AIRCRAFT PIPELINES AND PIPELINE COMPONENTS AEROQUIP HOSE ASSEMBLIES

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

FOR USE IN THE
ROYAL NAVY
ROYAL AIR FORCE

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AMENDMENT RECORD SHEET

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Chapter 1

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Introduction

1. The cost of the end fittings of a flexible hose assembly can amount to 80 per cent of the total cost of the assembly. This cost can be reduced by using Aeroquip hose and re-usable end fittings. When a hose becomes unserviceable, the end fittings of the defective hose can be removed and fitted to a new length of hose. Hoses are made of rubber or Teflon (PTFE) with an external reinforcing sleeve of stainless steel wire braid. The end fittings may be of British or American configuration.

Note...

This chapter is applicable to both the RN and RAF unless otherwise stated.

GENERAL

Assembly

2. Full details and instructions on the various types of Aeroquip hoses are given in the following chapters of this publication. These instructions are to be complied with when locally manufacturing hose assemblies. When testing and cleaning hoses, the instructions in this chapter are to be complied with.

WARNING...

(1) UNDER NO CIRCUMSTANCES SHOULD END FITTINGS, SUPPLIED BY THE MANUFACTURER IN A PRE LUBRICATED CONDITION BE USED FOR OXYGEN HOSE ASSEMBLIES.

(2) IT IS ESSENTIAL THAT DURING THE ASSEMBLY OF OXYGEN HOSES, THE ONLY LUBRICANT TO BE USED IS ZX24 S-718 DTD 900/4042 (34B/9105066). NO LUBRICANT IS TO BE USED WHERE OXYGEN PRESSURES OF 2,000 LBF/IN^2 AND ABOVE ARE LIKELY TO BE ENCOUNTERED.

Hose assemblies using 508 and 520 sockets

3. Where the outer cover of the hose is stripped to expose the wire braiding during assembly of the end fitting to the hose, if the threads of the sockets (Part No. 508 and 520) are damaged, the sockets are not to be re-used as their gripping potential is reduced.

Cleaning

4. All hose assemblies and component parts are to be thoroughly cleaned and degreased before inspection and after proof testing. Observe the following procedures:-

Hose assemblies with 624 Fire Sleeves

(1) Remove the fire sleeve before cleaning. When cleaning after proof testing, care must be exercised to avoid soaking the sleeve in cleaning fluid (see Table 1).

Hose assemblies without fire sleeve

(2) Flush or dip hose assemblies in cleaning fluid (Table 1) then brush, if necessary, to remove deposits.

(3) Dip component parts in cleaning fluid and blow dry with clean air.

TABLE 1

Cleaning fluids

Unit	Fluid		
Hose assemblies	Kerosene - commercial grade	))	White spirit may be used as an alternative
Fittings and component parts	Trichloroethane (33D/2201949) or equivalent	))	

Use of rubber removing tool S1021

5. The rubber removing tool (Aeroquip Part No. S1021) is shown in fig.1. The tool can be used for removing any rubber which may be lodged in the internal recess of the cutting spur of the end fitting after dismantling an end fitting. It can also be used to restore the concentricity of the cutting spur and the lip of the fitting. The correct size rubber removing tool should be used.

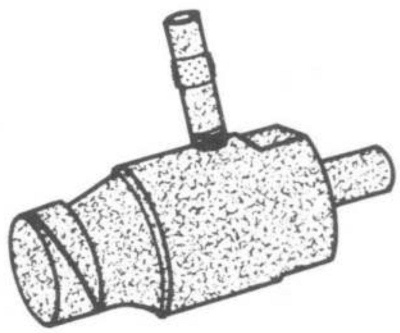


Fig.1. Rubber removing tool

Setting the angles of elbow fittings

6. Required angles may be obtained from a hose assembly drawing, by comparison to a good known hose assembly, or with an assembly mocked up on the installation. Preferably, the assembly to be replaced should be set up on a flat surface, vices and parallels set and clamped and the angles set on a protractor before the hose line is disassembled. See fig.2 to 7.

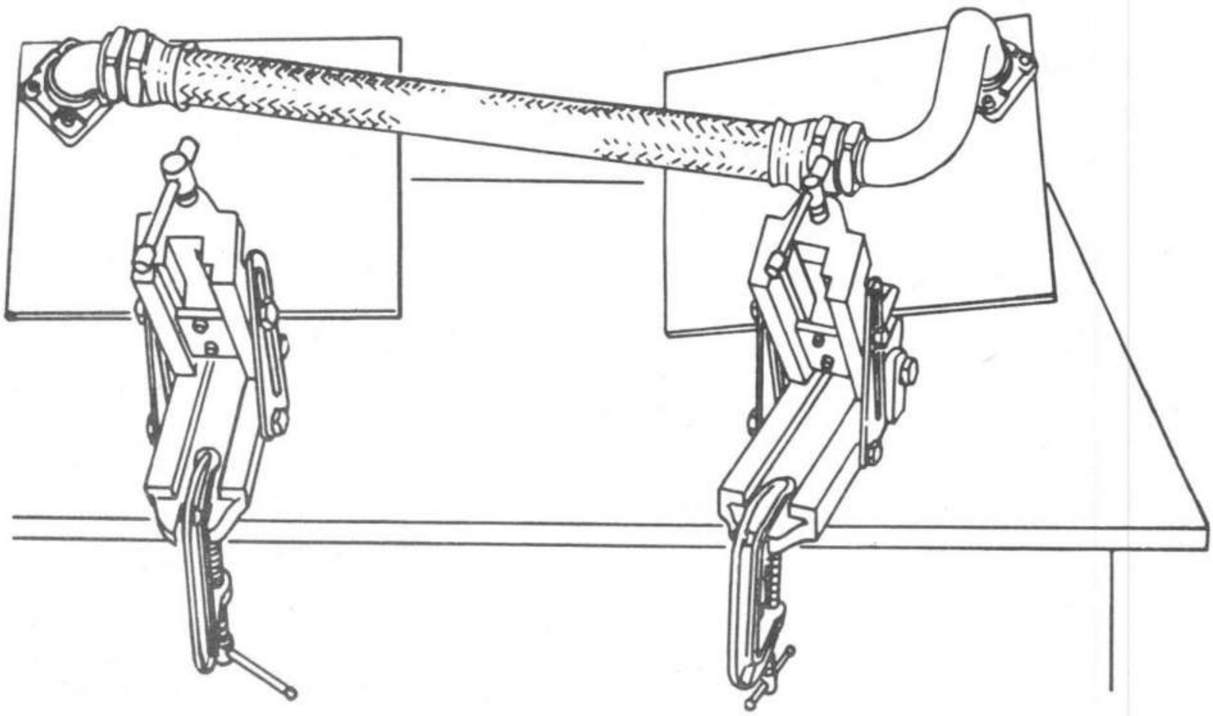


Fig.2 Measuring angle

Angular relationship tolerances

7. Where two end fittings have a specific angular relationship about the axis of the hose, the tolerance of the angular relationship should be $\pm$ 2 deg (see fig.3).

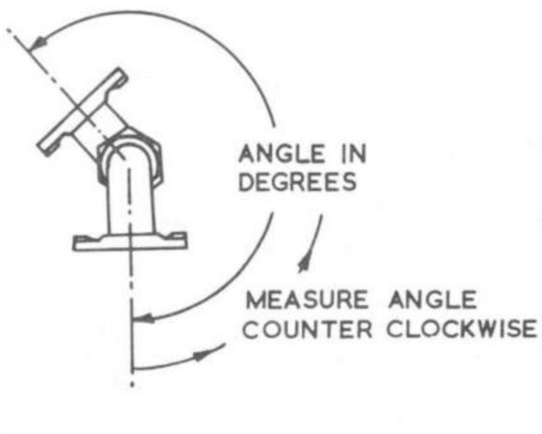


Fig.3 Angular relationship

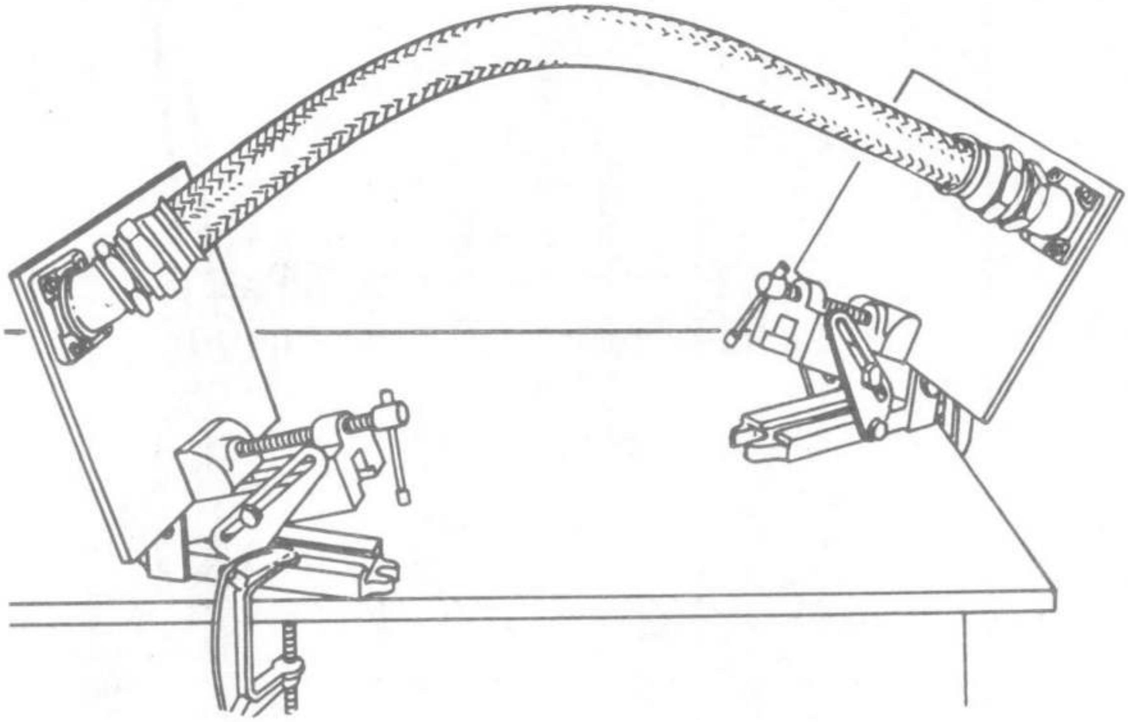


Fig.4 Setting position angles

Fig.4 shows the use of angle vices and universal flange mounting plates to form a fixture for setting position angles. Note:- angle vices or suitable clamps may be used.

