauge, low-pressure pipes. It is not approved for use with the AGS 1100 series of Flexatex hose fittings or Avimo couplings. It is provided for pipes ranging from 9.5 to 153 mm (0.375 to 6.0 in) od and for a pipe 254 mm (10.0 in) od.

Note ...

Where Linolite CC hose clips are already fitted to other than light-gauge, low pressure pipelines and are satisfactory in service, they must continue in use until unserviceable. They must then be replaced with AGS 605, AGS 606 or AGS 1000 clips.

6 The Linolite CC clip is of the single-turn band type. The head of the band or strap is doubled back over a square flat washer and spot-welded. The holes in the strap are punched from both sides into the hole in the square washer, thus holding it in position and forming a reinforced end. A retaining link is fitted to the strap to receive the tail-end of the strap when the clip is assembled. The join in the link must always be positioned next to the hose.

7 The strap is provided with a saddle which has a fixed bridge piece and a swivelling yoke. A spigot-ended screw is fitted into the yoke. The head of the screw is provided with a screwdriver slot and the first thread is upset to prevent the screw from coming out of the yoke. The saddle is made in two sizes. The small size has a 2 BA screw and is used only for the Size 1 hose clip. The large size has a $\frac{1}{4}$ in BSW screw and is used for Sizes 2 and 3 hose clips.

Fitting

8 The clip must be assembled as follows:-

8.1 Engage the hole in the strap head with the spigot-end of the screw, which must be screwed out as far as the first thread (fig 2, sketch A).

8.2 Slip the retaining link over the free end of the strap and hold it in approximately its final position at about 280 deg from the saddle (sketch B). The join in the link must be next to the hose.

8.3 Pass the free end of the strap round the hose, through the opening in the saddle between the yoke and the fixed bridge-piece (sketch B) and pull it tight. Bend the end of the strap back over the bridge-piece. The clip must now be reasonably tight on the hose without obvious slack.

8.4 Thread the free end of the strap through the retaining link and bend it back again. Cut the end of the strap off to a convenient length (sketch C).

8.5 Tighten the clip with a screwdriver. If the head of the strap does not ride smoothly over the bridge of the saddle while the screw is turned, force the head of the screw downwards to raise the strap-head clear of the obstruction. Tighten the screw to the requisite tension.

Note ...

Hose clips that are to be fitted in difficult positions in confined spaces must be made up on a mandrel of the same outside diameter as the hose for which the clip is required.

Removal and re-fitting

9 The clip can be readily removed from the hose during dismantling operations. The screw must be slackened back to the first thread and the strap head pushed off the spigot-end of the screw (sketch D) after which the head of the screw (sketch E) must be raised and the yoke and saddle levered clear of the strap head. The clip can now be released.

10 When a built-up hose clip is being refitted, it must be positioned on the hose and the strap head forced into position between the yoke and the bridge piece. To do this, the saddle must be raised so that the spigot end of the screw can be inserted behind the strap head and the screw then used to lever the yoke over the strap head. Finally the clip must be tightened to the requisite tension.

AGS 606

Description

11 The AGS 606 hose clip (fig 3) is a light form of clip for use with small pipes of up to 25.4 mm (1 in) outside diameter where the AGS 605 or Linolite CC clip is unsuitable or unnecessarily bulky. Sizes range from 7.9 to 25.4 mm (5/16 to 1 in).

12 The clip consists of a contractile brass channelled band encircled by a tempered steel ring. The ends of the steel ring are looped to take an adjusting screw and a forked locknut.

