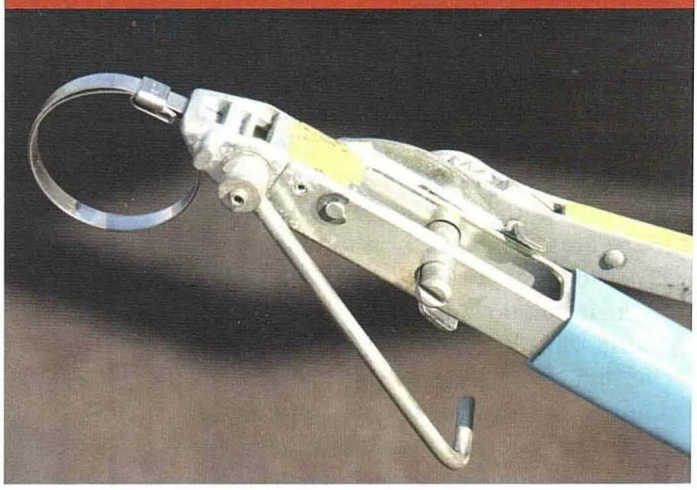
STEVE ELLS



Hosing Around

Flexible hoses for small aircraft

THE MAJORITY OF FLEXIBLE hose supplies for installation on small aircraft are manufactured in accordance with technical standard orders (TSO). The feds say, "A TSO is a minimum performance standard for specified materials, parts, and appliances used on civil aircraft." TSOs for flexible hoses include C42 for propeller feathering hoses, C75 for hydraulic hoses, and C53a for fuel and oil lines.

There are two basic hose tubes—"rubber" and Teflon (PTFE). All hose assemblies consist of three parts: the inner tube of rubber or Teflon, the reinforcement, and the cover. Sometimes the reinforcement does double duty as the reinforcement and the cover.

The cover or outer layer can be either the exposed woven stainless steel reinforcement (shiny), a braided polyester abrasion cover (usually blue), or a braided fabric layer (black) impregnated with a synthetic oil-resistant coating.

The inner part of rubber hose is made of either Buna-N synthetic rubber or a compound called HPS elastomer rubber that is able to tolerate slightly higher temperatures than Buna-N.

Teflon hoses can tolerate higher temperatures than rubber-style hoses and are compatible with nearly every substance and fluid. Equally as important is the fact that Teflon hoses, unlike rubber hoses, have an unlimited shelf life.

Eaton Aeroquip and Parker Stratoflex manufacture both rubber-like and Teflon hoses. Titeflex is less well-known in the small airplane world. It limits production to Teflon hoses.

THE FIRE ZONE

The fire zone is defined as the area on the engine side of the firewall. Always install fire-resistant or fire-proof hoses in the fire zone. A hose assembly is fire-resistant if it remains leak-free during the test outlined in C42—a 2,000° flame in very close proximity to the hose for five minutes. It's fireproof if it can remain leak-free when it's exposed to the flame for 15 minutes. What's the difference between a hose that is fire-resistant and one that isn't? The presence of either a slip-on asbestos-based fire sleeve or a molded-on (integral) fire sleeve. Slip-on fire sleeves need to be the proper size and be properly secured and sealed at each end to pass the rating tests.

Slip-on fire sleeves are usually a bright orange color, although black and blue are also available.

THE BUILD IT YOURSELF OPTION

The most commonly used flexible medium-pressure hoses are Stratoflex 11 and Aeroquip 303. These and other small hoses have a maximum working pressure of 3,000 psi.

These hoses are sized in 1/16-inch inside diameter (ID) increments. For instance the part number of 0.25-inch ID inner tube Stratoflex 111 hose is 111-4; for an Aeroquip it's 303-4. These hoses have a minimum bend radius of 3 inches. A -5 (0.312 ID) hose has a minimum bend radius of 3.38 inches

PHOTOGRAPHY COURTESY OF STEVE

The Desser hoses website, which can be found at *www.EAA.org/sportaviation* under This Month's Extras, illustrates additional options for Stratoflex hoses (tighter radiuses, abrasion resistant, electrical conductivity, etc.) that can be substituted for the 111 and 303 hoses.

Hose tubing is sold by the foot. End fittings can be installed in the field with hose assembly tools and are available in straight, 45-degree, and 90-degree orientations.

