

How To Identify, Select and Assemble  
Aeroquip® Brand Aircraft Hose and Fittings



*Powering Business Worldwide*

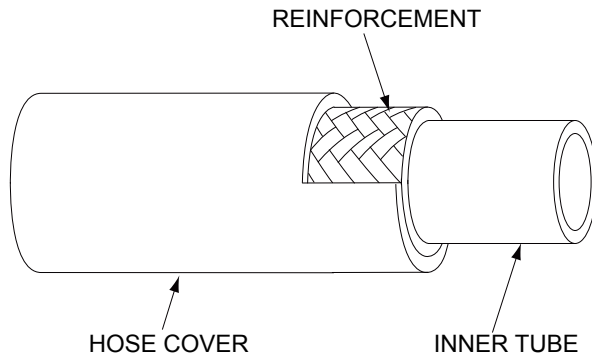
# Table of Contents

Hose Construction and Identification	3
Fitting Construction and Identification	7
Hose Assembly Procedures	10
Chafe Guards, Firesleeves and Internal Coils	16

# Hose Construction and Identification

## Rubber hoses consists of three basic parts:

1. Inner Tube
2. Reinforcement
3. Cover



## INNER TUBE

In designing an inner tube, certain requirements must be met if the tube is to perform its function satisfactorily. Some of these, requirements are:

1. It must be flexible.
2. It must retain its characteristics when exposed to specific high and low temperature ranges.
3. It must be impermeable to the substance or agent that it has to carry. (Must have minimum porosity).
4. It must be smooth to offer minimum resistance to flow.
5. It must be made of material which is chemically compatible with the substance or agent which it is to carry.

There are several different materials which are used in the manufacturing of inner tubes, however we will highlight only four:

1. Buna-N
2. Neoprene
3. PTFE
4. CPE

Some of the characteristics of these compounds are:

### ***Buna-N***

Buna-N is a synthetic rubber compound which has excellent resistance to petroleum based oils and solvents, and is an ideal material for inner tubes because of these properties.

### ***Neoprene***

Neoprene is a synthetic rubber compound which has an acetylene base. When compounded for use as an inner tube, it fulfills all of the necessary requirements for use as a tube although its resistance to petroleum based oils and solvents is not quite as good as Buna-N. However, Neoprene has better abrasion resistance characteristics than Buna-N.

### ***PTFE***

When PTFE is compounded and extruded into an inner tube, it provides certain features that are unexcelled in many ways. It is capable of operating under a very wide temperature range, -65°F to +450°F (-19°C to 233°C). It is compatible with nearly every substance or agent used. Its surface is wax like which provides minimum resistance to flow. Sticky, viscous materials will not cling to it. A PTFE tube has less volumetric expansion than a rubber tube and is non age sensitive for an unlimited shelf life.

### ***CPE***

CPE is a specially formulated elastomer compound related to the thermoplastic family. As a seamless tube, it retains its flexibility over a long period of time and has an unlimited shelf life. In addition, this versatile inner tube is compatible with nearly all petroleum based oils, aviation gas and JP fuels. The CPE tube is also unaffected by alcohols, coolants and solvents commonly used in aerospace systems.

# Hose Construction and Identification

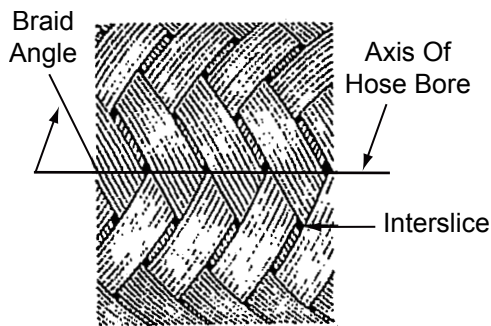
## REINFORCEMENT

The reinforcement is the strength member of the hose and gives the hose its pressure handling capability. This capability depends upon the type and quantity of materials used. The basic materials used as reinforcement are:

1. Fabric (Cotton, Rayon, Dacron, Polyester)
2. Wire (High Strength Carbon Steel or Stainless Steel)
3. Kevlar®

These materials are placed over the inner tube and are either braided or wrapped in various combinations and layers, depending upon the pressure requirements or design of the hose.

When the reinforcement is applied to the hose, it is done at a specific angle to the axis of the hose. This angle is sometimes referred to as the "braid angle."



When internal pressure is applied to a hose, forces develop which tend to make the hose either elongate or contract. (Depending on the type of reinforcement and/or braid angle.)

There is a neutral braid angle at which the forces exerted are balanced. The limits to which a hose is permitted to change length are controlled by quality control specifications.

## HOSE COVER

A hose cover is put over the reinforcement simply as protection from environmental damage. The hose cover does not add to the pressure capability of the hose... it simply protects the hose reinforcement from abrasion, moisture, rust, etc. PTFE hose, which has a stainless steel wire braid cover, is also available with integral silicone and polyester covers for added protection. Some rubber hose, for use in high pressure pneumatic applications, is made with a perforated cover. A perforated cover is used so that effusion will not cause blistering of the cover.

Now that we have looked at the hose on a general basis, it is important to examine more closely the specific types of hose, when, where and why they are used, and how to identify the various types.

## HOSE SIZES

The "Dash Numbering System" is used by most hose and fitting manufacturers to identify the size of the hose. All hose is measured for size by the I.D. (Inside Diameter) of the hose (or I.D. of the inner tube). This is compared with rigid tubing which is measured by the O.D. (Outside Diameter) of the tubing.

To determine the dash size, convert the tubing size (usually a fraction) into 16ths of an inch. The numerator of the fraction is then the dash size of the tubing or hose. For example, 1/4 inch tubing or hose, is converted into the fraction 4/16. Since the numerator is 4, the dash size is identified as -4. By using the dash numbering system, a hose can be connected with tubing maintaining the same I.D. throughout the system allowing uninterrupted flow of the fluid.

All Aeroquip brand hoses carry the dash size as part of the identification of the hose. On many hoses this is included in the lay line. The lay line is simply the identifying information printed or embossed on the cover of the hose. This identification is shown along the entire length of the hose, usually every 9 inches. Hose types that do not have lay lines are identified with a tape or tag, as is the case with hose with wire braid covers.

In addition to the size identification, the lay line usually will indicate the manufacturer, the part number of the hose and the date of manufacture.

A typical lay line looks like this:

1. MILSPEC Number
2. The dash number (for size)
3. The date of manufacture (quarter year/year) also referred to as the cure date
4. Hose manufacturer's code
5. AEROQUIP
6. Part number assigned to this style of hose
7. Operating pressure

MIL-DTL-8794-4-2Q07-54412 ---- MIL-DTL-8794-4-2Q07-54412

----- AEROQUIP 303-4 3000 PSIG ----- AEROQUIP 303-4 3000 PSIG -----

The types of hose are normally classified by the amount of pressure they are designed to withstand under normal operating conditions. The hose classifications are:

1. Low pressure (with fabric braid reinforcement)
2. Medium pressure (with one wire braid reinforcement in smaller sizes)
3. High pressure (with multiple reinforcement layers or Eaton Hi-Pac™ braid reinforcement)

The reinforcement is the chief difference between these classifications since high pressure hoses require a stronger reinforcement in order to handle their particular application. To achieve this stronger reinforcement for high pressure hose, the conventional method of construction has required multiple reinforcement layers.

