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# 2013 CATALOG


LEADING PROVIDER OF BOLT LOADING & REMOVAL SOLUTIONS

Products and Prices are subject to updates and changes. Please contact us for current quote.

2013

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# BOLTING TECHNOLOGY

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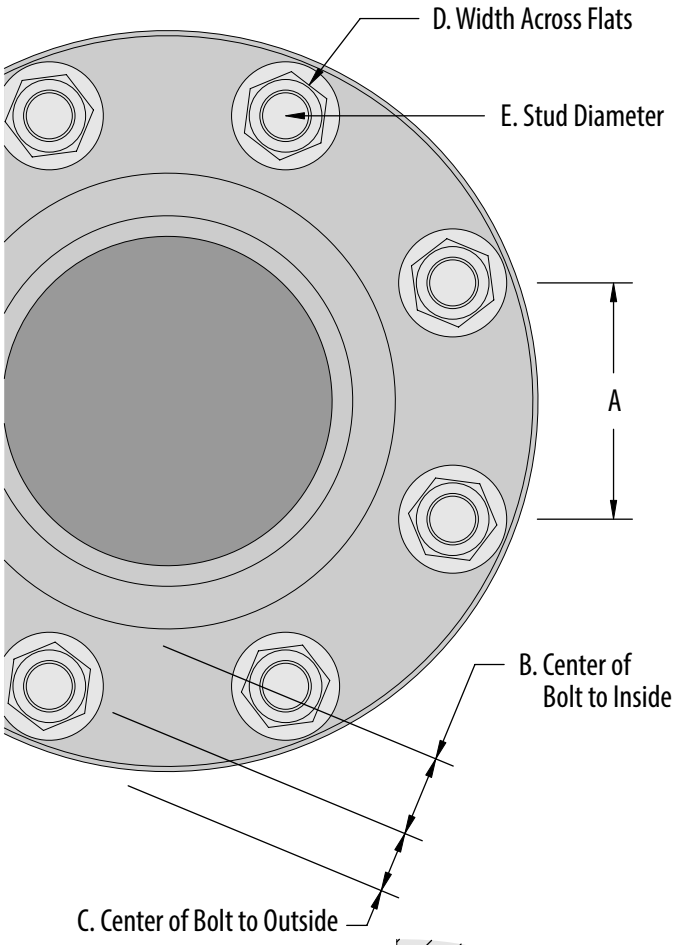
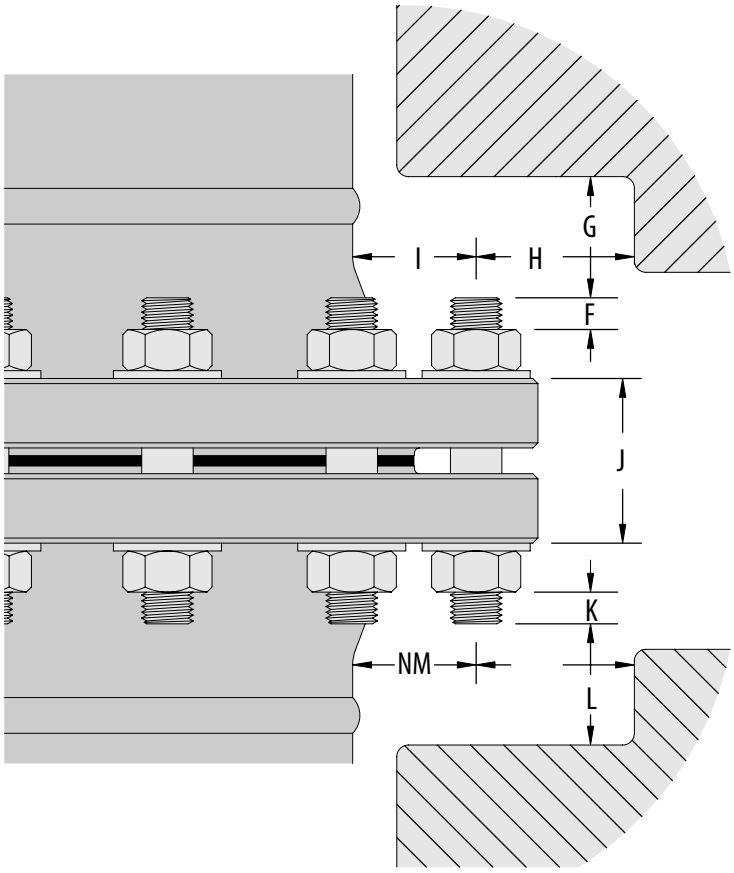
# Application Worksheet




A. Center of One Bolt to The Next: _____

B. Center of Bolt to Inside: _____

D. Size of Nut (Width Across Flats): _____

C. Center of Bolt to Outside: _____

E. Diameter of Stud: _____

* Number of Bolts: _____

**Top Side of Flange**

F. Length of Stud Above Nut: _____

G. Vertical Clearance Above Stud: _____

H. Horizontal Clearance to Outside: _____

I. Horizontal Clearance to Inside: _____

J. Grip Length: _____

**Bottom Side of Flange**

K. Length of Stud Below Nut: _____

L. Vertical Clearance Below Stud: _____

M. Horizontal Clearance to Outside: _____

N. Horizontal Clearance to Inside: _____

**Bolt & Additional Flange Info**

1. Bolt Material: _____

2. Yield Strength: _____

3. Operating Temp. (If Known): _____

4. Gasket(s) (Type & Material): _____

5. ANSI or API Designation: _____

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# Definition of Torque

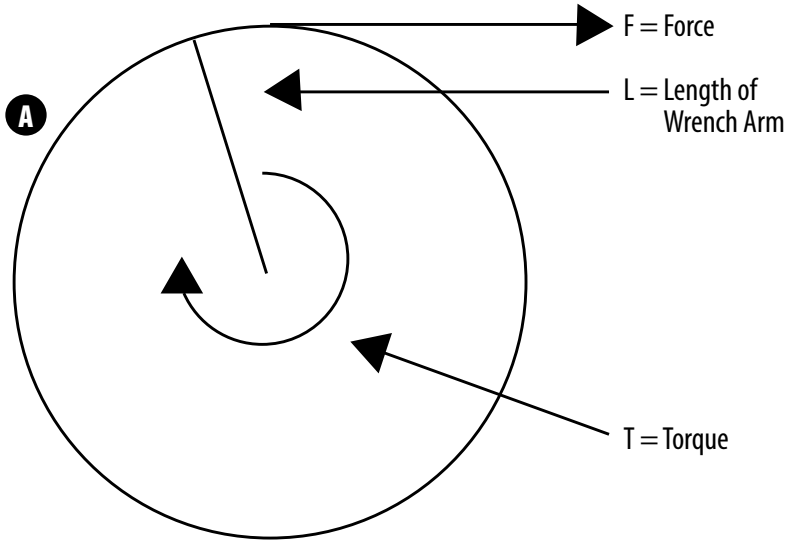
## BOLTING TERMS

**TENSION:** The act of stretching tight or state of being stretched tight. Stress of a pulling force on a body.

**TORQUE:** The measure of the tendency of a force to rotate the body upon which it acts about an axis.

**STRESS:** Forces exerted against each other by two surfaces in contact.

**PRELOAD:** Initial clamping force or tension in a fastener.



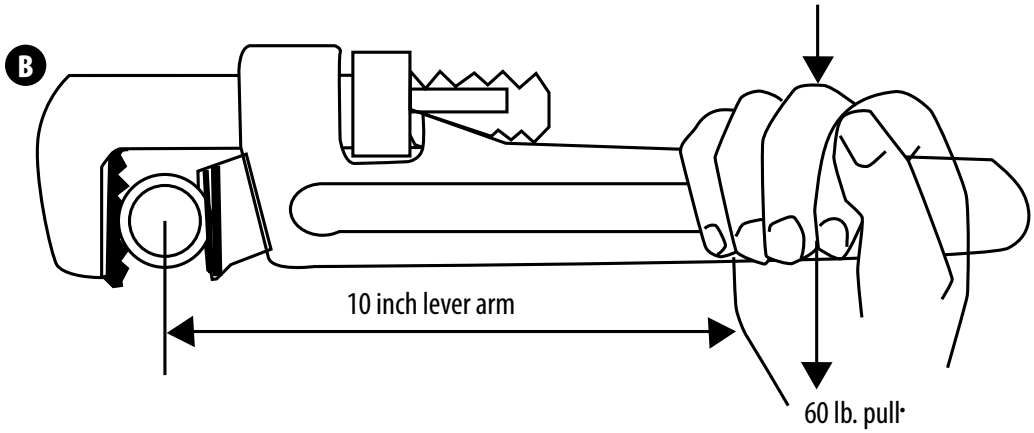

## BOLTING CALCULATIONS

**A:** The formula for torque may be expressed as:

**T = F x L**

T = Torque F = Force L = Length

**B:** In this example we substitute real numbers for the letters in the previous example. If a hand is pulling at the end of a 10" wrench arm and exerting 60 pounds of force, the resulting torque will be 600 in-lbs (600 = 60x10). To convert to ft-lbs we merely divide the result by 12. Thus we obtain 50 ft-lbs.




## WHAT HAPPENS WHEN WE TIGHTEN A BOLT?

The bolt acts as a heavy spring that clamps two or more pieces together.

When we turn a nut we stretch the bolt. Stretch or elongation provides clamping force.

Clamping force increases on a straight line until yield is reached.

Not enough clamping force allows the nuts to vibrate loose and causes leaks.

Too much clamping force causes gasket damage, bolt galling, flange damage and even bolt breakage.

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# Tool and Application Choices

| TOOL | APPLICATION | PROBLEM TO SOLVE | ADVANTAGES |
|---|---|---|---|
| **Spin-Torq 360° Rotating Wrench** | Breaking down<br>Making up<br>Continuous rotation of bolts & shafts | Need for:<br>Speed<br>Continuous rotation<br>Reversible rotation<br>SubSea / ROV | 360° Continuous Rotation of Nut, clockwise and counter-clockwise<br>36 times faster than ratchet wrenches<br>Continuous full power in both directions |
| **Auto-Torq Thinline Hydraulic Torque Wrench** | Breaking down<br>Making up | Clearance issues | 60° turn of nut before resetting<br>Cylinder engaged during power & retraction strokes<br>Wrench profile is narrower than the nut height |
| **IU-XL Ratchet Wrench** | Breaking down<br>Making up | Limited Space | Low profile<br>Direct fit over the nut |
| **SU-XL Ratchet Wrench** | Breaking down<br>Making up | Need for high torque<br>Use of one tool on multiple nut sizes | Desired torque at the touch of a button<br>Accurate to +/- 3%<br>Many socket sizes fit each wrench |
| **Auto-Splitter Nut Splitter** | Breaking down<br>Removing nuts | Corroded fasteners<br>Galled threads | Won't damage stud<br>Each model cuts multiple nuts sizes (from 3 to 9 per model)<br>Fits into tight spaces<br>NO Hot Permit required<br>Quick, safe & economical |
| **Auto-Tension Stud Tensioner** | Breaking down<br>Making up | Many studs<br>Large studs<br>Large flanges | Equal & simultaneous bolt load<br>Compact & lightweight<br>Reduces risk of galling fasteners |
| **Auto-Spreader Flange Spreader** | Replacing gaskets<br>Leveling machinery<br>Separating flanges | Frozen flanges<br>Need to replace gasket | Allows quick replacement of gaskets<br>One size fits all flanges<br>Only 3/32" clearance needed to fit spreader |

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# Tool and Application Choices

| TOOL | APPLICATION | PROBLEM TO SOLVE | ADVANTAGES |
|---|---|---|---|
| **Zip-Lift Robotic Crane Grapple** | Retrieve and abandon loads in hazardous environments | Connect and release lines to and from loads without human intervention | Zip-Lift pushes-on and pulls-off threaded lifting eyes |
| **Auto-Zip Robotic Stud Tensioner** | Connect bolted joints in deep water or other hazardous environments | Place stud tensioners on studs, pull studs into tension, rotate nuts and remove tensioner without human intervention | Auto-Zip pushes-on and pulls-off using ROVs or hardsuits<br>Hydraulic motor rotates nuts |
| **Auto-Zip Flange Pullers** | Pull flanged pipelines together SubSea | Heavy loads to pull and hold without human intervention | Double Zip-Nuts on each end of the pulling cylinder provide robotic control |
| **DTIs - Direct Tension Indicators** | Measure bolt load induced in each bolt in a flange | Inspect for bolt load without the use of strain gauges or instruments | DTIs measure bolt load using a feeler gauge |
| **Auto-Gripper Stud Remover** | Breaking down | Unable to remove studs from threaded hole | Especially useful on blind flanges<br>Eliminates flame cutting & machining |

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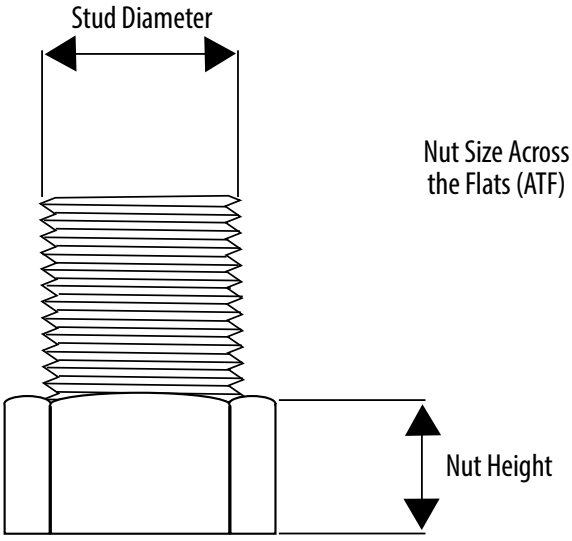
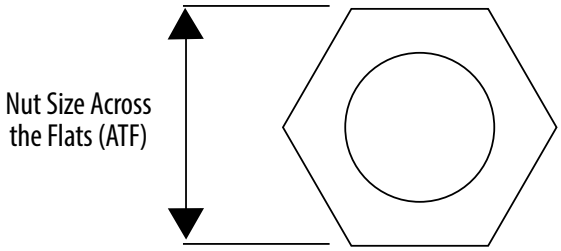
# Standard Stud & Heavy Hex Nut Specifications

| Stud Diameter Inches | Nut Size ATF / Hvy Hex - Inches | Nut Height Hvy Hex - Inches |
|---|---|---|
| 3/4 | 1-1/4 | 3/4 |
| 7/8 | 1-7/16 | 7/8 |
| 1 | 1-5/8 | 1 |
| 1-1/8 | 1-13/16 | 1-1/8 |
| 1-1/4 | 2 | 1-1/4 |
| 1-3/8 | 2-3/16 | 1-3/8 |
| 1-1/2 | 2-3/8 | 1-1/2 |
| 1-5/8 | 2-9/16 | 1-5/8 |
| 1-3/4 | 2-3/4 | 1-3/4 |
| 1-7/8 | 2-15/16 | 1-7/8 |
| 2 | 3-1/8 | 2 |
| 2-1/4 | 3-1/2 | 2-1/4 |
| 2-1/2 | 3-7/8 | 2-1/2 |
| 2-3/4 | 4-1/4 | 2-3/4 |

| Stud Diameter Inches | Nut Size ATF / Hvy Hex - Inches | Nut Height Hvy Hex - Inches |
|---|---|---|
| 3 | 4-5/8 | 3 |
| 3-1/4 | 5 | 3-1/4 |
| 3-1/2 | 5-3/8 | 3-1/2 |
| 3-3/4 | 5-3/4 | 3-3/4 |
| 4 | 6-1/8 | 4 |
| 4-1/4 | 6-1/2 | 4-1/4 |
| 4-1/2 | 6-7/8 | 4-1/2 |
| 4-3/4 | 7-1/4 | 4-3/4 |
| 5 | 7-5/8 | 5 |
| 5-1/4 | 8 | 5-1/4 |
| 5-1/2 | 8-3/8 | 5-1/2 |
| 5-3/4 | 8-3/4 | 5-3/4 |
| 6 | 9-1/8 | 6 |

