

# ForceTec®

## RIVETLESS NUT PLATE



### ADVANTAGES OVER OTHER NUT PLATE SYSTEMS:

- 3 to 10 times fatigue life improvement
- Installs over 6 times faster
- Rivetless and adhesive-free for superior process reliability
- Potential weight savings in both metal and composite structures
- Superior corrosion resistance
- Nut element easily replaceable



Over 15 Years  
of Proven  
Service History

**FTI**  
FATIGUE TECHNOLOGY

# FORCETEC<sup>®</sup>

## FORCETEC RIVETLESS NUT PLATE SYSTEM

The ForceTec Rivetless Nut Plate system is widely used as an alternative to traditional riveted nut plates, gang channels, or adhesively bonded nut plates. ForceTec's simple installation and fatigue life benefits make it a cost effective option, significantly reducing labor and maintenance costs over the life of the aircraft.

- In service since 1993
- Independently tested by outside agencies
- Approved and used by:
  - > Airbus
  - > Bell Helicopter Textron
  - > Boeing (Military and Commercial)
  - > Bombardier
  - > EADS
  - > Eurocopter
  - > Lockheed Martin
  - > Northrop Grumman
  - > US Department of Defense

Many of FTI customers use ForceTec fasteners in "non-fatigue" applications to:

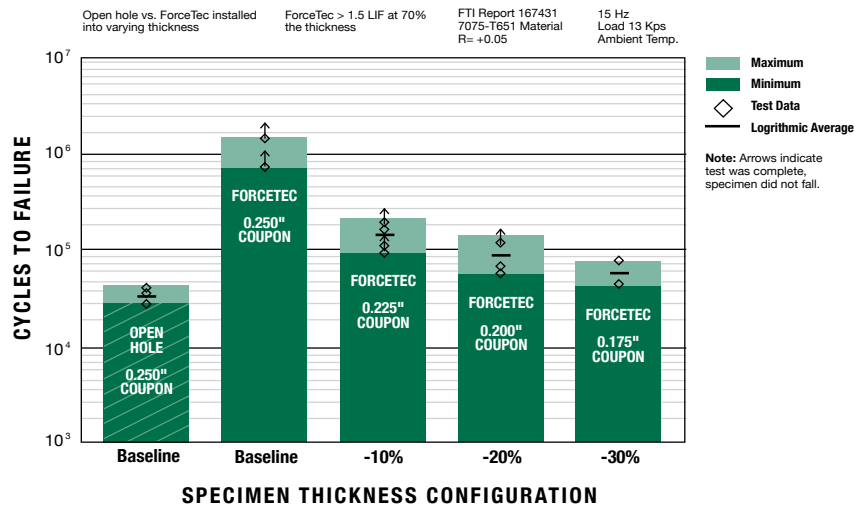
- Increase production rates
- Reduce overall costs
- Reduce structural weight
- Reduce life cycle costs
  - Rework damaged traditional nut plate holes



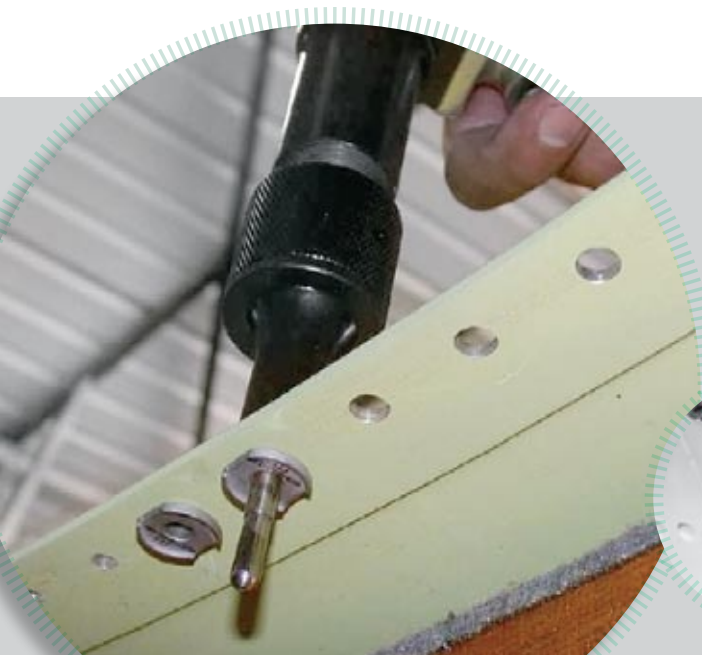
*Reworking damaged riveted nut plate holes with ForceTec.*

