

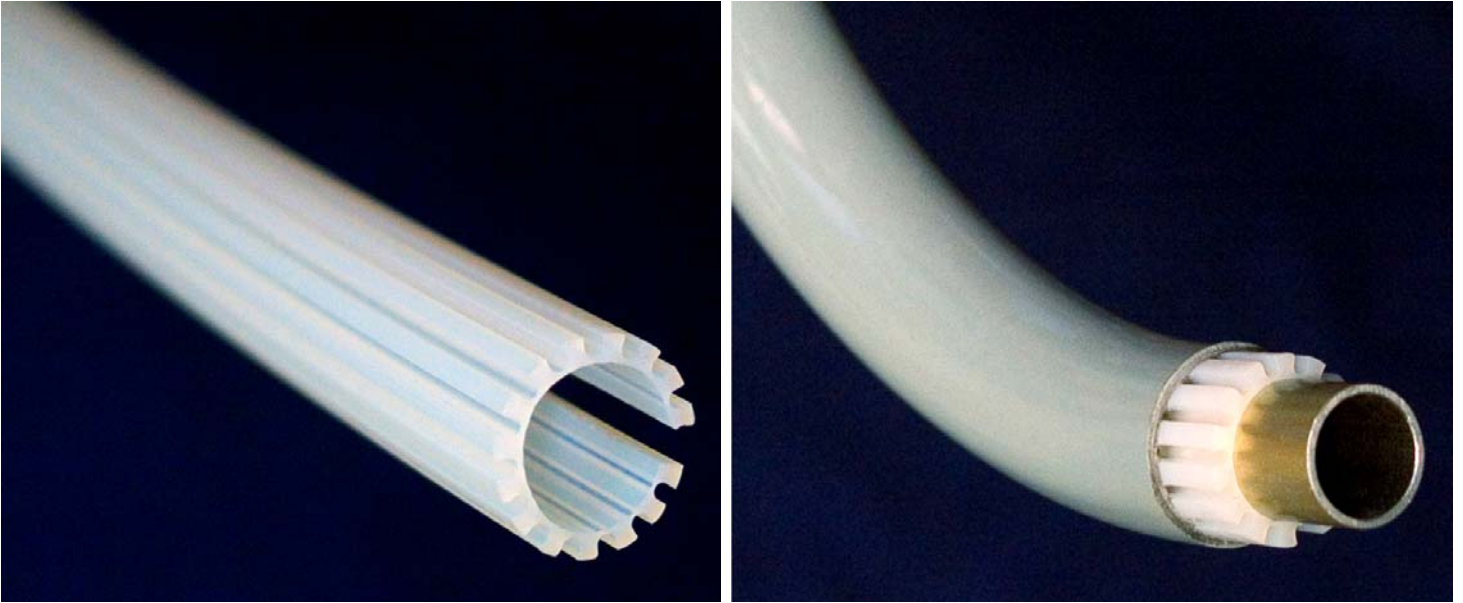
WOLFBEND™

DOUBLE WALL TUBE BENDING SYSTEM

www.wolfbend.com

U.S.PAT.5497809

**A Simple, Lightweight System That Makes
Bending Tube-in-a-Tube Practical And Easy**



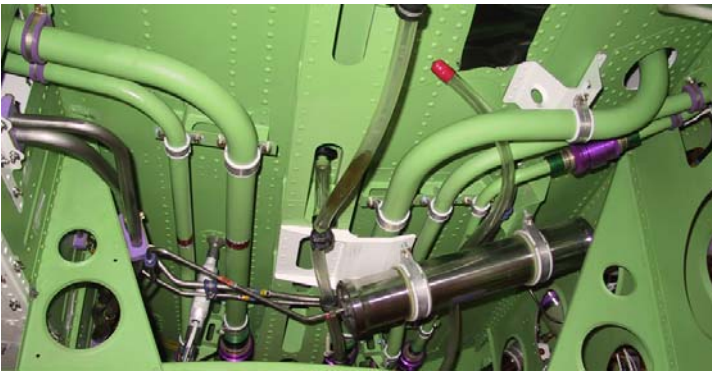
Wolfbend™ Sleeve and Tube Cutaway - .500/.750 Diameter 6061-T6 Aluminum, .028 wall



