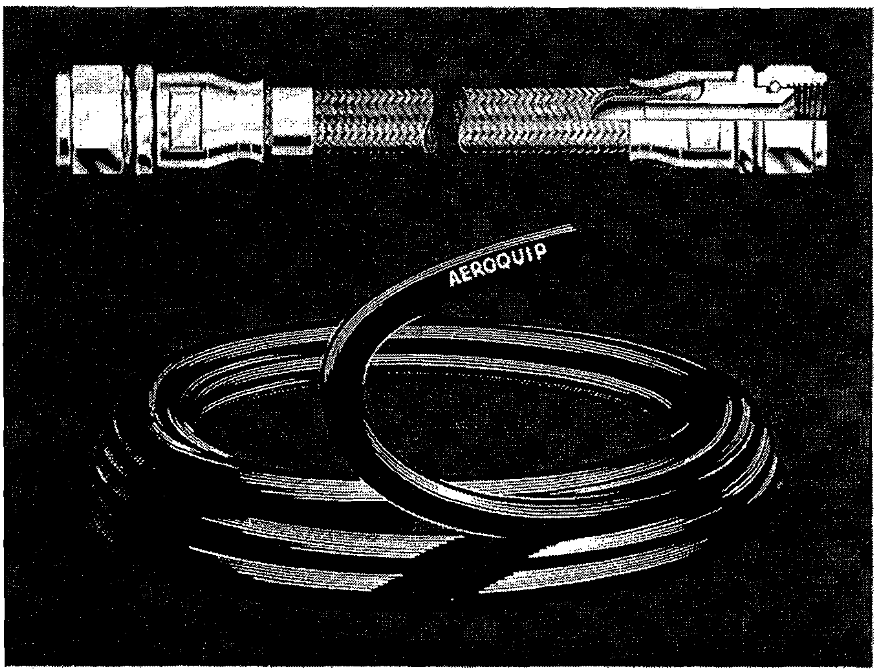
Aeroquip

Bulletin 1515

INSTALLATION AND CARE OF HOSE AND HOSE ASSEMBLIES



INSTALLATION AND CARE OF HOSE AND HOSE ASSEMBLIES

by Paul Baker

INTRODUCTION

When working on fluid systems in aircraft maintenance, do not overlook the importance of hose assemblies. In addition to being integral components of various systems, they have their own characteristics and require special attention.

Because hose assemblies are used extensively in hydraulic, pneumatic, vacuum, fuel, lube, vent and drain systems ...they are rated according to listed specs prepared for particular service environments. Environmental factors are numerous and include specified temperature, pressure and impulse conditions. Consequently, when hose assemblies are neglected, given careless attention, or are mishandled...the result may be leakage or some other failure in the system.

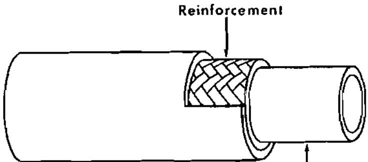
This bulletin is intended to provide a better understanding of hose construction, types of hose and fittings, pressure and temperature ranges, extra protection for hose, storage of bulk hose and assemblies, hose assembly identification, assembly procedures, proper installation, routing, and some of the in-service conditions of which to be aware.

GENERAL DATA

Aeroquip hoses fall into two basic categories: rubber and Teflon construction. Both categories are available in a variety of pressure ranges.

Low pressure hoses are designed for use at pressures up to 200 psi, medium pressure hoses for pressures from 200 to 1500 psi, and high pressure hoses for pressures from 1500 to 3000 psi.

Temperature ranges within each pressure category vary somewhat. Low pressure rubber hose has a temperature range from −65°F to +160°F. Hose styles in the medium pressure group are rated from a low range of −40°F to +250°F, to a high range of −65°F to +375°F. Rubber hoses in the high pressure group are rated from a range of −40°F to 200°F, to a range of −65°F to +375°F. Variations are affected by the hose tube compound, hose construction, hose size, and type of fitting used.



The proper selection of the hose construction to fit the application is of major importance. Generally, hose consists of three basic parts: (1) inner tube; (2) reinforcement; and (3) cover.

Some of the requirements the inner tube must meet in order to perform satisfactorily include: flexibility; resistance to cracking or deterioration when exposed to specific temperature ranges; minimum porosity; smoothness, for minimum resistance to flow; and chemical compatibility with the fluid it has to carry.

