

## Rigid Tube Fabrication

Titeflex has a wide range of in-house rigid tube assembly fabrication capabilities to service the demanding applications and requirements of the aerospace industry. We are accustomed to working with all of the typical aerospace materials including austenitic and "PH" stainless steels, nickel alloys (600, 625, 718, X750, Waspaloy, and Hasteloy), titanium, and aluminum. The knowledge and skill of our personnel enable us to tackle some of the toughest jobs that the industry has to offer.

Tube forming capabilities include rotary draw tube bending to 3" diameter, roll sweep bending to  $\frac{3}{4}$ " diameter, coiling to  $\frac{1}{2}$ " diameter, end finishing, and press forming.

Metal joining capabilities include orbital and manual GTAW (Gas Tungsten Arc Welding), induction brazing, vacuum furnace brazing, and torch brazing. We also perform vacuum heat treating (stress relieving, solution heat treating, and precipitation hardening) of materials other than aluminum.

As companions to metal joining we have a non-destructive testing lab certified for radiography and liquid penetrant inspection and in-house cleaning capability including titanium cleaning. Our non-destructive testing capabilities also include pressure testing with media and pressures as follows:

- **Air / Nitrogen / Helium**      **8,000 PSI**
- **Water**                              **15,000 PSI**
- **Skydrol**                              **8,000 PSI**

In addition to routine cleaning we also perform special cleaning, testing (particle count and NVR (Non Volatile Residue)), and protective packaging of components for oxygen systems and other systems having special cleanliness requirements.

We hold many aerospace customer approvals for special processes and are Nadcap accredited in Welding & Brazing, Furnace Brazing & Heat Treatment, Chemical Processing (including titanium cleaning), and Non-Destructive Testing (Radiography and LPI (Liquid Penetrant Inspection)).



# RIGID TUBING CAPABILITIES

## BENDING (Cold Forming):

### RANGE OF TUBE DIAMETER

1/16" to 3"

### PREFERRED MINIMUM CENTERLINE BEND RADII

#### Titanium

3 x Tube O.D. (³ 3% Flattening Allowance)

2 x Tube O.D. (³ 5% Flattening Allowance)

#### Ferrous & Nickel Alloys

1½ x Tube O.D. (³ 5% Flattening Allowance)

#### Non-Ferrous Alloys

1½ x Tube O.D. (³ 10% Flattening Allowance)

### PREFERRED MINIMUM DISTANCE BETWEEN BENDS

2 x Tube O.D. (Special Tooling Required for Shorter Lengths)

*Note: Material properties for elongation must be compatible with bend requirements.*

## JOINING:

### DC ORBITAL WELDING

12 Units 3/16" to 3" O.D.

### MANUAL WELDING

(20) Manual Weld Stations

(2) VAC Atmosphere Weld Chambers

Load/Unload Chamber 24" x 36"; 15" x 72"

Work Area 36" x 80"

### INDUCTION BRAZING

10 KVA to 50 KVA

### FURNACE BRAZING & HEAT TREATING

VFS MODEL HL 66

Work Zone 50" x 34" x 72"

Max. Temperature 2400°F

Vacuum 1.0 x 10<sup>-4</sup> Torr.

CNC Control

ABAR/IPSEN MODEL H3636 TURBOTREATER

Work Zone 24" x 24" x 36"

Max. Temperature 2400°F

Vacuum 1.0 x 10<sup>-4</sup> Torr. To 2 Bar

CNC Control

### TORCH BRAZING

### MECHANICAL ATTACHED FITTINGS

Deutsch DMA, Deutsch DMAA & Permaswage, Sierracin-Harrison, Elastomercy Swage, Wiggins/Hydraflow, Ringlok

## END FORMING:

### ANNEALED FERROUS, NICKEL OR NON-FERROUS

Flaring: 3/16" to 3" O.D. x .065 Wall Max.

Beading: 1/4" to 3" O.D. x .065 Wall Max.

Swaging: 2" O.D. Max. x .065 Wall Max.

## OUTSIDE SUBCONTRACT EXPERIENCE:

Plasma Coating  
Plating  
Dip Brazing  
Resistance Welding

Grinding  
Shot Peening  
Sheet Metal Forming  
Painting

## NON-DESTRUCTIVE TESTING:

### MEDIUM AND MAXIMUM PRESSURES

Air - 1,000 PSI

Water - 15,000 PSI

Inert Gas - 6,000 PSI

Skydrol - 10,000 PSI

### RADIOGRAPHIC INSPECTION

Maximum Material Thickness - 1" Equivalent SST  
Automatic Film Processing

### FLUORESCENT PENETRANT INSPECTION

Water Washable and Post - Emulsifiable System  
Normal to High Sensitivity

### ULTRASONIC

Shear Wave Impulse Echo by Contact Method

## INSPECTION:

3 Eaton Leonard Laser Visions: (2) Optima (1) Standard  
Non-Contact Tube Measuring Machine

Tolerance - Tube Envelope ± .005

- End Points ± .002

Networked to All Power Benders for Set-Up

Elongation/Springback Feedback

### MITUTOYO B706 COORDINATE MEASURING MACHINE

Measuring Range - X Axis 28", Y Axis 24", Z Axis 18"

## ENGINEERING:

### CATIA V4, V5

### UNIGRAPHICS NX9 CAD/SYSTEM (6 STATION), WINDOWS PLATFORM

### IGES, STEP, UG TRANSLATORS

3D Wire Frame & Solid Modeling

Tool, Jig & Fixture Design

Reverse Engineering of Assemblies

## TESTING:

### CLASS 1000 CLEAN ROOM CAPABILITIES

NVR Analysis

Particle Size & Weight Analysis

Packaging

## Titeflex Flex-Rigid Hybrid Assemblies

Titeflex Aerospace blends its vast experience in flexible hose fabrication and precision bending of rigid tubes to deliver flex-rigid assemblies. These hybrid assemblies combining flex hose with multi-bend tube are a Titeflex specialty and provide improved vibration dampening, ease of installation, and maintenance over strictly rigid tube. Titeflex can adapt flex hose to any rigid configuration, thereby reducing connection points between flex and rigid elements and eliminating leak opportunities. Flex-Rigid Assemblies can be found on commercial aircraft, military aircraft, engines, landing gear, space applications, and for power generation. Titeflex flex-rigid assemblies are used extensively in the International Space Station. For more information about how Titeflex can provide solutions for your fluid distribution needs through flex-rigid assemblies, please contact us.

