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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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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 specifications 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. Service stock numbers are applied to the hose assembly details given in Chapter 4, and elsewhere in the text where the details in Chapter 4 will not suffice.

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* To be issued later

Chapter 1-0

FLEXIBLE HOSE - GENERAL INFORMATION

CONTENTS

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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 each type of hose, with the applicable fittings and protective sleeving and procedures for the removal, repair and re-installation of hose assemblies are contained in Chapters 2 and 3 respectively.

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 great 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. Chapter 4 of this publication contains lists of all the hose asemblies which are fitted in Service aircraft and indicates which of these are cleared for replacement by local manufacture. 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-usable end fittings. Instructions for the local manufacture of hose assemblies are given in Chapter 3 of this publication.

4. A large number of specified standards apply to the manufacture of flexible hose and end fittings. In general terms these refer to applicaton 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. Chapter 2 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:-

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

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

(3) High pressure hose:- designed for use at pressures greater than 103.42 bar.

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.

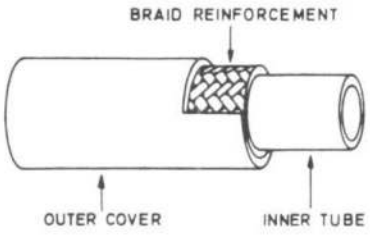

Fig. 1 Hose construction

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.

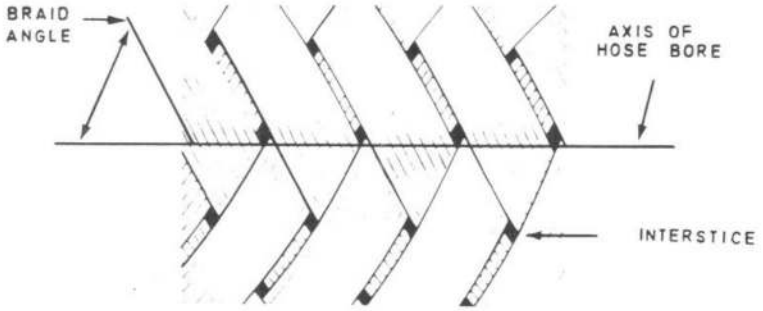

Fig. 2 Braided reinforcement

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 $\frac{1}{4}$ 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.

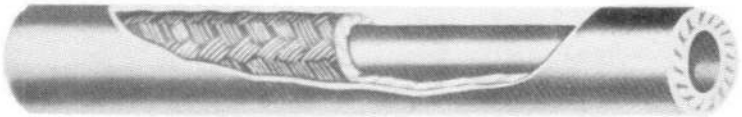

Fig. 1 Hose, Part No. 306

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'.

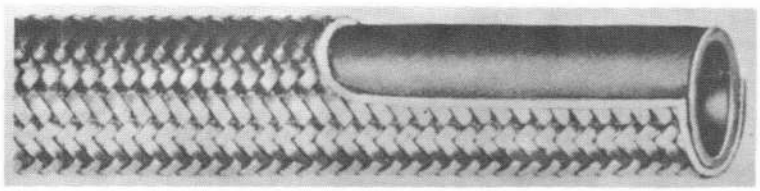

Fig. 3 Hose, Part No. 601

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.

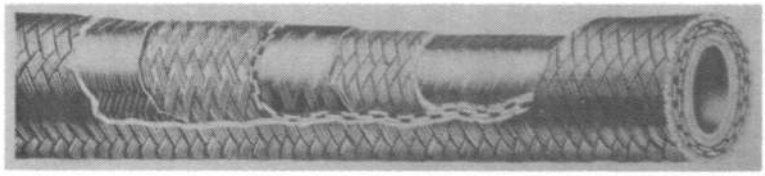

Fig. 4 Hose, Part No. 602

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.

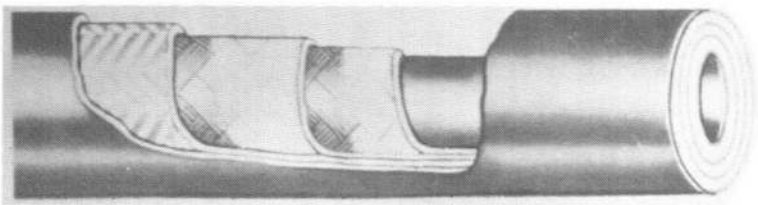

Fig. 5 Hose, Part No. 309

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.

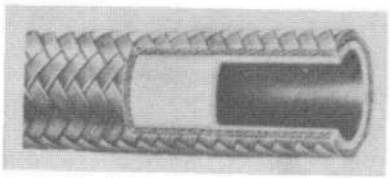

Fig. 6 Hose, Part No. AE246

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.

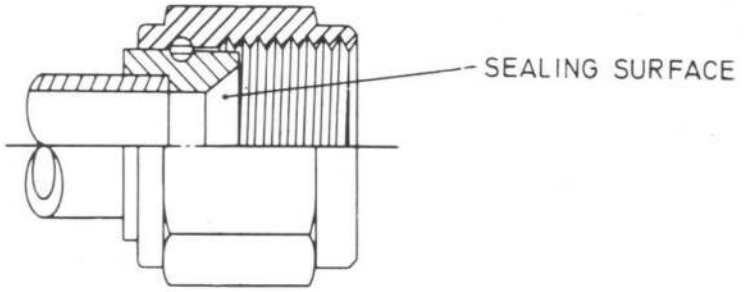

Fig. 1 Flared seal fitting

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^{o} 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.

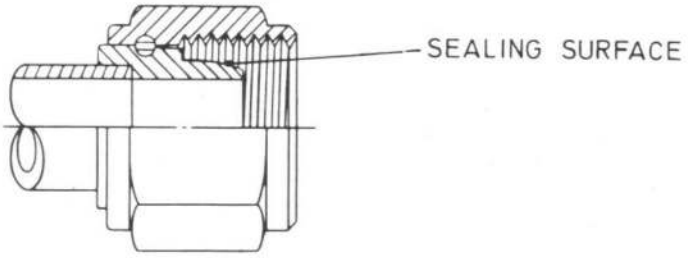

Fig. 2 'Globeseal' flareless seal fitting

'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^{o} taper tapered bore of the mated connection. The Globseal flareless fitting can be re-used many times provided the sealing surfaces are not damaged.

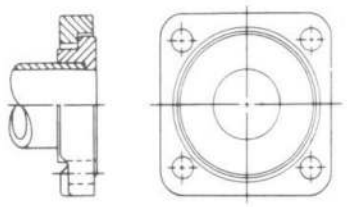

Fig. 3 Flanged seal fitting

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.

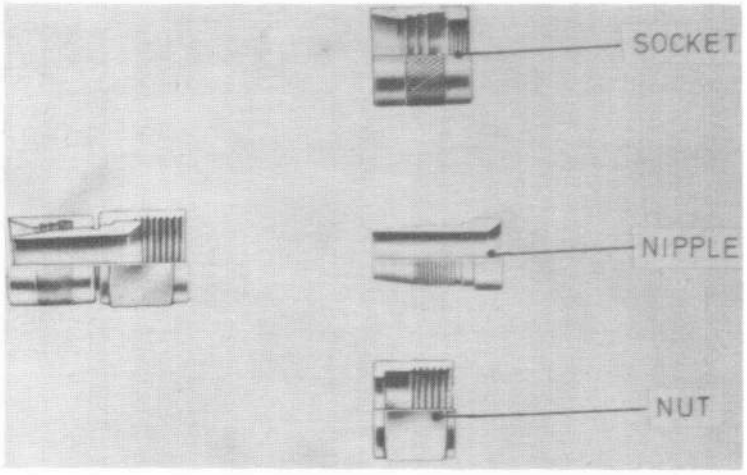

Fig. 4 Typical low pressure fitting

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.

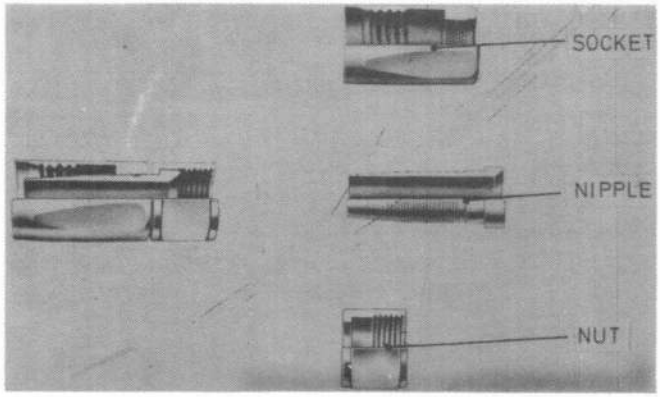

Fig. 5 Typical medium pressure fitting

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.