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# Bolt Sizes & Quantities for Flanges

**ANSI B16.5 FLANGES**

| Nominal Pipe Size (in.) | Class 150 Flanges | | Class 300 Flanges | | Class 400 Flanges | | Class 600 Flanges | | Class 900 Flanges | | Class 1500 Flanges | | Class 2500 Flanges | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) |
| 1/2 | 4 | 1/2 | 4 | 1/2 | 4 | 1/2 | 4 | 1/4 | 4 | 3/4 | 4 | 3/4 | 4 | 3/4 |
| 3/4 | 4 | 1/2 | 4 | 5/8 | 4 | 5/8 | 4 | 5/8 | 4 | 3/4 | 4 | 3/4 | 4 | 3/4 |
| 1 | 4 | 1/2 | 4 | 5/8 | 4 | 5/8 | 4 | 5/8 | 4 | 7/8 | 4 | 7/8 | 4 | 7/8 |
| 1-1/4 | 4 | 1/2 | 4 | 5/8 | 4 | 5/8 | 4 | 5/8 | 4 | 7/8 | 4 | 7/8 | 4 | 1 |
| 1-1/2 | 4 | 1/2 | 4 | 3/4 | 4 | 3/4 | 4 | 3/4 | 4 | 1 | 4 | 1 | 4 | 1-1/8 |
| 2 | 4 | 5/8 | 8 | 5/8 | 8 | 5/8 | 8 | 5/8 | 8 | 7/8 | 8 | 7/8 | 8 | 1 |
| 2-1/2 | 4 | 5/8 | 8 | 3/4 | 8 | 3/4 | 8 | 3/4 | 8 | 1 | 8 | 1 | 8 | 1-1/8 |
| 3 | 4 | 5/8 | 8 | 3/4 | 8 | 3/4 | 8 | 3/4 | 8 | 7/8 | 8 | 1-1/8 | 8 | 1-1/4 |
| 3-1/2 | 8 | 5/8 | 8 | 3/4 | 8 | 7/8 | 8 | 7/8 | * | * | * | * | * | * |
| 4 | 8 | 5/8 | 8 | 3/4 | 8 | 7/8 | 8 | 7/8 | 8 | 1-1/8 | 8 | 1-1/4 | 8 | 1-1/2 |
| 5 | 8 | 3/4 | 8 | 3/4 | 8 | 1 | 8 | 1 | 8 | 1-1/4 | 8 | 1-1/2 | 8 | 1-3/4 |
| 6 | 8 | 3/4 | 12 | 3/4 | 12 | 1 | 12 | 1 | 12 | 1-1/8 | 12 | 1-3/8 | 8 | 2 |
| 8 | 8 | 3/4 | 12 | 7/8 | 12 | 1-1/8 | 12 | 1-1/8 | 12 | 1-3/8 | 12 | 1-5/8 | 12 | 2 |
| 10 | 12 | 7/8 | 16 | 1 | 16 | 1-1/4 | 16 | 1-1/4 | 16 | 1-3/8 | 12 | 1-7/8 | 12 | 2-1/2 |
| 12 | 12 | 7/8 | 16 | 1-1/8 | 20 | 1-1/4 | 20 | 1-1/4 | 20 | 1-3/8 | 16 | 2 | 12 | 2-3/4 |
| 14 | 12 | 1 | 20 | 1-1/8 | 20 | 1-3/8 | 20 | 1-3/8 | 20 | 1-1/2 | 16 | 2-1/4 | * | * |
| 16 | 16 | 1 | 20 | 1-1/4 | 20 | 1-1/2 | 20 | 1-1/2 | 20 | 1-5/8 | 16 | 2-1/2 | * | * |
| 18 | 16 | 1-1/8 | 24 | 1-1/4 | 20 | 1-5/8 | 20 | 1-5/8 | 20 | 1-7/8 | 16 | 2-3/4 | * | * |
| 20 | 20 | 1-1/8 | 24 | 1-1/4 | 24 | 1-5/8 | 24 | 1-5/8 | 20 | 2 | 16 | 3 | * | * |
| 24 | 20 | 1-1/8 | 24 | 1-1/2 | 24 | 1-7/8 | 24 | 1-7/8 | 20 | 2-1/2 | 16 | 3-1/2 | * | * |

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# Bolt Sizes & Quantities for Flanges, Cont.

| B16.47 & M.S.S. SP 44 FLANGES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Pipe Size (in.) | Class 150 Flanges | | Class 300 Flanges | | Class 400 Flanges | | Class 600 Flanges | | Class 900 Flanges | |
| | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) | No. of Bolts | Bolt Dia. (in.) |
| 22 | 20 | 1-1/4 | 24 | 1-1/2 | 24 | 1-5/8 | 24 | 1-3/4 | * | * |
| 26 | 24 | 1-1/4 | 28 | 1-5/8 | 28 | 1-3/4 | 28 | 1-7/8 | 20 | 2-3/4 |
| 28 | 28 | 1-1/4 | 28 | 1-5/8 | 28 | 1-7/8 | 28 | 2 | 20 | 3 |
| 30 | 28 | 1-1/4 | 28 | 1-3/4 | 28 | 2 | 28 | 2 | 20 | 3 |
| 32 | 28 | 1-1/2 | 28 | 1-7/8 | 28 | 2 | 28 | 2-1/4 | 20 | 3-1/4 |
| 34 | 32 | 1-1/2 | 28 | 2 | 28 | 2 | 28 | 2-1/4 | 20 | 3-1/2 |
| 36 | 32 | 1-1/2 | 32 | 1-1/2 | 32 | 2 | 28 | 2-1/2 | 20 | 3-1/2 |
| 38 | 32 | 1-1/2 | 32 | 1-5/8 | 32 | 1-3/4 | 28 | 2-1/4 | 20 | 3-1/2 |
| 40 | 36 | 1-1/2 | 32 | 1-5/8 | 32 | 1-7/8 | 32 | 2-1/4 | 24 | 3-1/2 |
| 42 | 36 | 1-1/2 | 32 | 1-3/4 | 32 | 1-7/8 | 28 | 2-1/2 | 24 | 3-1/2 |
| 44 | 40 | 1-1/2 | 32 | 1-7/8 | 32 | 2 | 32 | 2-1/2 | 24 | 3-3/4 |
| 46 | 40 | 1-1/2 | 28 | 1-7/8 | 36 | 2 | 32 | 2-1/2 | 24 | 4 |
| 48 | 44 | 1-1/2 | 32 | 2 | 28 | 2-1/4 | 32 | 2-3/4 | 24 | 4 |
| 50 | 44 | 1-3/4 | 32 | 2 | 32 | 2-1/4 | 28 | 3 | * | * |
| 52 | 44 | 1-3/4 | 32 | 2-1/4 | 32 | 2-1/4 | 32 | 3 | * | * |
| 54 | 44 | 1-3/4 | 28 | 2-1/4 | 28 | 2-1/8 | 32 | 3 | * | * |
| 56 | 48 | 1-3/4 | 28 | 2-1/4 | 32 | 2-1/8 | 32 | 3-1/4 | * | * |
| 58 | 48 | 1-3/4 | 32 | 2-1/4 | 32 | 2-1/8 | 32 | 3-1/4 | * | * |
| 60 | 52 | 1-3/4 | 32 | 2-1/4 | 32 | 2-3/4 | 28 | 3-1/2 | * | * |

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# BOLT SPECIFICATIONS
## For Standard ANSI Flanges

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 1/2" - 150# | 4 | 1/2 | 2-1/2 | | |
| 1/2" - 300# | 4 | 1/2 | 2-3/4 | 3 | |
| 1/2" - 400# | 4 | 1/2 | 3-1/4 | 3 | 3 |
| 1/2" - 600# | 4 | 1/2 | 3-1/4 | 3 | 3 |
| 1/2" - 900# | 4 | 3/4 | 4-1/4 | 4-1/4 | 4 |
| 1/2" - 1500# | 4 | 3/4 | 4-1/4 | 4-1/4 | 4 |
| 1/2" - 2500# | 4 | 3/4 | 5-1/4 | 5-1/4 | 5 |
| 3/4" - 150# | 4 | 1/2 | 2-1/2 | | |
| 3/4" - 300# | 4 | 5/8 | 3 | 3-1/2 | |
| 3/4" - 400# | 4 | 5/8 | 3-1/2 | 3-1/2 | 3-1/4 |
| 3/4" - 600# | 4 | 5/8 | 3-1/2 | 3-1/2 | 3-1/4 |
| 3/4" - 900# | 4 | 3/4 | 4-1/2 | 4-1/2 | 4-1/4 |
| 3/4" - 1500# | 4 | 3/4 | 4-1/2 | 4-1/2 | 4-1/4 |
| 3/4" - 2500# | 4 | 3/4 | 5-1/4 | 5-1/4 | 5 |
| 1" - 150# | 4 | 1/2 | 2-3/4 | 3-1/4 | |
| 1" - 300# | 4 | 5/8 | 3-1/4 | 3-3/4 | |
| 1" - 400# | 4 | 5/8 | 3-3/4 | 3-3/4 | 3-1/2 |
| 1" - 600# | 4 | 5/8 | 3-3/4 | 3-3/4 | 3-1/2 |
| l" - 900# | 4 | 7/8 | 5 | 5 | 4-3/4 |
| 1" - 1500# | 4 | 7/8 | 5 | 5 | 4-3/4 |
| 1" - 2500# | 4 | 7/8 | 5-3/4 | 5-3/4 | 5-1/2 |
| 1-1/4" - 150# | 4 | 1/2 | 2-3/4 | 3-1/4 | |
| 1-1/4" - 300# | 4 | 5/8 | 3-1/4 | 3-3/4 | |
| 1-1/4" - 400# | 4 | 5/8 | 4 | 4 | 3-3/4 |
| 1-1/4" - 600# | 4 | 5/8 | 4 | 4 | 3-3/4 |
| 1-1/4" - 900# | 4 | 7/8 | 5 | 5 | 4-3/4 |
| 1-1/4" - 1500# | 4 | 7/8 | 5 | 5 | 4-3/4 |
| 1-1/4" - 2500# | 4 | 1 | 6-1/4 | 6-1/2 | 6 |

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 1-1/2" - 150# | 4 | 1/2 | 3 | 3-1/2 | |
| 1-1/2" - 300# | 4 | 3/4 | 3-3/4 | 4-1/4 | |
| 1-1/2" - 400# | 4 | 3/4 | 4-1/4 | 4-1/4 | 4 |
| 1-1/2" - 600# | 4 | 3/4 | 4-1/4 | 4-1/4 | 4 |
| 1-1/2" - 900# | 4 | 1 | 5-1/2 | 5-1/2 | 5-1/4 |
| 1-1/2" - 1500# | 4 | 1 | 5-1/2 | 5-1/2 | 5-1/4 |
| 1-1/2" - 2500# | 4 | 1-1/8 | 7-1/4 | 7-1/4 | 6-3/4 |
| 2" - 150# | 4 | 5/8 | 3-1/4 | 3-3/4 | |
| 2" - 300# | 8 | 5/8 | 3-1/2 | 4-1/4 | |
| 2" - 400# | 8 | 5/8 | 4-1/4 | 4-1/2 | 4 |
| 2" - 600# | 8 | 5/8 | 4-1/4 | 4-1/2 | 4 |
| 2" - 900# | 8 | 7/8 | 5-3/4 | 5-3/4 | 5-1/2 |
| 2" - 1500# | 8 | 7/8 | 5-3/4 | 5-3/4 | 5-1/2 |
| 2" - 2500# | 8 | 1 | 7-1/4 | 7-1/2 | 7 |
| 2-1/2" - 150# | 4 | 5/8 | 3-1/2 | 4 | |
| 2-1/2" - 300# | 8 | 3/4 | 4 | 4-3/4 | |
| 2-1/2" - 400# | 8 | 3/4 | 4-3/4 | 5 | 4-1/2 |
| 2-1/2" - 600# | 8 | 3/4 | 4-3/4 | 5 | 4-1/2 |
| 2-1/2" - 900# | 8 | 1 | 6-1/4 | 6-1/4 | 6 |
| 2-1/2" - 1500# | 8 | 1 | 6-1/4 | 6-1/4 | 6 |
| 2-1/2" - 2500# | 8 | 1-1/8 | 8 | 8-1/4 | 7-3/4 |
| 3" - 150# | 4 | 5/8 | 3-3/4 | 4-1/4 | |
| 3" - 300# | 8 | 3/4 | 4-1/4 | 5 | |
| 3" - 400# | 8 | 3/4 | 5 | 5-1/4 | 4-3/4 |
| 3" - 600# | 8 | 3/4 | 5 | 5-1/4 | 4-3/4 |
| 3" - 900# | 8 | 7/8 | 5-3/4 | 6 | 5-1/2 |
| 3" - 1500# | 8 | 1-1/8 | 7 | 7 | 6-3/4 |
| 3" - 2500# | 8 | 1-1/4 | 9 | 9-1/4 | 8-3/4 |

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# BOLT SPECIFICATIONS
## For Standard ANSI Flanges Cont.