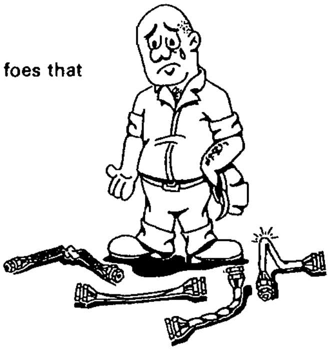
The reinforcement is the strength member of the hose and gives the hose its pressure capability. This capability depends upon the type and quality of materials used.

A hose cover is placed over the reinforcement primarily as protection from environmental damage. The cover does not add to the pressure capability of the hose but simply protects the hose reinforcement from abrasion, moisture, rust and other factors. In addition, chafe guards, firesleeves and internal coils may be used to protect the hose under unusual external conditions, and to extend normal service life.

Aeroquip fittings may be: (1) screw together compression fittings used on rubber hose; (2) ***"little gem"***® fittings designed for use with certain rubber hoses featuring advanced rubber compounds; (3) ***"super gem"***®, ***"super-C"***™ and "Compression Crimp" fittings designed for use with Teflon hose.

PROPER CARE

Hose and hose assemblies must be properly stored and cared for before being put into service. Misuse of hose will reduce the life of a hose assembly appreciably. Hose, whether it is rubber or Teflon types, must not be kinked, collapsed, twisted or bent sharply. Remember, hose assemblies all have a minimum bend radius. This should never be exceeded even while in storage.



Avoid those hose foes that pose woes.

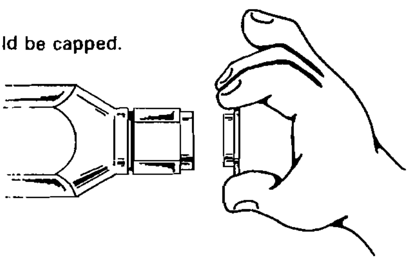
Good practice for rubber hose requires it be stored in dry areas in racks, stock bins or cartons, free from contamination. Generally, storage should be away from ozone or corrosive atmosphere, and temperatures should not exceed 120°F. Teflon hose is not restricted to such storage temperatures; storage of this type hose requires that it be stored generally (with exception of temperature) the same as rubber hose.

To minimize obsolescence or deterioration of hose in storage, follow "first-in, first-out" principle in using bulk hose and hose assemblies. All assemblies taken from storage should be proof-tested before being installed in aircraft.

Store hose in racks, bins or cartons.

Hose exceeding established age limits, or showing signs of cracks, separation of plies or other deterioration, should not be installed in aircraft.

Hose ends should be capped.



When stored, ends of hose and end fittings should be capped to prevent filtering of dirt and dust into the hose and fittings.

HOSE ASSEMBLY IDENTIFICATION

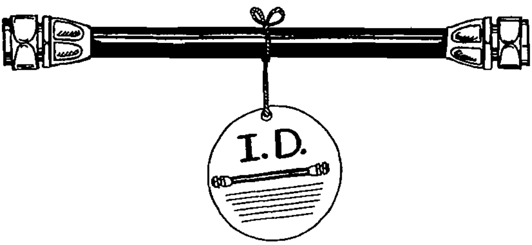
When replacing a hose assembly be sure to identify it correctly so that the right replacement can be made.

Some rubber hoses have a lay line printed on the cover to provide identifying information. Hoses with stainless steel outer braid are identified with a white tape.

A typical lay line, generally repeated every nine or ten inches along the length of the hose, will usually provide the following information:

1. Mil-Spec No.
2. Manufacturer's name
3. Part number assigned to style of hose
4. The dash number, or code letter, for size
5. The date of manufacture (quarter of year/year)
6. Hose manufacturer's code.

All hose assemblies should have the proper identification showing the part number, cure date of rubber hose, assembly date, and indication that the assembly has been pressure tested.



To prevent misapplication, unmarked hose assemblies *should not be used* unless they can positively be identified.

ASSEMBLY OF FITTINGS TO HOSE

After properly identifying the hose assembly to be replaced, and determining there is no replacement in storage, follow the *recommended* procedures in assembling a new hose line.

Use a compatible lubricant.