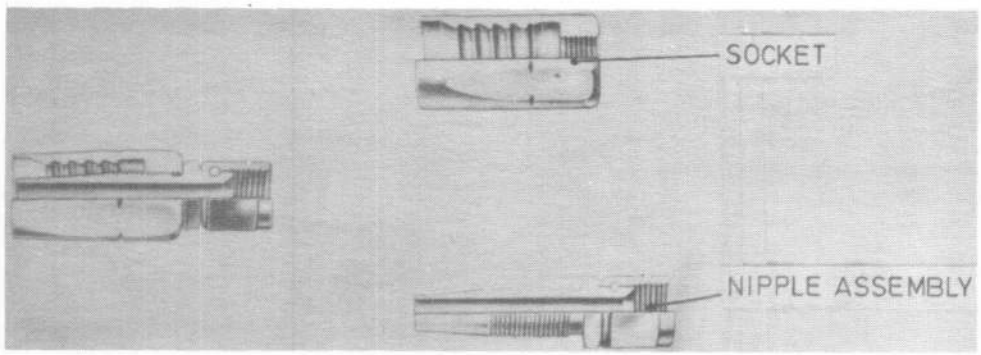

Fig. 6 Typical high pressure fitting

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.

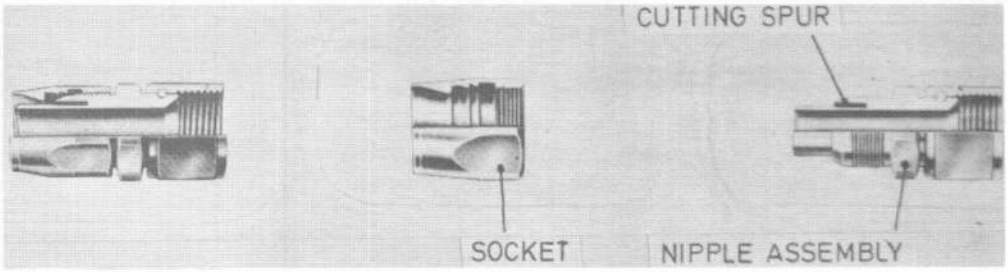

Fig. 7 Typical 'Little Gem' fitting

'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.

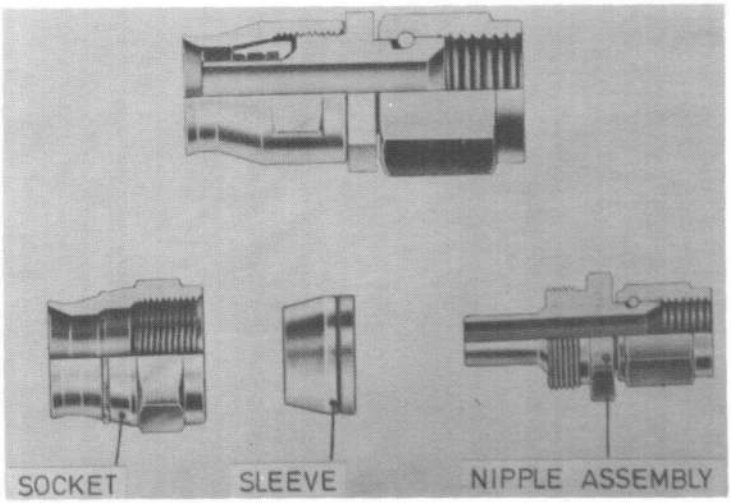

Fig. 8 Typical 'Super Gem' fitting

'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^{o} and 90^{o} 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.

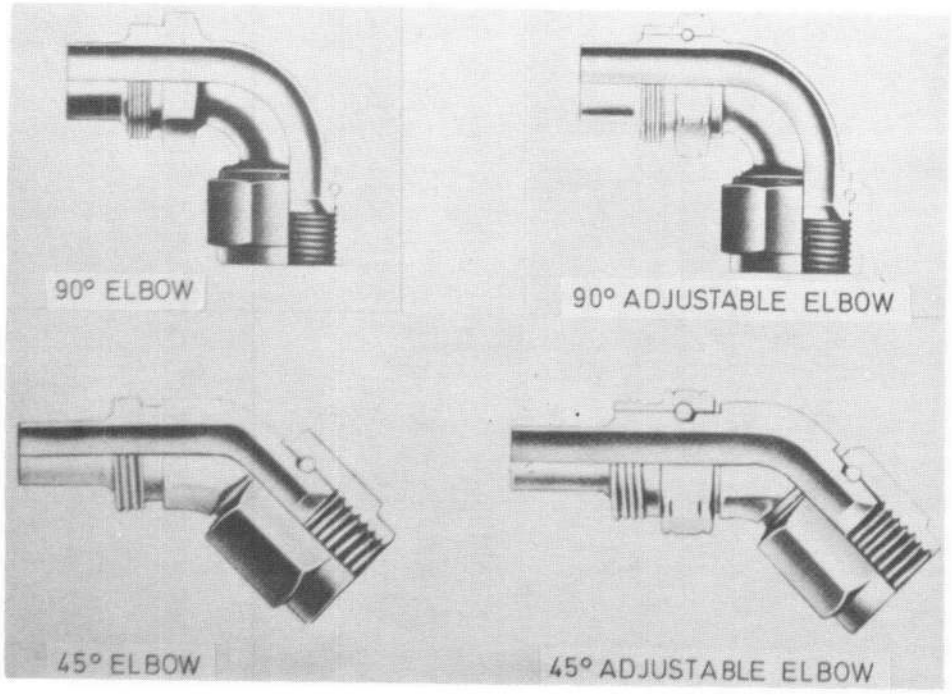

Fig. 9 Typical elbow fittings

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

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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).

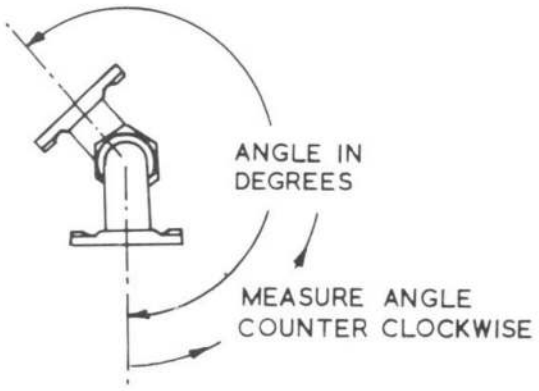

Fig. 1 Measurement of position angle

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

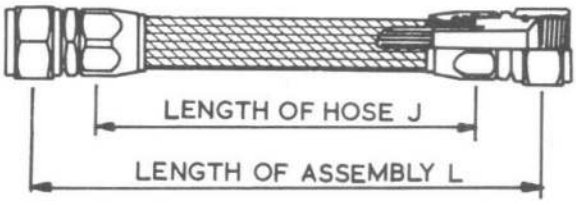

Fig. 2 Measurement of hose assembly length

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

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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).

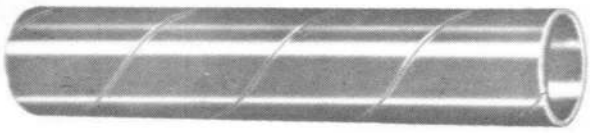


Fig. 2 Abrasion resistant coil Part No. AE208(900005)

(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.

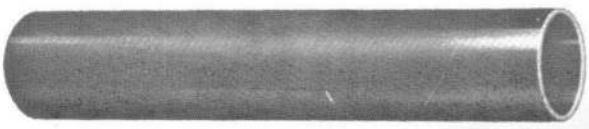


Fig. 3 Abrasion resistant sleeve Part No. AE251(900961)

(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).

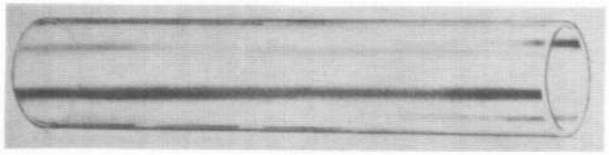


Fig. 4 Abrasion resistant sleeve Part No. 900223

(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).

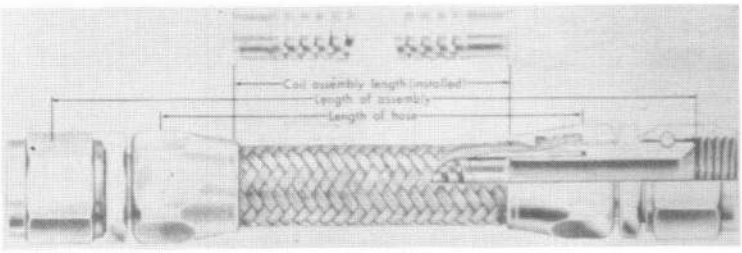


Fig. 8 Internal support coil

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

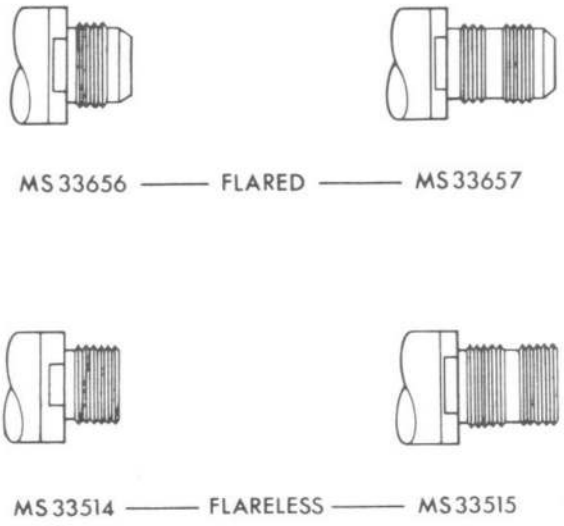


Fig. 9 Couplings - identity of thread forms

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	Coupling 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	T015519-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.