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 3-1/2" - 150# | 8 | 5/8 | 3-3/4 | 5-1/4 | |
| 3-1/2" - 300# | 8 | 3/4 | 4-1/2 | 5-1/4 | |
| 3-1/2" - 400# | 8 | 7/8 | 5-1/2 | 5-3/4 | 5-1/4 |
| 3-1/2" - 600# | 8 | 7/8 | 5-1/2 | 5-3/4 | 5-1/4 |
| 4" - 150# | 8 | 5/8 | 3-3/4 | 4-1/4 | |
| 4" - 300# | 8 | 3/4 | 4-1/2 | 5-1/4 | |
| 4" - 400# | 8 | 7/8 | 5-1/2 | 5-3/4 | 5-1/4 |
| 4" - 600# | 8 | 7/8 | 5-3/4 | 6 | 5-1/2 |
| 4" - 900# | 8 | 1-1/8 | 6-3/4 | 7 | 6-1/2 |
| 4" - 1500# | 8 | 1-1/4 | 7-3/4 | 7-3/4 | 7-1/2 |
| 4" - 2500# | 8 | 1-1/2 | 10-1/4 | 10-3/4 | 10 |
| 5" - 150# | 8 | 3/4 | 4 | 4-1/4 | |
| 5" - 300# | 8 | 3/4 | 4-3/4 | 5-1/2 | |
| 5" - 400# | 8 | 7/8 | 5-3/4 | 6 | 5-1/2 |
| 5" - 600# | 8 | 1 | 6-1/2 | 6-3/4 | 6-1/4 |
| 5" - 900# | 8 | 1-1/4 | 7-1/2 | 7-3/4 | 7-1/4 |
| 5" - 1500# | 8 | 1-1/2 | 9-3/4 | 9-3/4 | 9-1/2 |
| 5" - 2500# | 8 | 1-3/4 | 12 | 12-3/4 | 11-3/4 |
| 6" - 150# | 8 | 3/4 | 4 | 4-1/2 | |
| 6" - 300# | 12 | 3/4 | 5 | 5-3/4 | |
| 6" - 400# | 12 | 7/8 | 6 | 6-1/4 | 5-3/4 |
| 6" - 600# | 12 | 1 | 6-3/4 | 7 | 6-1/2 |
| 6" - 900# | 12 | 1-1/8 | 7-3/4 | 7-3/4 | 7-1/2 |
| 6" - 1500# | 12 | 1-3/8 | 10-1/4 | 10-1/2 | 10 |
| 6" - 2500# | 8 | 2 | 13-3/4 | 14-1/2 | 13-1/2 |
| 8" - 150# | 8 | 3/4 | 4-1/4 | 4-3/4 | |
| 8" - 300# | 12 | 7/8 | 5-1/2 | 6-1/4 | |
| 8" - 400# | 12 | 1 | 6-3/4 | 7 | 6-1/2 |
| 8" - 600# | 12 | 1-1/8 | 7-3/4 | 7-3/4 | 7-1/2 |
| 8" - 900# | 12 | 1-3/8 | 8-3/4 | 9 | 8-1/2 |
| 8" - 1500# | 12 | 1-5/8 | 11-1/2 | 12 | 11-1/4 |
| 8" - 2500# | 12 | 2 | 15-1/4 | 16 | 15 |

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 10" - 150# | 12 | 7/8 | 4-3/4 | 5-1/4 | |
| 10" - 300# | 16 | 1 | 6-1/4 | 7 | |
| 10" - 400# | 16 | 1-1/8 | 7-1/2 | 7-3/4 | 7-1/4 |
| 10" - 600# | 16 | 1-1/4 | 8-1/2 | 8-3/4 | 8-1/4 |
| 10" - 900# | 16 | 1-3/8 | 9-1/4 | 9-1/2 | 9 |
| 10" - 1500# | 12 | 1-7/8 | 13-1/4 | 13-3/4 | 13 |
| 10" - 2500# | 12 | 2-1/2 | 19-1/2 | 20-1/2 | 19-1/4 |
| 12" - 150# | 12 | 7/8 | 4-3/4 | 5-1/4 | |
| 12" - 300# | 16 | 1-1/8 | 6-3/4 | 7-1/2 | |
| 12" - 400# | 16 | 1-1/4 | 8 | 8-1/4 | 7-3/4 |
| 12" - 600# | 20 | 1-1/4 | 8-3/4 | 9 | 8-1/2 |
| 12" - 900# | 20 | 1-3/8 | 10 | 10-1/4 | 9-3/4 |
| 12" - 1500# | 16 | 2 | 14-3/4 | 15-1/2 | 14-1/2 |
| 12" - 2500# | 12 | 2-3/4 | 21-1/2 | 22-1/2 | 21-1/4 |
| 14" - 150# | 12 | 1 | 5-1/4 | 5-3/4 | |
| 14" - 300# | 20 | 1-1/8 | 7 | 7-3/4 | |
| 14" - 400# | 20 | 1-1/4 | 8-1/4 | 8-1/2 | 8 |
| 14" - 600# | 20 | 1-3/8 | 9-1/4 | 9-1/2 | 9 |
| 14" - 900# | 20 | 1-1/2 | 10-3/4 | 11-1/4 | 10-1/2 |
| 14" - 1500# | 16 | 2-1/4 | 16 | 17 | 15-3/4 |
| 16" - 150# | 16 | 1 | 5-1/2 | 6 | |
| 16" - 300# | 20 | 1-1/4 | 7-1/2 | 8-1/4 | |
| 16" - 400# | 20 | 1-3/8 | 8-3/4 | 9 | 8-1/2 |
| 16" - 600# | 20 | 1-1/2 | 10 | 10-1/4 | 9-3/4 |
| 16" - 900# | 20 | 1-5/8 | 11-1/4 | 11-3/4 | 11 |
| 16" - 1500# | 16 | 2-1/2 | 17-1/2 | 18-1/2 | 17-1/4 |
| 18" - 150# | 16 | 1-1/8 | 6 | 6-1/2 | |
| 18" - 300# | 24 | 1-1/4 | 7-3/4 | 8-1/2 | |
| 18" - 400# | 24 | 1-3/8 | 9 | 9-1/4 | 8-3/4 |
| 18" - 600# | 20 | 1-5/8 | 10-3/4 | 11 | 10-1/2 |
| 18" - 900# | 20 | 1-7/8 | 12-3/4 | 13-1/2 | 12-1/2 |
| 18" - 1500# | 16 | 2-3/4 | 19-1/2 | 20-1/2 | 19 |

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# BOLT SPECIFICATIONS
## For Standard ANSI Flanges Cont.

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 20" - 150# | 20 | 1-1/8 | 6-1/4 | 6-3/4 | |
| 20" - 300# | 24 | 1-1/4 | 8-1/4 | 9 | |
| 20" - 400# | 24 | 1-1/2 | 9-3/4 | 10 | 9-1/2 |
| 20" - 600# | 24 | 1-5/8 | 11-1/2 | 11-3/4 | 11-1/4 |
| 20" - 900# | 20 | 2 | 13-1/2 | 14-1/4 | 13-1/2 |
| 20" - 1500# | 16 | 3 | 21-1/2 | 22-1/2 | 21 |
| 22" - 300# | 24 | 1-1/2 | | | |
| 22" - 400# | 24 | 1-5/8 | | | |
| 22" - 600# | 24 | 1-3/4 | | | |
| 24" - 150# | 20 | 1-1/4 | 5-1/4 | 5-3/4 | |
| 24" - 300# | 24 | 1-1/2 | 9-1/4 | 10-1/4 | |
| 24" - 400# | 24 | 1-3/4 | 10-3/4 | 11-1/4 | 10-1/2 |
| 24" - 600# | 24 | 1-7/8 | 13 | 13-1/4 | 12-3/4 |
| 24" - 900# | 20 | 2-1/2 | 17-1/4 | 17-3/4 | 17 |
| 24 - 1500# | 16 | 3-1/2 | 24-1/2 | 25-3/4 | 24 |
| 26" - 150# | 24 | 1-1/4 | | | |
| 26" - 300# | 28 | 1-5/8 | | | |
| 26" - 400# | 28 | 1-3/4 | | | |
| 26" - 600# | 28 | 1-7/8 | | | |
| 26" - 900# | 20 | 2-3/4 | | | |
| 28" - 600# | 24 | 1-7/8 | | | |
| 30" - 150# | 28 | 1-1/4 | | | |
| 30" - 300# | 28 | 1-3/4 | | | |
| 30" - 400# | 28 | 2 | | | |
| 30" - 600# | 28 | 2 | | | |
| 30" - 900# | 20 | 3 | | | |

| Flange Designation | Bolt Qty. | Bolt Dia. (in.) | Bolt Length (in.) | | |
|---|---|---|---|---|---|
| | | | Raised Face | Ring Joint | |
| 34" - 150# | 32 | 1-1/2 | | | |
| 34" - 300# | 28 | 1-7/8 | | | |
| 34" - 400# | 28 | 2 | | | |
| 34" - 600# | 28 | 2-1/4 | | | |
| 34" - 900# | 20 | 3-1/2 | | | |
| 36" - 150# | 32 | 1-1/2 | | | |
| 36" - 300# | 32 | 2 | | | |
| 36" - 400# | 32 | 2 | | | |
| 36" - 600# | 28 | 2-1/2 | | | |
| 36" - 900# | 20 | 3-1/2 | | | |
| 38" - 300# | 28 | 1-7/8 | | | |
| 42" - 300# | 36 | 2 | | | |
| 42" - 400# | 32 | 2-1/2 | | | |
| 42" - 600# | 28 | 2-3/4 | | | |

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# API FLANGES
## Bolt Sizes & Quantities

| PIPE SIZE | 2,000 PSI | | | 3,000 PSI | | | 5,000 PSI | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of Studs | Stud Diameter | Nut Size "ATF" | No. of Studs | Stud Diameter | Nut Size "ATF" | No. of Studs | Stud Diameter | Nut Size "ATF" |
| 1-13/16 | | | | | | | | | |
| 2-1/16 | 8 | 5/8 | 1-1/16 | 8 | 7/8 | 1-7/16 | 8 | 7/8 | 1-7/16 |
| 2-9/16 | 8 | 3/4 | 1-1/4 | 8 | 1 | 1-5/8 | 8 | 1 | 1-5/8 |
| 3-1/16 | | | | | | | | | |
| 3-1/8 | 8 | 3/4 | 1-1/4 | 8 | 7/8 | 1-7/16 | 8 | 1-7/16 | 1-13/16 |
| 4-1/16 | 8 | 7/8 | 1-7/16 | 8 | 1-1/8 | 1-13/16 | 8 | 1-1/4 | 2 |
| 5-1/8 | | | | | | | | | |
| 7-1/16 | 12 | 1 | 1-5/8 | 12 | 1-1/8 | 1-13/16 | 12 | 1-3/8 | 2-3/16 |
| 9 | 12 | 1-1/8 | 1-13/16 | 12 | 1-3/8 | 2-3/16 | 12 | 1-5/8 | 2-9/16 |
| 11 | 16 | 1-1/4 | 2 | 16 | 1-3/8 | 2-3/16 | 12 | 1-7/8 | 2-15/16 |
| 13-5/8 | 20 | 1-1/4 | 2 | 20 | 1-3/8 | 2-3/16 | 16 | 1-5/8 | 2-9/16 |
| 16-3/4 | 20 | 1-1/2 | 2-3/8 | 20 | 1-5/8 | 2-9/16 | 16 | 1-7/8 | 2-15/16 |
| 18-3/4 | | | | | | | 20 | 2 | 3-1/8 |
| 20-3/4 | | | | 20 | 2 | 3-1/8 | | | |
| 21-1/4 | 24 | 1-5/8 | 2-9/16 | | | | 24 | 2 | 3-1/8 |
| 26-3/4 | 20 | 1-3/4 | 2-3/4 | 24 | 2 | 3-1/8 | | | |

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# API FLANGES
## Bolt Sizes & Quantities Cont.

| PIPE SIZE | 10,000 PSI | | | 15,000 PSI | | | 20,000 PSI | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of Studs | Stud Diameter | Nut Size "ATF" | No. of Studs | Stud Diameter | Nut Size "ATF" | No. of Studs | Stud Diameter | Nut Size "ATF" |
| 1-13/16 | 8 | 3/4 | 1-1/4 | 8 | 7/8 | 1-7/16 | 8 | 1 | 1-5/8 |
| 2-1/16 | 8 | 3/4 | 1-1/4 | 8 | 7/8 | 1-7/16 | 8 | 1-1/8 | 1-13/16 |
| 2-9/16 | 8 | 7/8 | 1-7/16 | 8 | 1 | 1-5/8 | 8 | 1-1/4 | 2 |
| 3-1/16 | 8 | 1 | 1-5/8 | 8 | 1-1/8 | 1-13/16 | 8 | 1-3/8 | 2-3/16 |
| 3-1/8 | | | | | | | | | |
| 4-1/16 | 8 | 1-1/8 | 1-13/16 | 8 | 1-3/8 | 2-3/16 | 8 | 1-3/4 | 2-3/4 |
| 5-1/8 | 12 | 1-1/8 | 1-13/16 | | | | | | |
| 7-1/16 | 12 | 1-1/2 | 2-3/8 | 16 | 1-1/2 | 2-3/8 | 16 | 2 | 3-1/8 |
| 9 | 16 | 1-1/2 | 2-3/8 | 16 | 1-7/8 | 2-15/16 | 16 | 2-1/2 | 3-7/8 |
| 11 | 16 | 1-3/4 | 2-3/4 | 20 | 2 | 3-1/8 | 16 | 2-3/4 | 4-1/4 |
| 13-5/8 | 20 | 1-7/8 | 2-15/16 | 20 | 2-1/4 | 3-1/2 | 20 | 3-1/8 | 4-13/16 |
| 16-3/4 | 24 | 1-7/8 | 2-15/16 | | | | | | |
| 18-3/4 | 24 | 2-1/4 | 3-1/2 | 20 | 3 | 4-5/8 | | | |
| 20-3/4 | | | | | | | | | |
| 21-1/4 | 24 | 2-1/2 | 3-7/8 | | | | | | |
| 26-3/4 | | | | | | | | | |

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# TORQUE ESTIMATING CHART

**ASTM A193, GRADE "B7" STUDS** | LUBRICANT: MOLY PASTE | NUT FACTORS (K): 0.14, 0.18 or 0.20
TORQUE VALUES CALCULATED USING MECHANICAL ENGINEERING "SHORT FORMULA":

$$T = K \text{ (Nut Factor)} \times \text{Clamp Load (Lbs)} \times \frac{D \text{ (Bolt Diameter - Inches)}}{12}$$

| Stud Diameter (Inches) | Nut Size (ATF) | Torque Values (Ft-Lbs) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 40% Yield | | | 50% Yield | | | 60% Yield | | |
| | | K=.14 | K=.18 | K=.20 | K=.14 | K=.18 | K=.20 | K=.14 | K=.18 | K=.20 |
| 1/2 | 7/8 | 35 | 45 | 50 | 43 | 56 | 62 | 52 | 67 | 75 |
| 5/8 | 1-1/16 | 69 | 89 | 99 | 87 | 111 | 124 | 104 | 134 | 148 |
| 3/4 | 1-1/4 | 123 | 158 | 175 | 153 | 197 | 219 | 184 | 237 | 263 |
| 7/8 | 1-7/16 | 198 | 255 | 283 | 248 | 318 | 354 | 297 | 382 | 424 |
| 1 | 1-5/8 | 297 | 382 | 424 | 371 | 477 | 530 | 445 | 573 | 636 |
| 1-1/8 | 1-13/16 | 435 | 560 | 622 | 544 | 700 | 778 | 653 | 840 | 933 |
| 1-1/4 | 2 | 613 | 788 | 875 | 766 | 984 | 1,094 | 919 | 1,181 | 1,313 |
| 1-3/8 | 2-3/16 | 831 | 1,068 | 1,187 | 1,038 | 1,335 | 1,483 | 1,245 | 1,602 | 1,780 |
| 1-1/2 | 2-3/8 | 1,097 | 1,410 | 1,567 | 1,371 | 1,762 | 1,958 | 1,645 | 2,115 | 2,350 |
| 1-5/8 | 2-9/16 | 1,417 | 1,822 | 2,025 | 1,772 | 2,278 | 2,531 | 2,126 | 2,733 | 3,037 |
| 1-3/4 | 2-3/4 | 1,784 | 2,293 | 2,548 | 2,230 | 2,867 | 3,185 | 2,675 | 3,440 | 3,822 |
| 1-7/8 | 2-15/16 | 2,214 | 2,847 | 3,163 | 2,768 | 3,559 | 3,954 | 3,321 | 4,270 | 4,745 |
| 2 | 3-1/8 | 2,715 | 3,490 | 3,878 | 3,393 | 4,090 | 4,848 | 4,072 | 5,235 | 5,817 |
| 2-1/4 | 3-1/2 | 3,925 | 5,046 | 5,607 | 4,906 | 6,308 | 7,009 | 5,887 | 7,569 | 8,411 |
| 2-1/2 | 3-7/8 | 4,921 | 6,327 | 7,030 | 6,151 | 7,909 | 8,788 | 7,382 | 9,491 | 10,545 |
| 2-3/4 | 4-1/4 | 6,620 | 8,512 | 9,457 | 8,275 | 10,639 | 11,822 | 9,930 | 12,767 | 14,186 |
| 3 | 4-5/8 | 8,658 | 11,132 | 12,369 | 10,823 | 13,915 | 15,461 | 12,987 | 16,698 | 18,554 |
| 3-1/4 | 5 | 11,080 | 14,246 | 15,829 | 13,850 | 17,807 | 19,786 | 16,620 | 21,369 | 23,743 |
| 3-1/2 | 5-3/8 | 13,903 | 17,875 | 19,861 | 17,379 | 22,344 | 24,827 | 20,854 | 26,813 | 29,792 |
| 3-3/4 | 5-3/4 | 17,190 | 22,102 | 24,558 | 21,488 | 27,627 | 30,697 | 25,785 | 33,153 | 36,836 |
| 4 | 6-1/8 | 20,943 | 26,927 | 29,919 | 26,179 | 33,659 | 37,398 | 31,415 | 40,390 | 44,878 |

**Material Yield Strength:**
1/2" - 2-1/4" Diameter Studs: 105,000 PSI
2-1/2" - 4" Diameter Studs: 95,000 PSI

**Number of Threads:**
1/2" Diameter Studs: 13 TPI
5/8" Diameter Studs: 11 TPI
3/4" Diameter Studs: 10 TPI
7/8" Diameter Studs: 9 TPI
1" - 4" Diameter Studs: 8 TPI

**The K Factor is an experimentally determined constant that relates the torque applied to the load induced in the fastener. This factor is affected by the condition of the fastener, the lubricant used and the condition of the flange.**
For example, the 0.18 K Factor listed above is based on the following conditions:
1. New condition of flanges, studs and nuts.
2. Thorough application of lubricant on all mating surfaces of flange, nut and stud.
3. Use of hardened steel washers.