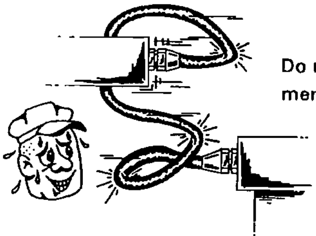
If, for some reason, the fittings of the old assembly are not reusable, these will also have to be identified and replaced. Hose length needed can be determined by measuring the old piece of hose or referring to the hose assembly drawing.

Care should be taken to avoid intermixing of different manufacturers' components to insure performance and compliance with FAA regulations. Where lubrication is required, care must be taken to use a lubricant that is compatible with the style of hose being assembled.

PROPER INSTALLATION

If the hose assembly that has been removed for replacement shows signs of leakage, corrosion, abrasion, or of having been kinked or twisted . . . then either the initial installation was improper, or the service conditions were unduly severe.

In most hose assembly applications it is advisable to restrain, protect, or guide the hose to protect it from damage by unnecessary flexing, pressure surges and contact with other components or structures. First, bend radii must be considered. Bend should be as generous as the installation space will allow, but in no case should it be less than that of the manufacturer's specifications.

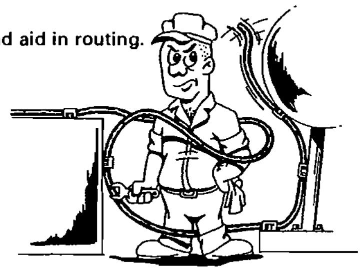


Do not exceed recommended bend radius.

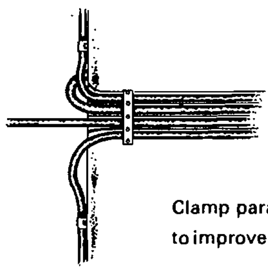
There are protective devices available, and are sometimes used, for special installation conditions. These are internal support coils, abrasion sleeves and various types of clamps with abrasion pads. These all have specific functions and should be utilized when required.

The use of hose clamps, properly positioned as the installation warrants, is essential. The hose clamp is designed primarily to stand off or separate the hose assembly from adjacent line, structure or components, as well as to aid in routing. The clamps should be snug enough to hold or position a line, yet not so tight that they cause a line to be restricted at the point of contact. All hose assemblies should be installed with slight bow or slack to permit both growth and contraction in the line because of pressure variations, as well as expansion of the engine and airframe components located between the two ends of the hose assembly.

Hose clamps isolate hose lines and aid in routing.



Parallel hose lines may be clamped together to improve appearance and function. Although the hose assemblies are, in a sense, operating together, each line is subject to its own impulse surges and other movements. Care must be taken so that relative movements of the assemblies will not cause the securing clamps to abrade the sleeve or hose. For example, high pressure and low pressure lines generally should not be clamped together as they tend to react differently in operation.

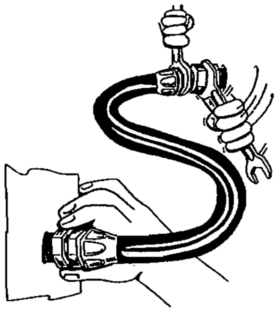


Clamp parallel hose lines together to improve appearance and routing.

A good practice to follow when installing hose assemblies would be to connect the most inaccessible end of the hose, and tighten only "finger tight" so the hose is free to turn during installation of the opposite fitting. Attach the other fitting in the same manner. Then properly orient the hose assembly along its routing and install the support clamps, making sure to distribute hose slack between the hose clamp and hose fitting connections. The hose clamps should not restrict travel or cause the hose line to be subjected to tension, torsion, compression, or sheer stress during its flexing cycle.

When this procedure has been followed, tighten the end fittings, making sure you do not twist the hose in the process. Use two wrenches, one on the swivel nut and one on the nipple hex.

Connect the more inaccessible end of hose first and only "finger tighten" before installing opposite fitting.



If when installing hose assemblies "common sense" precautions are observed, you will have trouble-free service. However, the human element enters when actual installations are made. Thus, the matter of individual judgment and skill on the part of technicians making the installation are very important factors.

If these few simple installation procedures are followed, the service life of hose assemblies will be increased and many service problems will be eliminated.