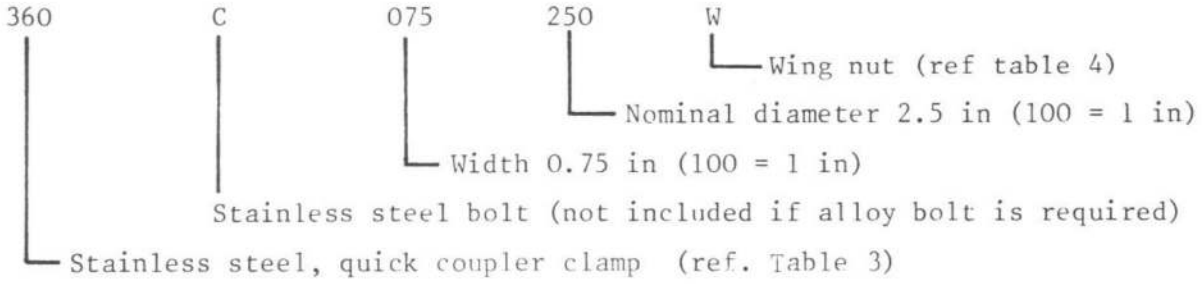
(2) Bracket support clamp - A band clamp which includes clips or lugs for securing to an adjacent structure.

(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 2-0

HOSES AND FITTINGS

1. The following sub-chapters cover all the types of hose used in the Services, giving brief details of their construction and usage, and listing the manufacturer's part numbers of the end fittings and protective sleeves that can be used with each hose.

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, e.g. a -3 fitting is used on a -3 hose.

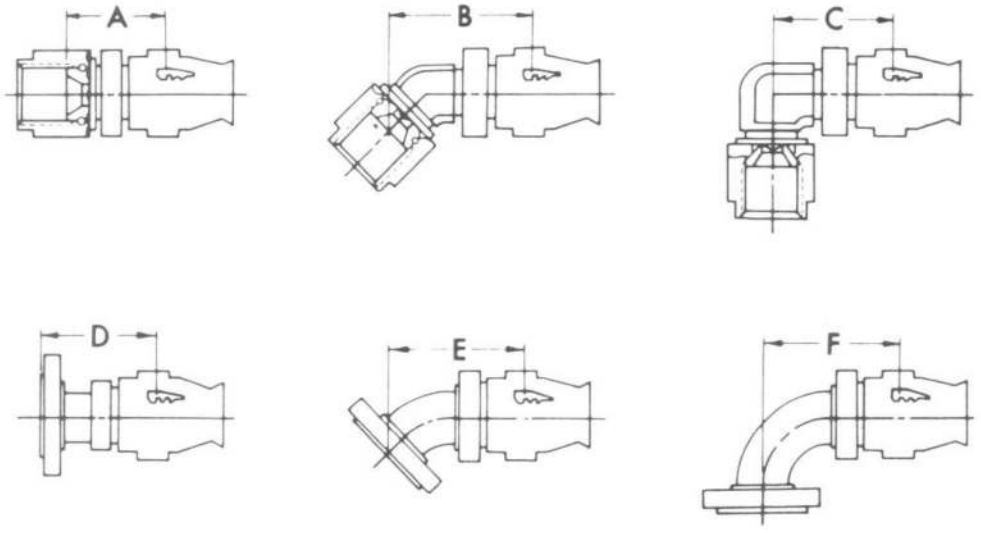


Fig. 1 Cut-off dimensions for various fittings

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

Chapter 2-3

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

Operating range:-

303	103.42 to 206.84 bar ($1b\ f/in^2$) (1500 to 3000 $1b\ f/in^2$)
302A	24.13 to 55.16 bar (350 to 800 $1b\ f/in^2$)

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	($1b\ f/in^2$)	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

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) THE ONLY LUBRICANT WHICH IS ALLOWED FOR USE WITH OXYGEN LINE ASSEMBLIES IS ZX24 (S-718) (REF. No. 34B/9427802) FOR LOW PRESSURE SYSTEMS, AND ZX32 (S-717) (REF. NO. 34B/2202430) FOR HIGH PRESSURE SYSTEMS.

(3) NO LUBRICANT IS TO BE USED WHERE OXYGEN PRESSURES OF 137.89 BAR (2000 LB F/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	-20	-26	-30	-38
Clamp size	3C	4C	4C	5C
Protective coil (external) 900005	-10	-10	-10	-10

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^{o}C (-65 to +200^{o}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^o 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 Clamp 900591B	-12 2C	-14 2C	-16 2C	-18 3C	-20 3C
Protective coil (external) 900005	-10	-10	-10	-10	-10

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 (2) (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	290-6	9/16-18
491	-8D	23.88	(0.94)	215-8D	271-8D	290-8D	3/4 -16
491	-10D	25.40	(1.00)	215-10D	271-10D	290-10D	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

Note...

MS24587 supersedes MS28740

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. mm	Cut-off dim. (in)	Components (Pt. No.) 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. mm	(in)	Components (Pt. No.) 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	(in)	Nipple assembly	Cut-off dim. mm	(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

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

Chapter 2-10

HOSE, PART NO. AE246

Operating range	Up to *275.79 bar (4000 lbf/in^2)
Temperature range	-59 to +204°C (-67 to +400°F)
Construction:-	
Inner tube	Extruded Teflon
Reinforcement	Densely packed small diameter wire braid
Identification	Bands showing specification, manufacturer's code number, operating pressure and date of assembly.
Application	High pressure, high temperature hydraulic systems

*Note...

The manufacturer's maximum operating pressure is 206.84 bar, but the hose is cleared by the Services for use up to 275.79 bar.

TABLE 1

Hose size and general data

Hose -Size	O.D.		*Operating pressure		Min bend radii	
	mm	(in)	bar	(lbf/in^2)	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

End fittings

Pt. No. -Size	Cut-off dim.		Components (Pt. 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)					

TABLE 2 (cont.)

Pt. No. -Size	Cut-off dim.		Components (Pt. No.)		
	mm	(in)	Socket	Nipple assembly	Sleeve
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) (-12)	69.60	(2.74)	AE18915J	AE18879J	AE18916J
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) (-12)	52.32	(2.06)	AE18915J	AE18881J	AE18916J
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) (-12)	38.10	(1.50)	AE18915J	AE18927J	AE18916J
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) (-12)	74.68	(2.94)	AE18915J	AE18883J	AE18916J
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) (-12)	52.32	(2.06)	AE18915J	AE18885J	AE18916J

TABLE 3

Protective sleeves

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	

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)			

TABLE 2

End fittings

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Flared, swivel nut, straight						
816	-3	16.25	(0.64)	516-3D	526-3	3/8 - 24
816	-4	16.50	(0.65)	516-4D	526-4	7/16- 20
816	-5	17.78	(0.70)	516-5D	526-5	1/2 - 20
816	-6D	19.30	(0.76)	516-6D	526-6D	9/16- 18
816	-8D	23.88	(0.94)	516-8D	526-8D	3/4 - 16
816	-10D	25.15	(0.99)	516-10D	526-10D	7/8 - 14
816	-12D	25.40	(1.00)	516-12D	526-12D	1.1/16- 12
816	-16D	29.46	(1.16)	516-16D	526-16D	1.5/16- 12
816	-20D	34.04	(1.34)	516-20D	526-20D	1.5/8 - 12
816	-24D	36.57	(1.44)	516-24D	526-24D	1.7/8 - 12
816	-32D	41.15	(1.62)	516-32D	526-32D	2.1/2 - 12
Flared, swivel nut, 45°						
8846	-3	26.67	(1.05)	516-3D	8746-3	3/8 - 24
8846	-4	25.91	(1.02)	516-4D	8746-4	7/16- 20
8846	-5	28.45	(1.12)	516-5D	8746-5	1/2 - 20
8846	-6D	30.99	(1.22)	516-6D	8746-6D	9/16- 18
8846	-8D	33.02	(1.30)	516-8D	8746-8D	3/4 - 16
8846	-10D	36.58	(1.44)	516-10D	8746-10D	7/8 - 14
8846	-12D	44.70	(1.76)	516-12D	8746-12D	1.1/16- 12
8846	-16D	46.48	(1.83)	516-16D	8746-16D	1.5/16- 12
8846	-20D	54.10	(2.13)	516-20D	8746-20D	1.5/8 - 12
8846	-24D	57.91	(2.28)	516-24D	8746-24D	1.7/8 - 12
8846	-32D	68.33	(2.69)	516-32D	8746-32D	2.1/2 - 12
Flared, swivel nut, 90°						
8891	-3	22.60	(0.89)	516-3D	8791-3	3/8 - 24
8891	-4	22.60	(0.89)	516-4D	8791-4	7/16- 20
8891	-5	24.38	(0.96)	516-5D	8791-5	1/2 - 20
8891	-6D	27.18	(1.07)	516-6D	8791-6D	9/16- 18
8891	-8D	28.96	(1.14)	516-8D	8791-8D	3/4 - 16
8891	-10D	32.26	(1.27)	516-10D	8791-10D	7/8 - 14
8891	-12D	41.40	(1.63)	516-12D	8791-12D	1.1/16- 12
8891	-16D	44.20	(1.74)	516-16D	8791-16D	1.5/16- 12