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# AutoSPLITTER Nut Splitter


- **Designed for Speed & Safety**
- **Designed for Operator Comfort**
- **Removes Corroded Nuts Fast**
- **Removes Frozen Nuts Safely**
- **Fits Tight Spaces**
- **Cuts through the Hardest Nuts**

LEADING PROVIDER OF BOLT LOADING & REMOVAL SOLUTIONS

Products and Prices are subject to updates and changes. Please contact us for current quote.
2013

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# AutoSPLITTER

With **FASTORQ's AutoSPLITTER**, you can cut through the largest frozen nuts in just seconds, with virtually no risk of injury or accident. It's easy. Simply slip the AutoSPLITTER head over the nut and apply hydraulic pressure. One cut frees even the most corroded nut so it can be turned. Or make two cuts, 180 degrees apart, to cleanly cut the nut away.

## The benefits add up:

**FAST:**

To remove a 3-1/2" nut with a torch or hammer and chisel might take up to 20 minutes. But you only need 20-30 seconds with AutoSPLITTER. Fast set-up too. AutoSPLITTER goes from the toolbox to in-use in less than five minutes.

**SAFE:**

No hammers, No impact. Operator has hands off during operation. No flames. No risk to volatile environments. No hot work permits required. AutoSPLITTER cuts smoothly so that there is no danger to the operator or the surrounding equipment.


*AutoSPLITTER cuts from 5/8" to 6-1/2" (16 - 165 mm) across the flats hexagonal nuts. You can use it for both inch and metric sizes, and with virtually any shape nut.* ***Round, square, 12-point and other special nuts will require the use of an adapter.*** *Also available, are adapters for splitting huck bolts.*

**QUIET:**

All you'll hear is the hum of the hydraulic pump and a reassuring "snap" when the nut is cut. With AutoSPLITTER, there's no noise pollution or risk of noise-related injury.

**PRECISE:**

You can easily calibrate the cutting chisel so only the nut is cut, with no damage to the bolt or stud threads.

**VERSATILE:**

AutoSPLITTER cuts through even the hardest nuts, including 2H (ASTM A 194/2H {Brinell hardness 248-352}). And each model of AutoSPLITTER can be used for a wide range of inch or metric nut sizes (see charts).

**MONEY SAVING:**

Nut removal takes less time, so downtime is reduced. And with AutoSPLITTER, you can avoid costly damage to bolts, studs and surrounding equipment.

## AutoSPLITTER outperforms and outlasts the competition

*Compare AutoSPLITTER with any other nut-splitter on the market. You'll find AutoSPLITTER wins hands down.*

**It's more versatile.**

One AutoSPLITTER does the work of several competitive models because each housing can be used with a wide range of nut sizes. With most other nut-splitters, one housing will only fit two nut sizes, forcing you to buy a larger number of housings. But each AutoSPLITTER housing fits 6-8 different sizes. With AutoSPLITTER, you can also use the hydraulic cylinders with more than one housing.

**It's more flexible.**

AutoSPLITTER's specially designed, so you can work from more angles and in more applications than with competitor's models. AutoSPLITTER fits all API and ANSI flanges and virtually all valve bonnets.

**It's more durable.**

AutoSPLITTERS are made to last. Our special metallurgy, hardening process and sharpening methods make our chisels good for dozens of cuts before resharpening - and many resharpenings before replacing!

*AutoSPLITTER's specially designed housing fits into tight spaces, so you can work from more angles and in more applications than with competitors' models. Paint, corrosion and nuts with rounded corners are no problem. Fits all API and ANSI flanges and virtually all valve bonnets.*

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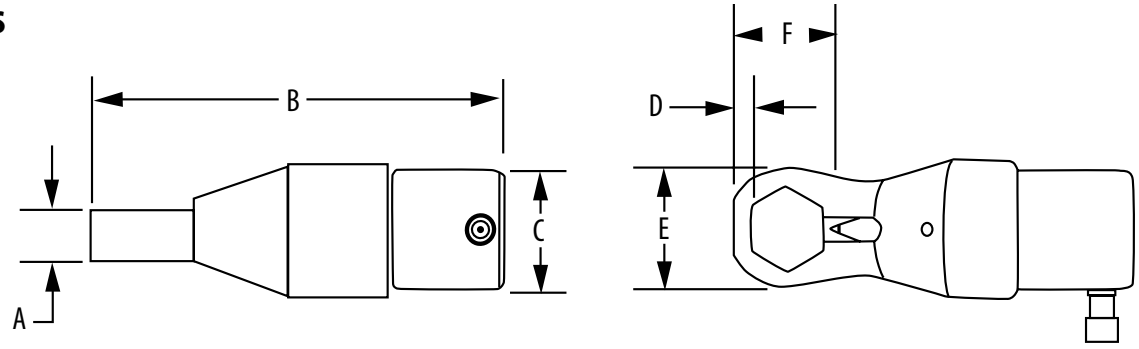
# Cuts the Nut Without Damaging the Stud

**STANDARD MODELS**




**AutoSPLITTER Dimensions**

| | STRAIGHT HEAD MODEL | Stud Diameter in (MM) | Nut Size A.T.F. in (MM) | "A" in (MM) | "B" in (MM) | "C" in (MM) | "D" in (MM) | "E" in (MM) | "F" in (MM) | Approx. Weight LBS (KG) |
|---|---|---|---|---|---|---|---|---|---|---|
| AS-DUO 25 | AS105 | 7/16" - 7/8" (11.1MM - 22.2MM) | 5/8" - 1 7/16" (15.9MM - 36.5MM) | 1 1/2" (38.1MM) | 11" (279.4MM) | 3.969" (100.8MM) | 0.421" (10.7MM) | 2.867" (72.8MM) | 7.479" (190.0MM) | 20LBS (9.1KG) |
| | AS200 | 7/8" - 1 1/4" (22.2MM - 31.8MM) | 1 5/16" - 2" (33.3MM - 50.8MM) | 1 1/2" (38.1MM) | 11 3/4" (298.5MM) | 3.969" (100.8MM) | 1/2" (12.7MM) | 3.618" (91.9MM) | 8.001" (203.2MM) | 21LBS (9.5KG) |
| AS-DUO 55 | AS204 | 1 1/4" - 1 1/2" (31.8MM - 38.1MM) | 1 7/8" - 2 3/8" (47.6MM - 60.3MM) | 2 1/4" (57.2MM) | 16.100" (408.9MM) | 6" (152.4MM) | 0.687" (17.4MM) | 3.903" (99.1MM) | 11.474" (291.4MM) | 61LBS (27.7KG) |
| | AS210 | 1 3/8" - 1 3/4" (39.4MM - 44.5MM) | 2 1/16" - 2 3/4" (52.4MM - 70MM) | 2 1/4" (57.2MM) | 16.100" (408.9MM) | 5.969" (151.6MM) | 0.672" (17.1MM) | 4.500" (114.3MM) | 11.375" (288.9MM) | 62LBS (28.1KG) |
| AS-DUO 100 | AS308 | 1 3/4" - 2 1/4" (44.5MM - 57.2MM) | 2 5/8" - 3 1/2" (66.7MM - 88.9MM) | 3" (76.2MM) | 17.750" (450.9MM) | 7 1/8" (181.0MM) | 0.875" (22.2MM) | 5 3/4" (146.1MM) | 17 3/4" (450.9MM) | 95LBS (43.1KG) |
| | AS314 | 2" - 2 1/2" ( 50.8MM - 63.5MM) | 3" - 3 7/8" (76.2MM - 98.4MM) | 3 1/8" (79.4MM) | 18" (457.2MM) | 7 1/8" (181.0MM) | 0.875" (22.2MM) | 6 1/4" (158.8MM) | 18" (457.2MM) | 100LBS (45.4KG) |
| AS-TRIO | AS404 | 2 1/2" - 2 3/4" (63.5MM - 69.9MM) | 3 3/4" - 4 1/4" (95.3MM - 108MM) | 3 3/4" (95.25MM) | 22 3/4" (577.9MM) | 9.875" (250.8MM) | 1 1/8" (28.6MM) | 7 1/2" (190.5MM) | 18" (457.2MM) | 205LBS (93KG) |
| | AS500 | 3" - 3 1/4" (76.2MM - 82.6MM) | 4 1/2" - 5" (114.3MM - 127MM) | 4 1/8" (104.8MM) | 23" (584.2MM) | 9.875" (250.8MM) | 1 1/8" (28.6MM) | 9" (228.6MM) | 19 1/4" (489.0MM) | 210LBS (95.3KG) |
| | AS506 | 3 1/4" - 3 1/2" (76.2MM - 88.9MM) | 4 7/8" - 5 3/8" (123.8MM - 136.5MM) | 4 1/8" (104.8MM) | 23 1/8" (587.4MM) | 9.875" (250.8MM) | 1 1/8" (28.6MM) | 9.375" (238.1MM) | 19 1/2" (495.3MM) | 215LBS (97.5KG) |
| | AS608 | 3 3/4" - 4" (95.3MM - 101.6MM) | 5 5/8" - 6 1/8" (142.9MM - 155.6MM) | 5" (127.0MM) | 24" (609.6MM) | 12 1/2" (1317.5MM) | 1.406" (35.7MM) | 11.720" (297.7MM) | 22" (558.8MM) | 387LBS (175.5KG) |

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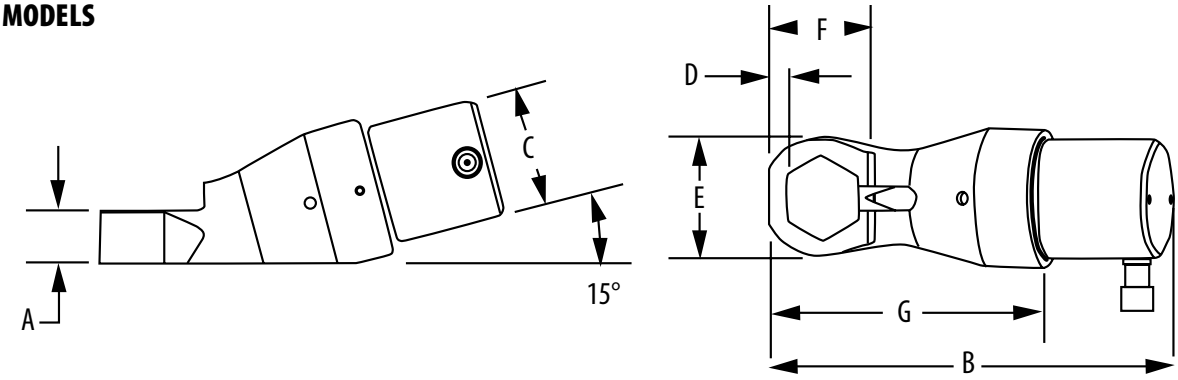
# Cuts the Nut Without Damaging the Stud

**ANGLE HEAD MODELS**




**AutoSPLITTER Dimensions**

| | ANGLE HEAD MODEL | Stud Diameter in (MM) | Nut Size A.T.F. in (MM) | "A" in (MM) | "B" in (MM) | "C" in (MM) | "D" in (MM) | "E" in (MM) | "F" in (MM) | Approx. Weight LBS (KG) |
|---|---|---|---|---|---|---|---|---|---|---|
| | AS100AH | 5/16" - 5/8" (7.9MM - 15.9MM) | 1/2" - 1 1/16" (12.7MM - 27MM) | 0.725" (18.4MM) | 8" (203.2MM) | 2 3/4" (69.9MM) | 1/4" (6.4MM) | 2" (50.8MM) | 5.533" (104.5MM) | 7LBS (3.2KG) |
| AS-DUO 25AH | AS105AH | 7/16" - 7/8" (11.1MM - 22.2MM) | 5/8" - 1 7/16" (15.9MM - 36.5MM) | 1 1/8" (28.6MM) | 11" (279.4MM) | 3.969" (100.8MM) | 0.437" (11.1MM) | 2.867" (72.8MM) | 7.438" (188.9MM) | 20LBS (9.1KG) |
| AS-DUO 25AH | AS200AH | 7/8" - 1 1/4" (22.2MM - 31.8MM) | 1 5/16" - 2" (33.3MM - 50.8MM) | 1 3/8" (34.9MM) | 11 3/4" (298.5MM) | 3.969" (100.8MM) | 1/2" (12.7MM) | 3.618" (91.9MM) | 7.938" (201.6MM) | 21LBS (9.5KG) |
| AS-DUO 55AH | AS204AH | 1 1/4" - 1 1/2" (31.8MM - 38.1MM) | 1 7/8" - 2 3/8" (47.6MM - 60.3MM) | 1 3/4" (44.5MM) | 16.100" (408.9MM) | 6" (152.4MM) | 0.687" (17.4MM) | 3.984" (101.2MM) | 11.490" (291.8MM) | 61LBS (27.7KG) |
| AS-DUO 55AH | AS210AH | 1 3/8" - 1 3/4" (39.4MM - 44.5MM) | 2 1/16" - 2 3/4" (52.4MM - 70MM) | 2" (50.8MM) | 16.100" (408.9MM) | 5.969" (151.6MM) | 3/4" (19.1MM) | 4.500" (114.3MM) | 12.062" (306.4MM) | 62LBS (28.1KG) |
| AS-DUO 100AH | AS308AH | 1 3/4" - 2 1/4" (44.5MM - 57.2MM) | 2 5/8" - 3 1/2" (66.7MM - 88.9MM) | 3.630" (92.2MM) | 19.640" (498.9MM) | 7 1/4" (184.2MM) | 3/4" (19.1MM) | 6 1/4" (158.8MM) | 13 1/4" (336.6MM) | 95LBS (43.1KG) |
| AS-DUO 100AH | AS314AH | 2" - 2 1/2" (50.8MM - 63.5MM) | 3" - 3 7/8" (76.2MM - 98.4MM) | 3 1/8" (79.4MM) | 20.14" (511.6MM) | 7 1/4" (184.2MM) | 0.875" (22.2MM) | 6 3/4" (171.5MM) | 13 3/4" (449.3MM) | 100LBS (45.4KG) |