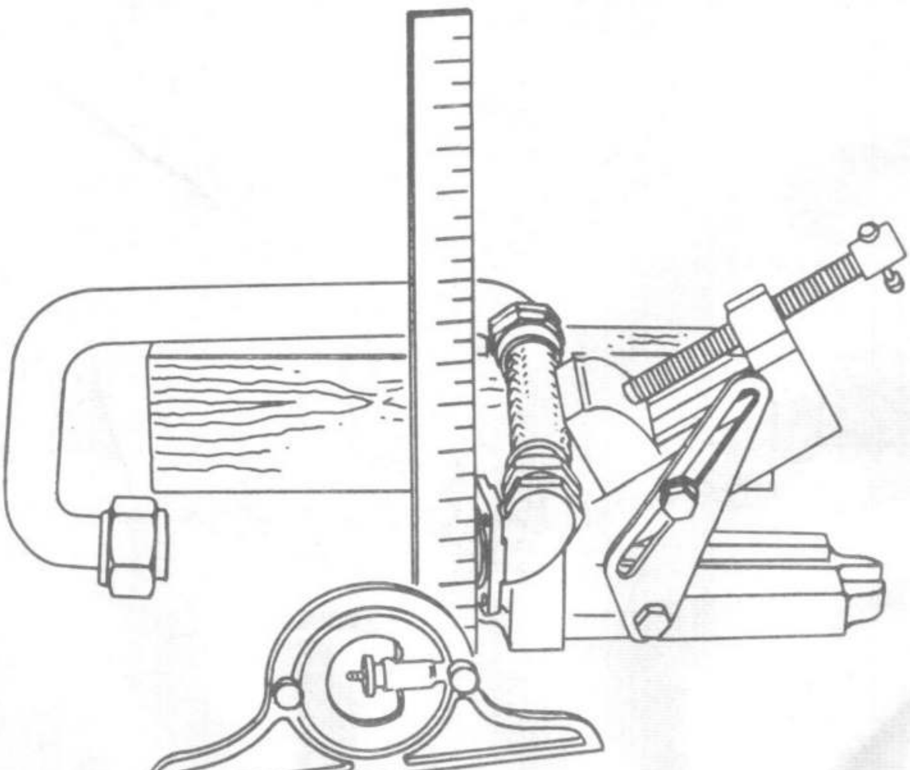


Fig.5 Checking flange face for angular relationship. (Using small parallel and protractor).

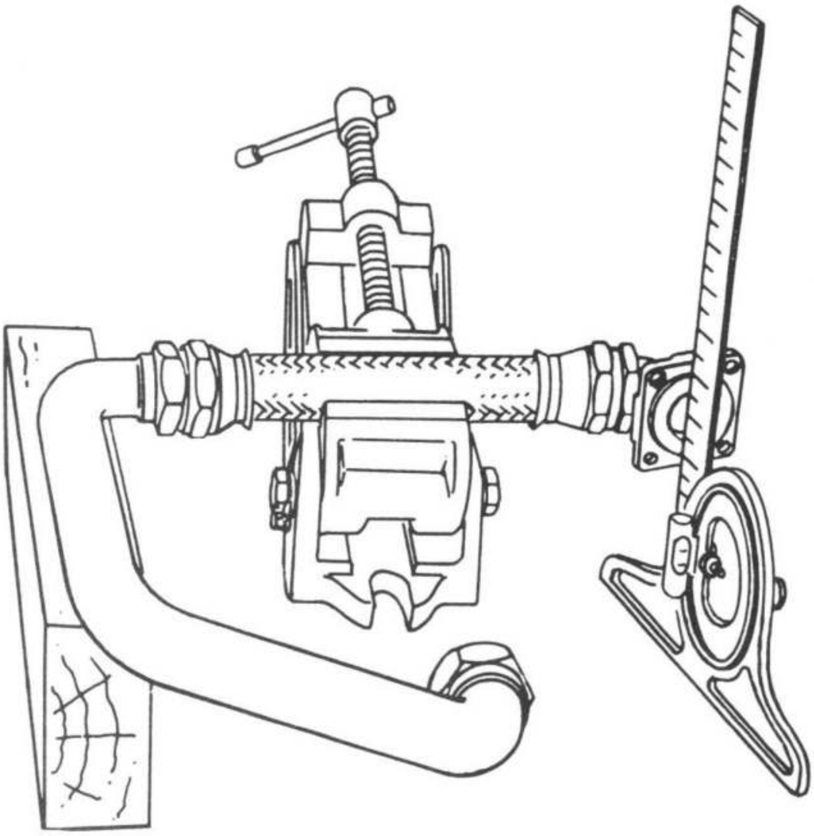


Fig. 6 Checking flange for relationship to 90 deg tangent. (Using small parallel and protractor).

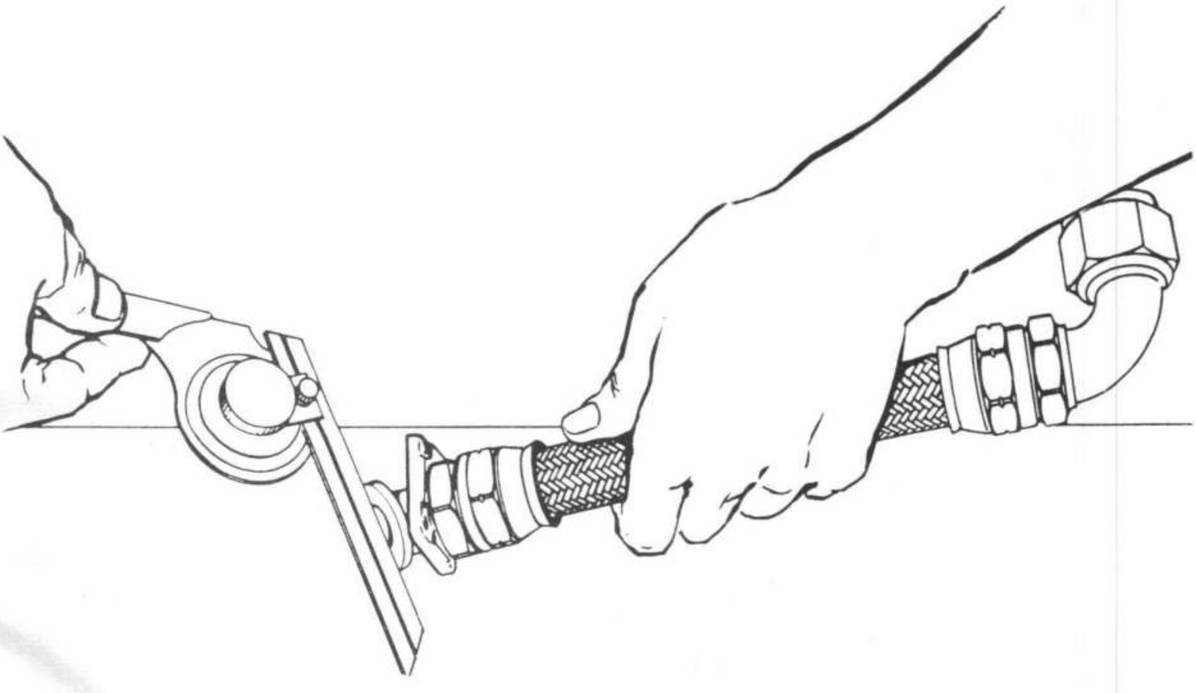
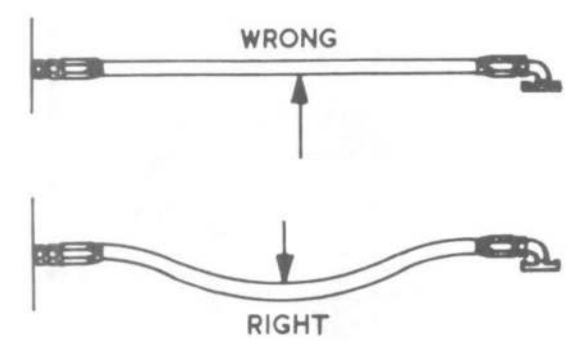


Fig. 7 Simple check for proper rotation of 90 deg elbow

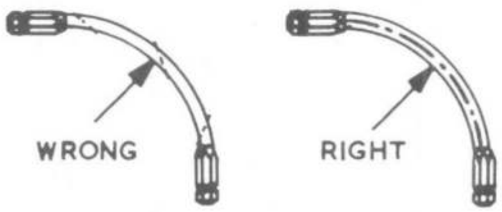
Rubber hose installation guide

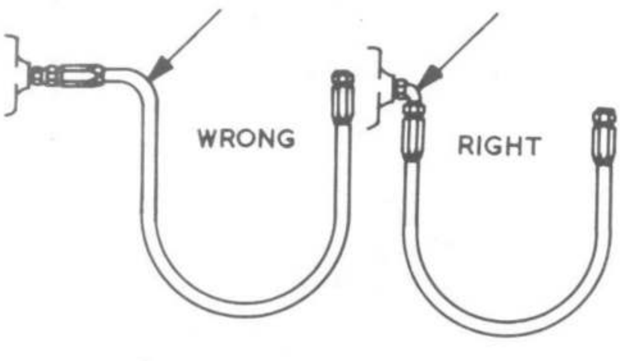
8. Fig. 8 details the procedures to be followed when installing rubber hoses.