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Flared, swivel nut, 90° (cont.)						
8891	-20D	52.32	(2.06)	516-20D	8791-20D	1.5/8 - 12
8891	-24D	56.39	(2.22)	516-24D	8791-24D	1.7/8 - 12
8891	-32D	67.31	(2.65)	516-32D	8791-32D	2.1/2 - 12
Flared, swivel nut, forged, 45°						
8851	-3	19.56	(0.77)	516-3D	8751-3	3/8 - 24
8851	-4	21.08	(0.83)	516-4D	8751-4	7/16- 20
8851	-5	23.88	(0.94)	516-5D	8751-5	1/2 - 20
8851	-6D	24.64	(0.97)	516-6D	8751-6D	9/16- 18
8851	-8D	34.29	(1.35)	516-8D	8751-8D	3/4 - 16
Flared, swivel nut, forged, 90°						
8893	-3	14.22	(0.56)	516-3D	8793-3	3/8 - 24
8893	-4	14.73	(0.58)	516-4D	8793-4	7/16- 20
8893	-5	15.24	(0.60)	516-5D	8793-5	1/2 - 20
8893	-6D	18.29	(0.72)	516-6D	8793-6D	9/16- 18
8893	-8D	22.35	(0.88)	516-8D	8793-8D	3/4 - 16
Swivel flange, straight				Socket	Nipple	Flange
8844	-12D	31.75	(1.25)	516-12D	8714-12D	9644-12D
8844	-16D	33.02	(1.30)	516-16D	8714-16D	9644-16D
8844	-20D	38.10	(1.50)	516-20D	8714-20D	9644-20D
8844	-24D	34.04	(1.34)	516-24D	8714-24D	9644-24D
8844	-32D	38.61	(1.52)	516-32D	8714-32D	9644-32D
Swivel, flange, 45°						
8845	-12D	40.64	(1.60)	516-12D	8745-12D	9644-12D
8845	-16D	42.67	(1.68)	516-16D	8745-16D	9644-16D
8845	-20D	49.02	(1.93)	516-20D	8745-20D	9644-20D
8845	-24D	51.56	(2.03)	516-24D	8745-24D	9644-24D
8845	-32D	59.94	(2.36)	516-32D	8745-32D	9644-32D
Swivel flange, 90°						
8890	-12D	41.40	(1.63)	516-12D	8790-12D	9644-12D
8890	-16D	44.20	(1.74)	516-16D	8790-16D	9644-16D
8890	-20D	52.32	(2.06)	516-20D	8790-20D	9644-20D
8890	-24D	56.39	(2.22)	516-24D	8790-24D	8644-24D
8890	-32D	67.31	(2.65)	516-32D	8790-32D	9644-32D

TABLE 2 (cont.)

Pt. No.	-Size	Cut-off dim.		Components (Pt. No.)		
		mm	(in)	Socket	Nipple assembly	Thread
Globeseal, flareless, straight						
826	-4	20.32	(0.80)	516-4D	536-4	7/16- 20
826	-6D	24.38	(0.96)	516-6D	536-6D	9/16- 18
826	-8D	29.72	(1.17)	516-8D	536-8D	3/4 - 16
826	-10D	32.00	(1.26)	516-10D	536-10D	7/8 - 14
826	-12D	32.26	(1.27)	516-12D	536-12D	1.1/16- 12
826	-16D	36.58	(1.44)	516-16D	536-16D	1.5/16- 12
826	-20D	41.15	(1.62)	516-20D	536-20D	1.5/8 - 12
826	-24D	46.99	(1.85)	516-24D	536-24D	1.7/8 - 12
Globeseal, flareless, 45°						
880112	-6D	34.54	(1.36)	516-6D	885112-6D	9/16- 18
880112	-8D	36.83	(1.45)	516-8D	885112-8D	3/4 - 16
880112	-10D	41.40	(1.63)	516-10D	885112-10D	7/8 - 14
880112	-12D	49.02	(1.93)	516-12D	885112-12D	1.1/16- 12
880112	-16D	51.56	(2.03)	516-16D	885112-16D	1.5/16- 12
880112	-20D	59.18	(2.33)	516-20D	885112-20D	1.5/8 - 12
Globeseal, flareless, 90°						
880114	-6D	27.18	(1.07)	516-6D	885114-6D	9/16- 18
880114	-8D	28.96	(1.14)	516-8D	885114-8D	3/4 - 16
880114	-10D	32.26	(1.27)	516-10D	885114-10D	7/8 - 14
880114	-12D	41.40	(1.63)	516-12D	885114-12D	1.1/16- 12
880114	-16D	44.20	(1.74)	516-16D	885114-16D	1.5/16- 12
880114	-20D	52.32	(2.06)	516-20D	885114-20D	1.5/8 - 12
Globeseal, flareless, forged, 45°						
8852	-3	23.37	(0.92)	516-3D	8752-3	3/4 - 24
8852	-4	23.88	(0.94)	516-4D	8752-4	7/16- 20
8852	-5	26.67	(1.05)	516-5D	8752-5	1/2 - 20
8852	-6D	28.19	(1.11)	516-6D	8752-6D	9/16- 18
8852	-8D	38.10	(1.50)	516-8D	8752-8D	3/4 - 16
Globeseal, flareless, forged, 90°						
8894	-3	22.61	(0.89)	516-3D	8794-3	3/8 - 24
8894	-4	22.61	(0.89)	516-4D	8794-4	7/16- 20
8894	-5	24.38	(0.96)	516-5D	8794-5	1/2 - 20
8894	-6D	27.18	(1.07)	516-6D	8794-6D	9/16- 18
8894	-8D	28.96	(1.14)	516-8D	8794-8D	3/4 - 16

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

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

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.

WARNING...

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.

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 tools. The machinery (Table 1) is hand operated and can be used for cutting and stripping the hose, 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 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

Detail of machine tools

Tool	Part No.	Service stock No.
Hose cut off machine	480/1	3A/4448
Hand strip machine	RPD/362/1	3A/4449
Hand clamp machine	F2636	3A/2061383

TABLE 2

Detail of assembly tool kits

For British fittings			For American fittings		
Part No.	-Size	Service stock No.	Part No.	-Size	Service stock 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

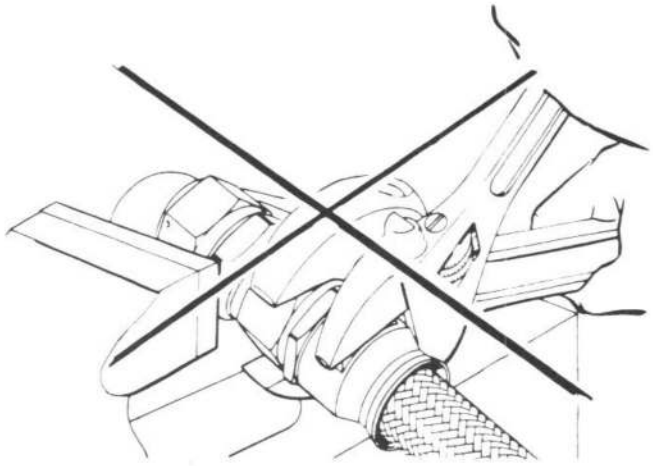


Fig.2 Incorrect method of loosening swivel nut connections

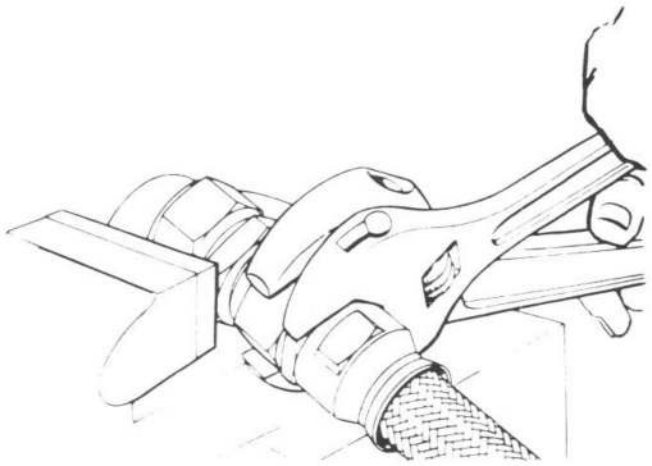


Fig.3 Correct method of loosening swivel nut connections

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.

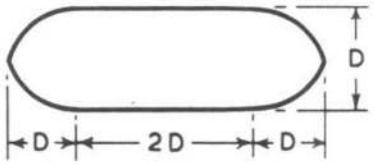


Fig.1 Bobbin for hose bore test

TABLE 1

Ball size chart for bore obstruction checks

Hose -size	Ball size		Hose -size	Ball size	
	mm	in		mm	in
-4	1.98	5/64	-12	12.7	1/2
-5	3.57	9/64	-16	18.65	47/64
-6	5.16	13/64	-20	24.21	61/64
-8	7.14	9/32	-24	28.58	1.1/8
-10	9.52	3/8	-32	34.92	1.3/8

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.