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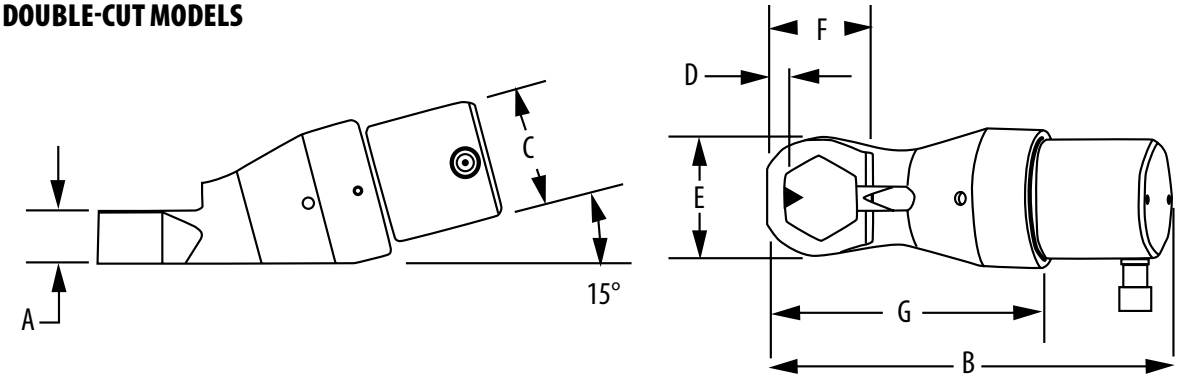
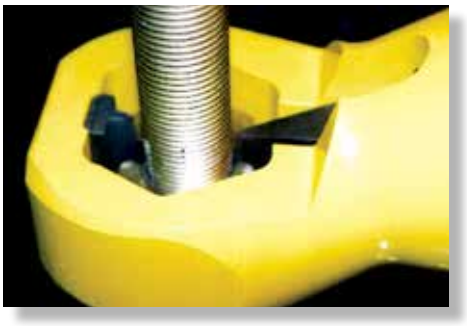
# Cuts the Nut Without Damaging the Stud

**ANGLE HEAD DOUBLE-CUT MODELS**




**AutoSPLITTER Dimensions**

| DOUBLE CUT MODEL | Stud Diameter in (MM) | Nut Size A.T.F. in (MM) | "A" in (MM) | "B" in (MM) | "C" in (MM) | "D" in (MM) | "E" in (MM) | "F" in (MM) | Approx. Weight LBS (KG) |
|---|---|---|---|---|---|---|---|---|---|
| AS100AH-DC | 5/16" - 1/2" (7.9MM - 15.7MM) | 1/2" - 3/4" (12.7MM - 19.1MM) | 0.725" (18.4MM) | 8" (203.2MM) | 2 3/4" (69.9MM) | 0.778" (19.8MM) | 1" (25.4MM) | 5 3/4" (146.1MM) | 7LBS (3.2KG) |
| AS105AH-DC | 7/16" - 3/4" (11.1MM - 19.05MM) | 5/8" - 1 1/4" (15.9MM - 31.75MM) | 1 1/8" (28.6MM) | 11" (279.4MM) | 3.969" (100.8MM) | 0.914" (23.2MM) | 1.434" (36.4MM) | 7.590" (192.8MM) | 20LBS (9.1KG) |
| AS200AH-DC | 7/8" - 1" (22.2MM - 25.4MM) | 1 7/16" - 1 5/8" (36.5MM - 41.28MM) | 1 1/2" (38.1MM) | 11.44" (290.58MM) | 4" (101.6MM) | 1/2" (12.7MM) | 3.624" (92.05MM) | 4" (101.6MM) | 21LBS (9.5KG) |
| AS204AH-DC | 1 1/4" - 1 3/8" (31.8MM - 34.9MM) | 1 7/8" - 2 3/16" (47.6MM - 55.6MM) | 1 3/4" (44.5MM) | 16.100" (408.9MM) | 6" (152.4MM) | 1.507" (38.3MM) | 2.240" (56.9MM) | 11.993" (304.6MM) | 61LBS (27.7KG) |
| AS210AH-DC | 1 3/8" - 1 1/2" (34.9MM - 38.1MM) | 2 1/16" - 2 3/8" (52.4MM - 60.3MM) | 2" (50.8MM) | 16.100" (408.9MM) | 5.969" (151.6MM) | 1.388" (35.3MM) | 4 3/4" (120.7MM) | 12.187" (309.5MM) | 62LBS (28.1KG) |
| AS308AH-DC | 1 3/4" - 2 1/4" (44.5MM - 57.2MM) | 2 5/8" - 3 1/2" (66.7MM - 88.9MM) | 3.630" (92.2MM) | 19.640" (498.9MM) | 7 1/4" (184.2MM) | 1.725" (43.8MM) | 6 1/4" (158.8MM) | 13 1/4" (336.6MM) | 95LBS (43.1KG) |



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# Power Units for AutoSPLITTER models

All AutoSPLITTER models require 10,000 PSI hydraulic pumps (sold separately). We supply electric, air and manually driven power units. When electricity or air power are not available, select from Models 100H or 150H. With each pump you will receive 12 feet of hydraulic hose plus all fittings and quick disconnects needed. Just like the quality you rely on from all our tools, Fastorq Power Units are designed to handle your most challenging needs without fail!

**SPEED:** More speed, power and durability than any other power unit in the industry.

**ACCURACY AND EASE:** Set the torque and with the touch of a button.

**VERSATILITY:** Get the power and control you need in a complete range, from 150 to 150,000 ft./lbs.

**RELIABILITY:** **E**very power unit is fully tested by FASTORQ® technicians and is delivered ready for operation complete with the necessary hoses, controllers and quick disconnects.

**THE DIFFERENCE:** Competitive power units utilize 2-stage pumps. The first stage provides a high flow rate (speed) up to 1,000 psi (10% of torque capacity). When the torque requirement exceeds 10% (1,000 psi), the second stage takes over and the flow rate (speed) is reduced to one tenth (see chart).

### 115E, 215E - ELECTRIC

- 110/220 volts A/C and 115 volt A/C.
- Maximum pressure to 10,000 psi.
- Dump and 4-way valve models.
- Motor sizes from 1/2 to 1.5 hp.

### 105A, 205A - AIR

- 40 psi to 120 psi.
- Maximum pressure to 10,000 psi (30,000 psi for stud tensioner units).
- 2- and 4-way valve models.
- Motor sizes from 1/4 to 6 hp.

### 100H, 150H - MANUAL

- Foot-powered, single- and two-speed models available.
- Maximum pressure to 10,000 psi.
- Per stroke range .99 @ 200 psi to .662 @ 325 psi.

115E


215E

105A


205A

150H


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# AutoSPREADER Flange Spreader


- **Fits & Spreads All Flange Sizes**
- **Hydraulic & Manual Models**
- **10,000 Lbs Force per Spreader**
- **Opens 3" Wide Gap in One Pass**
- **Easy – One Man Operation**
- **Lightweight – Just 12 Lbs**

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# AutoSPREADER
## Superior Safety & Versatility

**UNIVERSAL:**

- One Size Fits All Flange Sizes

**SAFE:**

- No Loose Wedges or Parts
- Jaws Open Parallel
- No Drift - It Stays Put
- Can Be Remotely Operated
- Safety Blocks Included

**POWERFUL:**

- 10,000 Lbs of Force per Spreader

**WIDE GAP:**

- Opens 3" Wide Gap in a Single Pass
- Ample Space for Working in Gap

**SIMPLE OPERATION:**

- Easy - One Man Operation
- Lightweight - Just 12 Lbs
- Only 3/32" Needed for Jaw Insertion

**VERSATILE:**

- Gasket Maintenance
- Turning Blinds
- Separate Manways
- Open Vessels
- Bearing Removal
- Impeller Removal
- Lifting
- Leveling
- Lowering
- Aligning

### Manual Model MS10K

Simply place the manual AutoSPREADER jaws between the flange faces and turn the ratchet handle. A force of 100 ft-lbs on the 18" ratchet handle provides 10,000 lbs of spreading force to create up to a 3" wide gap.

### Hydraulic Model HS10K

With the hydraulic AutoSPREADER, a five ton hydraulic cylinder provides 10,000 lbs of spreading force. A standard hand pump powers one AutoSPREADER, or multiple units, with ease. As with the manual model, the HS10K provides 10,000 lbs of spreading force per unit, and 20,000 lbs when using a pair. Up to a 3" wide gap can be achieved in a single pass.

### Opens a 3" Wide Gap in a Single Pass

**Inserts into Narrow Gaps**
As little as a 3/32" gap is needed for inserting jaws

**Versatile Shop Tool**
Lift–Level–Align
Simplify ordinary tasks

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# AutoSPREADER
# Superior Safety & Versatility

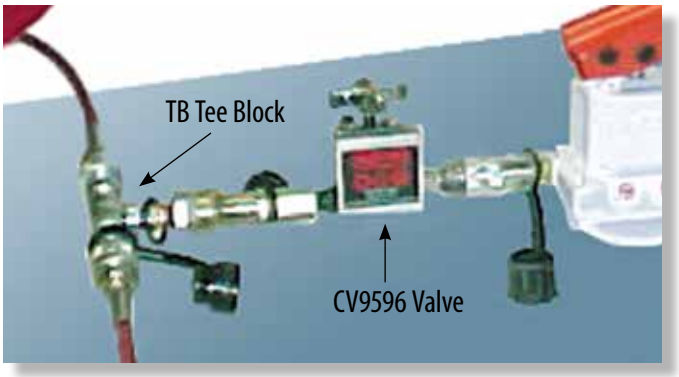
## Multi-Step Safety Block

Model S10K-SB Safety Blocks provide a safe and efficient operation when separating a flange. The operator can choose a desired width: 1", 2" or 3". The aluminum block is lightweight, and the handle can be easily gripped, even when wearing gloves.

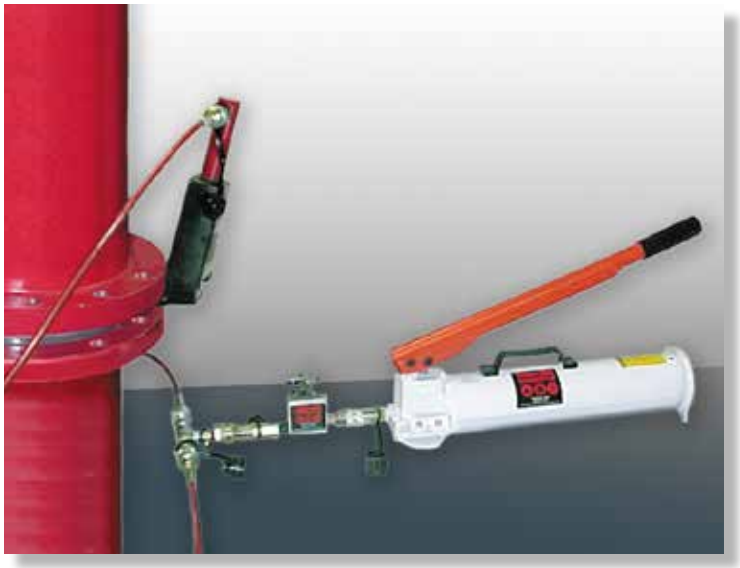
When safety blocks are inserted into the gap of the flange, the AutoSPREADER is closed and the load is then transferred to the safety blocks, enabling the operator to work safely on the gasket surface.

## Hydraulic Power Source

HS10K Hydraulic Flange Spreaders may be used in multiple units connected to a common pump. A load lowering valve controls the rate of travel. The optional isolation valves enable the operator to control each AutoSPREADER independently. All HS10K pumps, hoses and accessories are supplied with quick disconnects, filled and fully tested.




A 100H2 Pump with TB Tee Block, two hoses and CV9596 Load Lowering Valve are recommended for operating two HS10Ks simultaneously.



Hand Pump Model 100H2 is recommended to provide hydraulic power to a pair of HS10K AutoSPREADERs.

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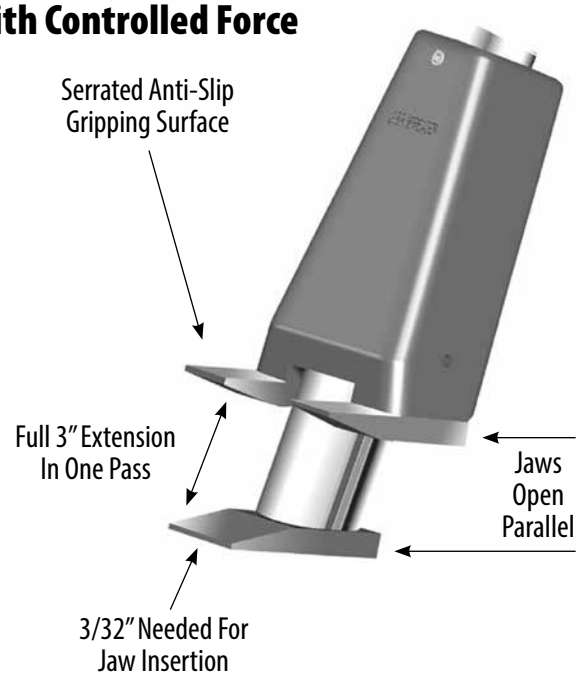
# AutoSPREADER
# Flange Spreader

## Opens Any Size Flange with Controlled Force




| Specification | Imperial | | Metric | |
|---|---|---|---|---|
| | HS10K | MS10K | HS10K | MS10K |
| Weight | 12 lbs | 13.5 lbs | 5.4 kg | 6.1 kg |
| Length | 14" | 13.25" | 355 mm | 336 mm |
| Width of Jaws | 4.5" | 4.5" | 114 mm | 114 mm |
| Width of Body | 4.5" | 4.5" | 114 mm | 114 mm |
| Jaws Closed | 0.09" | 0.09" | 2.3 mm | 2.3 mm |
| Jaws Open | 3" | 3" | 76.2 mm | 76.2 mm |
| Jaw Penetration | 1.5" | 1.5" | 38.1 mm | 38.1 mm |
| Rated Force | 10,000 lbs | 10,000 lbs | 44.5 kn | 44.5 kn |

### FASTORQ® POWER UNITS – For Best Speed & Performance

| Model | Requirement | Maximum Pressure | Oil Delivery | Value | Reservoir Capacity | Dimensions & Weight | Included Accessories |
|---|---|---|---|---|---|---|---|
| 100 H2 Manual Single Speed | Hand Powered | 10,000 PSI | .16 (cu in/stroke) | Controlled Load Holding & Lowering | 55 CI | 28" L 4.75"W 6" H 22 lbs | Pair of 12 ft Hoses, Tee Block & Load Lowering Valve |
| 150H2 or 150F2 Manual Two Speed | Hand OR Foot Powered | 10,000 PSI | .65 @ 1,400 PSI .16 @ 10,000 PSI (cu in/stroke) | Controlled Load Holding & Lowering | 152 | 28" L 4.75"W 6" H 32 lbs | Pair of 12 ft Hoses, Tee Block & Load Lowering Valve |

Model 100H2 Hand Pump

AutoSPREADERs and Safety Blocks are packed in a durable metal toolbox with custom insert