Eaton has developed a high pressure hose reinforced with a single layer of densely packed fine diameter wire, this hose is braided in such a way that the hose withstands the same high pressures which were conventionally handled by two wire braid reinforced hose. These densely packed small diameter wires, called Aeroquip brand Hi-Pac braid, absorb stress more uniformly resulting in a stronger wire braid with less metal and weight.

#### LOW PRESSURE RUBBER HOSE (Eaton Part No. 306)



Low Pressure is generally classified as any pressure below 250psi.

Eaton's Aeroquip brand 306 hose is constructed with a seamless synthetic compound rubber inner tube. Over the tube is placed a single layer of braided cotton reinforcement. The outer cover is synthetic rubber which is compounded to resist abrasion and is oil, moisture, and mildew resistant. The hose is black in color with a yellow lay line consisting of "LP"; MIL-DTL 5593, size, date of manufacture, and hose manufacturer's code. Spaced 180° is "Aeroquip 306-size," operating pressure and a hose lot number.

Aeroquip brand 306 hose is available in sizes -2 through -10. This hose is used in air or vacuum instrument systems, automatic pilots and lines to pressure gauges as specified in MVW620. Hose assemblies conform to AN6270. Hose conforms to MIL-DTL-5593. The temperature range for Aeroquip 306 hose is -65°F to +160°F (-19°C to 72°C).

#### MEDIUM PRESSURE RUBBER HOSE (Eaton Part No. 303, 302A)



Medium pressure hose is generally rated at operating pressures of 1500psi. However, Eaton's 303 hose is designed to operate with

pressures up to 3000psi in sizes -3, -4 and -5. The recommended operating pressure will vary depending on the size of the hose. The larger the hose the lower the recommended operating pressure, and the smaller the size, the greater the pressures.

Aeroquip brand 303 and 302A medium pressure hose is constructed with a seamless synthetic rubber inner tube. Over the tube is placed a rubber impregnated cotton braid, designed to bond the tube to the single layer of wire braid which is applied next. Over this is placed a synthetic rubber impregnated oil resistant fabric braid.

The outer cover is designed to be oil, mildew and abrasion resistant. The cover is grey-black in color with a yellow lay line consisting of "MIL-DTL-8794," size, date of manufacture and hose manufacturer's code. Spaced 180° from this is "Aeroquip 303-size" or "Aeroquip 302A-size" and operating pressure.

Aeroquip brand 303 hose is available in sizes -3 through -12. Aeroquip brand 302A hose is available in sizes -16 through -32

The operating temperatures for 303 hose are -65°F to +250°F (-54°C to 122°C) and -40°F to +250°F (-40°C to 122°C) for the 302A hose.

This type of hose is used for aircraft hydraulic, pneumatic, fuel, oil and coolant systems specified in MS33620. Hose assemblies conform to MS28741 and MIL-DTL-8795. Hose conforms to MIL-DTL-8794.

#### MEDIUM PRESSURE ENGINE FUEL/OIL HOSE (Eaton Part No. 601/AE701)



Eaton's Aeroquip brand 601/AE701 hose is constructed with a seamless, specially formulated, synthetic rubber compound inner tube. Over the inner tube is a partial inner braid of stainless steel wire and a full coverage outer braid of the same material. The hose is identified by its bright wire braid outer cover and a tape, spaced at regular intervals, showing "Aeroquip 601/AE701, hose manufacturer's code, hose cure date, date of manufacture and operating pressure.

This hose is available in sizes -3 through -32. The hose is used for aircraft power plant and airframe fuel and oil lines. It is recommended for use whenever weight and flexibility are prime factors. 601/AE701 hose can be used for hydraulic return lines (petroleum base fluid systems), but should not be used in hydraulic impulsing pressure applications. This hose conforms to MIL-DTL-83797.

The temperature range is -65°F to +300°F (-54°C to +149°C) for all sizes in continuous operation. It may be used at -65°F to +375°F (-54°C to 191°C) upon approval of installation by Eaton.

# Hose Construction and Identification

## **MEDIUM PRESSURE PTFE HOSE (Eaton Part Nos. 666/667)**



Eaton's Aeroquip brand 666/667 PTFE hose is constructed with a seamless extruded PTFE resin inner tube. The tube of Aeroquip brand 666 hose is covered with a single layer of type 300 Series stainless steel wire braid. The 667 hose has two layers of this same wire braid. The hose is identified by a white tape showing "Aeroquip 666 or 667-Size," manufacturer's code, "MIL-DTL-27267," operating pressure and lot number.

PTFE hose is unaffected by fuels, lube oils, coolants or solvents commonly used in aircraft service. 666/667 hose is a medium pressure hose for use in hydraulic, ballistic, steam and most pneumatic applications. 666 hose is available in sizes -4 through -12 and 667 hose is available in sizes -16 through -24. The hose conforms to MIL-DTL-27267 and hose assemblies conform to MIL-DTL-25579. The temperature range for 666/667 hose is -65°F to +450°F (-54°C to 233°C).

## **HIGH PRESSURE PTFE HOSE (Eaton Part No. AE246)**



The AE246 hose is constructed with a seamless extruded PTFE resin inner tube. AE246 hose has one layer of stainless steel wire braid reinforcement in sizes -4 through -10. The -12 size has two layers of stainless steel wire braid reinforcement.

AE246 hose is for use in high pressure, 3000 psi, hydraulic systems. Its temperature range is -65°F to +450°F (-54°C to 233°C). The hose and hose assemblies conform to AS1339\*.

\*NOTE: AE24-12 hose meets or exceeds the performance requirements of AS1339.

# Fitting Construction and Identification

Almost any manufacturer can build a hose that will withstand a given amount of pressure by simply applying enough reinforcement over an inner tube extrusion. The difficult part is to manufacture a hose that will consistently perform well under a full range of actual operating conditions (impulse, flexing, heat, cold, aging, etc.) and to design and manufacture fittings that will work well with that hose under the same range of conditions. In other words, no hose line can be better than its "weakest link" whether it is the hose, the fitting, or the two in combination.

Hose fittings are available in many shapes, each designed to fulfill certain requirements.

It is important to know why a fitting is made the way it is and how to identify the various fitting types. Certain fittings are usable only with certain hoses, and cannot be interchanged without expecting failure of the hose assembly.

Before discussing hose fittings, we will first explain some of the hose and fitting industry terminology used in the United States.

AN - These initials stand for Army and Navy. AN standards are issued by the Aeronautical Standards Board and represent agreement between the U.S. Air Force and the Department of the Navy, Bureau of Aeronautics, on the part standardized.