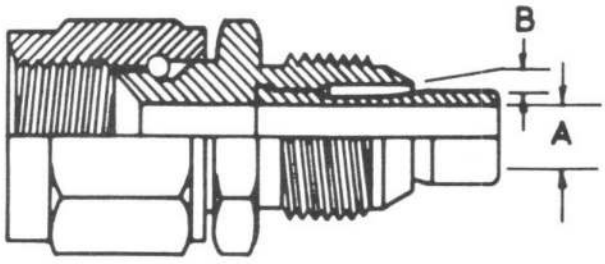


Fig.2 Cutting spur and nipple shank clearances

(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

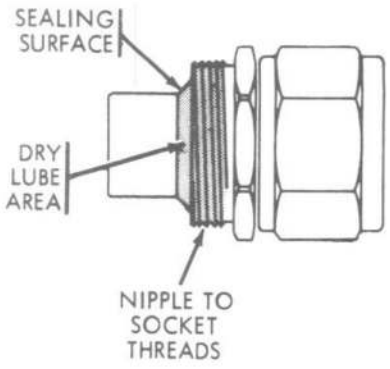


Fig.3 Hose sealing surface of 'Super Gem' fittings

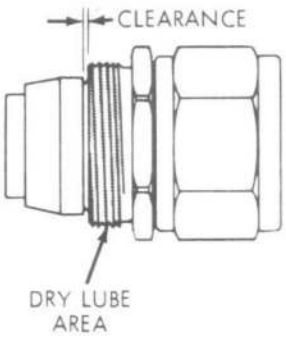


Fig.4 Nipple/sleeve clearance

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.

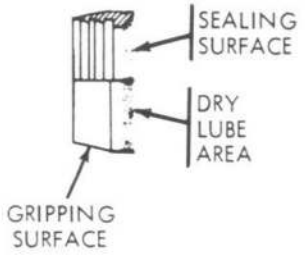


Fig.5 Nipple sleeve

Nipple sleeve (fig. 5)

18. Check the sealing surface for nicks, dents, scratches or galling. Visually inspect the gripping surface for severe brunelling from the hose braids, crimping or ovality. Sleeves which exhibit any signs of damage must be scrapped.

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.

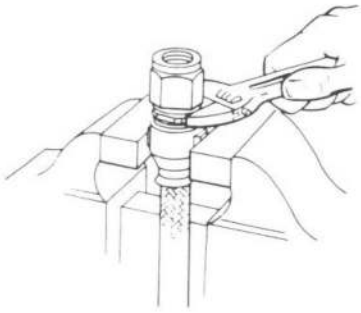


Fig.2 Removing the nipple assembly

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:-

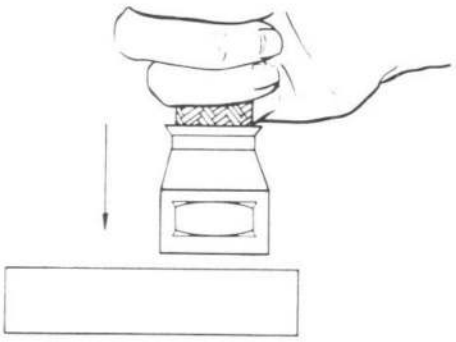


Fig.3 Loosening the 'SuperGem' socket

(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.

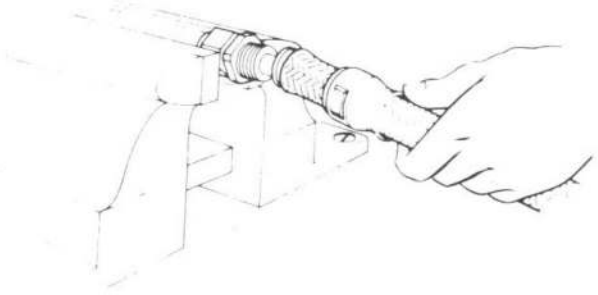


Fig.4 Removing the sleeve

(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 firesleeve, 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...

DO NOT LUBRICATE FITTINGS INTENDED FOR USE IN OXYGEN SYSTEMS.

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.

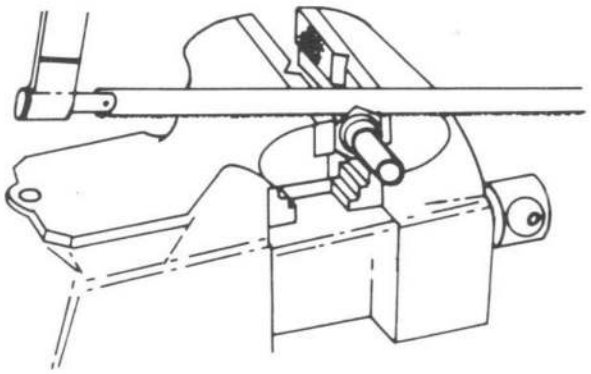


Fig.1 Removing the wired on nut

(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).

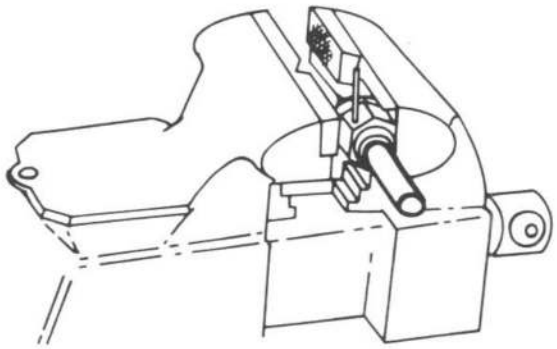


Fig.2 Locating the new retaining wire

(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 hexagaon surface (fig. 3).

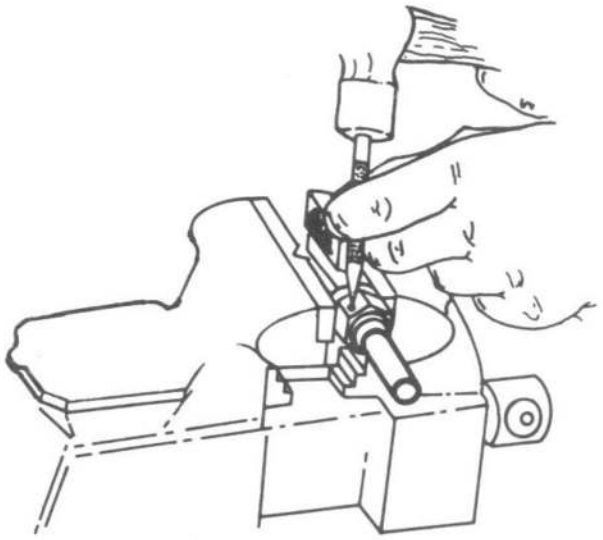


Fig. 3 Setting the retaining wire

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 thr 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).

TABLE 1

Firesleeve sealing compounds

Type of firesleeve (Aeroquip Part No.)	Sleeve and dip compound (Aeroquip Part No.)
624A (grey)	AE10187-001
AE198 (red)	AE13702-001

Chapter 3-6

MAKING UP THE HOSE ASSEMBLY BY LOCAL MANUFACTURE

CONTENTS

TABLES

ILLUSTRATIONS

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.

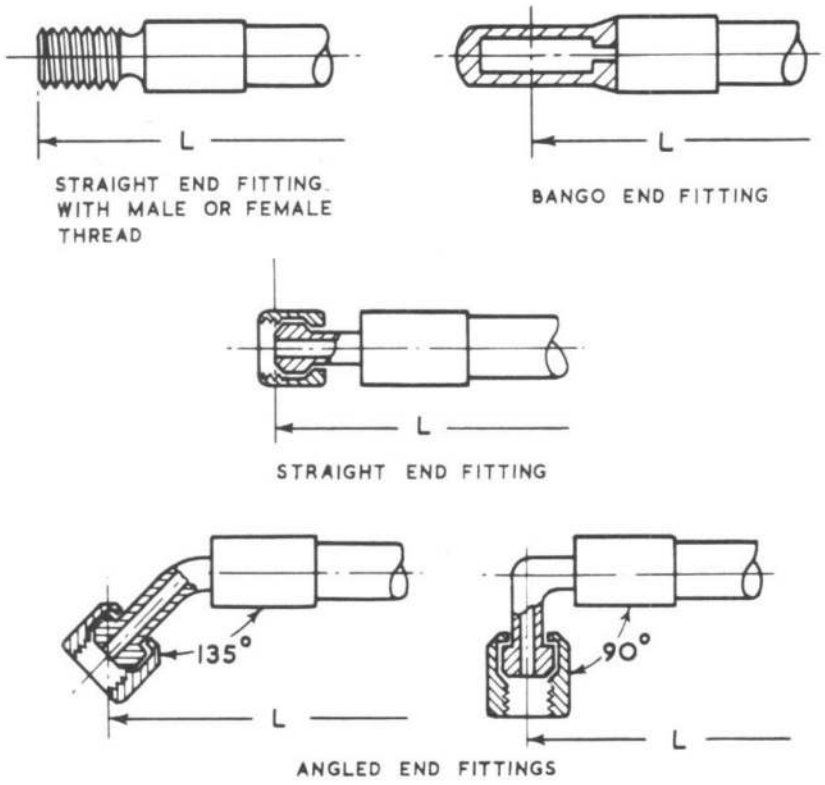


Fig.1 Measurement of hose assembly length

GENERAL INFORMATION

Measurements

2. The length of a hose assembly is measured between the two points at which the connection sealing surfaces 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 Chapter 2 with the fittings applicable to the types of hose used in Service aircraft.