## Save weight by reducing structural thickness using ForceTec in fatigue designed applications

ForceTec is installed into the structure by radially expanding the nut plate retainer barrel into the hole creating a high interference fit between the barrel and the structure. This process also cold expands the fastener hole in the parent structure inducing beneficial residual stresses. Testing has proven that this added fatigue life benefit could allow the thickness of the parent structure to be reduced by up to 30% without compromising the structure's fatigue life.



*A 0.250" thick, open hole specimen was tested against four different thickness sized ForceTec specimens using the same load and ever increasing net section stress. The results showed that ForceTec in a 0.175" thick coupon achieved a service life greater than the baseline specimen life. This is a reduction of 0.075" or 30% of the baseline specimen thickness. (FTI Report #167431)*



## A SUPERIOR INSTALLATION PROCESS

On a major United States Air Force program, 260,000 ForceTec retainers were installed with zero defects on over 80 aircraft sets. The elimination of defective installations and the elimination of "Red-Tags" with the ForceTec System will reduce assembly and maintenance costs.



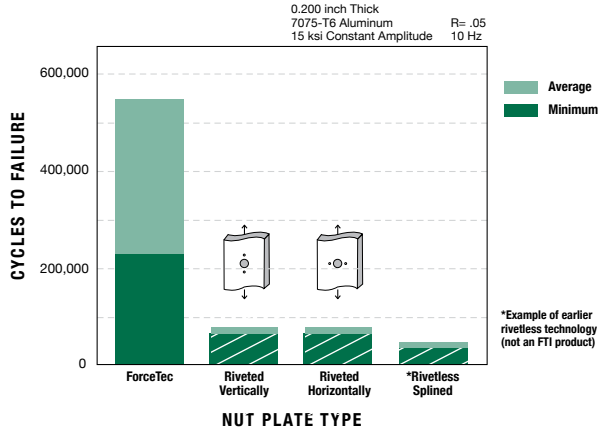
*ForceTec retainers installed in cargo aircraft floor rails.*

# FORCETEC OUTPERFORMS OTHER NUT PLATE SYSTEMS

## Fatigue Enhancement/Damage Tolerance

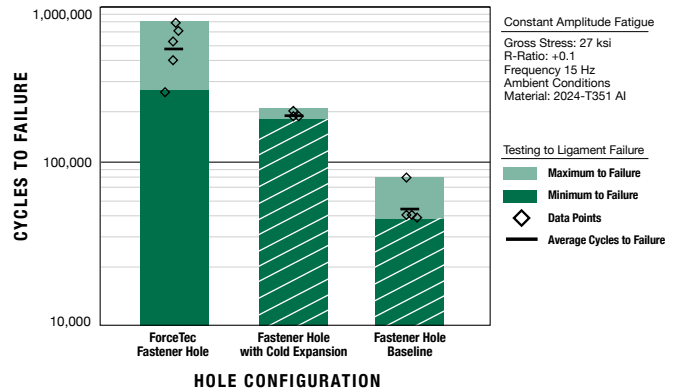
The ability of ForceTec to abate the effects of cyclic tensile loads on the durability of metal structures is well documented. Given a known operating loads spectrum, the fatigue life of a component with a ForceTec nut plate installed is typically 3-10 times greater than an un-enhanced component. ForceTec also improves damage tolerance of the installation by reducing crack propagation rate or arresting the growth of small cracks.