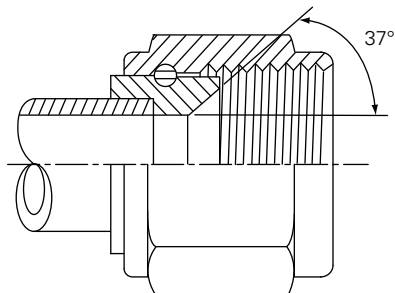
MS - These initials stand for Military Standard. MIL standards are those issued and agreed upon by joint action of the U.S. Army, Air Force and Navy Departments.

Our area of concern with AN and MS Standards is limited to threads and sealing surfaces of fittings. These standards dictate the sizes of threads as well as the number of threads per inch of the threaded surface. In general, only two types of threads are provided on MS and AN fittings. These are tube threads and pipe threads, both of which may be 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 seal is provided by the threads and a sealing compound. With tube threads, the fitting is sealed where the flared portion of the tube fits against a cone seat.

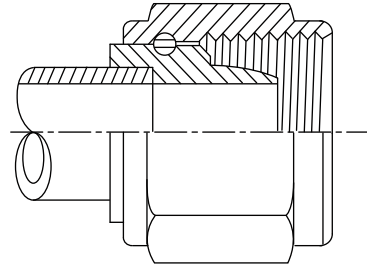
## SEALING SURFACE

The surface or area of a hose fitting which fits a similar or mating surface of another hose fitting, port, adapter, or surface, for the purpose of effecting a complete, safe, and functional seal is called a sealing surface.

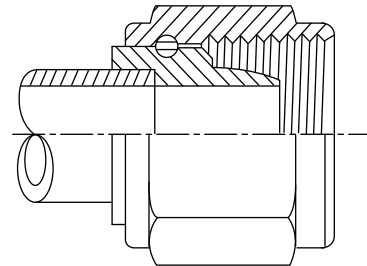
Aircraft or aerospace hose fittings can have any one of our five types of seals and can be found on both crimped and reusable fittings.



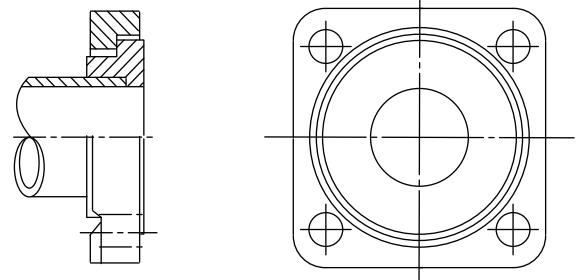
The first is the flare type or cone seat seal (above) used on MS and AN fittings. The AN, or 37° flare, originated during World War II, was called the AN (Army Navy) fitting. It may be reused many times if sealing surfaces are not damaged.



The Globeseal™ fitting (above) is an Aeroquip brand design and is basically the same as the flareless fitting except it is a one piece and machined design. It is shorter in overall length than the 3 piece flareless fitting and can be torqued to the same values as an AN type fitting.



The NAS 1760 flareless fitting (above) is another widely used fitting configuration with a similar one piece, machined design. It provides a control nose which makes the fitting less susceptible to damage from over tightening compared to other flareless designs.



The flange type seal (above) requires an O-ring or gasket to effect a seal. This type of seal should be inspected for nicks, scratches, or warping before use, to insure a leak-proof seal. Care should be used in installing a flange type seal so as not to over tighten and warp the flange. Flange type seals require use of reduced operating pressure in the system and proof test pressure to avoid damage.

Dynamic Beam Seal per assembly AS85421.

## HOSE FITTINGS

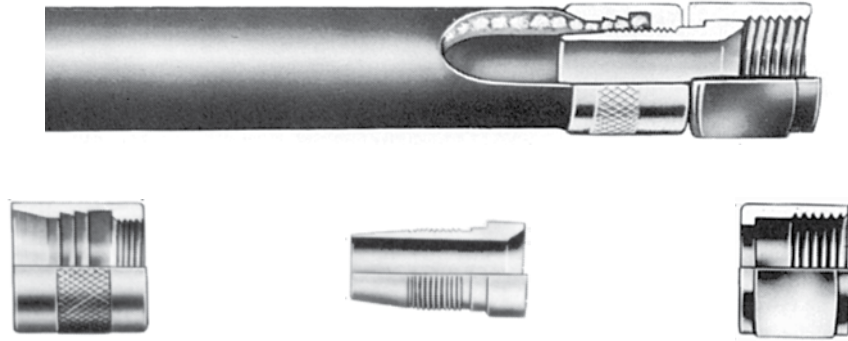
Some fittings are referred to as "Detachable Reusable Fittings" or "Screw Together Fittings." This type can be disassembled and reused when hose lines wear out or become damaged. The socket grips the hose cover and the nipple is inserted into the hose and screwed into the socket.

Other fittings are called "Crimp Fittings" or "Permanent Fittings." These cannot be reused and are permanently attached to the hose to become an integral part of the assembly.

# Fitting Construction and Identification

## LOW PRESSURE REUSABLE RUBBER HOSE FITTINGS

The low pressure hose fitting is a compression type fitting consisting of three pieces - the socket, nipple and nut. The standard fitting material is aluminum and conforms to MIL-DTL-38726 and MS27404. This type of fitting is commonly used with Eaton's Aeroquip brand 306 hose.



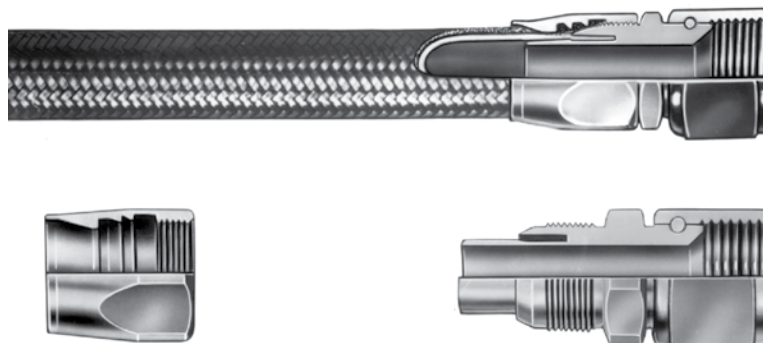
## MEDIUM PRESSURE REUSABLE RUBBER HOSE FITTINGS

The basic medium pressure fitting consists of three pieces - the socket, nipple and nut. It is a compression type fitting and conforms to MS24587. The nut and nipple in the -3 through -6 sizes are cadmium plated steel. In all other sizes these parts are aluminum. The sockets for all sizes are aluminum. The fitting is used on Eaton's Aeroquip brand 303 and 302A hoses.



## "little gem" REUSABLE FITTINGS

The "little gem" fitting is a two piece construction consisting of a socket and nipple assembly. The fitting works on a lip seal principle rather than the compression principle. The nipple spur cuts a lip in the inner tube, raising a "flap" which acts as a positive lip type seal. The nut and nipple in sizes -3, -4 and -5 are cadmium plated steel. Nut and nipple in larger sizes are anodized aluminum. The sockets for all sizes are anodized aluminum. The fittings conform to MIL-DTL-83798. The "little gem" fitting is used on Eaton's Aeroquip brand 601 and AE701 hoses.



