



AEROSPACE ENGINEERING BULLETIN

AEB
256B

HOSE/FITTINGS

AEROQUIP

**announces a
major breakthrough
in reducing
aircraft
postcrash
fires**



TSO approved Aeroquip crashworthy fittings and flexible hose. Meets TSO C-53a amended for 250 psi operating pressure. Conforms to MIL Standard 1290.

Aeroquip crashworthy fittings provide a new level of safety for general aviation aircraft

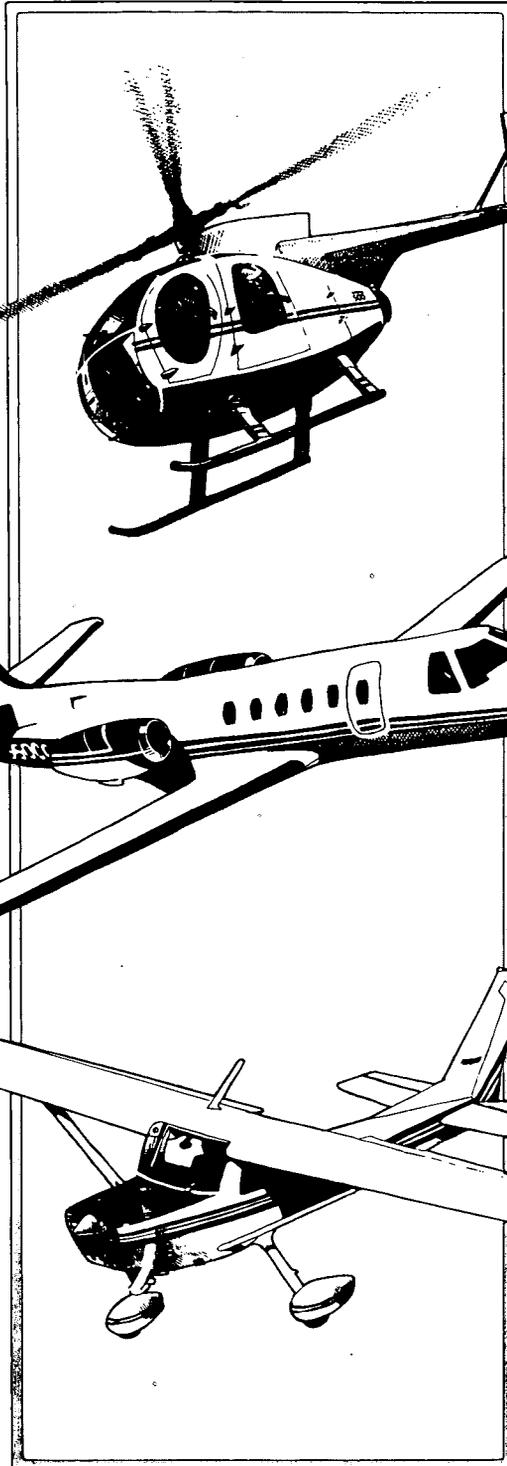
Now, Aeroquip engineering know-how makes it possible to greatly lessen the risk of post-crash fires. Crashworthy hose fittings that separate on impact, actuating a built-in safety flapper help prevent fuel loss from either the fuel lines or the fuel tank. By containing the fuel in this manner, pilot and passengers chances of escaping a post-crash fire are greatly increased.

Redundancy has always been the watchword in the design of aircraft. Back-up in mechanical functions is vital to safety and survival. This same concept likewise pertains to the design of Aeroquip crashworthy hose fittings. These fittings provide the best protection available in time of critical need—the need to contain fuel on impact.

Even the best trained pilot is at the mercy of mechanical failure to some degree. When and if a failure occurs, the small cost of crashworthy hose fittings will indeed prove to be inexpensive protection.

Research shows safety factor of crash-resistant fuel systems with crashworthy fittings and flexible hose.

According to research conducted by the National Advisory Committee for Aeronautics (NACA), more than twice as many fatalities occur in crashes followed by fire than those without. A study by the National Transportation Safety Board (NTSB-AAS-80-2) determined that postcrash fires are a much more significant problem today than 30 years ago. A study of 22,002 general aircraft accidents revealed 59% of the accidents involving postcrash fires resulted in fatalities.