### FORCETEC INCREASES FATIGUE LIFE OVER OTHER NUT PLATES



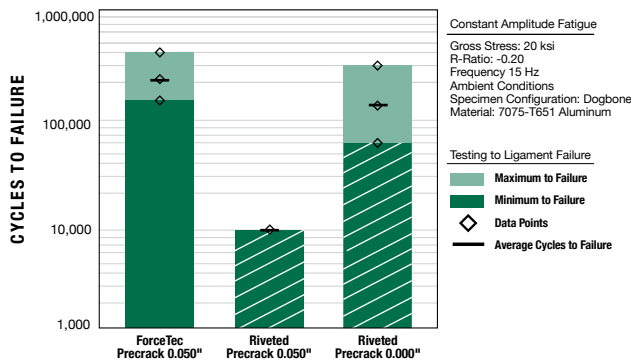
Installation of ForceTec cold expands the fastener hole to increase the fatigue life of the installation plus it eliminates attachment rivet holes and other induced stress risers. (FTI Report #33820)

### FORCETEC OUTPERFORMS COLDWORKED OPEN HOLES



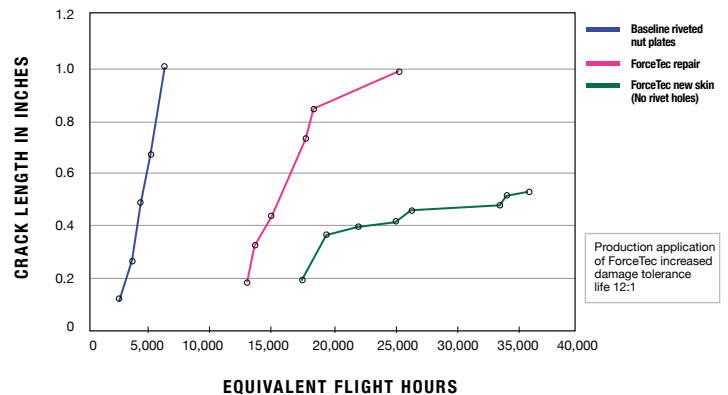
ForceTec provides additional benefit over coldworked nut plate fastener holes by protecting the hole with an interference fit "bushing." (FTI Report #83823)

### FORCETEC IMPROVES DAMAGE TOLERANCE 6 TIMES LONGER LIFE ON AVERAGE



Damage tolerance testing with 1/4" nut plates showed ForceTec installed with a 0.050" pre-crack performed better than an un-cracked riveted nut plate installation. (FTI Report #89408)

### FORCETEC IMPEDES CRACK GROWTH 7 TIMES LONGER LIFE



Replacement of riveted nut plates with ForceTec to remove fatigue cracks on fighter aircraft access panel door attachments extended the life over 7:1. (FTI Report #85874)



Sealed ForceTec in a wing access panel mounting.

## 6 TIMES FASTER INSTALLATION

A major OEM time study completed of ForceTec showed that in the time it took to install 100 riveted nut plates, they could install 665 ForceTec retainers with zero defective installations.

Other customers have also completed time and motion studies. They all confirm a 6.6:1 or greater, process time improvement.

ForceTec also allows the immediate assembly of components without waiting for the mandatory one to seven day curing of adhesive with the bonded-on type of nut plate.

# FORCETEC INSTALLATION

## PROCEDURE

**Slide the split sleeve onto the mandrel**



**Insert the retainer into the starting hole from either side**



**Insert the mandrel/sleeve assembly through the retainer**



**Activate the hydraulic puller unit**



**Retract the mandrel all the way through the sleeve and retainer**



**Remove the split sleeve and insert the nut element**



*Shown above is the mandrel/sleeve installation method. FTI also offers a sleeveless method and an accelerated installation method for even quicker retainer installation. Contact FTI for more details.*

**Process integrity verification tooling is also available.**

## SPECIAL INSTALLATIONS

FTI has also developed tooling for access-restricted areas and quick field maintenance.



*Right Angle Puller for holes in pockets or areas with limited front-side access.*



*Offset Adapter for installs in tight and restricted areas.*



*Hand Puller for quick field service installations.*

## TRIMMING TOOLS



FTI offers a trimming tool to shave excess barrel material after installation to ensure flushness. Tooling is also available to cut retainers to specific lengths prior to installation. This reduces the number of different grip lengths required.



## IMPROVES COMPOSITE/HYBRID ASSEMBLIES

ForceTec's design offers many benefits when installed in composite structures and hybrid joints. The ForceTec design meets NASM-25027 torque and pushout requirements without rivets or adhesive thereby improving installation time and process reliability. ForceTec also protects the hole in the composite structure from damage while improving the open hole compression strength of the material. ForceTec facilitates one up assembly when used with ForceMate bushings in hybrid structures.