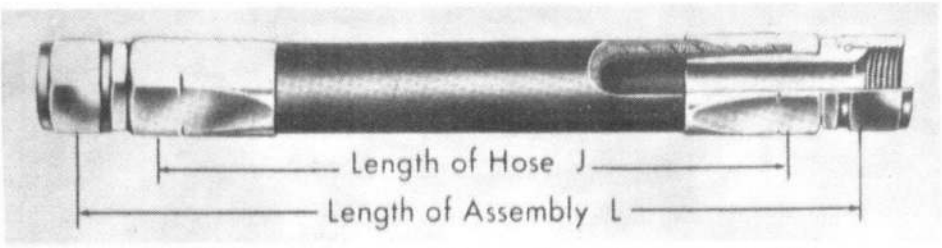


Fig.2 Length of hose in a hose assembly

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 814 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, AE204,AE246	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. 23026 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).

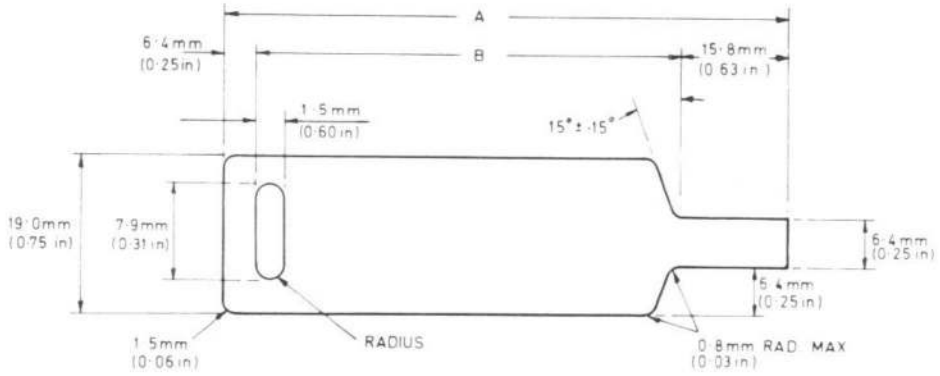


Fig.3 Identification band, Part No. 23036

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).

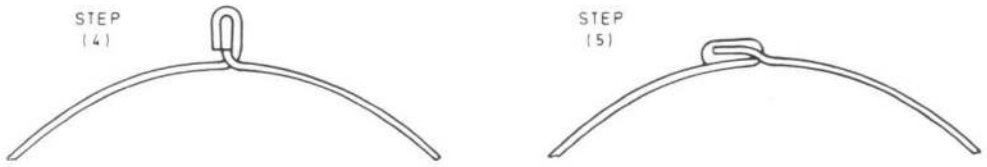


Fig.4 Securing the identification band

(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	73.31	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.