U.S. Army study proves crash-resistant fuel systems save lives

Crash-resistant fuel systems featuring crashworthy fittings and flexible hose have been used in Army helicopters since 1970 with great success. By far the most impressive finding of the study revealed 52 fatalities and 31 fire related injuries in crashes of helicopters without crash-resistant fuel systems. However, in accidents of those equipped with crash-resistant fuel systems, there were no injuries or fatalities caused by fire.

Although the crash-resistant fuel system has been used almost exclusively in helicopters, it can be adapted to fixed-wing aircraft as well.

FAA research (FAA-RD-78-28) into fuel containment for Part 23 aircraft has shown that . . . crash-resistant fuel cells used with self-sealing frangible fuel line couplings can effectively reduce postcrash fuel fires in general aviation aircraft. Therefore, the Safety Board believes that the regulation should be amended to require incorporation of crash-resistant fuel systems in general aviation aircraft.

Aeroquip crashworthy hose fittings meet MIL-STD-1290 for crash-resistant fuel systems

Aeroquip engineers faced with the challenge of developing products for crash-resistant fuel systems, began working on a solution in early 1970.

MIL-STD-1290 specifications call for, in addition to crash-resistant fuel tanks, the following other fuel system requirements:

1. Fuel lines consisting of flexible hose armoured with braided steel.
2. Fuel systems, at critical failure points, to be fitted with crashworthy, self-sealing breakaway couplings.

The basic idea of the crash-resistant fuel system is to absorb energy on impact and minimize failures that result in the escape of flammable fluids in a crash.

Early in 1979, Aeroquip developed a hose assembly with a self-sealing crashworthy end fitting. Research and study responses from aircraft manufacturers indicated a hose assembly meeting a +250°F. temperature and 250 psi operating pressure requirement would provide a level of safety equivalent to TSO C-53a Type A and C specifications. Aeroquip then retested its crashworthy end fittings at +250°F. and a pressure of 250 psi. All testing required by TSO C-53a for Type A and Type C hose assemblies was satisfactorily completed and approved. Test reports are available upon request.

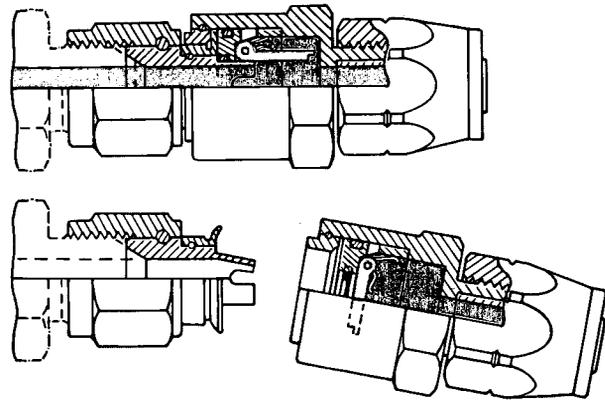
Weight and cost are negligible in consideration of the safety factor.

Crashworthy fittings add minimal weight and cost to the aircraft.

All that's required is to remove an existing TSO approved hose assembly and replace it with the new TSO approved crashworthy assembly without additional certification.

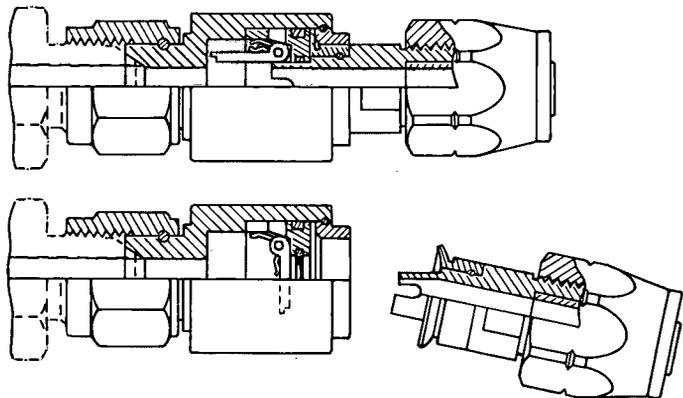
Caution: Extremely important, however, is proper installation with consideration given to the direction of fuel flow and proper fitting selection to contain fuel at fuel source in a crash mode. Installation of Aeroquip crashworthy fittings should only be performed by licensed A & P mechanics at an FAA/TSO approved overhaul facility. Contact Aeroquip engineering for special design considerations and recommendations.