*ForceTec installed in composite.*

# APPLICATIONS

ForceTec can be used in any structure (new production or rework) where nut plates are needed. ForceTec is also approved for primary structural attachment.



FUSELAGE



WINGS



ACCESS PANELS



HINGE ATTACHMENTS



STRUCTURAL ATTACHMENTS

# MATERIALS & CONFIGURATIONS

The ForceTec system comes in both standard and metric sizes and can be uniquely designed to work in special applications. The system accepts a standard floating nut or a sealed domed nut that fits tightly over the nut plate for a secure seal in areas exposed to fluids or fuel.



STAINLESS STEEL (OPEN & SEALED)

*These retainers are also available with cadmium plating, IVD aluminum coating or anodized aluminum coatings.*



ALUMINUM (OPEN & SEALED)



TITANIUM (OPEN & SEALED)



SPECIAL CONFIGURATIONS/APPLICATIONS

*Panel and Hi-Torque Fasteners*

## BETTER CORROSION RESISTANCE

ForceTec retainers are initially placed clearance fit into the starting hole of a structure. This initial clearance ensures the integrity of corrosion preventive coatings. Once expanded into place, the corrosion preventive coatings on ForceTec retainers are uniformly distributed at the interface of the retainer and the hole to provide the best coating integrity available.



AIRCRAFT CARGO SIDE PANEL  
(Top: Riveted nut plate / Bottom: ForceTec)

### CORROSION TEST

*An outside agency performed a 1000-hour salt fog test to compare the corrosion resistance between ForceTec, riveted nut plates, and bonded nut plates. The test proved that ForceTec nut plates are more resistant to corrosion than both riveted and bonded nut plates.*

## QUICK AND EASY MAINTENANCE

The ability to quickly make repairs and perform routine maintenance is greatly needed on today's aircraft fleet. The ForceTec system allows the simple removal and replacement of a damaged nut element. The process only takes seconds per hole.

Replacement of the nut element in competing riveted nut plates requires drilling out and re-installing attachment rivets, which could damage the structure. For bonded fasteners, replacement requires removing the bonded base and preparing the surface to accept the renewed bonding adhesive, which can cause unreasonable delays waiting for the bond to cure.



*The ForceTec nut is a removable component and can be replaced in seconds.*

FTI designs and manufactures a full range of cold expansion products for the aerospace industry. These products are specifically engineered to achieve aircraft production and cost initiatives; meet design goals, production rates and aircraft performance objectives; and provide life-cycle cost savings.

Here are some of FTI's other innovative products:



### **Split Sleeve Cold Expansion™**

#### **Fatigue Life Enhancement of Holes in Metal Structures**

- Enhances structural fatigue life
- Increases the durability and damage tolerance of holes
- One-sided operation
- Over 38 years proven service



### **ForceMate®**

#### **Bushing Installation System**

- Reduces labor time and installation costs
- Consistent interference fit
- Resists migration and rotational forces
- Improves fatigue life and damage tolerance of parent structure
- Superior installation reliability



### **TukLoc®**

#### **Blind Fastening System**

- Easy hole preparation
- No additional sealants required
- Rapid installation
- Highly reliable process



### **Flexmate®**

#### **Advanced Aerospace Fitting**

- Fatigue life improvement
- Simple one-piece design
- Minimum envelope
- Minimum weight
- Excellent sealing and electrical conductivity



FTI's corporate headquarters and manufacturing plant is located just 5 minutes from the Sea-Tac International Airport and 10 minutes from downtown Seattle, Washington.

## **FTI SERVICES**

Fatigue Technology Inc. is the world leader in cold expansion technology. We have pioneered this science since 1969 and have advanced the cold expansion process to develop cost savings ideas for production simplification, manufacturing and maintenance time-saving, and improved aircraft structural performance. We offer our customers a full range of services to support their applications.

#### **THESE SERVICES INCLUDE:**

- On-site product support
- Technical training
- Engineering/design support
- Product and materials testing
- Research and development services
- Field repairs and upgrades

*(Please contact us to discuss your current application.)*



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