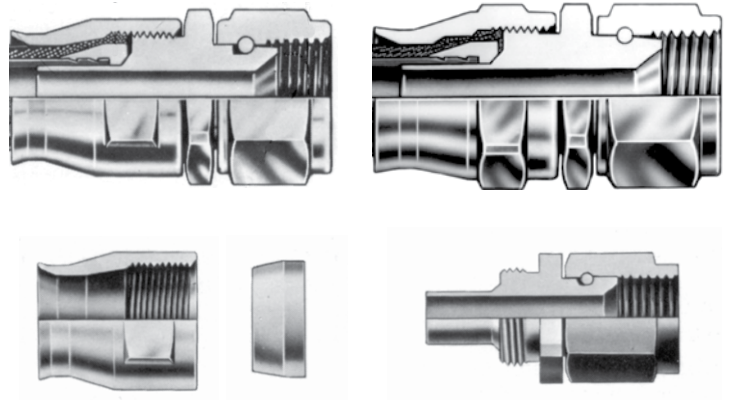


## ***“super gem”*<sup>®</sup> REUSABLE MEDIUM AND HIGH PRESSURE PTFE HOSE FITTINGS**

The *“super gem”* fitting for medium and high pressure PTFE hoses consists of 3 basic parts: the nipple/nut assembly, socket and sleeve. This fitting uses a lip seal on the tube, a metal seal between the nipple and sleeve, and compression between sleeve and socket to effect a grip on the wire. The nipple/nut assembly will be either of aluminum or stainless steel for medium pressure hose and all stainless steel for the high pressure hose. The sleeve will always be stainless steel for both types of hoses. The sockets for medium pressure hose will have only two wrench flats, commonly called the “flat sockets.” The high pressure hose sockets are hex

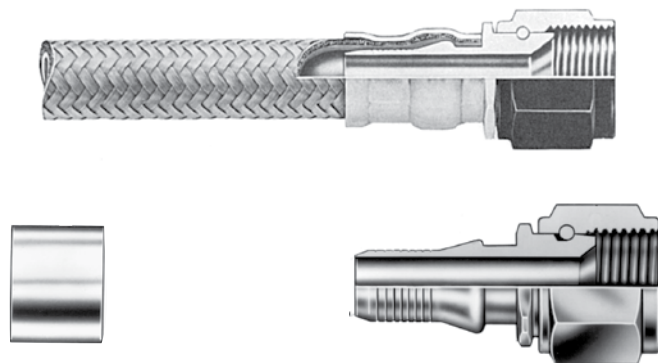
type. A dry film lubricant, which is grey or black in color, is applied to the threads and sealing surface of the nipple and sealing surface of the sleeve on medium pressure fittings. On sockets in sizes 8 and above for medium pressure hose, the lubricant is applied to the threads. Only the nipple threads are coated with this lubricant on the high pressure fittings.

The major difference between the medium and high pressure fittings is their size. The high pressure fittings being heavier due to the high working pressures required. Medium pressure fittings conform to MIL-DTL-27272.



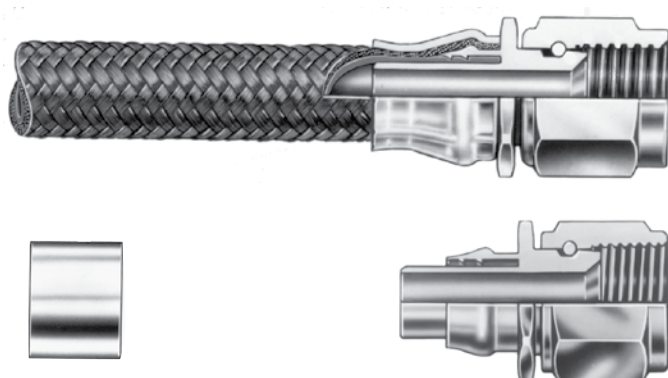
## **MEDIUM PRESSURE COMPRESSION CRIMP PTFE HOSE FITTINGS**

The compression crimp fitting for medium pressure PTFE hose consists of two parts - the nipple assembly and socket. The unique combination of the “ramped” nipple and crimping pattern used results in superior fitting retention under pressure. The nipple assembly is available in stainless steel with stainless steel sockets in sizes -3 through -16 and aluminum with stainless steel sockets in sizes -8 through -16. Compression crimp fittings are used on Eaton's Aeroquip brand 666/667 hose and assemblies conform to MIL-DTL-25579.



## ***“super-C”*<sup>™</sup> MEDIUM AND HIGH PRESSURE PTFE HOSE FITTINGS**

The *“super-C”* fitting for medium and high pressure PTFE hose consists of two parts, the nipple assembly and socket. It is a lip seal crimp fitting that becomes an integral part of the assembly and provides permanent protection from leakage. The nipple assembly and socket are stainless steel. *“super-C”* fittings are used on Eaton's Aeroquip brand AE246 hose as well as many other medium and high pressure PTFE hose. The medium pressure hose assemblies conform to MIL-DTL-25579.



# Hose Assembly Procedures

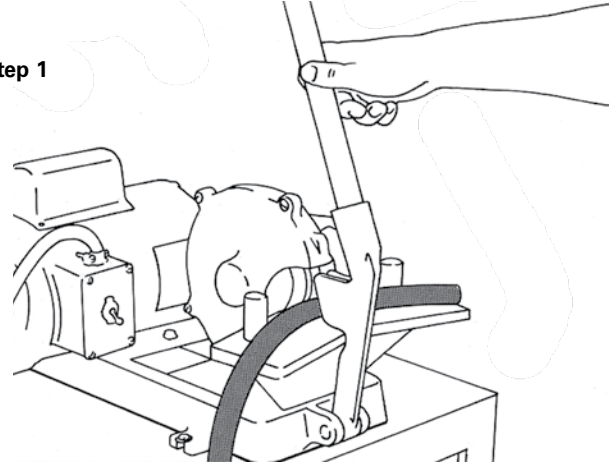
The first step in assembling a hose line is to determine what type hose and fittings are needed and what hose length is required. Hose length can be determined by measuring the old piece of hose or referring to the hose assembly drawing. If a new hose assembly is being made, the following information is needed:

- A. Working Pressure
- B. Temperature
- C. Type of Fluid
- D. Type of Fittings
- E. Length Between Connections

After this information is obtained, refer to Eaton's Conveyance Systems Product Catalog 117, item number EAC100-1F, to determine which hose and fittings are to be used.