Crashworthy fittings are designed to breakaway on impact, at which time a built-in safety flapper closes to prevent fuel spillage.



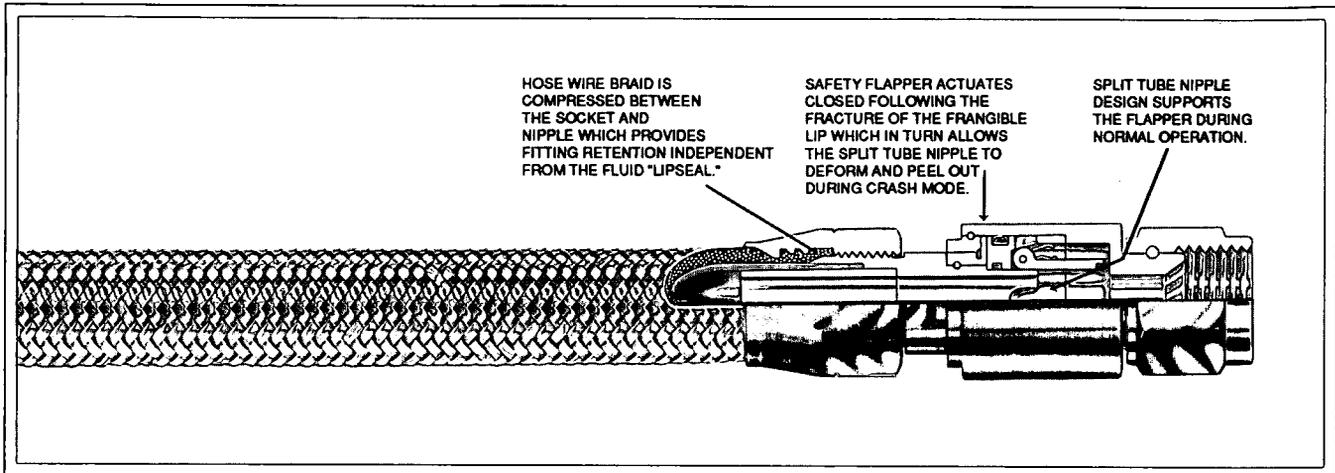
Hose Assembly Sealed

Proper selection of the correct crashworthy fitting style depends on the direction of the fuel flow in the system. See page 4.



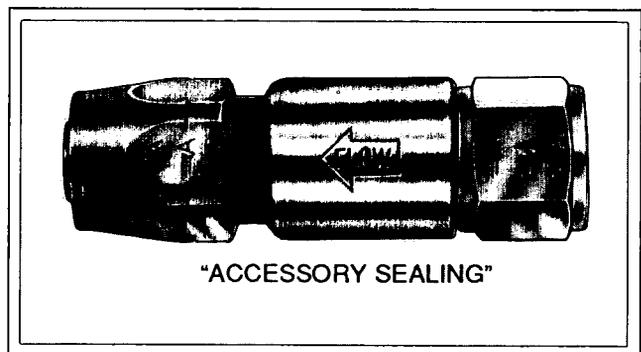
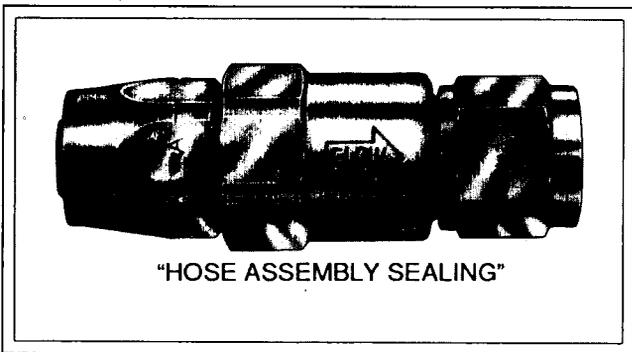
Accessory Sealed

Crashworthy fittings



Aeroquip crashworthy hose fittings are available in two different styles, "hose assembly sealing" and "accessory sealing". Proper selection depends on the direction of fuel flow in the system. The basic purpose of the crashworthy fitting is to contain the fuel at the fuel source, helping to prevent spillage or leakage which would have the greatest potential of feeding a fire in a crash mode.