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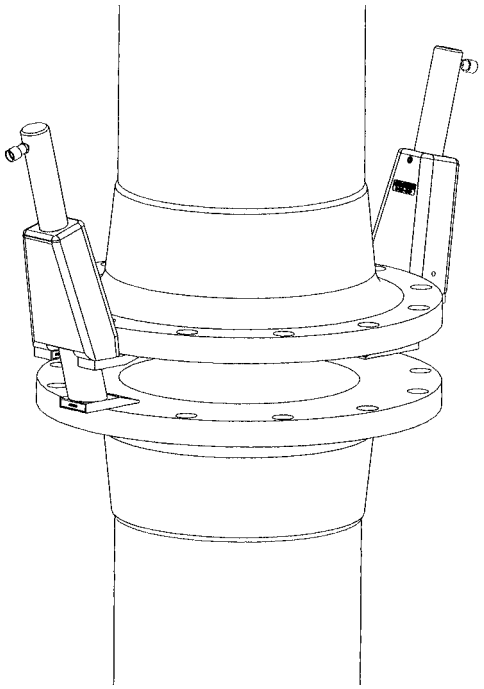
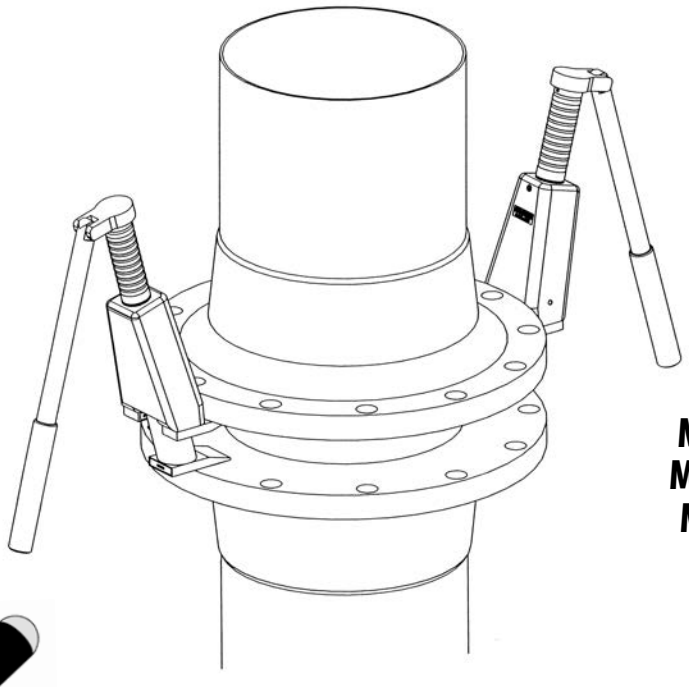
# AutoSPREADER
# Manual & Hydraulic Flange Spreaders

- **AutoSPREADERs** provide up to 10,000 lbs of spreading force per each unit - Manual OR Hydraulic
- **AutoSPREADERs** are available in DUO sets (pairs) or individualy, and are packed in a durable metal toolbox with a custom insert
- Standard 10K PSI hand power units will operate single or multiple hydraulic **AutoSPREADERs** with ease
- Up to a 3" wide gap can be achieved in a single pass, allowing fast and safe inspection and maintenance of flange surfaces and gasket replacement
- A gap of only 3/32" is needed to insert an **AutoSPREADER**



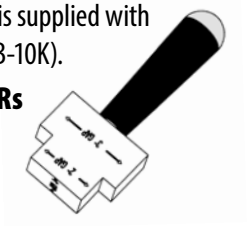
**HS10K Hydraulic Model**



**MS10K Manual Model**

Each **AutoSPREADER** unit is supplied with a Multi-Step Safety Block (SB-10K).

Duo Sets of **AutoSPREADERs** contain two Safety Blocks.



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# Multi-Step Safety Block

## S10K-SB Safety Block for AutoSPREADER

The S10K-SB Safety Block offers the following features to enhance the safe and efficient operation of the AutoSPREADER Flange Spreader.

## MULTI-STEP DESIGN

- Each safety block has three steps: 1", 2", 3"
- This allows the operator to choose the width of flange separation.

## EASY GRIP HANDLE

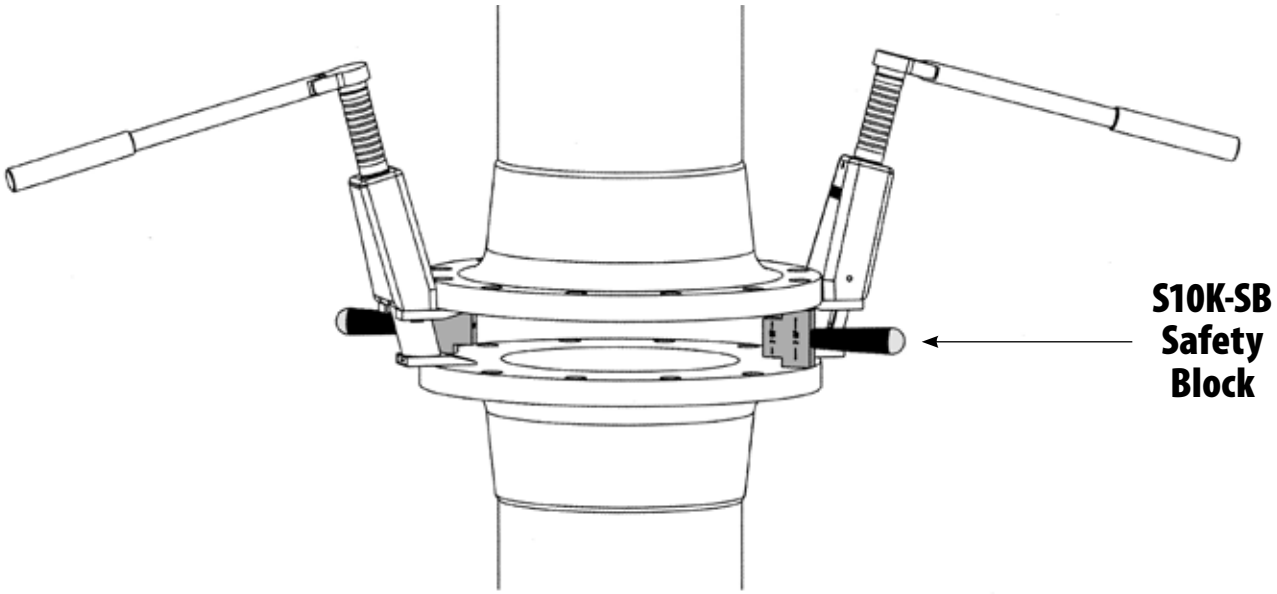
- The handle allows the operator to easily grip the safety block, even when wearing gloves.

## LIGHT WEIGHT

- The aluminum block is light weight and easy to handle.

## SECURE SUPPORT

- After the AutoSPREADER opens the flange, the S10K-SB Safety Blocks are inserted in the gap between the flanges. The flange spreaders are then closed to transfer the load to the safety blocks, enabling the operator to work more safely on the gasket surfaces.

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# SpinTORQ

## Patented 360° Continuous Rotation Hydraulic Torque Wrench


- **36 times faster than ratcheting wrenches**
- **Fully reversible, full power in both directions**
- **Operates in tight spaces**
- **Manual or robotic control**
- **Durable stainless steel body**
- **Torque Range 200 – 7,000 ft-lbs**
- **Three motor sizes, nine wrench sizes**
- **Stack Sockets & Inserts**

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# SpinTORQ

## Continuously Rotating Hydraulic Torque Wrench
## 36 Times Faster than Ratcheting Torque Wrenches!

- **Certifications: CE Ex II 2 G c T3**
- **Fully Reversible - with Full Power - in Both Directions**
- **Operates in Tight Spaces**
- **Accuracy is +/- 3%**
- **Robotic or Manual Control**
- **Operates @ 200 to 2500 PSI, up to 10 RPM**
- **Durable Stainless Steel Body**
- **10 Models from 200 to 7,000 ft. lbs.**
- **Hex Inserts and Stack Sockets Available**


**Model IL360**

The patented technology of the SpinTORQ wrench provides a 360° degree continuous rotation to create speed and accuracy with little effort, compared to hydraulic wrenches that offer a ratcheting technique. It can take 10 seconds to rotate a nut 10 degrees with the standard ratcheting method, taking approximately six minutes to complete one rotation. In the same application, the SpinTORQ will provide 6 revolutions per minute, thus 36 times faster. The convenience of full power in both directions, together with tremendous speed, results in dramatic time-saving benefits.

The SpinTORQ wrench fits most ANSI and API flanges, and is ideal for both underwater and topside projects. It is powered by a hydraulic motor and adapts to a wide range of wrench head sizes. In addition to the 9 standard models, FASTORQ® engineers will design and custom-build SpinTORQ wrenches to meet a customer's special need.

*The Nuytco Research Limited's Deepworker 2000 mini submarine with a SpinTORQ attached to the manipulator. Designed to work up to 2,000 feet beneath the ocean's surface. Displayed at the Offshore Technology Conference in Houston, Texas.*

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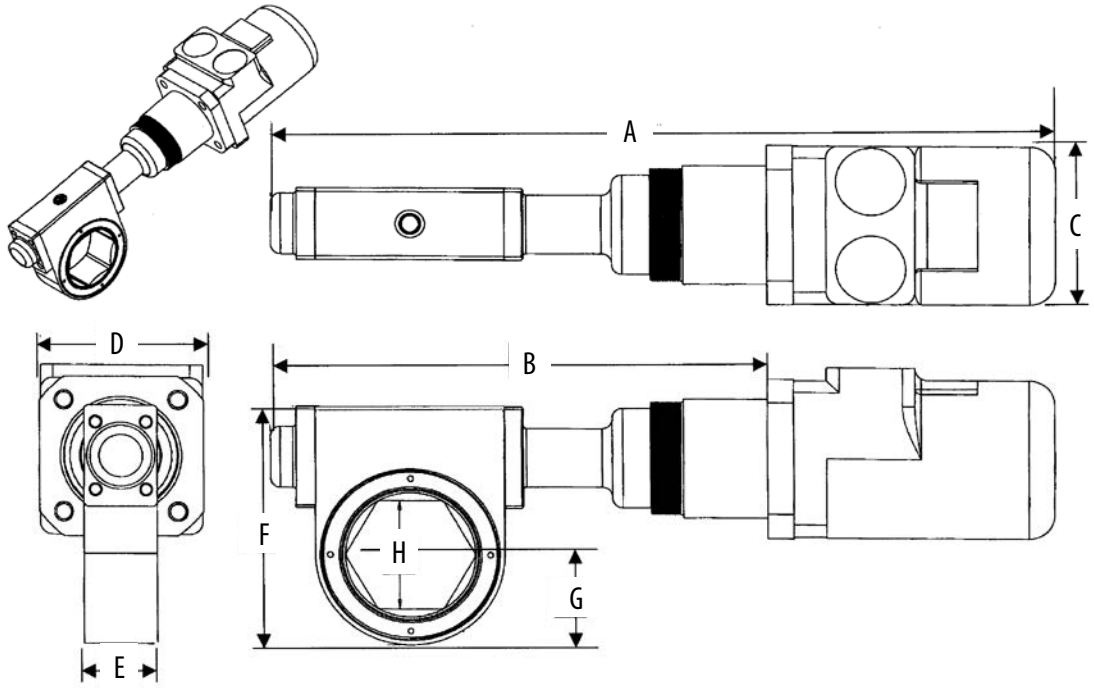
# SpinTORQ
## Weights & Dimensions




| Model | Hex Sizes Inches (MM) | Torque Range FT-LB (N-M) | Dimensions | | | | | | | | Weight Hex Head Only LBS. (KGM) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A Inches (MM) | B Inches (MM) | C Inches (MM) | D Inches (MM) | E Inches (MM) | F Inches (MM) | G Inches (MM) | H Inches (MM) | |
| IL360-113 | 1-13/16 (46) | 200-700 (270-950) | 15.50 (393.7) | 9.75 (247.65) | 3.625 (92.08) | 3.281 (83.34) | 1.312 (33.32) | 3.875 (98.43) | 1.400 (35.56) | 1-13/16 (46) | 5.00 (2.3) |
| IL360-200 | 2 (50) | 200-900 (270-1220) | 15.50 (393.7) | 10.250 (260.35) | 3.625 (92.08) | 3.281 (83.34) | 1.500 (38.1) | 5.000 (127) | 1.875 (47.63) | 2 (50) | 6.50 (2.9) |
| IL360-203 | 2-3/16 (55) | 300-1200 (400-1630) | 16.00 (406.4) | 10.250 (260.35) | 3.625 (92.08) | 3.281 (83.34) | 1.500 (38.1) | 5.000 (127) | 1.875 (47.63) | 2-3/16 (55) | 6.50 (2.9) |
| IL360-206 | 2-3/8 (60) | 400-1600 (540-2170) | 17.625 (447.68) | 11.750 (298.45) | 3.625 (92.08) | 3.281 (83.34) | 1.875 (47.63) | 5.625 (142.88) | 2.000 (50.8) | 2-3/8 (60) | 12.00 (5.4) |
| IL360-209 | 2-9/16 (65) | 600-2200 (800-3000) | 18.500 (469.90) | 12.750 (323.85) | 3.625 (92.08) | 3.281 (83.34) | 2.000 (50.8) | 6.125 (155.58) | 2.250 (57.17) | 2-9/16 (65) | 15.50 (7.0) |
| IL360-212 | 2-3/4 (70) | 800-2800 (1100-3800) | 18.500 (469.90) | 12.750 (323.85) | 3.625 (92.08) | 3.281 (83.34) | 2.000 (50.8) | 6.125 (155.58) | 2.250 (57.17) | 2-3/4 (70) | 14.50 (6.6) |
| IL360-215 | 2-15/16 (75) | 1000-3400 (1350-4600) | 19.00 (482.6) | 13.25 (336.55) | 3.750 (95.25) | 3.281 (83.34) | 2.250 (57.15) | 6.520 (165.61) | 2.285 (58.04) | 2-15/16 (75) | 18.00 (8.18) |
| IL360-302 | 3-1/8 (80) | 1200-4000 (1630-5420) | 19.00 (482.6) | 13.25 (336.55) | 3.750 (95.25) | 3.281 (83.34) | 2.400 (60.96) | 7.250 (184.15) | 2.750 (69.85) | 3-1/8 (80) | 23.00 (10.45) |
| IL360-308 | 3-1/2 (89) | 1400-5000 (1900-6780) | 21.500 (546.1) | 14.00 (355.6) | 4.000 (101.6) | 3.281 (83.34) | 2.500 (63.5) | 8.000 (203.2) | 3.000 (76.2) | 3-1/2 (90) | 28.00 (12.7) |
| IL360-314 | 3-7/8 (98) | 2100-7000 (2850-9500) | 21.500 (546.1) | 14.00 (355.6) | 4.000 (101.6) | 3.281 (83.34) | 2.500 (63.5) | 8.000 (203.2) | 3.000 (76.2) | 3-7/8 (98) | 28.00 (12.7) |

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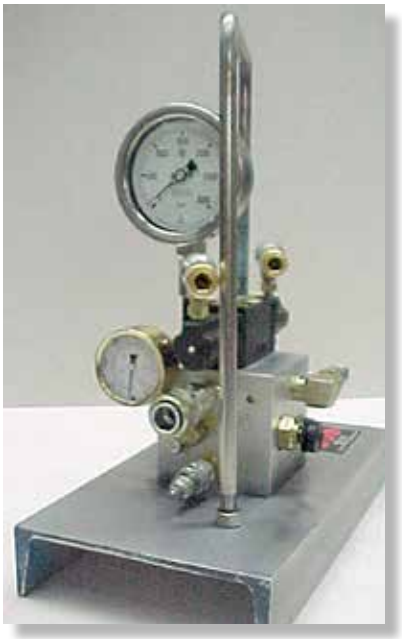
# SpinTORQ

## 603A Power Unit – Super High-Speed Linear Displacement Double-Acting Plunger Pump


**FEATURES:**

- Driven by a 6-HP reciprocating air motor to provide 10-GPM maximum oil flow at "no load" and 4-GPM at 1,500 PSI.
- Maximum output pressure: 3,000 PSI
- Integrated control console:
  - Easy to reach and use controls
  - Pressure reducing valve for pressure (torque) control
  - Flow control valve for speed control
  - Air pilot operated 4-way valve for directional control
  - Glycerin-filled easy to read pressure gauge
- Inlet & outlet hydraulic ports for use with external hydraulic source in place of 603A hydraulic pump
- Pair of high flow hydraulic hoses: 25-ft. long, filled, tested and complete with quick disconnects
- Three-button remote control assembly: Set, Forward, Hold, and Reverse; with 25-ft. of hose
- Air inlet filter, regulator, lubricator assembly
- Air requirement: 150 CF M @100 PSI
- 2.5-Gallon hydraulic reservoir, complete with oil level and temperature gauge
- Spin-on 10-micron oil filter
- All mounted on a 2-wheel mobile hand truck for maximum portability