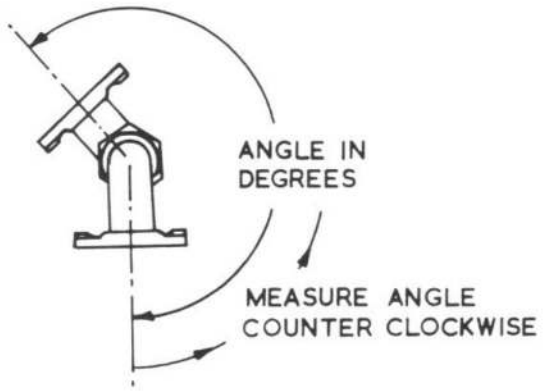


Fig. 5 End view of angular relationship

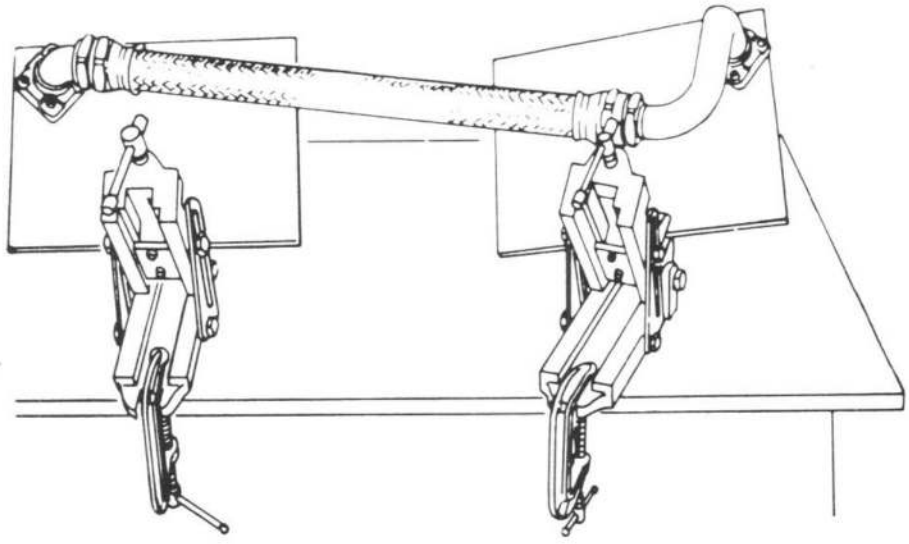


Fig. 6 Setting up to measure the angles

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

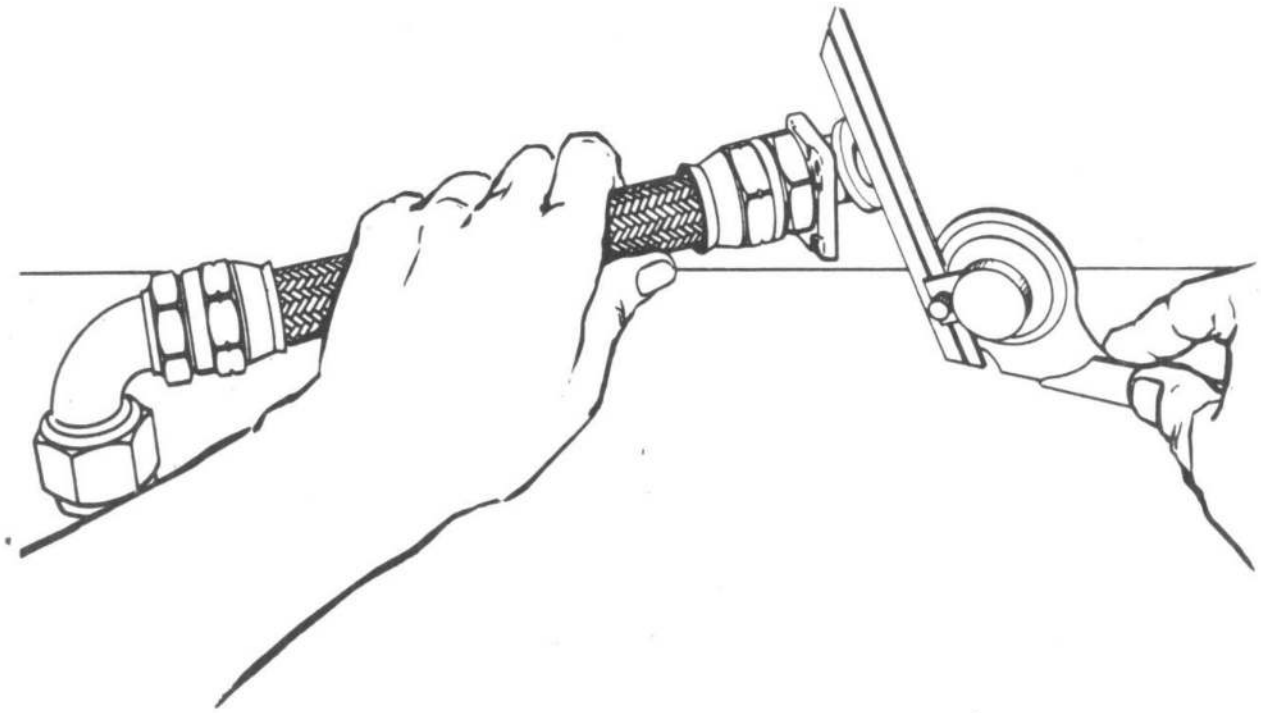


Fig.7 Simple check for proper angular relationship

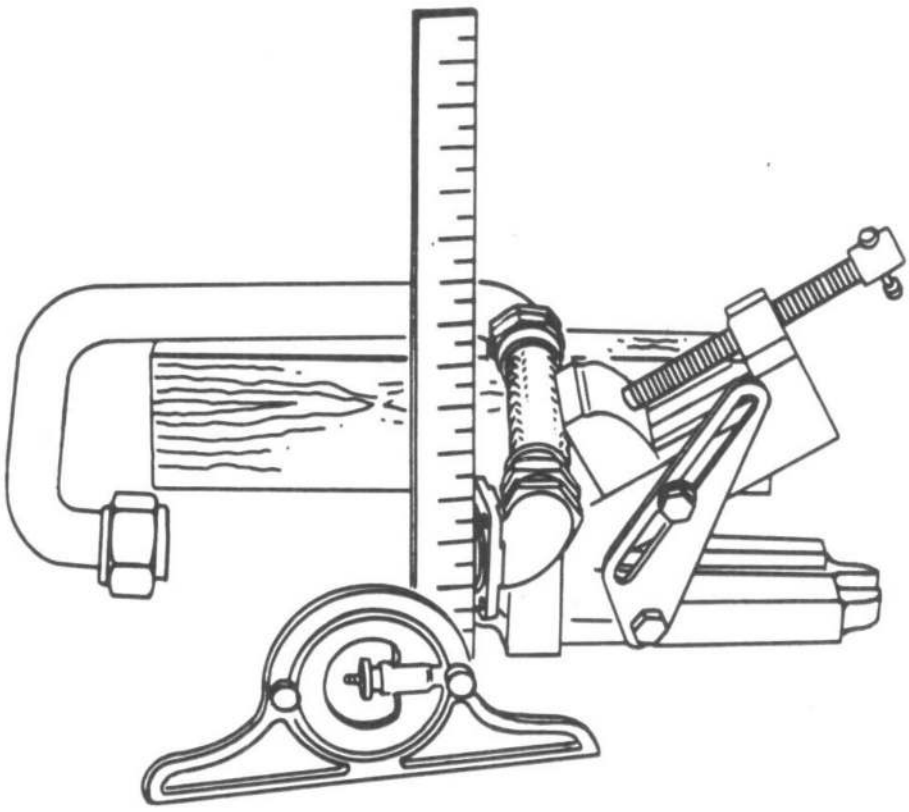


Fig.8 Checking flange face for angular relationship

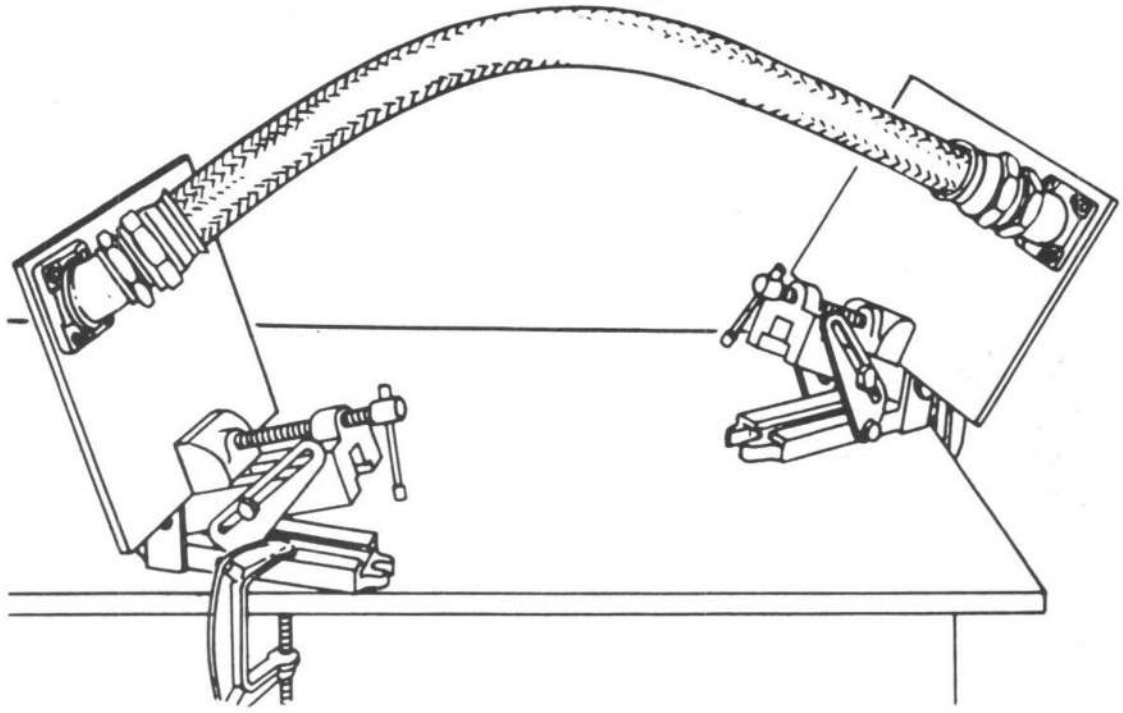


Fig.9 Method of setting angular relationship

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).

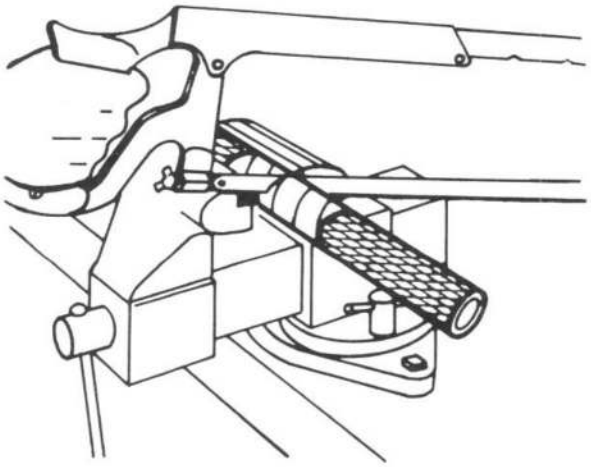


Fig.10 Cutting the hose

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:-

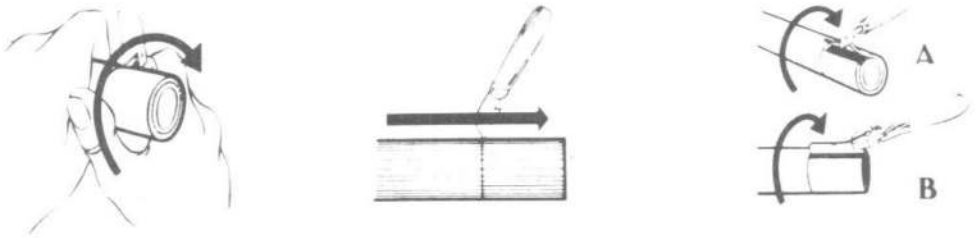


Fig.11 Outer cover removal

(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 AE13696-001 is used on hose Pt. No. 309 and Dow-Corning sealant is used on hose part No. 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 maximum permissible gap between socket and nipple hexagon surfaces is 1.6 mm (1/16 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 less than 1.6 mm (1/16 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 assemblies)

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 maximum acceptable gap between hexagon and socket i.e. 0.8 mm (1/32 in) for 617 hose, 1.6 mm (1/16 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.

Procedure using hose Pt. No. 601 and Pt. No. AE701

(Lightweight rubber hose assembly)

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.

(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.

(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.

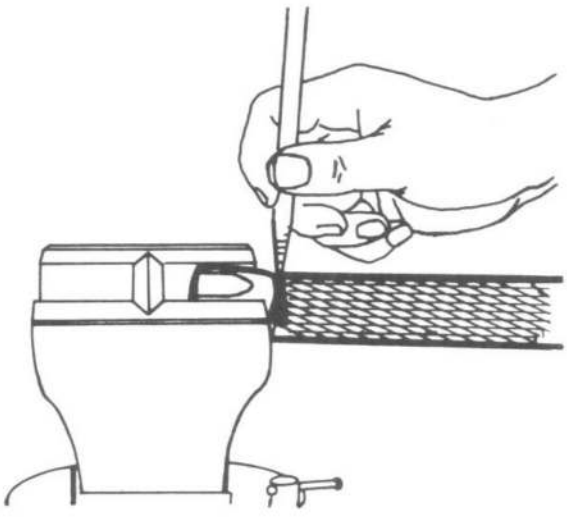


Fig.13 Marking the hose for check of push out

Note...

Step (3) is applicable only to fittings where the nut is not wired on to the nipple to form a nipple assembly.

(3) Place the swivel nut over the threads of the nipple and screw the nut onto an assembly mandrel of the correct size, or onto an AN815 adaptor.

(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.

(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).

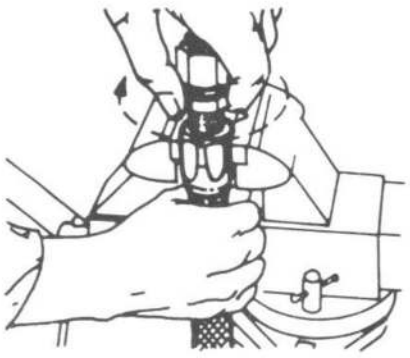


Fig.14 Engaging the nipple/socket threads

(6) Check the hose for push out from the socket by reference to the marking made at step (2).

Note...

If push out has occurred; remove the nipple assembly and repeat the procedure from step 1.

(7) While continuing to hold the hose against push out, complete the assembly using a spanner on the driving hexagon of the nipple assembly (fig. 15). The maximum permissible gaps between the adjacent surfaces of the nipple and socket are:- .993 mm (0.041 inches) for sizes -3, -4, and -5; and .794 mm (0.031 in) for sizes -6 and upwards.

(8) Finally check for hose push out by reference to the mark made at step (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

(1) Tighten both elbows to the maximum permissible gap between nipple and socket.

(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 using hose Pt. Nos. 666, 667, 676, AE116, AE206 and AE246

(Medium pressure and high pressure Teflon hose assemblies)

WARNING...

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

(2) THE ONLY LUBRICANT WHICH IS ALLOWED FOR USE WITH OXYGEN LINE ASSEMBLIES IS ZX24 (S-718) (REF. NO. 34B/9427802) FOR LOW PRESSURE SYSTEMS, AND ZX32 (S-717) (REF. NO. 34B/2202430) FOR HIGH PRESSURE SYSTEMS.