After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

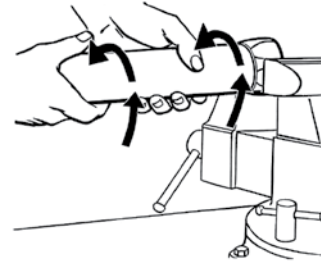
Step 1



## ASSEMBLY INSTRUCTIONS - 306, 303, and 302A HOSE

Step 1. Cut hose squarely to length. Use hose cut-off machine or fine tooth hacksaw. Do not remove the cover. If using a hacksaw wrap hose with several layers of tape before cutting.

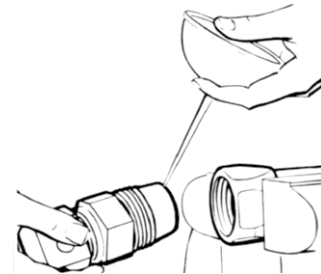
Step 2



Step 2. Place socket in vice. Do not over tighten vice on thin walled sockets of lightweight fittings. Screw hose counterclockwise into socket until it bottoms. Back-off 1/4 turn.

Step 3. Tighten nipple and nut on assembly mandrel. The use of Eaton's Aeroquip brand S1051 hand assembly tools are recommended to avoid damage to the sealing surface and to properly support the inner tube.

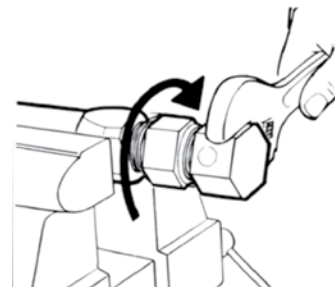
Step 4



Step 4. Lubricate inside of hose and nipple threads liberally. Use lubricating oil, petrolatum or light grease.

Step 5. Screw nipple into socket and hose using wrench on assembly tool hex. Nut must swivel freely when assembly tool is removed. Maximum allowable gap between nut and socket is 1 1/16 inch. On -32 and larger sizes see, [www.eaton.com/aerospace](http://www.eaton.com/aerospace) distributor listing.

Step 5



Step 6. After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

**ELBOW HOSE ASSEMBLIES - 303 and 302A**

Step 1. Cut hose squarely to length. Use hose cut-off machine or fine tooth hacksaw. If using a hacksaw, wrap hose with tape before cutting. Do not remove cover.

Step 2. Place socket in vise. Do not over tighten vise on thin walled sockets of lightweight fittings. Screw hose counterclockwise into socket until it bottoms. Back-off 1/4 turn.

Step 3. Flange elbow fittings. Drop flange over threaded end of nipple. Nipple shoulder must fit into counter-bore of flange.

Step 4. Lubricate inside of hose and nipple threads liberally. Use lubricating oil, petrolatum or light grease.

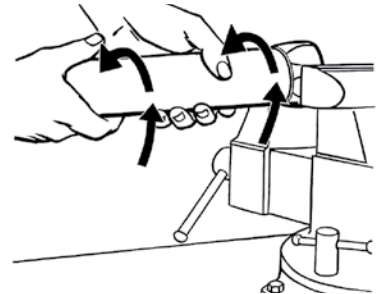
Step 5. Screw nipple into socket and hose using wrench on elbow hex. Tighten until hex is snug against socket. On -32 and larger sizes, see [www.eaton.com/aerospace](http://www.eaton.com/aerospace) distributor listing.

Step 6. Adjustments may be necessary to obtain the desired position angle between two elbows. In order to minimize backing off elbows to position, the following procedure should supplement Step 5.

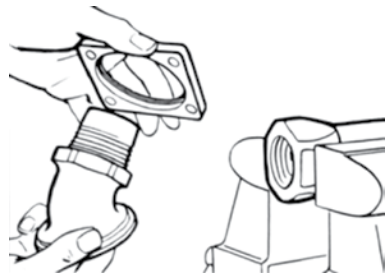
- A. Tighten both elbows to maximum allowable gap, then start to position for relative angle between the elbows.
- B. Finish assembly by adjusting both elbows. Backing off to position should be avoided and in no case should exceed 1/4 turn.
- C. Maximum allowable gap between nipple hex and sockets is 1/16" using 303 and 302A hoses.

Step 7. After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

**Step 2**



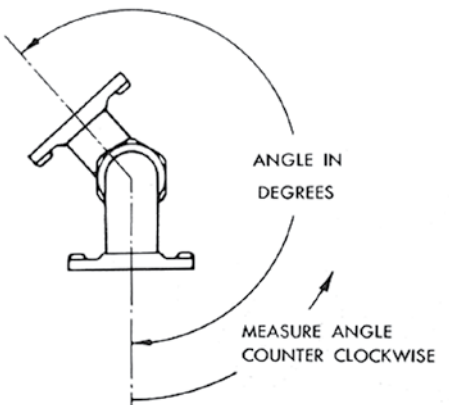
**Step 3**



**Step 5**



**Step 6**

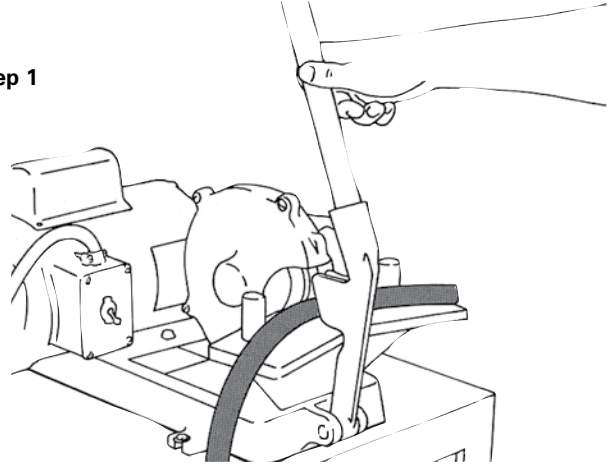


# Hose Assembly Procedures

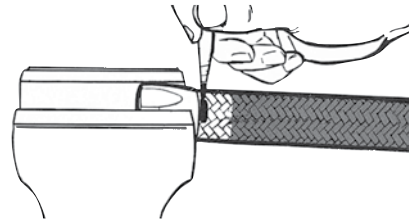
## ASSEMBLY INSTRUCTION – 601/AE701

- Step 1. Cut hose squarely to length. Use hose cut-off machine or fine tooth hacksaw. To minimize wire braid flareout, wrap hose with tape and saw through tape. Remove tape before Step 2.
- Step 2: Insert hose in socket with a twisting, pushing motion until hose is in line with back of socket threads.
- Step 3. Important - mark hose position around hose at rear of socket. Use a grease pencil, painted line or tape. This will determine if hose movement has occurred when nipple is assembled.
- Step 4. Lubricate inside of hose and nipple threads liberally. Use SAE 30 lubricating oil. Avoid getting oil in the cutting spur of the nipple.
- Step 5. 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 Step 3.
- Step 6. Complete assembly using wrench while continuing to hold in position. Maximum allowable gap is 1/32 inch.
- Step 7. **IMPORTANT** - check for hose push out by observing hose position mark. None should be evident in sizes -3 through -10. In sizes -12 through -32, 1/32 inch is allowable.
- Step 8. After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