## ST-CU Flow Control Unit – For Use with Rig or Shop Hydraulic Systems to Power SpinTORQ Wrenches



**FEATURES:**

- Integrated control console:
  - Pressure reducing valve for pressure (torque)control
  - Flow control valve for speed control
  - Air pilot operated 4-way valve for directional control
  - Glycerin-filled easy to read pressure gauge
- Inlet & outlet hydraulic ports for use with external hydraulic source
- Adjustable perssure (torque) control from 200 PSI to 3000 PSI
- Adjustable speed control from 2-GPM to 20-GPM
- Pair of High Flow Hydraulic Hoses: 25 ft. long, filled, tested and complete with quick disconnects
- Three-button remote control assembly: Set, Forward, Hold, and Reverse
- Provided with 25 ft. of hose
- Air requirement: 50 CFM @80 PSI to operate remote control
- Complete with hooks for positioning at job site

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FASTORQ TOTAL ASSURANCE GUARANTEE — ALL POWER UNITS 1-YEAR WARRANTY

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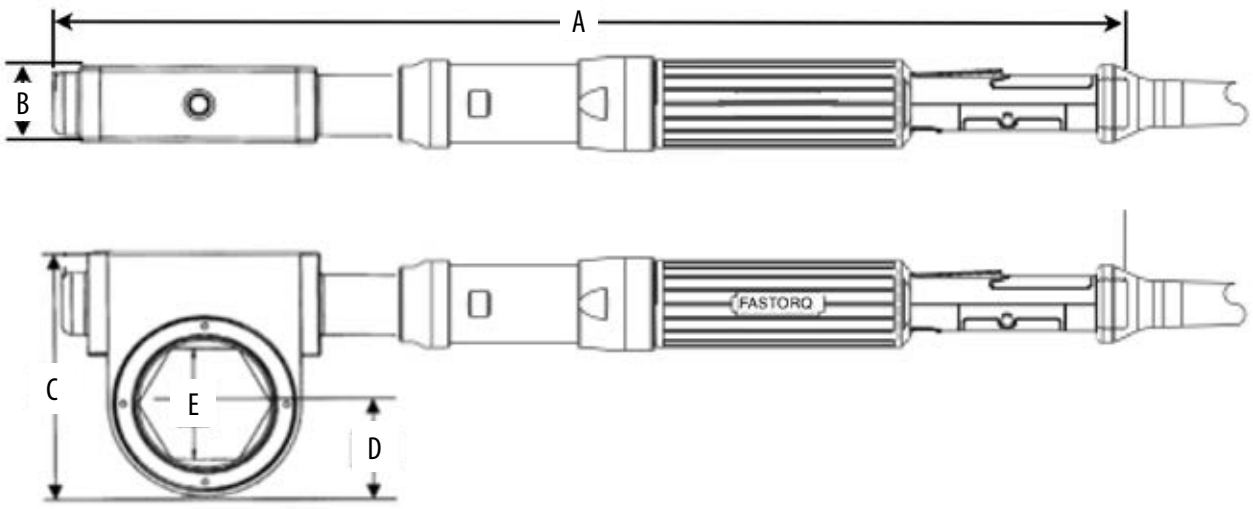
# SpinTORQ DC




| Model | Hex Sizes Inches (MM) | Torque Range FT-LB (N-M) | Dimensions | | | | | Weight Hex Head LBS. (KGM) | Weight Motor LBS. (KGM) |
|---|---|---|---|---|---|---|---|---|---|
| | | | A Inches (MM) | B Inches (MM) | C Inches (MM) | D Inches (MM) | E Inches (MM) | | |
| IL360-113 | 1-13/16 (46) | 200-700 (270-950) | 27.02 (686.31) | 1.312 (33.32) | 3.875 (98.43) | 1.400 (35.56) | 1-13/16 (46) | 5.00 (2.3) | 10.3 (4.7) |
| IL360-200 | 2 (50) | 200-900 (270-1220) | 27.52 (699.01) | 1.500 (38.1) | 5.000 (127) | 1.875 (47.63) | 2 (50) | 6.50 (2.9) | 10.3 (4.7) |
| IL360-203 | 2-3/16 (55) | 300-1200 (400-1630) | 27.52 (699.01) | 1.500 (38.1) | 5.000 (127) | 1.875 (47.63) | 2-3/16 (55) | 6.50 (2.9) | 10.3 (4.7) |
| IL360-206 | 2-3/8 (60) | 400-1600 (540-2170) | 29.02 (737.11) | 1.875 (47.63) | 5.625 (142.88) | 2.000 (50.8) | 2-3/8 (60) | 12.00 (5.4) | 10.3 (4.7) |
| IL360-209 | 2-9/16 (65) | 600-2200 (800-3000) | 30.42 (772.67) | 2.000 (50.8) | 6.125 (155.58) | 2.250 (57.17) | 2-9/16 (65) | 15.50 (7.0) | 11.5 (5.3) |
| IL360-212 | 2-3/4 (70) | 800-2800 (1100-3800) | 30.42 (772.67) | 2.000 (50.8) | 6.125 (155.58) | 2.250 (57.17) | 2-3/4 (70) | 14.50 (6.6) | 11.5 (5.3) |
| IL360-215 | 2-15/16 (75) | 1000-3400 (1350-4600) | 30.92 (785.37) | 2.250 (57.15) | 6.520 (165.61) | 2.285 (58.04) | 2-15/16 (75) | 18.00 (8.18) | 11.5 (5.3) |
| IL360-302 | 3-1/8 (80) | 1200-4000 (1630-5420) | 30.92 (785.37) | 2.400 (60.96) | 7.250 (184.15) | 2.750 (69.85) | 3-1/8 (80) | 23.00 (10.45) | 11.5 (5.3) |
| IL360-308 | 3-1/2 (89) | 1400-5000 (1900-6780) | 33.57 (852.68) | 2.500 (63.5) | 8.000 (203.2) | 3.000 (76.2) | 3-1/2 (90) | 28.00 (12.7) | 16.3 (7.4) |
| IL360-314 | 3-7/8 (98) | 2100-7000 (2850-9500) | 33.57 (852.68) | 2.500 (63.5) | 8.000 (203.2) | 3.000 (76.2) | 3-7/8 (98) | 28.00 (12.7) | 16.3 (7.4) |

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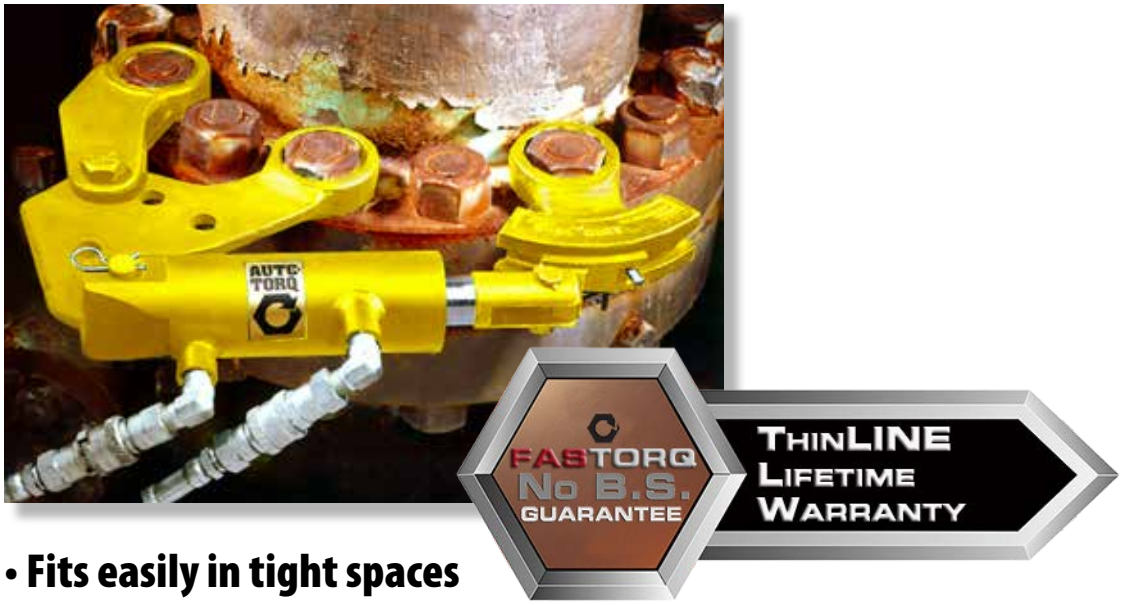
# ThinLINE Series

## Hydraulic Torque and Ratcheting Wrenches




- **Fits easily in tight spaces**
- **Thinner than the nut height**
- **Light weight, "best power to weight ratio in the industry."**
- **Interchangeable wrench heads and reaction units available for any nut size**
- **Torque range up to 138,250 ft. lbs.**
- **Custom designs available**
- **Stack Sockets & Inserts**

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# ThinLINE Wrench

## APPLICATIONS

- **Wellheads**
- **Blowout Preventers**
- **Heat Exchanger Channel Heads**
- **Piping Flanges**
- **Restricted Spaces**

**SAFE:**

The cylinder is engaged during both power and retraction strokes, insuring safety of operation.

**DURABLE:**

Simple, strong, in-line precision-cast stainless steel components provide maximum dependability.

**UNIQUE:**

Provides torque in both the "push" and "pull' modes. Each wrench size is engineered to fit on all standard ANSI and API flanges.

**VERSATILE:**

Interchangeable wrench heads and reaction units are available for standard nut sizes within each ThinLINE series. Larger or smaller sizes can be customized. Metric and Imperial sizes available.

**PRACTICAL:**

Fits easily in tight spaces where there are obstructions above the nuts. The wrench is thinner than the nut height.

**FAST & EFFICIENT:**

Delivers 60º turn of the nut before resetting the wrench.

**LIGHT-WEIGHT:**

The best power to weight ratio in the industry.

**CUSTOM DESIGN:**

Custom designs available for any application.


**ThinLINE** wrenches provide safe, accurate torquing in the tightest, hard-to-reach places. FASTORQ® offers ThinLINE wrenches in a range of sizes to fit almost any application or custom designed for challenging applications. ThinLINE wrenches are recommended for use on wellheads, blowout preventers, heat exchanger channel heads and piping flanges.

*Hydraulic ThinLINE wrench on a tight, hard-to reach wellhead application. For best speed and performance, power the ThinLINE wrenches with FASTORQ® Power Unit Model 610A.*

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# ThinLINE Wrench

## 610A Power Unit

For best speed and performance we recommend powering ThinLINE wrenches with an AutoTORQ Power Unit.

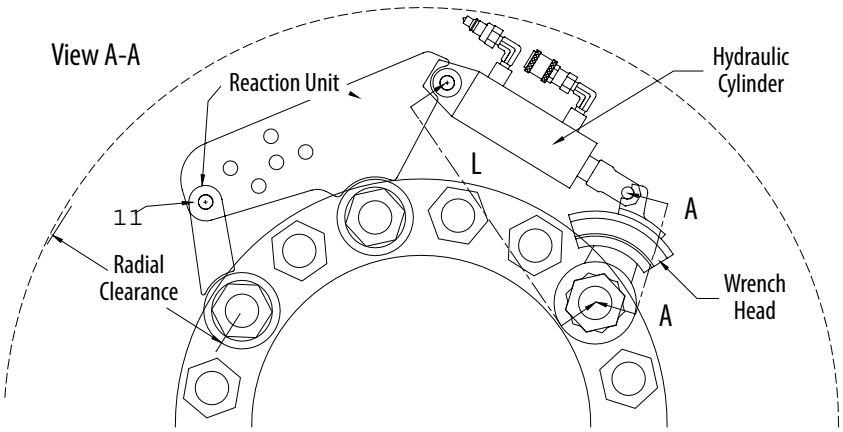
Model 610A (shown) operates up to ten times faster than traditional torque wrench power units.

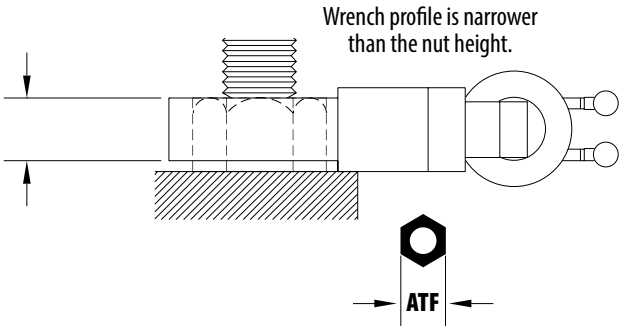

**EXAMPLE SET:**

Standard wrench sizes for model 200-6:

2-3/16" - 2-3/8" - 2-9/16"
2-3/4" - 2-15/16" - 3-1/8"

Each size includes a wrench head and reaction unit. All wrenches in this series use the 200-6 hydraulic cylinder.




| Model | Color | Maximum Torque | | Range of Bolt Sizes | | Range of Nut Sizes - ATF | | Radial Clearance | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ft. Lb. @ 5500 PSI | Nm @ 380 Bar | In | MM | In | MM | In | MM |
| 150-4 | Orange | 3,240 | 4,406 | 3/4 - 1-1/4 | 19-32 | 1-1/4 - 2 | 32-51 | 9 | 228 |
| 200-6 | Yellow | 8,640 | 11,710 | 1-3/8 - 2 | 33-52 | 2-3/16 - 3-1/8 | 55-80 | 11 | 280 |
| 250-9 | Green | 20,250 | 27,450 | 1-7/8 - 3 | 48-85 | 2-5/16 - 4-5/8 | 75-120 | 14 | 365 |
| 325-12 | Blue | 41,840 | 56,730 | 2-3/4 - 3-1/2 | 70-89 | 4-1/2 - 5-3/8 | 110-135 | 20 | 500 |
| 325-18 | Black | 68,440 | 92,790 | 3-1/2 - 4 1/4 | 89-108 | 5-3/8 - 6-1/2 | 135-165 | 25 | 685 |
| 400-24 | Black | 138,230 | 187,410 | 4 - 5 1/4 | 102-133 | 6-1/8 - 8 | 135-210 | 30 | 762 |