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

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

(1) Slip two sockets, skirt to skirt, over the 'necked down' end of the hose.

(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.

(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.

(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.

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

(6) Bring up the socket and hand-start the threads.

(7) Place the socket hexagon in the vice and, using a spanner, tighten the nipple hexagon until the clearance between nipple hexagon and socket is 1.2 mm (3/64 in). Tighten further to align flats of nipple and socket.

Chapter 3-7

CLEANING

1. All hose assemblies and component parts should be thoroughly cleaned before inspection. Hose assemblies must also be thoroughly cleaned after proof testing, and immediately prior to installation. Firesleeving should be removed before cleaning and replaced before installation.

WARNING...

HOSE ASSEMBLIES FOR USE IN OXYGEN SYSTEMS MUST BE CLEANED BY SPECIAL PROCEDURES BEFORE INSTALLATION. REFER TO THE PARTICULAR SYSTEM INSTRUCTIONS.

2. The most satisfactory method of cleaning a hose assembly is by agitation and/or soft brushing while immersed in white spirit or kerosene.

CAUTION...

Do not use a wire brush. Do not use white spirit with rubber hose.

3. When the hose assembly has been cleaned it must be thoroughly dried by use of a low pressure dry filtered air or nitrogen service line. This is especially important after cleaning prior to installation.

4. When cleaning dismantled end fitting components, special attention must be paid to removal of any rubber torn from the hose assembly. This can be removed easily by using the rubber removal tool (part No. S1021) of the correct size. Wire brushes and scrapers must not be used.

Chapter 3-8

TESTING

1. Hose assemblies which have been made up locally must be tested under pressure for leakage. The test pressure is to be one and a half times the working pressure of the assembly. If applicable, the hose assembly is also to be tested for electrical continuity.

Note...

Protective sleeving should not be fitted until completion of the proof testing and must be removed if satisfactory observation of the test is to be achieved.

2. Except for those intended for use in oxygen and pitot lines, all hose assemblies should be proof tested using the standard hydraulic test bench and fluid OM-15. All normal safety precautions must be strictly observed. Oxygen and pitot hose assemblies are to be proof tested when installed, the hoses are to be installed clean and dry and testing is to be in accordance with the relevant system information.

3. When pressure testing a hose assembly, on a test rig, one end is loosely blanked and the fluid (OM-15) is pumped into the other end. When the fluid begins to emerge from the loosely blanked end, the blank fitting is tightened to ensure a complete seal. The pressure of the fluid is then increased in stages to the final test pressure (one and a half times the working pressure of the hose assembly). The hose assembly must withstand the proof test pressure and no leakage is permissible. After three minutes the test pressure may be relieved.

4. On completion of test, and before installation hose assemblies are to be cleaned in accordance with the instruction in sub-chapter 3-7. Any protective sleeving required may be fitted after this cleaning. Blanking caps are to be fitted to hose assemblies which are not required for immediate use.

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.

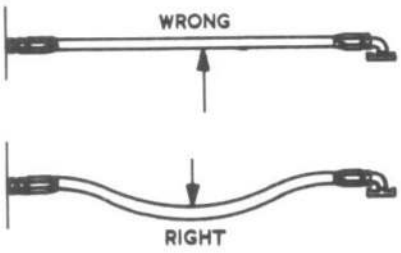
(6) As far as possible, rubber hose is to be stored in straight lengths on shelves. When rubber hose is coiled, the outside of each turn of the coil is in slight tension and this can lead to 'exposure cracking' due to ozone attack, with consequent unserviceability.

Chapter 3-10

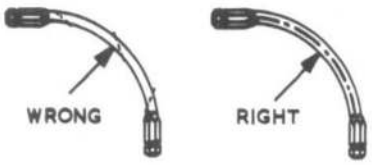
INSTALLATION OF HOSE ASSEMBLIES

Rubber hose assemblies

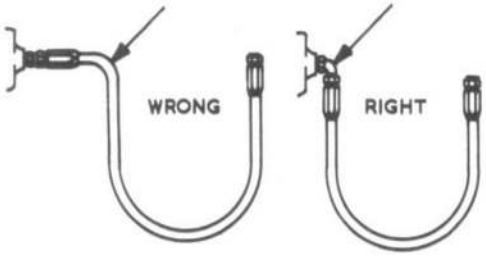
1. Fig. 1 details the installation techniques that should be adopted when placing rubber hose assemblies in service.



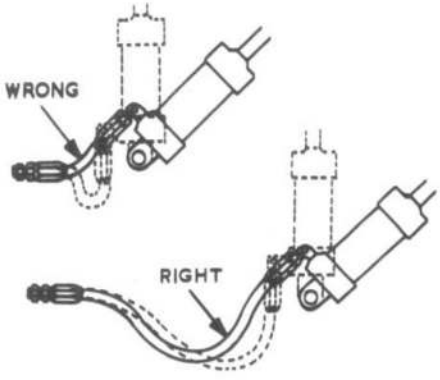
(1) Provide slack or bend in the hose line to provide for changes in length that will occur when pressure is applied.



(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

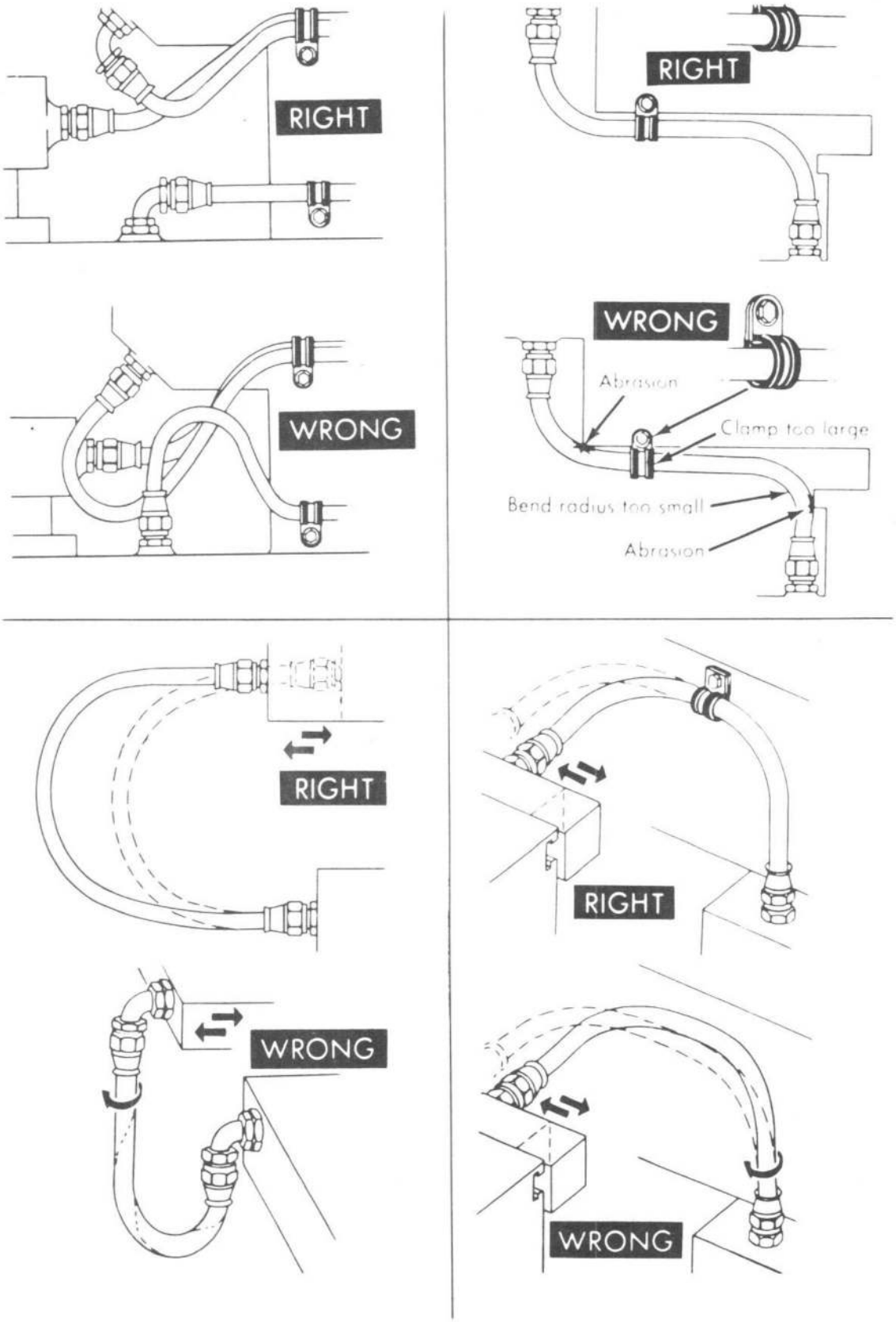


Fig.2 Teflon hose installation techniques

Teflon hose assemblies

2. Fig. 2 illustrates the installation techniques that should be adopted when placing Teflon hose assemblies in service. Additional points to be noted are as follows:

(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) 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.

(3) Kinking - extra care should be exercised to avoid kinking Teflon hose lines on installation or removal. Kinking is generally caused by the following conditions:-

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

(b) Removed lines. Teflon hose tends to preform itself in hot service conditions. On no account should Teflon hose be straightened on removal from installation.

(c) 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.

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