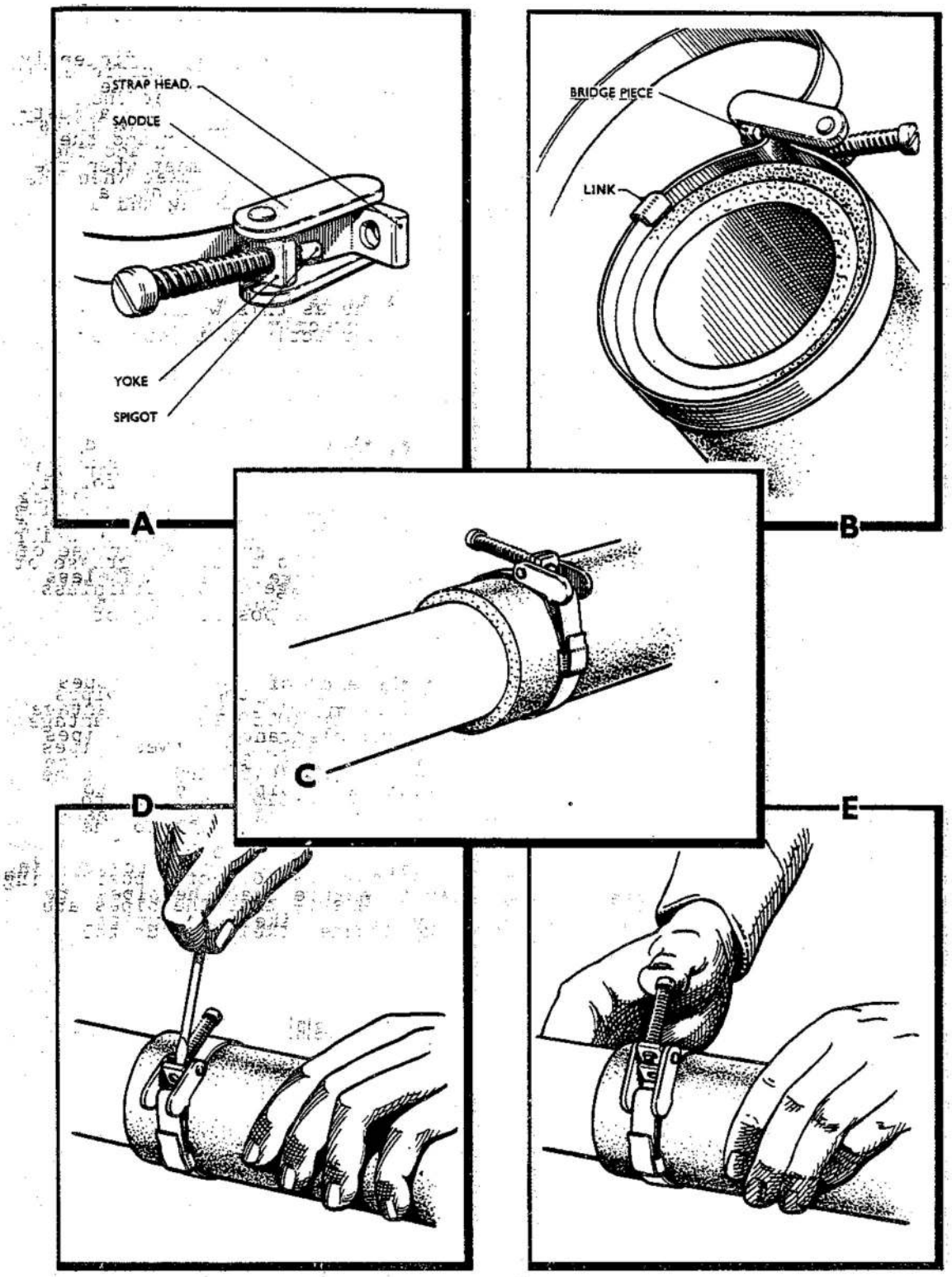


Fig 2 Fitting Linolite CC hose clip

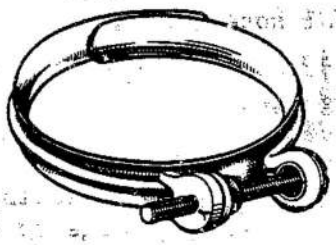


Fig 3 AGS 606 hose clip

Fitting

13 The adjusting screw must be unscrewed until the clip is opened sufficiently to slip over the rubber tubing. The tubing must then be pushed over the pipe end and the clip positioned on the end of the rubber tubing. The adjusting screw must be tightened so that the band is reduced in diameter and the rubber tubing compressed. If the looped ends of the steel ring meet when the adjusting screw is tightened, the clip is too large for the tubing and a smaller clip must be fitted.