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

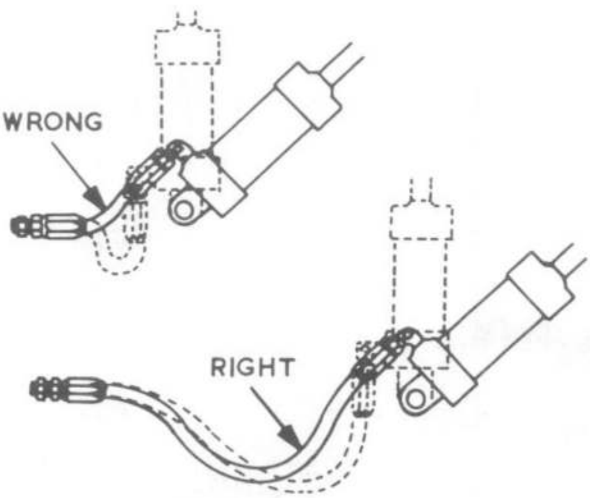


2. Observe linear stripe. The hose must not be twisted. High pressures applied to a twisted hose may cause failure or loosen the nut.





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. 8 Rubber hose installation techniques

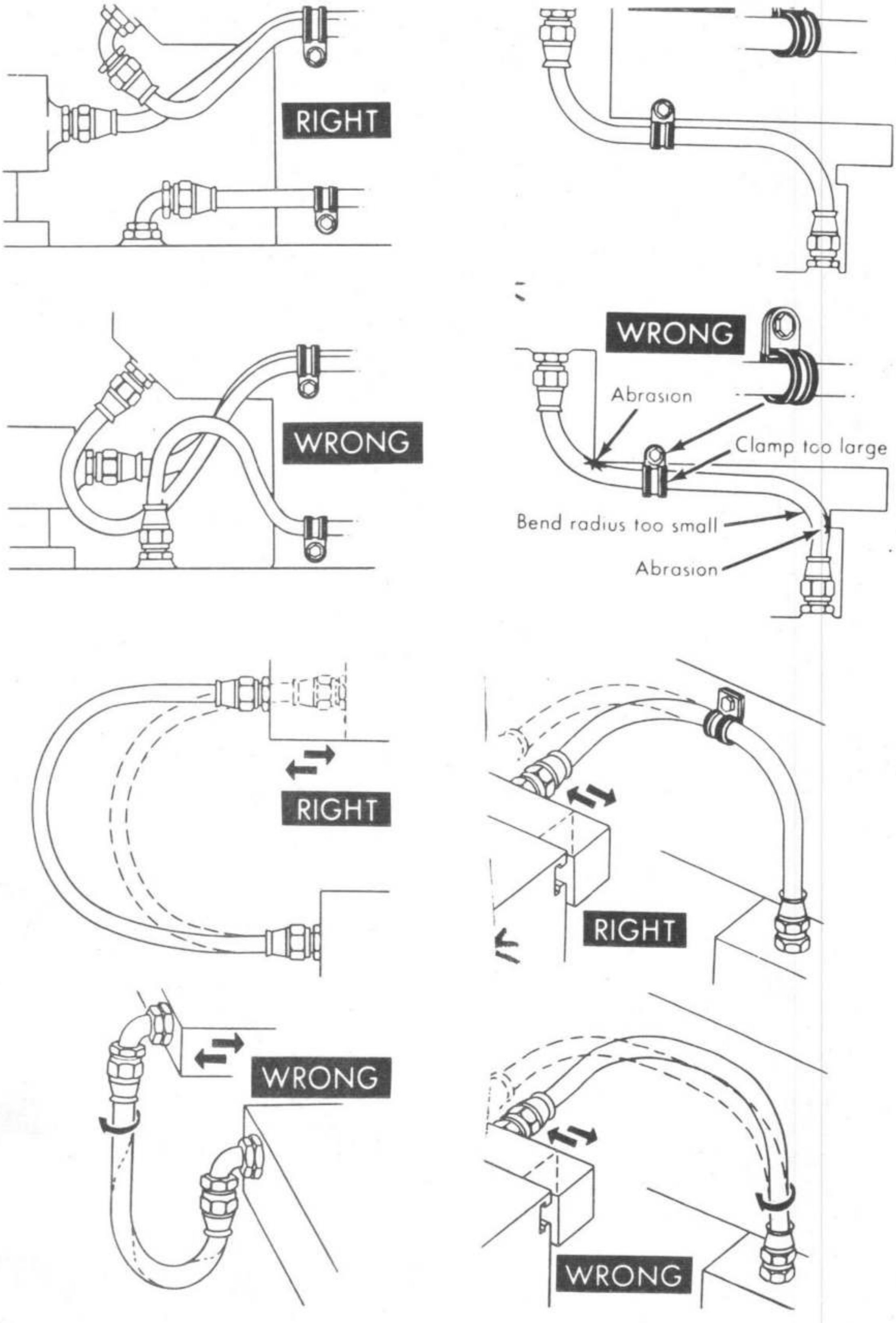


Fig. 9 PTFE (TEFLON) hose installation techniques

PTFE (TEFLON) hose removal and installation guide

9. Fig. 9 details the procedures to be followed when removing and installing PTFE (TEFLON) hoses. The following points should also be taken into consideration when removing this type of hose.

(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 PTFE hose lines on installation or removal. Kinking is possible under the following conditions:-

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

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

(c) Twisting. Flexing installation 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.

Hose markings

10. Hose assemblies which have been made up locally are to be marked for identification purposes in accordance with A. P.101A-0300-1A, Chap.1 (Formerly A. P.1464D, Vol.1, Part 2, Sect.3, Chap.2), using the approved methods of application for international markings. The assemblies are also to be marked with identification bands as detailed in para.29.

Protective sleeves

11. (1) Various types of protective sleeves are used on hose assemblies to give protection against fire, or the stainless steel braiding chafing the airframe as considered necessary.

(2) (RN ONLY). When replacement hoses are locally manufactured, if a protective sleeve (other than fireproof) was fitted to the reject hose, the new hose should be fitted with heat shrinkable protective sleeve, Part No. Aeroquip 900223, of the correct size as indicated in appropriate chapter of this AP, regardless of which type of protective sleeve was fitted to the unserviceable item.

HOSE MEASUREMENTS

Hose assembly length

12. The length of a hose assembly is measured between the two points as shown in fig.10 for the various types of end fittings.

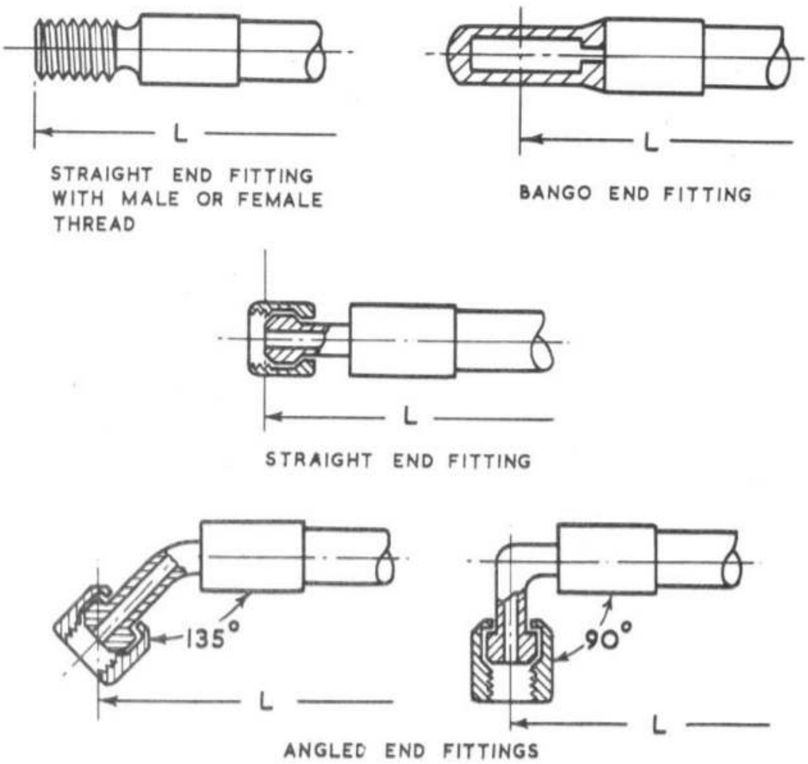


Fig.10 Measurement of hose lengths

Hose assembly length tolerance

13. The tolerance allowed for a specific type hose and various lengths is shown in the following table.

Hose type	Length	Tolerance
302A, 303, 306	18 inches or less	$\pm$ 1/8 inch
602, 611, 617	18 to 36 inches	$\pm \frac{1}{4}$ inch
	36 inches or longer	$\pm$ 1 per cent
309	24 inches or less	$\pm$ 1/8 inch
	24 to 36 inches	$\pm \frac{1}{4}$ inch
	36 to 50 inches	$\pm \frac{1}{2}$ inch
	50 inches or longer	$\pm$ 1 per cent

cont...