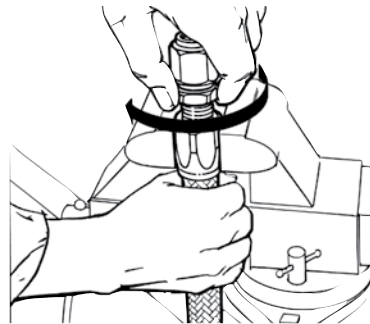
Step 1



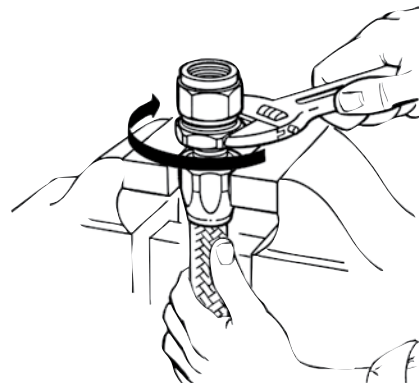
Step 3



Step 5



Step 6



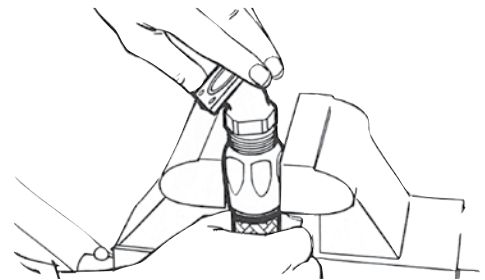
**ELBOW HOSE ASSEMBLIES - 601/AE701**

- Step 1. Follow Steps 1 through 3 as shown for 601/AE701 hose on page 12.
- Step 2. Flange elbow fittings. Drop flange over threaded end of nipple. Nipple shoulder must fit into counter-bore of flange.
- Step 3. Lubricate inside of hose and nipple threads liberally. Use SAE30 lubricating oil. Avoid getting oil in the cutting spur of the nipple.
- Step 4. Same as Step 5 for 601/AE701 hoses on page 12.
- Step 5. Complete assembly by using wrench on elbow hex while continuing to hold hose in position. Tighten until hex is snug against socket or maximum 1/32 inch gap. On forged elbow, use wrench on forging flats. Tighten until shoulder is snug against socket or maximum 1/32 inch gap.
- Step 6. Adjustments may be necessary to obtain the desired position angle between two elbows. In order to minimize backing off elbows to position, the following procedure should supplement Step 5:
  - A. Tighten both elbows to within 1/32 inch of socket then start to position for relative angle between elbows.
  - B. Finish assembly by adjusting both elbows. Backing off to position should be avoided and in no case should exceed 1/4 turn. Maximum allowable gap between hex and socket is 1/32 inch.
- Step 7. **IMPORTANT** - check for hose push out. See Step 7 for 601/AE701 hoses on page 12.
- Step 8. After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

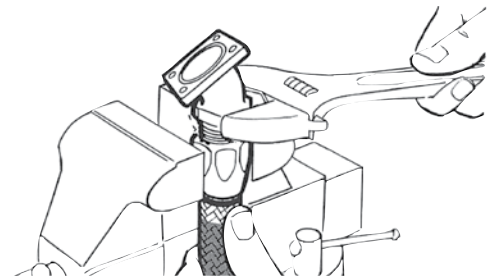
**Step 3**



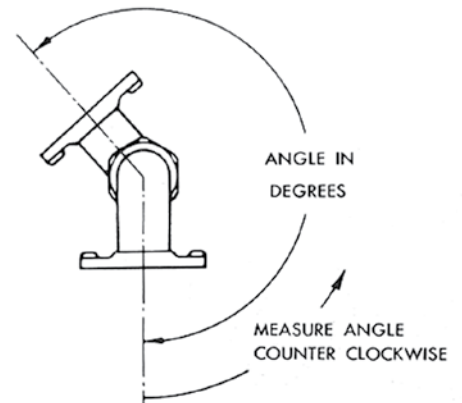
**Step 4**



**Step 5**



**Step 6**



# Hose Assembly Procedures

## ASSEMBLY INSTRUCTIONS 666/667 & AE246

Step 1. Hose length - Determine hose cut-off length by subtracting fitting cut-off factor from the hose assembly length or by calculating the length from the information shown on the hose assembly drawing. The cut-off length may also be determined by measuring the used length of hose being replaced.

Cut hose squarely. A hose cut-off wheel is recommended. However, a fine tooth hacksaw may be used. To prevent a flare out of the wire end during the cut-off operation, wrap tape around the hose at the cut-off point. After the hose is cut, and just prior to installing sockets, the tape must be removed.

Step 2. Install sockets - Place two sockets skirt to skirt in a vise and work hose through sockets with a twisting, pushing motion. Inserting sockets over "neck down" end of hose will facilitate assembly. Sockets for AE246-12 are more readily installed from each end of the hose.

On extra long assemblies, the sockets may be installed on each end of the hose individually.

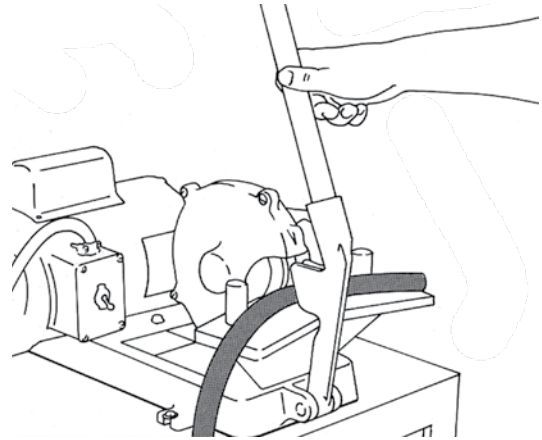
Step 3. Size tube and flare braid - Place nipple hex in vise. Push one end of hose onto the nipple and work gently in circular motion to aid in separating the wire braid from the tube. Remove hose from nipple.

Step 4. Install sleeve - Carefully insert sleeve between braid and tube O.D., using caution that no wires are trapped between the sleeve and tube O.D. Complete positioning by pushing end of sleeve against flat surface until tube bottoms against shoulder in sleeve I.D. Visually inspect to see that tube end is bottomed against sleeve shoulder and that no wires are trapped under sleeve.

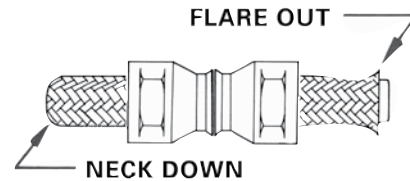
Step 5. Size tube to sleeve - Size tube to sleeve by pushing hose onto the nipple until the sleeve bottoms against the nipple chamfer. Remove and recheck to be certain that the sleeve is still properly positioned. Again push hose onto the nipple until the sleeve is bottomed against the nipple chamfer.

NOTE: When assembling new fittings no lubrication is needed as component parts are dry film lubricated at the time of manufacture. After reuse of the fitting, if undue wearing of the dry film or bare metal is observed, the thread area should be lubricated with Molykote G-N™.