Note ...

The clip must not be sprung over the rubber tubing as this would cause distortion. Ensure that the forked locknut is correctly positioned over the steel ring.

MAKING A JOINT

14 If new hose connections prove difficult to fit, they may be lubricated with their working medium i.e. glycol or water for coolant hoses, oil for oil hoses. Oil is not to be used on hoses for cooling system. Local over-heating will be caused if even a small quantity gets into the coolant and the interior of the hose may be damaged if it is of the Spencer Moulton type. No grease of any description is ever to be used as it provides a leakage path. Stainless steel pipes must be sandblasted at the ends to reduce the possibility of leakage.

15 Hoses must be fitted so that the gap between the ends of the metal pipes is not less than 6.35 mm (0.25 in) or more than 12.7 mm (0.50 in). Advantage may be taken of this tolerance to obtain the maximum clearance between pipes and adjacent components. A general clearance of 12.7 mm (0.50 in) should be aimed at, although smaller clearances are permissible on pipes subject to little relative movement. The main coolant pipe from the radiator to the pump on all types of engine change units is frequently found to have insufficient clearance; this can generally be overcome by correctly positioning the pipes within the hoses. Care must be taken to ensure that the pipes are in alignment and that the ends are free from any damage likely to cut the bore of the hose.

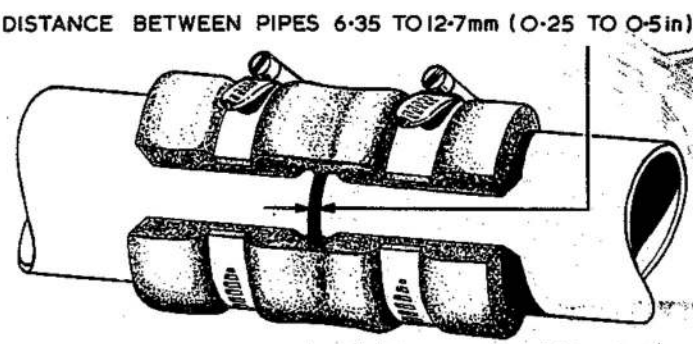


Fig 4 Typical hose joint

16 In particular, when making a joint in a cooling system with onion rubbers, it is essential that each packing piece is located so that the corrugation fits into the corresponding groove in the rubber (fig 5). If this is not done, the edge of the packing piece will bite into the rubber and severely strain it internally over the beading on the pipe end causing fracture of the rubber with consequent loss of coolant and severe damage to the engine. When correctly positioned, the packing piece overhangs the edge of the rubber; it must not be flush.

17 The clip must be placed squarely on the hose in the centre of the packing piece and tightened using a torque screwdriver with a torque of 20 lb/in for the KB type of hose (black with two yellow bars), and 25 lb/in for the Spencer Moulton type of hose (which has external cord braiding).

18 It is most important, particularly with the Spencer Moulton hose, that clips are re-tightened after the first ground run of the engine, as this causes some settling of the rubber and slackening of the clips. Excessive initial tightening, to avoid re-tightening after ground run, is useless and dangerous. The re-tightening must be done with the hose as cool as possible and any checks on hose clips must be done when they are in a cold condition i.e. below 50 deg C. This is because the rubber is less plastic when cool. With KB hoses at temperature above 70 deg C it may be impossible to apply a torque of 20 lb/in.

19 Clips fitted to Spencer Moulton hose should not require further tightening more frequently than every 200 hours. This period may be increased depending on local operating conditions.