Hose type	Length	Tolerance
601	8 inches or less	$\pm$ 1/8 inch
	8 to 16 inches	$\pm$ 3/16 inch
	16 to 24 inches	$\pm$ $\frac{1}{4}$ inch
	24 to 36 inches	$\pm$ 5/16 inch
	36 inches or longer	$\pm$ 1 per cent
PTFE	18 inches or less	$\pm$ 1/8 inch
	18 to 36 inches	$\pm$ $\frac{1}{4}$ inch
	36 to 50 inches	$\pm$ $\frac{1}{2}$ inch
	50 inches or longer	$\pm$ 1 per cent

PRE-INSTALLATION EXAMINATION AND TESTS

(RAF ONLY)

14. Hose assemblies which have been made up locally must, whenever possible, be tested under pressure for leakage and a test must also be made for electrical continuity (where this is required). The pressure test must be made with the fluid which the particular hose is intended to carry, with the exception of the following:-

(1) Hoses for fuel systems should be tested with kerosene.

(2) Hoses for pneumatic systems should be tested with water.

(RN ONLY)

15. Hose assemblies which have been made up locally, must be tested under pressure for leakage and a test made for electrical continuity where applicable. (Where no min test pressure is stated, this is to be taken as one and one half times working pressure). All pipes, EXCEPT OXYGEN AND PITOT, should be tested using the standard hydraulic test bench and fluid OM15, observing all normal precautions. On completion of testing, hose assemblies are to be cleaned using white spirit and dried with air prior to installation. Oxygen and Pitot hoses are to be installed clean and dry, then tested in situ in accordance with the appropriate sections of the relevant A.P.'s for these systems.

16. When pressure testing an assembly, one end is loosely blanked and the appropriate fluid is pumped into the other end. When the fluid begins to seep out of the loosely blanked end fitting, the blank is tightened to ensure a complete seal. The pressure of the fluid in the hose is then increased to the minimum test pressure stated in the appropriate chapter of this A.P. for that particular hose assembly; the hose must withstand that pressure without leaking for 2 or 3 minutes.

17. Every hose assembly must be examined to ensure that the hose is free from obstruction and foreign matter. A satisfactory visual examination can be made by laying the hose in a length of angle iron so that it is perfectly straight, and looking through the bore of the hose while a light or reflector is placed at the other end.

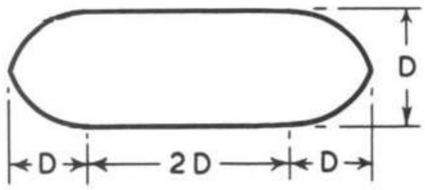
Ball and bobbin test

18. The bore of a hose assembly can be tested for obstruction or restriction by holding the hose in a vertical position and passing a ball bearing through it. The ball should be the size required just to pass through the end fitting.

19. Should a suitable ball bearing not be available, a similar test can be made using a locally manufactured bobbin as illustrated in fig.11. Hose which fail these tests should be discarded.

Note...

It will not be possible to make a bobbin test on hoses with angle end fittings.



BOBBIN FOR HOSE BORE TEST

Fig.11 Bobbin for hose bore test

STORAGE AND HANDLING

General

20. Rubber 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 65 deg 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.

Precautions

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

22. Where rubber is installed 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.

23. 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.

24. Ozone may be increased by electrical discharge of generators or motors in use and as this has a deleterious effect on rubber, rubber equipment should not be stored in the immediate vicinity of electrical plant in operation.

25. Rubber equipment 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.

26. As far as possible, rubber tubing is to be stored in straight lengths on shelves. When rubber tubing 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.

Bulk hose

27. To minimise absolescence or deterioration of hose in storage, follow 'first-in, first out' principle when releasing stock. The open ends of bulk hose held in storage should, after being cut, have the ends sealed using Firesleeve End Dip and Sealant, Part No. AE10187-001, to prevent the ingress of moisture, etc. between the layers of the hose.

Testing and protection

28. All hose assemblies taken from storage should be proof tested prior to installation in aircraft. After testing, hose assemblies are to be thoroughly drained then fitted with blanking caps until required for use. Corrosion protection should be given to end fittings if necessary. The end fittings on air or instrument hose assemblies are not to be oiled, but dried throughly and fitted with oil and grease proof caps. Oxygen hoses complete with blanks should be stored in a 'dry' state.

IDENTIFICATION BANDS (PART NO. 23026)

29. Hose assemblies are to be identified using a permanent metal band, stamped or etched with the following information:-

Hose Part No. or section ref.

Unit serial number

Hose batch number

Date of manufacture

The correct band size for a particular hose is given in Table 2. The bands are not to be removed when the hose is installed in an aircraft.

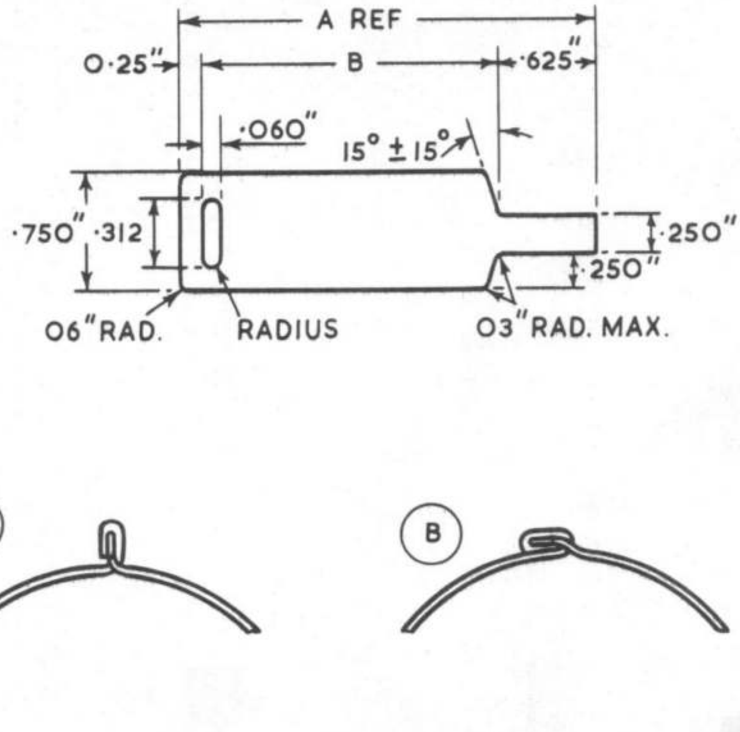


Fig.12 Identification band (Part No. 23036)

Fitting

30. The identification bands (fig.12) are to be fitted securely and shall not slide when the hose is supported vertically by the band. Fit as follows:-

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

(2) Bend end approximately 90 deg at the slot.

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

(4) Bend tap end 180 deg over band and then bend flat down against the band.

TABLE 2

Identification band selection chart

Band Size	Lengths (fig.12) A	B	For use with Aeroquip hose 677	306	309	302 303A	2651 2652	601	656	666 676	667	If fire sleeve used 624
1	1 15/32 in	·719in								-3		
2	1 21/32in	·906in								-4		
3	1 11/16in	·938in							-1			
4	1 13/16in	1·062in						-3				
5	1 7/8in	1·125in	-4							-5		
6	1 15/16in	1·188in							-2			
7	2 1/32in	1·281in						-4				
8	2 1/16in	1·312in								-6		
9	2 3/32in	1·344in		-4		-3	-3					
10	2 1/8in	1·375in							-3			
11	2 3/16in	1·438in						-5				
12	2 9/32in	1·531in				-4	-4					
13	2 5/16in	1·562in							-4			
14	2 11/32in	1·594in						-6				
15	2 13/32in	1·656in	-6							-8		
16	2 15/32in	1·719in										-5
17	2 1/2in	1·750in		-6		-5	-5					
18	2 21/32in	1·906in			-4			-8	-6			
19	2 11/16in	1·938in										-6
20	2 23/32	1·969in	-8							-10		

Band Size	Lengths (fig.12) A	Lengths (fig.12) B	For use with Aeroquip hose 677	306	309	302 303A	2651 2652	601	656	666 676	667	If fire sleeve used 624
21	2 25/32in	2·031in				-6	-6					
22	2 7/8in	2·125in										-7
23	3 1/16in	2·312in		-8	-6	-8	-8		-9			-8
24	3 1/8in	2·375in						-10		-12		
25	3 15/32	2·719in			-8				-10			-10
26	3 17/32in	2·781in				-10	-10					
27	3 9/16in	2·812in						-12				
28	3 21/32in	2·906in										-11
29	3 7/8in	3·125in										-12
30	3 15/16in	3·188in			-10				-12	-16		-13
31	4 1/32in	3·281in				-12						
32	4 3/16in	3·438in						-16				
33	4 1/4in	3·500in										
34	4 11/32in	3·594in							-13			
35	4 1/2in	3·750in			-12	-16			-15			
36	4 5/8in	3·875in										-16
37	4 23/32in	3·969in								-20		
38	4 31/32in	4·219in							-17			
39	5 1/32in	4·281in									-16	-18
40	5 1/16in	4·312in						-20				
41	5 1/4in	4·500in							-18			
42	5 11/32in	4·594in			-16	-20						
43	5 7/16in	4·688in										
44	5 13/16in	5·062in										-22
45	5 7/8in	5·125in						-24				
46	6 1/8in	5·375in				-24						
47	6 7/32in	5·469in									-20	
48	6 19/32in	5·844in										
49	7 7/16in	6·688in						-32				-30
50	7 17/32in	6·781in				-32						-32

INSPECTION OF HOSE LINES REMOVED FROM SERVICE

External

31. External inspection of hose lines removed from service. All hose assemblies shall be inspected to determine if the assembly can be returned to service, repaired or replaced.

Note...