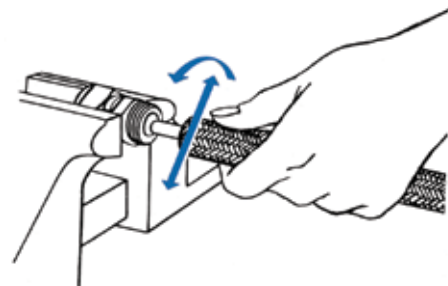
Step 1



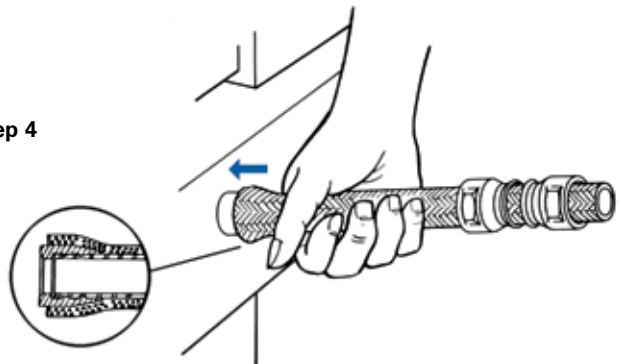
Step 2



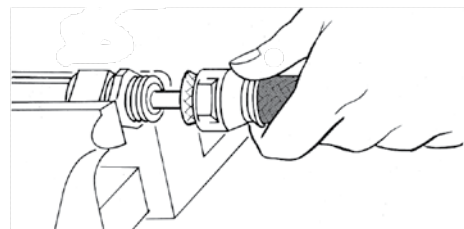
Step 3



Step 4

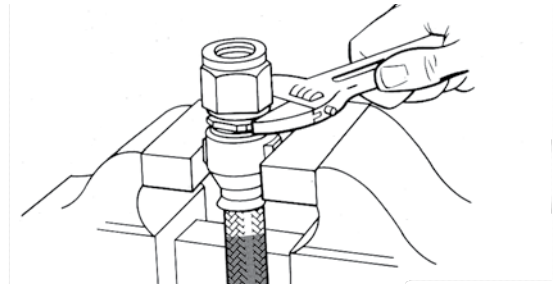


Step 5



Step 6. Engage socket and tighten - Slide socket forward and thread onto nipple by hand. (Special tool required for -12 size.) Remove assembly and place the socket in vise. Using a wrench on the nipple hex, tighten to a gap of 1/32 inch nominal for all sizes. (Gap may vary from 0.023 to 0.046 inch.)

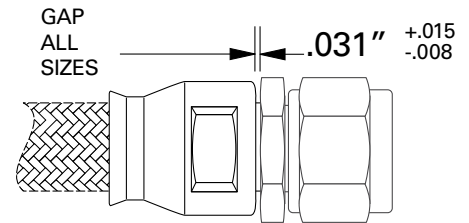
Step 6



Step 7. Gap is measured between socket and nipple hex as shown.

NOTE: Standard elbow fittings may be assembled using the procedure above. Special elbows may be assembled by holding the nipple in a vise.

Step 7



Step 8. After hose assembly, all hoses shall be cleaned, inspected and proof tested per the applicable specifications.

**CLEAN, INSPECT, PROOF TEST**

Clean - Clean hose after cutting to length. Be sure all cutting residue is dislodged. After assembly, clean each hose assembly internally using clean, dry compressed air.

Inspect - Examine hose assembly internally for cut or bulged inner tube, obstructions and cleanliness. Examine Aeroquip brand hose assemblies with "little gem" fittings for hose push out. Inspect for proper gap between nut and socket or hex and socket. Nuts should swivel freely.

Proof Test - Test hose assemblies in straight, horizontal position and observe for evidence of leakage while maintaining test pressure. Several hose assemblies may be tested at one time by connecting them in series.

Step 1A. Liquid Test Medium - tighten cap only after all trapped air has bled from assembly. Use a heavy plastic protective cover when applying pressure.

Step 1B. Air or Gas Test Medium - test assemblies under water. On hoses having a braided outer cover, allow time for entrapped air to escape from braid. The system operating pressure is recommended as the pneumatic test pressure. Do not submerge hose assemblies configured with chafe guard or firesleeve. Use protective cover during testing.

Step 2. Use proper proof test fluid specified for hose:

TYPE	HOSE No.	PROOF TEST FLUID
Hydraulic, pneumatic, fuel, oil and coolants	303, 302A, 601/AE701	Hydraulic oil, MIL-PRF-5606* or water
Air or instrument	306	Dry oil-free air or Nitrogen, grade A, Type 1 (MIL-N-6011)

NOTE: PTFE Hose Assemblies - Refer to drawing or an Eaton Catalog for proof test data.

Step 3. Drain and cap.

- Step 4. Corrosion protection of fittings on hose assemblies.
- A. Corrosion resistant steel, and aluminum alloy fittings require no additional treatment.
  - B. Fittings on air or instrument hose assemblies should not be oiled. Dry thoroughly and cap with oil and grease free caps.

\* Flush after proof testing using oleum or other neutral spirits.

**STORAGE AND HANDLING**

Step 1. Bulk hose and hose assemblies - hose should be stored away from sunlight, heat, ozone, etc. To minimize obsolescence or deterioration of hose in storage, follow "first in, first out" principle in releasing stock for production or shipment.

Step 2. Short hose lengths or assemblies may be conveniently stored in closed containers to protect them from dust. Other hose assemblies should have the ends capped. Hose assemblies made up in the field should be marked with the date of assembly before being placed in storage.

NOTE: All hose assemblies taken from storage should be proof-tested prior to installation in aircraft.

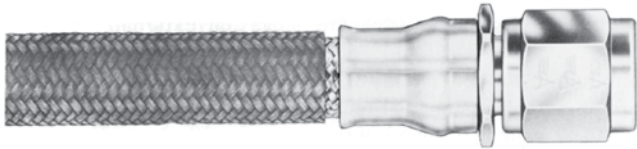
Step 3. Age of rubber - Hose exceeding established age limits of AS1933 or showing signs of weather checking, cracks, or separation of plies, should not be installed in aircraft.

# Chafe Guards, Firesleeves & Internal Coils

Chafe guards, firesleeves and internal coils are used to protect the hose and to extend normal service limits. Several types of chafe guards are available for use with any type of hose. A brief description of these follow:

## CHAFE GUARDS

### Integral Polyester Chafe Guard



Available as part numbers:

AE566 (666/667 hose)

AE546 (AE246 hose)

AE501 (AE701 hose)

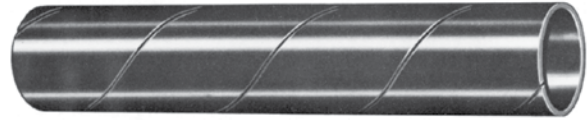
Eaton's Aeroquip brand braided polyester chafe resistant hose is manufactured by braiding polyester yarn onto wire braid covered hose styles. The tough polyester braid withstood 1,000,000 abrasion test cycles without exposing the wire braid. The sleeve adds minimal weight to the hose assembly and does not impair its flexibility. This protective sleeve has a temperature range of -65°F (-53°C) to +300°F (+148°C).