Slip-on fire sleeve material is also sold by the foot. According to the manufacturers, the only way a slip-on fire sleeve installation is guaranteed to be fire-resistant is if each end is dipped in a coating (part number 5027 $188/quart) before each end is secured with a stainless steel band.

In spite of this warning it's not uncommon to see slip-on sleeves that are end-sealed with red high temperature room temperature vulcanize (RTV) and clamped with safety wire. High temp RTV is widely available.

DO IT YOURSELF?

Medium pressure hoses can be built up in the field. Slip-on fire sleeves can also be installed in the field. Helpful information is posted on both the Precision Hose Technology and the Desser Hoses websites.

It's wise to lay out hose routings to use straight fittings if possible; 45-degree and 90-degree fittings are twice to five times more expensive. Mandrels are needed to install straight end fittings. They can be purchased one at a time or in a set; the most commonly used on small airplanes are sizes -3, -4, -5, and -6.

A Band-It tool is needed to properly clamp the end of a slide-on fire sleeve. Aircraft Spruce carries a production tool that costs around $140 or an economy tool for around $25.

COMPARISON COSTS

I whipped up a cost sheet for locally assembling a 3-foot-long medium-pressure 1/4-inch ID hose assembly consisting of 111-4 or 303-4 hose with one straight and one 45-degree fitting, installing a slip-on fire sleeve and securing the ends with the proper banding. The parts alone cost was between $130 and $160 depending on which hose was used, Aeroquip hose being less expensive. Half of this expense is due to the 45-degree fitting. If both fittings are straight, the cost is reduced by approximately $60. These rough numbers do not include the cost of the mandrel tool, the fire sleeve end seal dipping solution, or the banding tool. Quotes from Desser and Precision Hose Technology for integral type hose built to the same specifications ranged from $143 to $171. A quote for the same commercially produced non-fire-sleeved hose was only slightly less expensive.

might as well be buried in the backyard; we'll never find it again. That's one of the primary reasons I decided not to sheetrock the walls. All of those exposed studs and the hidey-holes between them are golden storage areas in which my primary storage tools are a screwdriver bit in my 3/8-inch Milwaukee and a handful of sheetrock screws, which make hanging something instantaneous. When I'm looking for something I haven't used in a while, I know it's hanging somewhere up on this wall or that wall. And the space between the studs? It's priceless! When you give it some thought, it's amazing what you can store "in" the walls.

I consider the open ceiling and its rafters to be the equivalent of overhead floor space: It's just like the floor, but you only put stuff up there that you won't be using for a while. Stuff like 3-inch walnut planks, 100-pound practice bombs, and, more important, components of the project at hand that are finished and painted but you want them somewhere that they can't be damaged. The 14-inch ceiling rafters are perfect for that. Also—and this is important—a 10-foot ceiling will let you sling completed wings and such from the overhead. In small shops, this is a big deal!

Of course, if you're unlucky enough to live somewhere that has winter, all that wall and ceiling storage is probably better sacrificed for the installation of effective insulation. There's nothing worse than a cold shop.

By the way, not sheetrocking the walls and ceiling greatly increases the building's vulnerability to fire, and I seriously considered sheetrocking it for that reason alone. However, I decided to put in a sprinkler system instead. DIY system parts are plentiful, and the only hassle was running a cold water line in, but it was worth it for the peace of mind.

Incidentally, a side thought in my head when I'm hanging tools, etc. on the walls is that there is some shop-type stuff that I just like to look at. So, I view some of the wall areas as "look at" walls: look at what I found! It's a small exhibit of what I think is neat stuff. So, I work a little harder at arranging those. But, not much.

Yeah, I know the majority of you have tidy, orderly-as-an-operating-room workshops. But, right now I'm betting there a number of you reading this who are relieved to find that it's okay to look sloppy as long as you really aren't sloppy. There's a difference between being sloppy and being orderly-in-a-relaxed-fashion. Sloppy can breed sloppy work, which we don't want, and you spend too much time looking for things. Orderly, regardless of its form, breeds progress, completion, and good craftsmanship. And those are our goals. EAA

Budd Davisson, EAA 22483, is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of *Flight Journal* magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on *www.AirBum.com*.