Lines removed because of expiration of service life are to be disassembled and fittings salvaged.

32. Unsleeved hose lines. Thoroughly examine hose externally for evidence of twisting, kinking, abrasion and broken wires.

(1) Abrasion and broken wires. Random broken wires are acceptable in low pressure systems; however, if excessive wire breakage, either general or localized as a result of abrasion etc. is found, the hose assembly is to be scrapped.

Note...

The following is offered as rule-of-thumb measure:-

(1) If two (2) or more broken wires per plait or more than six (6) broken wires per lineal foot are found, or any broken wire in a position where kinking is suspected, the hose should be scrapped. Crossed-over reinforcement wires are not to be the cause for scrapping.

(2) Hydraulic pressure lines. Hose lines used on hydraulic pressure which are found to have broken wires are to be scrapped and the fittings salvaged.

(3) Kinking. Any hose assembly showing evidence of dents, kinks or twisting is to be scrapped.

33. Fire Sleeved Hose Lines

(1) Fuel or oil soaked fire sleeve is to be scrapped.

(2) Severely abraded or mutilated fire sleeve is to be scrapped.

(3) Slight abrasion or frayed ends may be salvaged, repaired and returned to stock.

(4) Undamaged fire sleeve may be returned to stock.

Internal

34. Internal inspection of hose lines removed from service.

35. Restrictions. Carefully examine hose internally for restriction, tube collapse or other signs of hose damage.

36. Inspection procedures. The following internal inspection procedures are recommended:-

(1) Straight hose assemblies. Hose ID can be checked by looking through hose at a light source.

(2) Elbow fitting on one end. Insert flexible light into one end and examine from straight end.

(3) Elbow fittings on both ends. Insert flexible inspection light into one end and examine from opposite end with dental-type mirror. This procedure is only practical on larger size hose assemblies.

(4) See paragraph 18 for details of ball and bobbin tests.

Chapter 2

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TABLES

ILLUSTRATIONS

ILLUSTRATIONS (cont...)

Introduction

1. The contents of this chapter are relevant to both the R.N. and R.A.F. unless otherwise stated.

DESCRIPTION

2. Aeroquip 601 hose consists of a seamless synthetic rubber tube which is externally reinforced with a strainless wire braid (fig.1). It is extensively used in aircraft and power plant fuel and oil systems where flexibility, light-weight and fire resistance are the prime considerations. A complete list of the various sizes of hose and relevant installation data is given in Table 1 of this chapter.

3. The hose is identified by tape, which is secured around the braid and shows the manufacturer's code number and the cure data at regular intervals along the length of the hose. On attachment of fittings (hose assembly),a metal band is secured around the hose to show full details of the assembly (see Chapter 1, para.29). The basic date for lifing purposes is the cure date. Regardless of age, hose showing signs of weathering, cracking or separation must not be used. The hoses are used in aircraft power plants and airframe fuel and oil systems.

CAUTION...

They are not recommended for high pressure hydraulic application.

4. They have an operating pressure range of between 200 to 1000 lb/in^2, and will operate satisfactorily at a temperature range of between -40 deg F to +300 deg F.

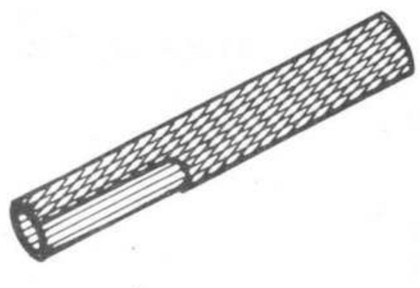


Fig.1 601 Hose

TABLE 1

List of 601 hoses and installation data

Part No.	Size I.D. (in)	Size O.D. (in)	PRESSURES lbf/in^2 Max. Operating	Min Test	Min Test Pressure (Flange Fittings) RAF ONLY	Min. Burst	Min. Bend Radii* (in)	Weight per inch (in)	Sleeve Part No.	Clamp Part No.	PROTECTIVE SLEEVE Part No. NAVY ONLY
601-3	0.156	0.375	1000	3000		6000	1.75	0.008	624-7	900591 B1C	900223-2
601-4	0.219	0.438	1000	3000		6000	2.00	0.010	624-8	900591 B1C	900223-2
601-5	0.281	0.484	1000	3000		6000	2.25	0.012	624-9	900591 B2C	900223-3
601-6	0.344	0.547	1000	3000		6000	2.50	0.013	526-10	900591 B2C	900223-3
601-8	0.438	0.641	1000	2500		5000	3.50	0.014	624-12	900591 B2C	900223-4
601-10	0.562	0.797	1000	2500	1500	5000	4.00	0.017	624-16	900591 B2C	900223-5
601-12	0.688	0.938	1000	2000	1500	3750	4.50	0.024	624-18	900591 B3C	900223-5
601-16	0.875	1.156	750	1500	1500	2500	5.50	0.032	624-22	900591 B3C	900223-7
601-20	1.125	1.437	500	1300	1250	2000	8.00	0.041	624-26	900591 B4C	900223-9
601-24	1.375	1.704	250	800	750	2000	9.00	0.056	624-30	900591 B4C	900223-9
601-32	1.781	2.094	200	600	600	1200	12.50	0.075	624-38	900591 B5C	900223-1

Fittings

5. The various types of 601 hose and fittings are shown in fig.2. Each end fitting consists of a socket and a nipple assembly, an example of a straight fitting is shown in fig.3. Different types of end fittings are designed for use with other types of Aeroquip hoses, only fittings recommended by the manufacturers are to be used with 601 hose. Nuts and nipples from sizes -3 to -5 are of cadmium plated steel whilst sizes -6 and those shown in fig.2, including sockets, are anodised aluminium.

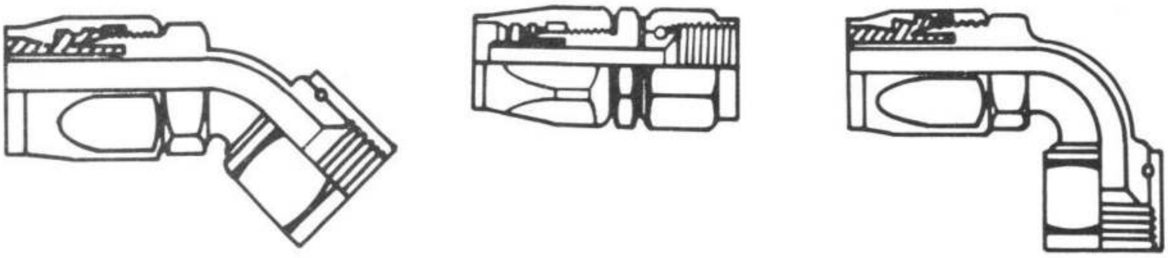


Fig.2 End fittings

Material and finish:

Nut and nipple, sizes 3, 4 and 5, cadmium-plated steel. Nut and nipple, sizes 6 up, and socket are anodized aluminium. All materials and finishes conform to applicable specifications for end fittings used in aircraft fluid systems.

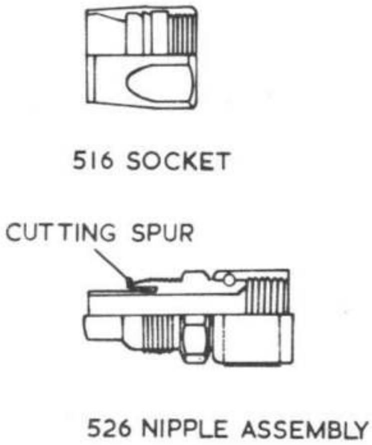


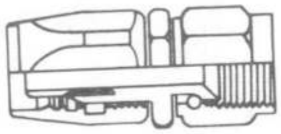
Fig.3 Straight fitting

6. These fittings use a circumferential cutter or spur on the nipple assembly (refer to fig.3) to cut into the end of the hose during initial assembly, so as to form a positive fluid seal. At the same time as the seal is formed, the outer wire braid is separated from the rubber hose, forced over the external surface of the spur and then gripped by the socket. This action prevents the hose blowing off the end fitting when pressure is applied. To ensure correct fitment, the assembly instructions contained in this chapter are to be strictly adhered to. All hose assemblies must be proof tested, cleaned and identification and marking bands fitted, before being made available for installation.

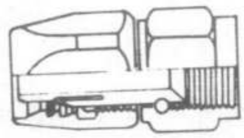
Design change - straight swivel end fittings

7. The design of straight swivel end fittings has been improved to eliminate damage

to socket seats and swivel nuts caused by over-tightening the fitting on to adaptors and slipping on assembly. This has now been overcome by adding a hexagon to the nipple for gripping and spacing purposes, see fig.4. There is no change in the nipple or hose assembly part numbers.



OLD DESIGN



NEW DESIGN

Fig.4 Design change

DISMANTLING

Complete hose assembly

8. Before attempting to dismantle hose assemblies incorporating elbow fittings, check the angular relationship of the end fittings and assembly length to facilitate subsequent assembly of its replacement. Then proceed to dismantle the hose as follows:-

(1) (a) If fitted with fire sleeve, remove the fire sleeve clamps and pull back the sleeve from end.

(b) Where heat shrinkable protective sleeve is fitted, remove sufficient sleeve from each end to facilitate removal of the end fitting.

(2) Fit vice clamps (Part No. F1983) to the jaws of a bench vice and place the socket in the vice. Use the correct size spanner and unscrew the nipple assembly from the socket (fig.5). It should be noted that with end fittings of the old design, it is necessary to lock the nut of the nipple assembly (using the correct assembly mandrel), in order to unscrew the nipple assembly from the socket.

CAUTION...

The degree of 'vice grip' must be limited to prevent distortion of the socket.