### AE138 (646) Protective Sleeve



Eaton's Aeroquip brand AE138 protective sleeve is a fuel, oil and ozone resistant Neoprene scuff cover which can be field installed on hose assemblies. The sleeve protects hose assemblies from abrasion and scuffing in ground servicing or airborne applications thru a temperature range of -65°C (-53°C) to +250°F (121°C). The AE138 sleeve can be ordered in bulk and installed on preassembled lines as needed.

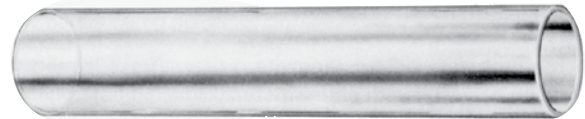
### AE208 (900005) Protective Coil (External)



Eaton's Aeroquip brand AE208 coil is made of lightweight nylon and is designed to afford abrasion resistance at temperatures of -65°F (-53°C) to +200°F (93°C). It is installed by winding or spirally wrapping around the hose. The natural gap between each coil decreases the possibility of entrapped moisture. The AE208 coil is recommended for applications where hose assemblies are exposed to moisture.

Aeroquip brand AE208 coil is available in only two sizes, -4 and -10, which allows a minimum of inventory. The -4 size is used with hose up to .562 inches in diameter.

### AE506 (900179) Protective Sleeve



Eaton's Aeroquip brand AE506 protective sleeve is an extruded, translucent, seamless tube made with Teflon™ FEP 100 fluoroplastic resin. This sleeve is recommended for abrasion protection in high temperature applications, -65°F (-53°C) to +400°F (204°C). Aeroquip brand AE506 PTFE sleeve is unaffected by fuels, lube oils, coolants, or solvents used in aircraft service.

When supplied in bulk, each length is identified by a tape showing "AE506-Size" on sleeve manufacturer's code on each end in less than ten foot lengths and on each end plus every ten feet on longer lengths.

### AE251 (900223) Protective Sleeve (Shrinkable Type)



Eaton's Aeroquip brand AE251 sleeve is a heat shrinkable Polyolefin tubing, transparent white in color. The AE251 sleeve is recommended where a skintight fit is desired. Temperature range of AE251 is - 65° F (-53°C) to +275°F (135°C).

During installation the sleeve is positioned between the end fittings and shrunk into the hose by application of heat, either in an over or with a portable heat gun.

Aeroquip brand shrinkable Polyolefin sleeving is available in a wide variety of colors.



## Firesleeves

Eaton's offers several different firesleeve options:

1. A fiberglass material with a synthetic rubber compound applied to the outer surface
2. A silicone impregnated fiberglass cloth, and
3. A silicone rubber compound extruded directly onto wire braid hose styles.

The fiberglass or silicone serves to insulate the hose from the intense heat of a fire. A firesleeve does not increase the service temperature of a hose line. Its purpose is to protect the hose from direct fire long enough to either extinguish the fire or until the aircraft lands safely.

### AE102



AE102 firesleeve is a uniform layer of braided fiberglass tubing impregnated and overlaid with a flame resistant silicone rubber. The fiberglass yarn used in the braid is closely spun to provide maximum protection. 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 or Skydrol 500. It has a continuous operating temperature range of -65°F (-53°C) to +500°F (260°C).

AE102 firesleeve is identified by its orange colored outer surface with a single black layline consisting of "Aeroquip brand AE102-size-code" every 10 inches.

### Flexwrap Silicone Firesleeve



Flexwrap sleeving is split sleeve which allows minimum sleeve diameters to be installed (wrapped) over hose assemblies regardless of end fitting configuration. The sleeve is a silicone impregnated fiberglass cloth which provides for easy field replacement of firesleeve and repair of hose assemblies at the operator level.

### Integral Silicone Firesleeve



Available as part numbers:

AE466 (666/667 hose)

AE446 (AE246 hose)

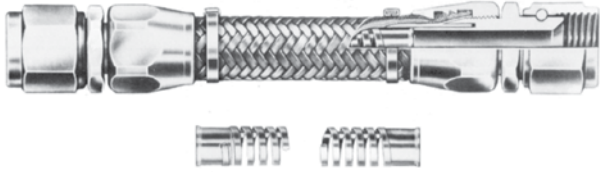
AE402 (601 hose)

AE401 (AE701 hose)

Eaton's Aeroquip brand Integral Silicone Firesleeve is an asbestos free sleeve which is extruded directly onto the wire braid to form a smooth, tight bond. The sleeve's integral design provides excellent chafe resistance, eliminates the use of band clamps and prevents fluid wicking. This hose/sleeve combination meets the fire test requirements of TSO-C53A Type D and TSO-C75 Types IIIA and IIIB. It has a temperature range of -65°F (-53°C) to +450°F (232°C).

# Chafe Guards, Firesleeves & Internal Coils

## 900780 Internal Support Coil



The 900780 internal support coil is used to prevent damage to hoses which are subject to mishandling, vacuum applications, or tight installations.

The 900780A internal sleeve is used in conjunction with the internal support coil. They are clamped in place and act as an anchor point for the coil and prevent the coil from moving.

The internal support coil is a flat, helically wound, stainless steel reinforcing coil of 302 type - AMS 5516.

To determine the 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 hose assembly standard drawing.
2. Determine applicable formula for size and type of hose from table below.
3. Compute length of coil needed as shown:

Example: Hose 601/AE701 with a....

Cut length of hose ("J" Factor) of 20 inches.

Formula:

3.4 (J-2.4)

3.4 (20-2.4)

3.4 (17.6)

3.4 x 17.6 = 59.8 coils.

## Internal Coil Selector Table

Hose No.	DashSize	900800A Sleeve Size	900780 Coil Size	Coil Formula	900591B Clamp Size
302A	-16	14C	14C	3.5 (J-2.7)	3C
	-20	15C	15C	2.7 (J-3.1)	4C
	-24	17C	17C	2.8 (J-3.2)	4C
	-32	18C	18C	2.8 (J-4.1)	5C
303	-12	13C	13C	5.2 (J-3.3)	3C
601/AE701	-12	21C	13C	5.2 (J-2.2)	2C
	-16	14C	14C	3.4 (J-2.4)	3C
	-20	15C	15C	2.6 (J-2.7)	4C
	-24	17C	17C	2.7 (J-2.9)	4C
666	-32	31C	18C	2.6 (J-3.3)	5C
	-12	13C	13C	5.3 (J-1.5)	3C
667	-16	14C	14C	3.5 (J-1.7)	3C
	-20	15C	15C	2.8 (J-2.1)	4C
	-24	17C	17C	2.8 (J-2.2)	5C



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