20 Clips on synthetic rubber hoses in cooling systems require fairly frequent re-tightening when used on engine change units in extremely cold regions. However, the majority of bursts and leaking hoses are caused by two frequent re-tightening which must be avoided because even if the hose is not weakened to the extent that its bursting point is below the system's working pressure, its life will be greatly reduced.

21 On no account must screwdrivers or the like be used to remove hoses, as damage to the pipe connection will result. Hoses must be removed after being cut along their length, taking care not to damage the pipe beneath. In no circumstances must a used hose be re-fitted; it is impossible to re-marry identations in the pipe end fittings and the hose correctly.

22 Any bonding on a joint must be replaced in a tight and serviceable condition.

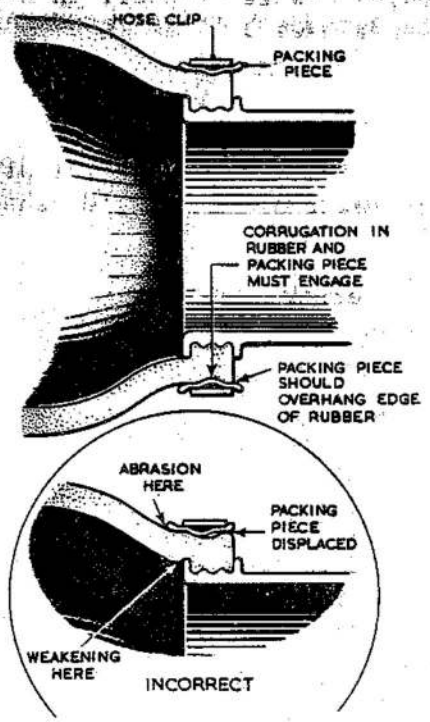


Fig 5 Fitting onion rubbers

Chapter 6

POLYTHENE TUBING

Introduction

1 Polythene tubing of 9.5mm (3/8in) inside diameter and 1.6mm (1/16in) wall is used in aircraft drainage systems, for example to drain cabin moisture.

DESCRIPTION

2 The tubing is light, flexible, easy to handle and a good thermal insulator.

Cold bends

3 A natural bow in the tube may be restrained between two attachment points with hose clips but, owing to the elasticity of the material, the tube will revert to its original position when the hose clips are removed.

Hot bends

4 A permanent bend may be formed by either of the following methods. In both instances the bore must be supported by a bending spring or other suitable device, to prevent distortion.

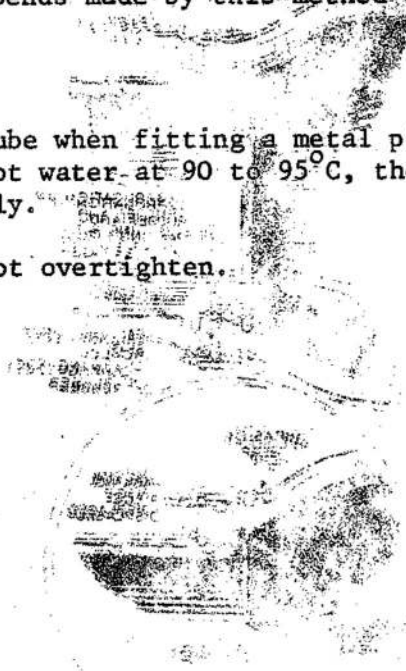
4.1 Insert the supporting device into the tube which must be immersed in boiling water, then bent to the required shape. This shape must be retained, in a jig if necessary, until the tube is cool, when the support may be withdrawn. Bends made by this method will spring back slightly and due allowance should be made.

4.2 Insert the support into the tube which must be heated in a bath of glycerine or a strong solution of calcium chloride at 105 to 108°C. Bend the tube as required, allow it to cool, in a jig if necessary, then withdraw the support. Bends made by this method are almost free from stress.

Metal junctions

5 To avoid cracking the tube when fitting a metal pipe or junction, immerse the end in clean hot water at 90 to 95°C, then fit the tube to the pipe or junction immediately.

6 Fit hose clips but do not overtighten.



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