(3) Remove the socket and fire sleeve (where applicable) from the hose.

(4) Remove the fitting from the opposite end of the hose as detailed in (2) and (3) above.

Note...

All hose is to be scrapped. Fire sleeves and fittings must be examined for possible re-use (see para.9).

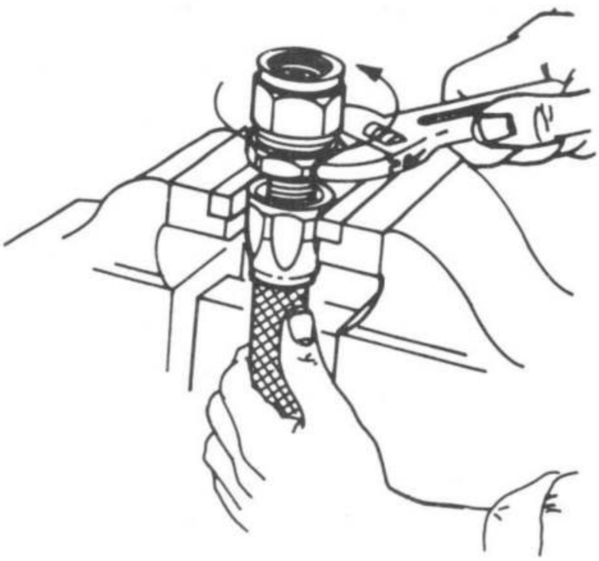


Fig.5 Removing nipple assembly

REPAIR AND REPLACEMENT

Hose assemblies

9. All damaged hose assemblies are to have the end fittings removed and salvaged for re-use, subject to the examination in accordance with para.10. The hose, complete with heat shrinkable protective sleeve (if fitted), must be scrapped, fire sleeves should be examined for possible re-use.

Fittings (Navy only)

10. End fittings which have been salvaged are to have the external surfaces and, as far as possible, the internal surfaces examined for damage resulting from corrosion, chafing, impacting or overtightening. The cutting spurs are to be checked for cleanliness of the internal recesses and concentricity of using the appropriate rubber removal tool (para.14), and the nipple assembly securing nut retaining (setting) wire checked for security.

Fittings (RAF only)

11. Replace all fittings found unsuitable for re-use. Damaged swivel nuts can be replaced as detailed in para.12.

Note...

This is applicable to the RAF only.

Removal and replacement of the wire retension type swivel nuts (RAF only)

12. Before attempting to remove a wire on type swivel nut, the nipple must be thoroughly examined (fig.6), to ensure that it has none of the following defects:-

(1) Nicks or indentations on the connection end in sealing area 'A'.

(2) Taper and thread of hose end has not been deformed as a result of misassembly.

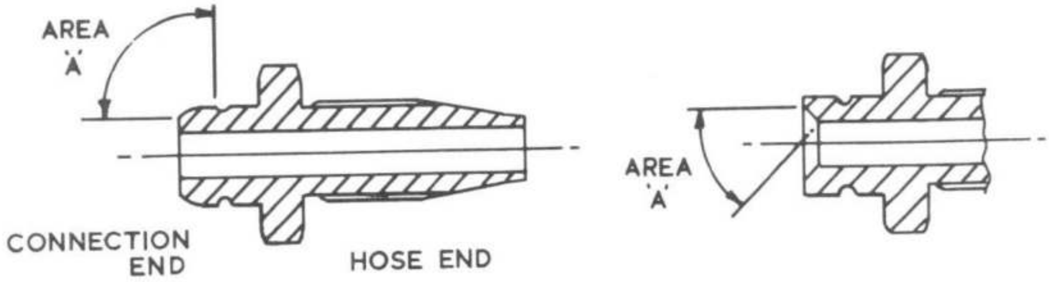


Fig.6 Nipple profile

13. Providing the nipple is satisfactory, the procedure to be followed for removing a wire retension swivel nut is shown in figs. 7 (a) and (b).

Cleanning the nipple spur

14. Any rubber torn from the hose during the dismantling procedure which remains lodged in the internal recesses of the cutting spur, is to be removed using the rubber removal tool (Aeroquip Part No. S1021), of the correct size (fig.8).

Note...

This tool should also be used to check the cutting spur of the nipple assembly for concentricity.

Nipple spur repair (RAF only)

15. The rubber removing tool can also be used to restore the concentricity of cutting spur and lip of the fitting. A nipple spur that is bent out may be re-worked, although damage must not exceed ·015in. A nipple spur that is dented or collapsed may be re-shaped providing the nipple will accept the knife edge of the rubber removing tool.

Nipple shank

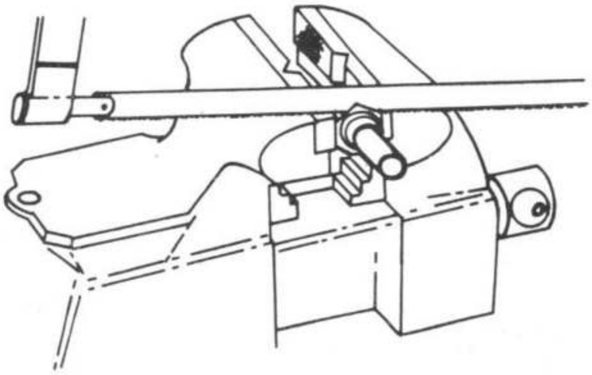
16. The nipple shank is to be concentric and undamaged.

Note...

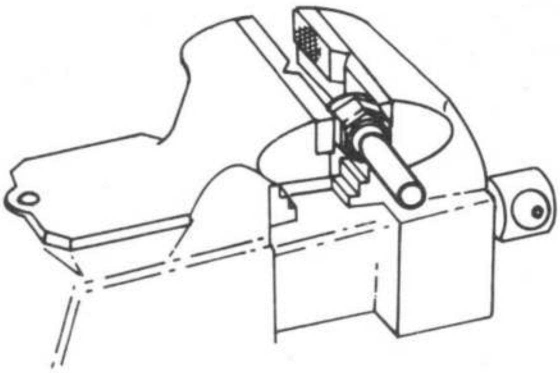
If the nipple spur edge is rolled or torn during the re-shaping and rubber removing operation, the part is to be scrapped.

17. If the rubber removing tool is not available, the annular or recess dimensions (nipple spur inside diameter to nipple shank outside diameter), is to be checked for acceptability by the dimensions listed in the following table in conjunction with reference to fig.9.

(1) Place nut of end fitting in a vice (fitted with vice clamps) with the wire hole at the top.



(2) With a fine-blade hack-saw, cut the nut approximately 1/16in deep all the way round, in line with the hole. The front section of the nut should now fall off.



(3) With a pair of pliers, grip the tang of the wire and pull out of groove, slip the back of the nut off the nipple.

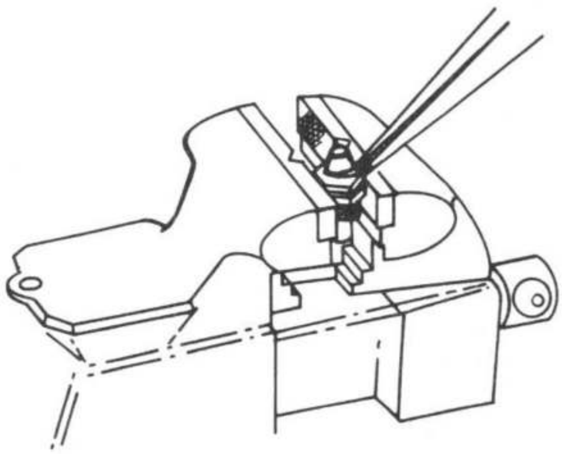
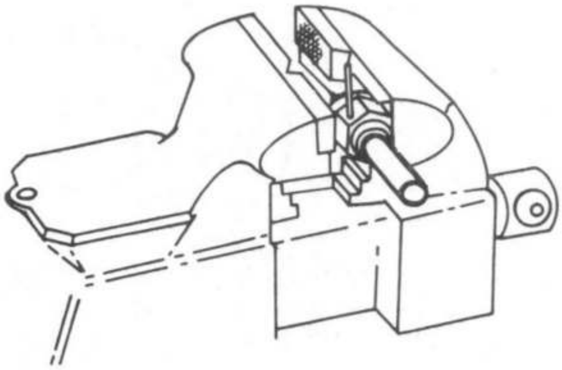


Fig. 7 (a) Wire retension swivel nut removal (RAF only)

(4) Check that the wire groove and seating area of the nipple are still suitable for re-use. If so, place new nut in the vice with the wire hole at the top, place nipple inside nut and push wire into hole.



(5) Use a small hammer to drive wire into nut.

(6) Punch wire below hexagon with a flat bottomed punch.