IN-SERVICE CONDITIONS

When hose assemblies are installed in a system, there are several conditions you must consider:

SAFETY FACTOR

Safety factor of 4 to 1 is generally recommended for hose assemblies. This means the operating pressure to which a hose assembly is subjected should not exceed 25% of the minimum burst pressure. This safety factor, however, will vary sometimes depending upon the type hose being used.

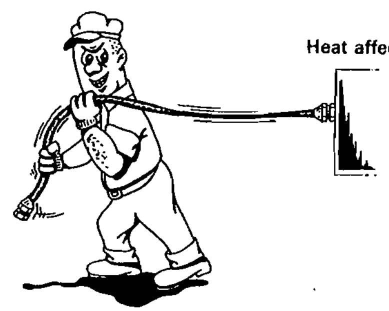
HYDRAULIC SHOCK

Liquid flowing through a closed system is subject to pressure pulses. For example, hydraulic pump chops the hydraulic fluid into small quantities as it is forced through the system. This action results in the fluid moving in a rippling motion. This must always be taken into consideration, as this rippling motion can shake the system until fatigue failure occurs. Another problem is created every time a valve opens or closes, or an actuator suddenly causes the hydraulic fluid to stop or change direction. This sudden change causes hydraulic shock.

Some engineers have "de-tuned" the more extreme surges from hydraulic systems by substituting flexible hose assemblies for a section of rigid tubing, allowing the hose assembly sufficient room to flex and dampen pulsations.

HEAT EFFECT ON HOSE

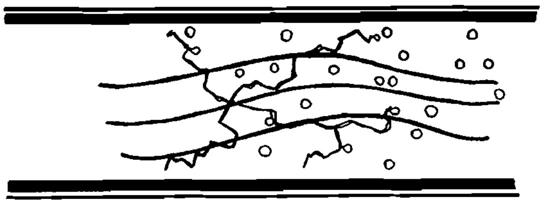
Heat has an effect on rubber-like materials and tends to harden them, causing a loss of the desirable elasticity in the material. Most rubber hoses are given a temperature range rating in the literature pertaining to them, e.g., −40°F to +250°F or −65°F to +275°F. The upper temperatures are the top limit to which a hose assembly should be exposed when used at, or near, its maximum rated operating pressure. For good hose service life, exposure at, or near, these temperatures at rated operating pressures should be held to a minimum for best results.



Heat affects hose elasticity.

Hose failure under conditions of high temperatures plus high pressure usually take the form of early leakage at the junction of the hose and fitting. One other condition which will cause severe and rapid hardening of hose inner liner materials is the introduction of air bubbles into the fluids. This is especially true in high temperature oil systems. The entrapped hot air will oxidize and harden the inner liner tube at a rate of two to four times faster than air-free fluids.

Air bubbles in fluids will cause hardening and cracking of the hose's inner liner.



The effect of heat on Teflon hose is completely different from that of rubber hose. Unlike the more common organic rubber compounds, Teflon or "Tetrafluorethylene", as it is more properly known, does not harden when being used at elevated temperatures (−67°F to +400°F), but stays uniform in texture and consistency.

Corrosion

The reinforcement in some styles of rubber hose assemblies is carbon steel. These hoses have an outer cover that protects the carbon steel wire braid from corrosion. Damage to the outer cover which permits exposure of the reinforcement to corrosive atmosphere will result in failure of the reinforcement. Hose assemblies with damaged outer covers should be discarded before corrosion leads to hazardous failure.

Damage to the outer cover of the hose exposes the reinforcement to corrosion.

To avoid the problem of corrosion, Teflon and newer styles of rubber hose with stainless steel braid should be used.

CONCLUSION

Because of the complexity and number of interrelated factors, it is impossible to cover every maintenance aspect of hose assemblies in depth in a short bulletin. However, it is hoped the reader will become more aware of the importance of hose assemblies in fluid systems and will give them the particular attention they deserve.

Should there be any area of hose assembly maintenance in which more detailed information is desired, please contact your Aeroquip Distributor, or Aeroquip Corp. in Jackson, Michigan.

Aeroquip Corporation
Engineered Systems Group
Aerospace Division
300 S. East Avenue, Jackson, MI 49203-1972
Phone: 517-787-8121, Fax: 517-787-5758
www.aeroquip.com

JP 1.5M 3-92

Litho in U.S.A.