Main Landing Gear Bay Wolfbend™ Fuel Lines



Stainless Steel Wolfbend™ Fuel Lines in Engine Pylon



Belly Fairing Wolfbend™ Fuel Lines



Fuselage Under Floor Wolfbend™ Fuel Lines



Double Wall Coupling with Drain

HOW IT WORKS

A Wolfbend™ sleeve is inserted between the pre-formed tubes which prevents wrinkling and buckling of tube walls during bending. The sleeve is only required in bend areas, and remains inside the finished assembly providing support to the inner tube. Slots in the Wolfbend™ sleeve allow fluid passage between the tubes. Wolfbend™ Grounding spacers are used at tube ends to provide electrical bonding between tubes and maintain concentricity at end fittings.

DESIGN FEATURES

- May be used with any formable tube material using conventional tooling without limitations over existing methods of forming.
- Operating pressure is only limited by type of tubing and fittings used.
- Simple hand assembly before bending.
- Wolfbend™ sleeve is only required in bend areas. Straight sections are left empty (weight and cost savings).
- Shrouded tube assemblies can be formed quickly using stock materials (former methods required customized detailed part design and manufacture from outside suppliers).
- A larger portion of pressure testing can be done “on the bench” (former methods required that most of this be accomplished after aircraft installation).
- Wolfbend™ sleeve may also be used as a simple tube support in long straight tube sections.
- Channels in Wolfbend™ sleeve and grounding spacer create an outer conduit for drainage of hazardous fluid or gas leaks.
- Outer tube may also be used to introduce a cooling or heating medium, or as a heat shield.

ADVANTAGES

Meets FAA/JAA requirements for shrouded fuel lines in passenger, baggage, and fire hazard areas, while providing the following advantages over other methods:

- 20% to 60% manufacturing cost savings
- 25% to 60% weight savings
- 30% to 80% savings on detail part count
- No x-ray inspection required
- Capable of smaller bends
- Less on aircraft assembly
- More damage tolerant
- Fewer couplings required (increased system reliability)
- Securely supports inner tube
- Provides integral electrical bonding

DISADVANTAGES OF OTHER SHROUDING METHODS

REMOVABLE METAL SHROUD / METAL LINE

- Requires couplings at each bend to allow assembly (excessive number of parts and leak paths).
- Requires large bends and large shroud diameter.
- Line and shroud are only grounded to bulkhead, not to each other.
- Difficult to provide support to inner line.

RUBBER SHROUD / METAL LINE

- Shrouds are prone to damage (mishandling, dropped tools, slipped screwdriver).
- Small leaks are difficult to isolate.
- Shroud can be clamped or collapsed around line, blocking drainage.
- Climb and descent pressure cycling fatigues and cracks shrouds.
- Shrouds can not be used above 30 psi operating pressures.

METAL OR RUBBER SHROUD / FLEXIBLE LINE

- Requires large shrouds and bends.
- Very heavy.

METAL SHROUD WELDED OVER METAL LINE

- High cost and labor intensive.
- Requires 100% x-ray inspection.
- High scrap rate.
- Welds are inherently less reliable.

METAL SHROUD / METAL LINE (FORMED WITH HOT WAX, CERROBEND, SAND OR SHOT FILLER)

- Difficult to keep tubes concentric when filling and bending.
- Impractical to manufacture long tubes with many bends as scrap rates become intolerable.
- X-ray inspection required.
- Difficult to remove filler material completely, creating a line contamination risk.
- Labor intensive to place spacers between tubes for support after filler is removed.
- Burn risk for hot wax and Cerrobend (metal alloy) fillers.
- Metal alloy fillers contain lead and cadmium (serious health risk).
- Can't be used for tight bends without increasing wall thickness and/or using softer tube material (fillers do not flow and maintain their integrity well on the stretched side of the bend).