For example, let's suppose a fuel line running from the fuel tank to the fuel pump is connected at the inlet port. If this inlet port fitting was accidentally knocked off at the pump a "hose assembly sealing" crashworthy fitting would automatically seal the hose line, which helps prevent further fuel spillage from the hose. If the accident had occurred on the outlet side of the pump, an "accessory sealing" crashworthy fitting would perform the same safety function.



Material and finish

Crashworthy hose fittings are anodized aluminum. All materials and finishes conform to applicable specifications for end fittings used in aircraft fluid systems. To aid proper selection, flow direction arrows are impression stamped on the frangible section of the fitting.

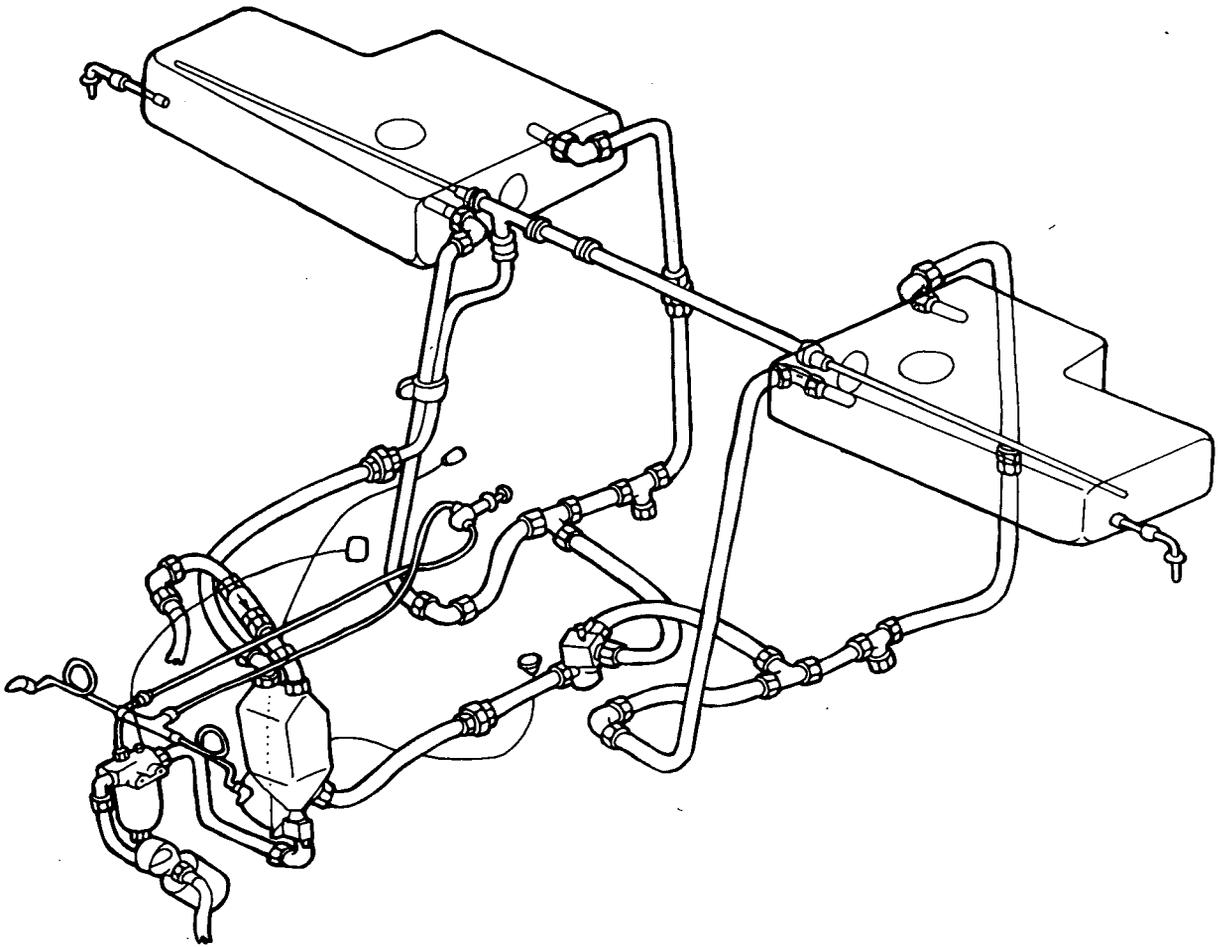
Caution: To assure proper application due to differences in fuel line routing on various aircraft, installation of Aeroquip crashworthy fittings should be performed by licensed A & P mechanics at an FAA/TSO approved overhaul facility. In addition, the use of Aeroquip crashworthy fittings does not guarantee a postcrash fire will not occur. Circumstances, such as metal fuel tank rupture or severing of fuel lines without or away from the crashworthy fitting may cause the escape of flammable fluids in a crash. Contact Aeroquip regarding recommendations for specific applications.