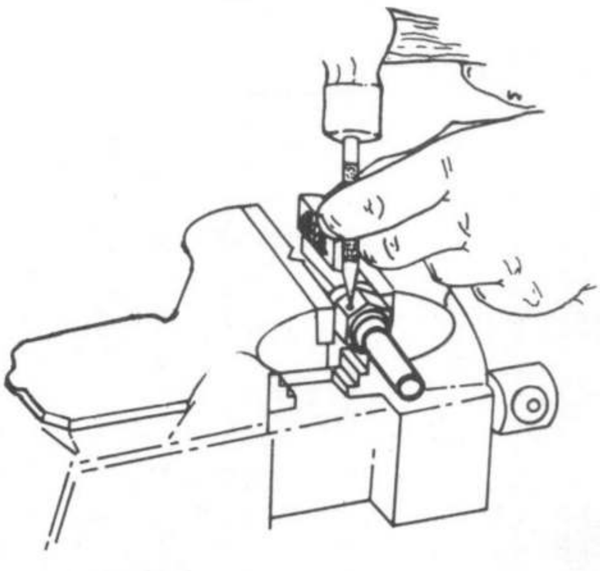


Fig.7 (b) Wire retension swivel nut removal (RAF only)

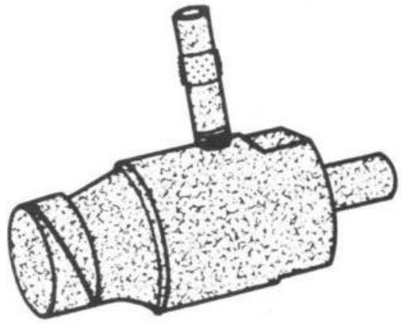


Fig. 8 Rubber removing tool (Part No. S1021)

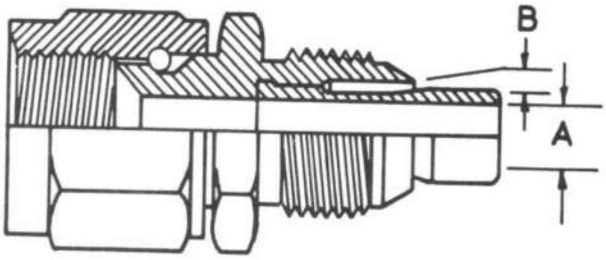


Fig. 9 Nipple spur and nipple shank dimensions

Size	A Max	A Min	B Min
-3	.240	.217	.031
-4	.303	.283	.029
-5	.358	.337	.029
-6	.415	.398	.025
-8	.534	.511	.035
-10	.669	.642	.041
-12	.791	.767	.037
-16	.986	.957	.043
-20	1.261	1.229	.048
-24	1.486	1.460	.038
-32	1.961	1.927	.049

All dimensions in inches

The cutting edge of the spur is to be smooth and concentric to the dimensions shown.

ASSEMBLY

General

17. The following instructions must be followed when manufacturing hose assemblies from new or salvaged components.

Note...

Assembly mandrels are not needed for hand assembly of new fittings which have a driving hexagon on the nipple. Old design fittings, without a driving hexagon, require the use of an assembly mandrel (fig.10).

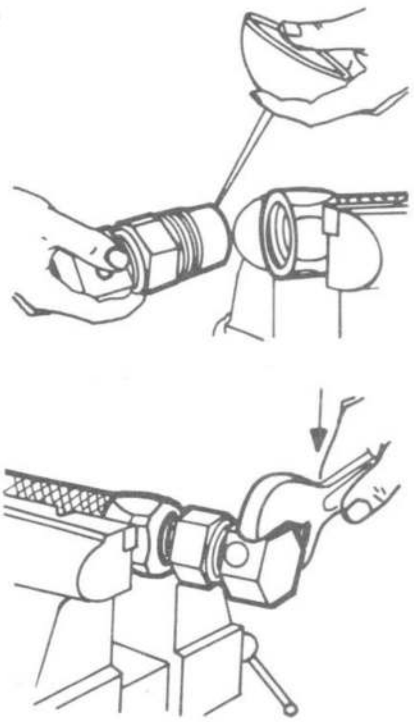


Fig.10 Using an assembly mandrel

Straight swivel fittings

18. (1) Determine the length of the hose by subtracting the cut-off factors in Table 2 from the required length of the assembly, noting the variation in the dimensions D and B, if a change is being made from old design to new design end fittings, or vice versa. With reference to fig.11, to make hose assembly of length 'L', cut hose to length 'J'. The procedures for performing this task are detailed in (2) to (7).

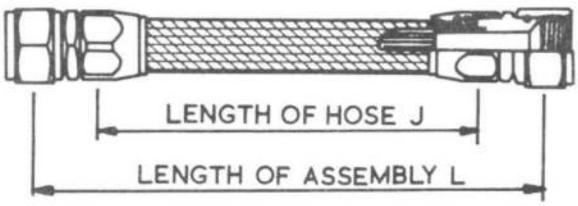


Fig.11 Hose with straight swivel fitting

(2) Fit vice clamps (Part No. F1983) to vice and clamp hose in the vice. Cut hose squarely to length. Use hose cut-off machine or fine tooth hacksaw. To minimize wire braid flare-out, wrap hose with masking tape and saw through tape. Remove tape before proceeding to (3).

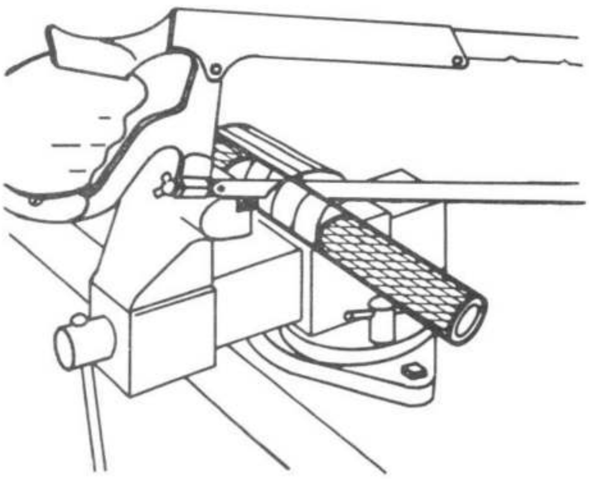


Fig.12 Cutting hose

(3) Fit socket in the vice and insert hose in socket with a twisting, pushing motion until hose is in line with back of socket threads.

(4) Important - mark hose position around hose at rear of socket. Use a grease pencil, painted line or tape.

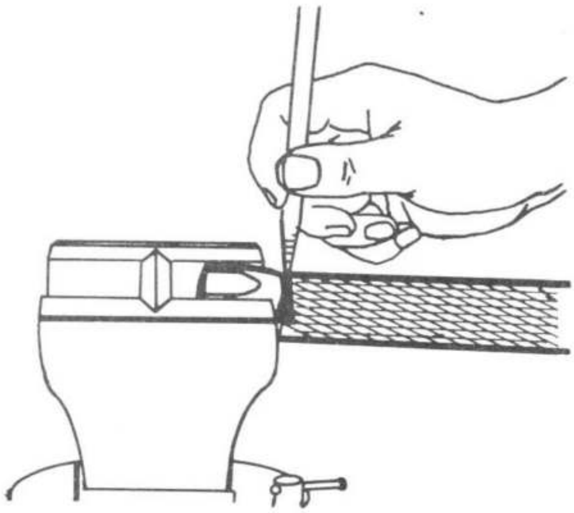


Fig.13 Marking hose

(5) Lubricate inside of hose and nipple threads liberally. Use SAE 30 lubricating oil.

CAUTION...

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

(6) Fit the nipple assembly onto the assembly mandrel required. Carefully insert nipple and engage nipple and socket threads while holding hose in position with other hand. Make sure that hose does not push out of socket by observing mark made in (4).

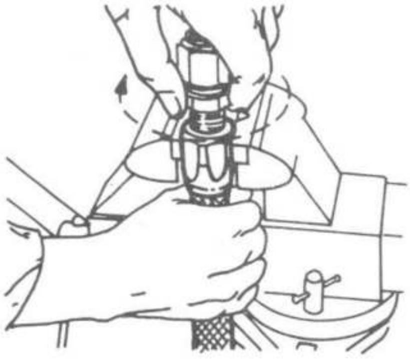


Fig.14 End fitting hose assembly

(7) Complete assembly using spanner while continuing to hold hose in position. Maximum allowable gap is ·041 inches in sizes 3,4 and 5 and ·031 inches in sizes 6 and upwards.

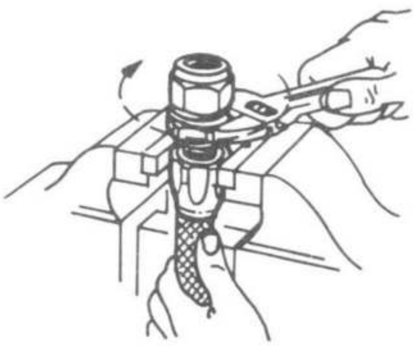


Fig.15 Tightening end fitting

<u>Hose assembly tolerance length</u>

8in or less	$\pm$ 1/8 in
8in to 16in	$\pm$ 3/16 in
16in to 24in	$\pm$ $\frac{1}{4}$ in
24in to 36in	$\pm$ 5/16in
36in or longer	$\pm$ 1 per cent

(8) Finally, check for hose push-out by observing hose position mark. None should be evident. If hose push-out has occurred, dismantle fitting, push hose back into correct position, re-lubricate and assemble.

(9) Proof test assembly in accordance with instructions in Chapter 1. No push-out should occur on sizes 3 to 11. For sizes 12 upwards the push-out of the hose should not exceed 1/32in after proof test.

Elbow fittings

19. The required angles at which the end fittings (relative to one another) should be when the manufacturing process is complete, may be obtained from:-

(1) The appropriate hose assembly drawing, and using the methods described in Chapter 1, para. (6) and (7).

(2) By comparison with a good known hose assembly.

(3) By an assembly mock up on the intended points of installation.

20. Determine the length of the hose by subtracting the cut-off factors in Table 2. With reference to fig.16, to make hose assembly of length 'L', cut hose to length 'J'. The procedures for performing this task are detailed in (1) to (7).

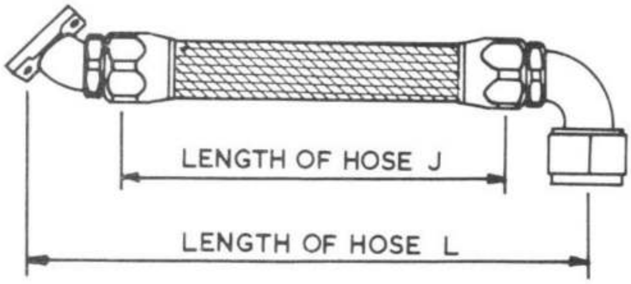


Fig.16 Hose with elbow fittings

(1) Follows steps (2), (3) and (4) of para.18.