DISADVANTAGES COMMON TO MOST OTHER METHODS

- Require more time consuming, difficult and costly assembly in aircraft.
- Greater risk of damaging parts when assembling in tight or limited spaces.
- Require customized detail part design and manufacture from outside suppliers.
- Longer, more expensive design cycle time.



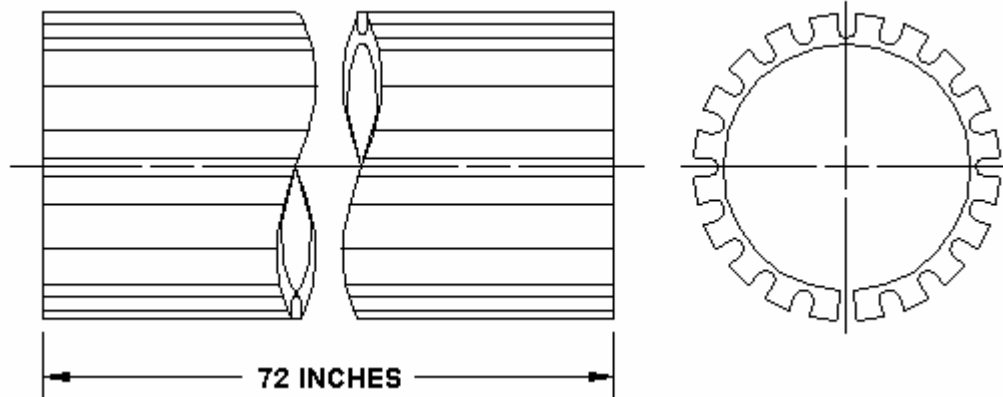
Fuselage Bulkhead Wolfbend™ Fuel Lines



Main Wing Tank Wolfbend™ Fuel Vent Line

WOLFBEND™ SLEEVE SPECIFICATIONS

| PART NUMBER | INNER TUBE O.D. | OUTER TUBE O.D. | OUTER TUBE WALL THICKNESS | SLEEVE WEIGHT LBS/FT |
|-------------|-----------------|-----------------|---------------------------|----------------------|
| FD9286-6 | 0.375 | 0.625 | 0.028 | 0.0788 |
| FD9286-8 | 0.500 | 0.750 | 0.028 | 0.1007 |
| FD9286-12 | 0.750 | 1.000 | 0.028 | 0.1485 |
| FD9286-16 | 1.000 | 1.250 | 0.028 | 0.2003 |
| FD9286-20 | 1.250 | 1.500 | 0.028 | 0.2521 |
| FD9286-24 | 1.500 | 1.750 | 0.028 | 0.3039 |



Used on commercial and business aircraft:

- | | |
|--|---|
| <p>Bombardier</p> <ul style="list-style-type: none"> • CRJ200/700/900 • Global Express 5000/XRS <p>Cessna</p> <ul style="list-style-type: none"> • Citation Mustang | <ul style="list-style-type: none"> • Challenger 300/604/605/800/850 • Dash 8-Q400 |
|--|---|

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| <ul style="list-style-type: none"> • Aerospace Industrial Development Corporation (Taiwan) • BHW Components Limited (Lancashire, United Kingdom) • Cessna • Mitsubishi Heavy Industries | <ul style="list-style-type: none"> • Aero Arc (Torrance, California) • Bombardier Aerospace • GE Elano Canada • OSM Partners, LLC (Savannah, Georgia) |
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Wolfbend™ Sleeve can be sized for other applications. Contact us!

WOLFBEND

LLC

DOUBLE WALL TUBE BENDING SYSTEMS

www.wolfbend.com

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