Forces required to actuate frangible section

Size	Tensile Load (lbs.)	Bending Moment (inch lbs.)
-6	220 - 320	200 - 400
-8	550 - 750	450 - 650
-10	550 - 750	450 - 650
-12	650 - 850	490 - 690

Generally, the force required to fracture the frangible section of the hose fittings is 50%, or less, of the force required to pull the hose out of the fitting socket.

Typical fuel line installation with crashworthy fittings



MIL-STD-1290 specifications recommends fuel lines consisting of flexible hose armoured with braided steel and crashworthy self-sealing couplings at critical failure points. The recommended hose for this application is Aeroquip AE701* AQP™ hose. It consists of a seamless specially formulated synthetic compound inner tube which is compatible with virtually all fluids

commonly used in aerospace systems. This hose retains its flexibility over a long period of time and has a practically unlimited shelf life. AE701 hose is reinforced with strong stainless steel wire braid consisting of a partial inner braid and full coverage outer braid. AE701 hose assemblies are approved under TSO-C53a Type A (unsleeved) and Type C (firesleeved).

** Aeroquip 601 hose is also approved for these applications. Please contact Aeroquip for 601 hose assembly part numbers with crashworthy fittings.*

Part numbering system makes it easy for you to order crashworthy AE701 hose assemblies with 37° flared, UNJF threads.

Straight and single elbow assemblies / swivel flared to crashworthy swivel flared fittings.

In order to properly specify the correct hose assembly you need, please use the numbering system shown. Straight and single elbow assemblies are identified by the number on this page beginning with AE701. Part numbers shown on this page are for assemblies

with "hose assembly sealing" crashworthy fittings on one end and "little gem"® AN swivel fittings on the other. The next page shows "accessory sealing" hose assemblies. Assemblies may be ordered either with or without firesleeves.

AE701 31XX K 0184

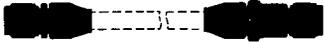
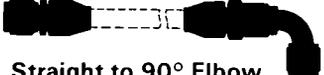
Base Number for all straight and single elbow assemblies

Assembly length in inches; always four digits, last digit indicates fractional length in 1/8's of an inch.

Size Code

Hose Dash Size	-6	-8	-10	-12
Letter Code	G	H	J	K

Hose Assembly Sealing

Assembly Fitting Configurations	Unsleeved	With AE102 Firesleeve
 Straight to Straight	3153	3159
 Straight to 45° Elbow	3154	3160
 Straight to 90° Elbow	3155	3161

AE701 31XX K 0184

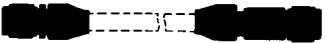
Base Number for all straight and single elbow assemblies

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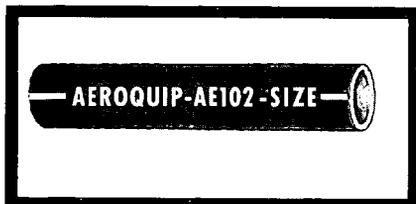
Size Code

Hose Dash Size	-6	-8	-10	-12
Letter Code	G	H	J	K

Accessory Sealing

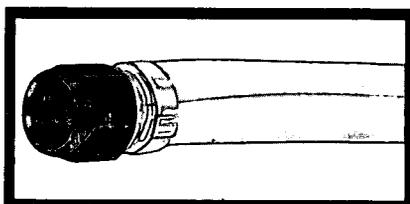
Assembly Fitting Configuration	Unsleeved	With AE102 Firesleeve
 Straight to Straight	3150	3156
 Straight 45° Elbow	3151	3157
 Straight to 90° Elbow	3152	3158

Firesleeves for crashworthy hose assemblies



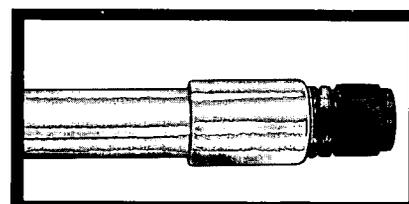
AE102 Fire-Resistant Sleeve

This sleeve is a uniform layer of braided fiberglass tubing overlaid with an orange flame-resistant silicone rubber. Meets fire resistance requirements of FAA TSO-C53a or TSO-C75. Continuous operating temperature range of -65°F. to +450°F. Request AEB-250.