(2) For flange elbow fittings, drop flange over threaded end of nipple. Nipple shoulder must fit into counterbore of flange.

(3) Lubricate inside of hose and nipple threads liberally. Use SAE30 lubricating oil.

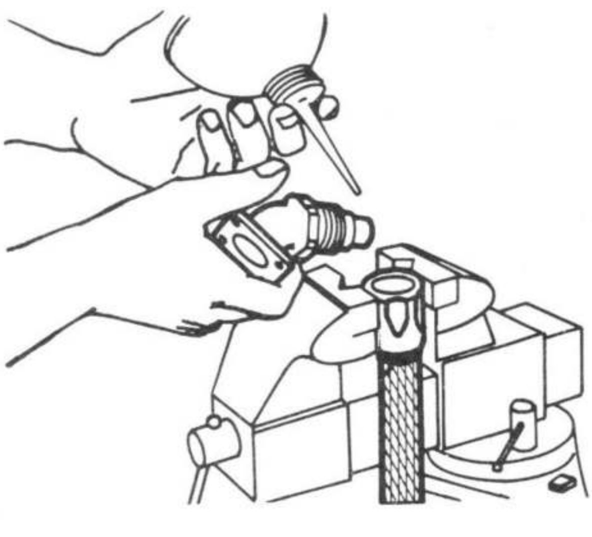


Fig.17 Lubricating fitting

CAUTION...

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

(4) Carefully insert nipple and engage nipple and socket threads while holding hose in position with other hand. Make sure hose does not push out of socket by observing mark.

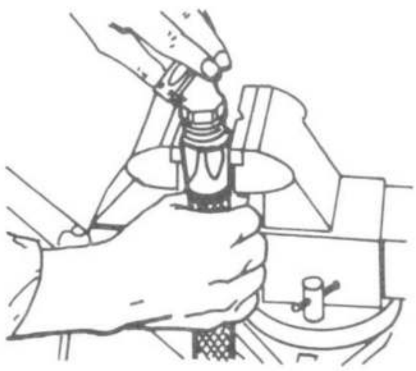


Fig. 18 Elbow fitting - hose assembly

(5) Complete assembly using spanner on elbow hex while continuing to hold hose in position. Tighten until hex is snug against socket. On forged elbow, use spanner on forging flats. Tighten until shoulder is snug against socket.

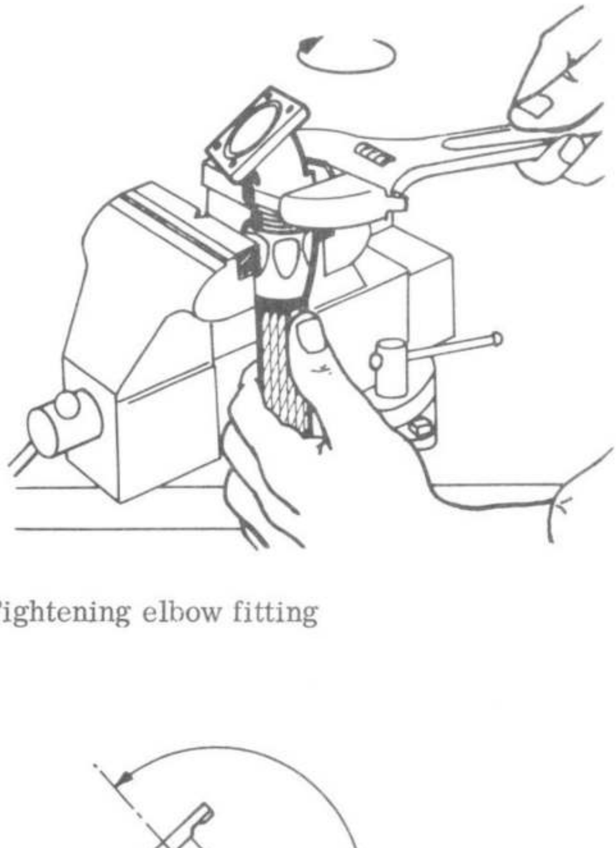


Fig. 19 Tightening elbow fitting

(6) Adjustments may be necessary to obtain the desired position angle ($\pm$ 2 deg) between two elbows. In order to minimize backing off elbows to position, the following procedures should supplement (5).

(a) Tighten both elbows to within ·031 in of socket, then start to position for relative angle between elbows.

Fig. 20 Positioning

(b) Finish assembly by adjusting both elbows. Backing-off position should be avoided and, in no case, should exceed $\frac{1}{4}$ turn. Maximum allowable gap between the hexagon and the socket joint surface is 0·041in for hose sizes, 3, 4 and 5 and 0·31in for sizes 6 and above.

(7) Finally, check for hose push-out and clean, inspect and proof test.

Note...

Hose push-out after proof test should not exceed 1/32in on size 12 and up. None is allowable in smaller sizes.

TABLE 2

Hose cut-off factors

Note...

Hose cut-off factors are for one end only. Add cut-off factors for each end together and subtract from the desired hose assembly length to find the correct hose length (see para.17 and 19).

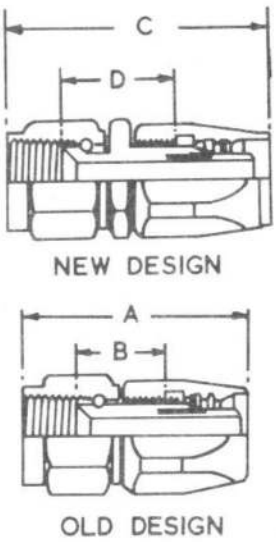


Fig.21 Hose cut-off factor (straight swivel fittings)

	OLD DESIGN			NEW DESIGN		
	Hose size	A	Hose cut-off factor (B)	C	Hose cut-off factor (D)	D-B
	-3	1.40	0.49	1.64	0.64	0.15
	-4	1.46	0.51	1.70	0.65	0.14
	-5	1.53	0.56	1.76	0.70	0.14
	-6	1.63	0.60	1.89	0.76	0.16
	-8	1.95	0.76	2.22	0.94	0.18
	-10	2.16	0.80	2.44	0.99	0.19
	-12	2.28	0.79	2.58	1.00	0.21
	-16	2.62	0.92	2.96	1.16	0.24
	-20	2.88	1.05	3.28	1.34	0.29
	-24	3.12	1.14	3.53	1.44	0.30
	-32	3.64	1.27	4.08	1.62	0.35

All dimensions in inches

cont...

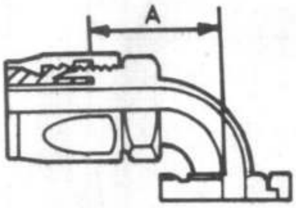


Fig.22 Hose cut-off factor (90 deg flange)

Fitting Part No.	Hose cut-off factor (A) (ins)	Swivel nuts RAF ONLY	Wire RAF ONLY
8890-12D	1.63		
8890-16D	1.73		
8890-20D	2.06		
8890-24D	2.22		
8890-32D	2.67		

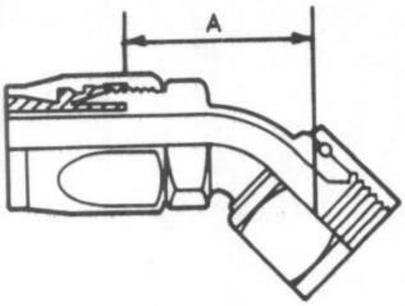


Fig.23 Hose cut-off factor (45 deg swivel fitting)

8846-3	1.05		
8846-4	1.05		
8846-5	1.13		
8846-6D	1.22		
8846-8D	1.30		
8846-10D	1.44	029001	900303-1
8846-12D	1.75		
8846-16D	1.88		
8846-20D	2.13		
8846-24D	2.28		
8846-32D	2.70		

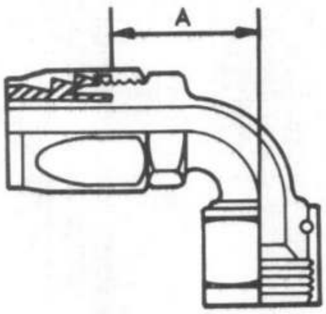
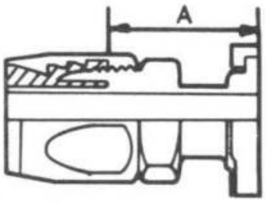
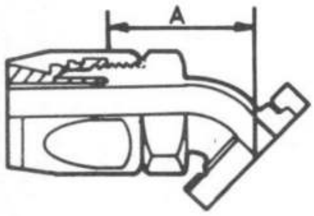


Fig.24 Hose cut-off factor (90 deg swivel fitting)

8891-3	0.89		
8891-4	0.89		
8891-5	0.97		
8891-6D	1.06		
8891-8D	1.14		
8891-10D	1.27		
8891-12D	1.63	029001	900303-1
8891-16D	1.73		
8891-20D	2.06		
8891-24D	2.22		
8891-32D	2.67		

	Fitting Part No.	Hose cut-off factor (A) (ins)
 Fig. 25 Hose cut-off factor (straight flange fitting)	8844-12D	1.25
	8844-16D	1.30
	8844-20D	1.50
	8844-24D	1.34
	8844-32D	1.53
 Fig. 26 Hose cut-off factor (45 deg flange fitting)	8845-12D	1.61
	8845-16D	1.67
	8845-20D	1.94
	8845-24D	2.05
	8845-32D	2.38


U/V LIGHTING
LOW
UP