AE272 Flexwrap Firesleeve

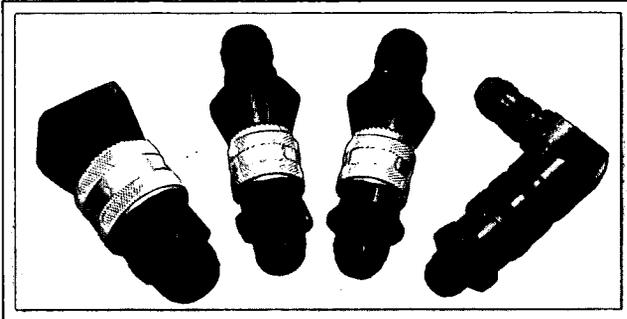
Flexwrap is a split silicone impregnated fiberglass cloth sleeve which allows minimum sleeve diameters to be wrapped over hose assemblies regardless of end fitting configuration. Provides for easy field replacement or firesleeve repair on hose assemblies. Meets TSO Specs. Request AEB-220.



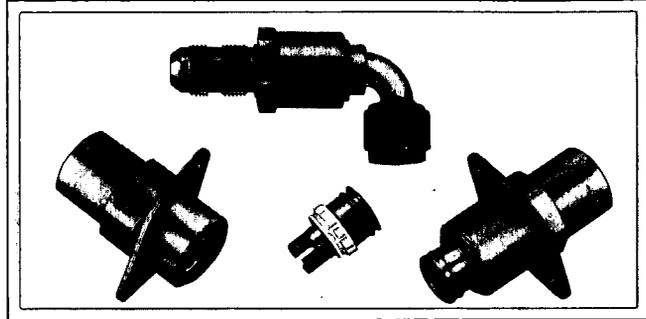
AE401 Integral Silicone Covered Hose

Aeroquip's integral silicone covered hose consists of an extruded silicone cover applied directly onto the hose wire reinforcement braid to form a smooth, tight bond. Available as AE401 hose (AE701 hose with integral silicone cover) the hose/cover combination meets fire test requirements of TSO-C53a Type C. Request AEB-251. Consult Aeroquip for part numbers of AE401 hose with crashworthy fittings.

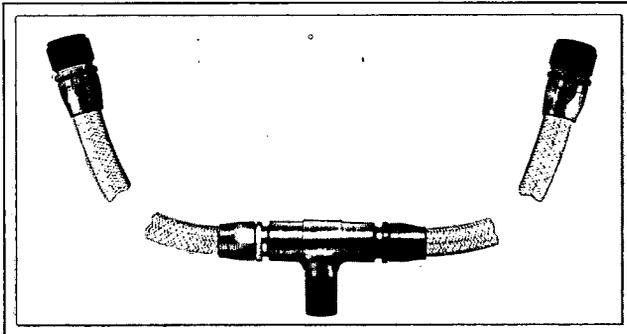
Additional crashworthy components for special design considerations



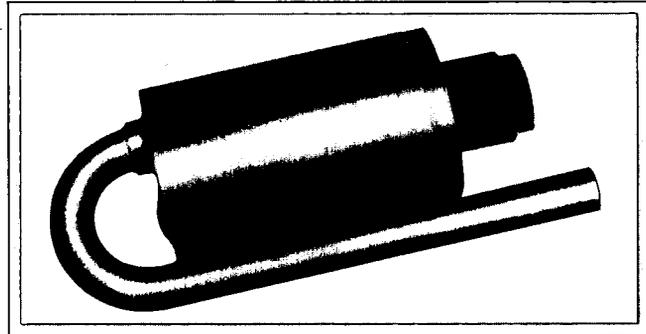
Crashworthy Couplings



Engine Feed and Crossover Crashworthy Fittings



AE701 AQP Hose with Crashworthy "T" Assembly



Fuel Tank Vent / Rollover Crashworthy Shutoff Valve

These are only a few examples of crashworthy valves designed for advanced aircraft fuel systems. Contact Aeroquip or your nearest Aeroquip Aerospace Division Distributor if you'd like assistance in designing crashworthy valves and hose assemblies for use in your aircraft.



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