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# ThinLINE
# Hydraulic Wrench Model Numbers

| Wrench Series | Nut Size (ATF) | Wrench Assembly Model # | Wrench Head Only Model # | Reaction Rings Only Model # |
|---|---|---|---|---|
| 150-4 Series 150 Cylinder 3,240 Ft. Lbs. at 5,500 PSI 4,406 Nm at 380 bar | 1-1/4″ | TLH104-4 | TLH104-4W | TLH104-4R |
| | 1-7/16″ | TLH107-4 | TLH107-4W | TLH107-4R |
| | 1-5/8″ | TLH110-4 | TLH110-4W | TLH110-4R |
| | 1-13/16″ | TLH113-4 | TLH113-4W | TLH113-4R |
| | 2″ | TLH200-4 | TLH200-4W | TLH200-4R |
| | 32 mm | TLM032-4 | TLM032-4W | TLM032-4 |
| | 36 mm | TLM036-4 | TLM036-4W | TLM036-4 |
| | 41 mm | TLM041-4 | TLM041-4W | TLM041-4 |
| | 46 mm | TLM046-4 | TLM046-4W | TLM046-4 |
| | 51 mm | TLM051-4 | TLM051-4W | TLM051-4 |
| 200-6 Series 200 Cylinder 8,640 Ft. Lbs. at 5,500 PSI 1,750 Nm at 380 bar | 2-3/16″ | TLH203-6 | TLH203-6W | TLH203-6R |
| | 2-3/8″ | TLH206-6 | TLH206-6W | TLH206-6R |
| | 2-9/16″ | TLH209-6 | TLH209-6W | TLH209-6R |
| | 2-3/4″ | TLH212-6 | TLH212-6W | TLH212-6R |
| | 2-15/16″ | TLH215-6 | TLH215-6W | TLH215-6R |
| | 3-1/8″ | TLH302-6 | TLH302-6W | TLH302-6R |
| | 55 mm | TLM055-6 | TLM055-6W | TLM055-6R |
| | 60 mm | TLM060-6 | TLM060-6W | TLM060-6R |
| | 65 mm | TLM065-6 | TLM065-6W | TLM065-6R |
| | 70 mm | TLM070-6 | TLM070-6W | TLM070-6R |
| | 75 mm | TLM075-6 | TLM075-6W | TLM075-6R |
| | 80 mm | TLM080-6 | TLM080-6W | TLM080-6R |
| 250-9 Series 205-9 Cylinder 20,250 Ft. Lbs. at 5,500 PSI 27,540 Nm at 380 bar | 2-15/16″ | TLH215-9 | TLH215-9W | TLH215-9R |
| | 3-1/8″ | TLH302-9 | TLH302-9W | TLH302-9R |
| | 3-1/2″ | TLH308-9 | TLH308-9W | TLH308-9R |
| | 3-7/8″ | TLH314-9 | TLH314-9W | TLH314-9R |
| | 4-1/4″ | TLH404-9 | TLH404-9W | TLH404-9R |
| | 4-5/8″ | TLH410-9 | TLH410-9W | TLH410-9R |
| | 75 mm | TLM075-9 | TLM075-9W | TLM075-9R |
| | 80 mm | TLM080-9 | TLM080-9W | TLM080-9R |
| | 90 mm | TLM090-9 | TLM090-9W | TLM090-9R |
| | 100 mm | TLM100-9 | TLM100-9W | TLM100-9R |
| | 110 mm | TLM110-9 | TLM110-9W | TLM110-9R |
| | 120 mm | TLM120-9 | TLM120-9W | TLM120-9R |

| Wrench Series | Nut Size (ATF) | Wrench Assembly Model # | Wrench Head Only Model # | Reaction Rings Only Model # |
|---|---|---|---|---|
| 325-12 Series 325-12 Cylinder 41,480 Ft. Lbs. at 5,500 PSI 56,902 Nm at 380 bar | 4-1/4″ | TLH404-12 | TLH404-12W | TLH404-12R |
| | 4-5/8″ | TLH410-12 | TLH410-12W | TLH410-12R |
| | 5″ | TLH500-12 | TLH500-12W | TLH500-12R |
| | 5-3/8″ | TLH506-12 | TLH506-12W | TLH506-12R |
| | 110 mm | TLM110-12 | TLM110-12W | TLM110-12R |
| | 120 mm | TLM120-12 | TLM120-12W | TLM120-12R |
| | 130 mm | TLM130-12 | TLM130-12W | TLM130-12R |
| | 135 mm | TLM135-12 | TLM135-12W | TLM135-12R |
| 325-18 Series 325-18 Cylinder 68,440 Ft. Lbs. at 5,500 PSI 93,078 Nm at 380 bar | 5-3/8″ | TLH506-18 | TLH506-18W | TLH506-18R |
| | 5-3/4″ | TLH512-18 | TLH512-18W | TLH512-18R |
| | 6-1/8″ | TLH602-18 | TLH602-18W | TLH602-18R |
| | 6-1/2″ | TLH608-18 | TLH608-18W | TLH608-18R |
| | 135 mm | TLM135-18 | TLM135-18W | TLM135-18R |
| | 145 mm | TLM145-18 | TLM145-18W | TLM145-18R |
| | 155 mm | TLM155-18 | TLM155-18W | TLM155-18R |
| | 165 mm | TLM165-18 | TLM165-18W | TLM165-18R |
| 400-24 Series 400-24 Cylinder 138,230 Ft. Lbs. at 5,500 PSI 187,993 Nm at 380 bar | 6-1/8″ | TLH602-24 | TLH602-24W | TLH602-24R |
| | 6-1/2″ | TLH608-24 | TLH608-24W | TLH608-24R |
| | 6-7/8″ | TLH614-24 | TLH614-24W | TLH614-24R |
| | 7-1/4″ | TLH704-24 | TLH704-24W | TLH704-24R |
| | 7-5/8″ | TLH710-24 | TLH710-24W | TLH710-24R |
| | 8″ | TLH800-24 | TLH800-24W | TLH800-24R |
| | 155 mm | TLM155-24 | TLM155-24W | TLM155-24R |
| | 165 mm | TLM165-24 | TLM165-24W | TLM165-24R |
| | 175 mm | TLM175-24 | TLM175-24W | TLM175-24R |
| | 185 mm | TLM185-24 | TLM185-24W | TLM185-24R |
| | 195 mm | TLM195-24 | TLM195-24W | TLM195-24R |
| | 210 mm | TLM210-24 | TLM210-24W | TLM210-24R |

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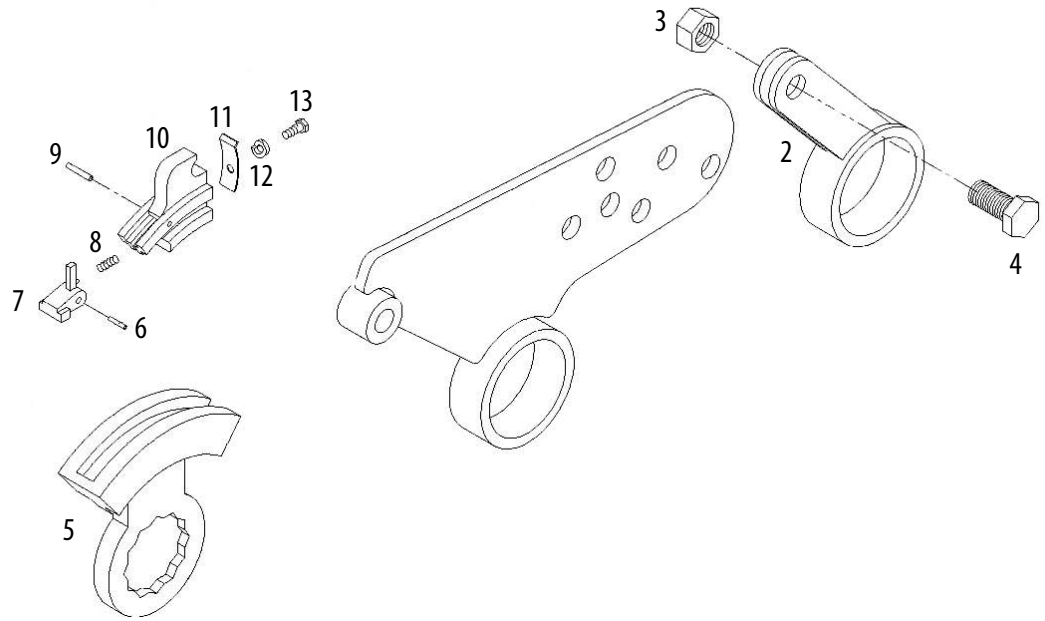
# ThinLINE
# Hydraulic Ratchet Wrench Parts List

## 4" Series 150 ThinLINE Component Parts




**Parts list and component pricing for the 4" (ORANGE) ThinLINE Series**

| Item # | Part # | Description |
|---|---|---|
| 1 + 2 | TLH____ -4R * | Reaction Plate & Reaction Leg Assembly |
| 3 | NT08-13GR8Z | 1/2" Nut, Grade 8 - Zinc Coated |
| 4 | HHCS08-13X20GR8Z | 1/2" X 1-1/4" Hex Head Cap Screw |
| 5 thru 13 | TLH____ -4W * | Wrench Head & Pawl Carrier Assembly |
| 6 thru 13 | B94067AS | 4" Pawl Carrier Assembly |
| 6 | RP2X12 | 1/8" x 3/4" Roll Pin |
| 7 | A94144 | 4" Pawl |
| 8 | 13B020GE/S | Pawl Spring |
| 9 | RP2X16 | 1/8" X 1" Roll Pin |
| 10 | B94067 | 4" Pawl Carrier |
| 11 | A87059 | Clevis Spring |
| 12 | LW4-SS | 1/4" Lock Washer |
| 13 | SHCS4-20X08SS | 1/4" x 1/2" Socket Head Cap Screw |

*** See Prices for Wrench Series 150-4**

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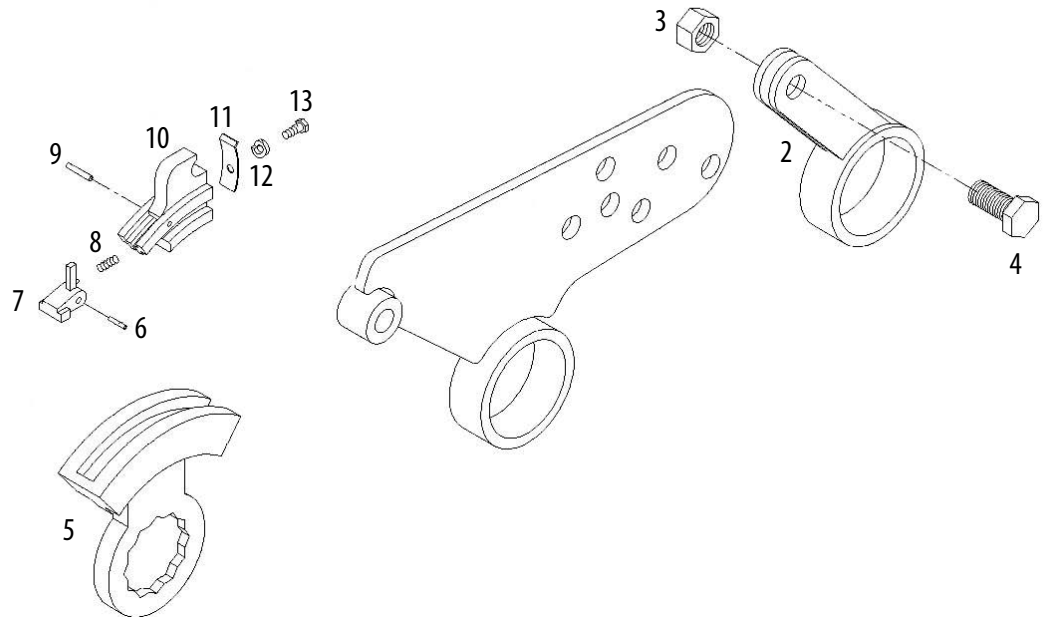
# ThinLINE
# Hydraulic Ratchet Wrench Parts List

## 6" Series 200 ThinLINE Component Parts




**Parts list and component pricing for the 6" (YELLOW) ThinLINE Series**

| Item # | Part # | Description |
|---|---|---|
| 1 + 2 | TLH____ -6R * | Reaction Plate & Reaction Leg Assembly |
| 3 | NT12-10GR8Y | 3/4" Nut, Grade 8 - Yellow Zinc Coating |
| 4 | HHCS12-10X28GR8Y | 3/4" X 1-3/4" Hex Head Cap Screw |
| 5 thru 13 | TLH____ -6W * | Wrench Head & Pawl Carrier Assembly |
| 6 thru 13 | A92052AS | 6" Pawl Carrier Assembly |
| 6 | RP2X12 | 1/8" x 3/4" Roll Pin |
| 7 | L84212 | 6" Pawl |
| 8 | 13B020GE/S | Pawl Spring |
| 9 | RP2X12 | 1/8" X 3/4" Roll Pin |
| 10 | A92052 | 6" Pawl Carrier |
| 11 | L81225 | Clevis Spring |
| 12 | LW4-SS | 1/4" Lock Washer |
| 13 | SHCS4-20X08SS | 1/4" x 1/2" Socket Head Cap Screw |

*** See Prices for Wrench Series 200-6**

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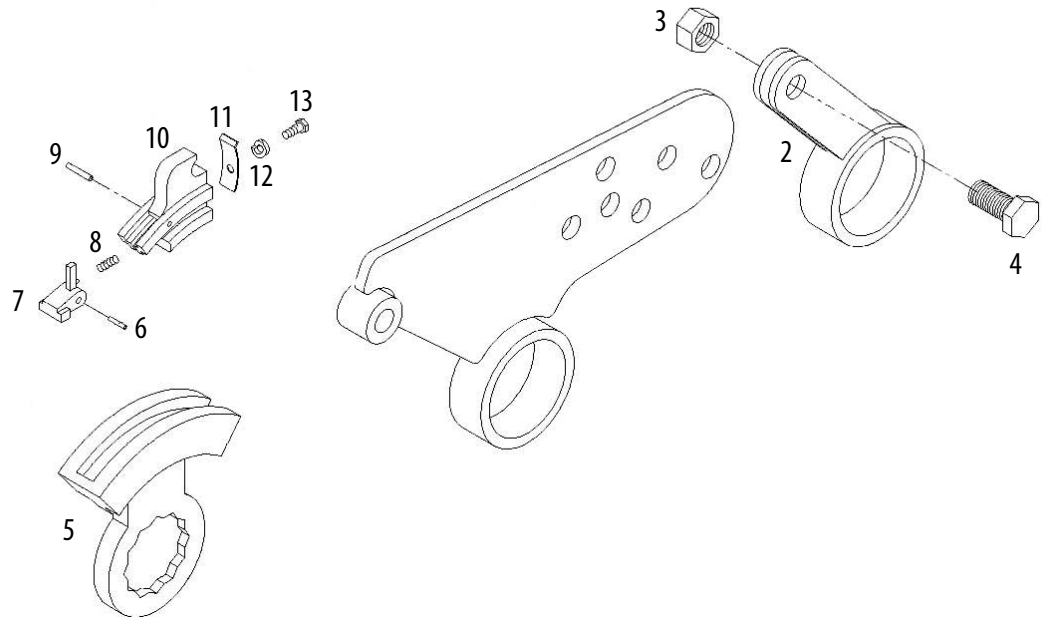
# ThinLINE
# Hydraulic Ratchet Wrench Parts List

## 9" Series 250 ThinLINE Component Parts




**Parts list and component pricing for the 6" (GREEN) ThinLINE Series**

| Item # | Part # | Description |
|---|---|---|
| 1 + 2 | TLH____ -9R * | Reaction Plate & Reaction Leg Assembly |
| 3 | NT12-10GR8Y | 3/4" Nut, Grade 8 - Yellow Zinc Coating |
| 4 | HHCS12-10X28GR8Y | 3/4" X 1-3/4" Hex Head Cap Screw |
| 5 thru 13 | TLH____ -9W * | Wrench Head & Pawl Carrier Assembly |
| 6 thru 13 | B87099AS | 9" Pawl Carrier Assembly |
| 6 | RP2X12 | 1/8" x 3/4" Roll Pin |
| 7 | L84212 | 9" Pawl |
| 8 | 13B020GE/S | Pawl Spring |
| 9 | RP2X12 | 1/8" X 3/4" Roll Pin |
| 10 | B87099 | 9" Pawl Carrier |
| 11 | L81225 | Clevis Spring |
| 12 | LW4-SS | 1/4" Lock Washer |
| 13 | SHCS4-20X08SS | 1/4" x 1/2" Socket Head Cap Screw |

*** See Prices for Wrench Series 250-9**

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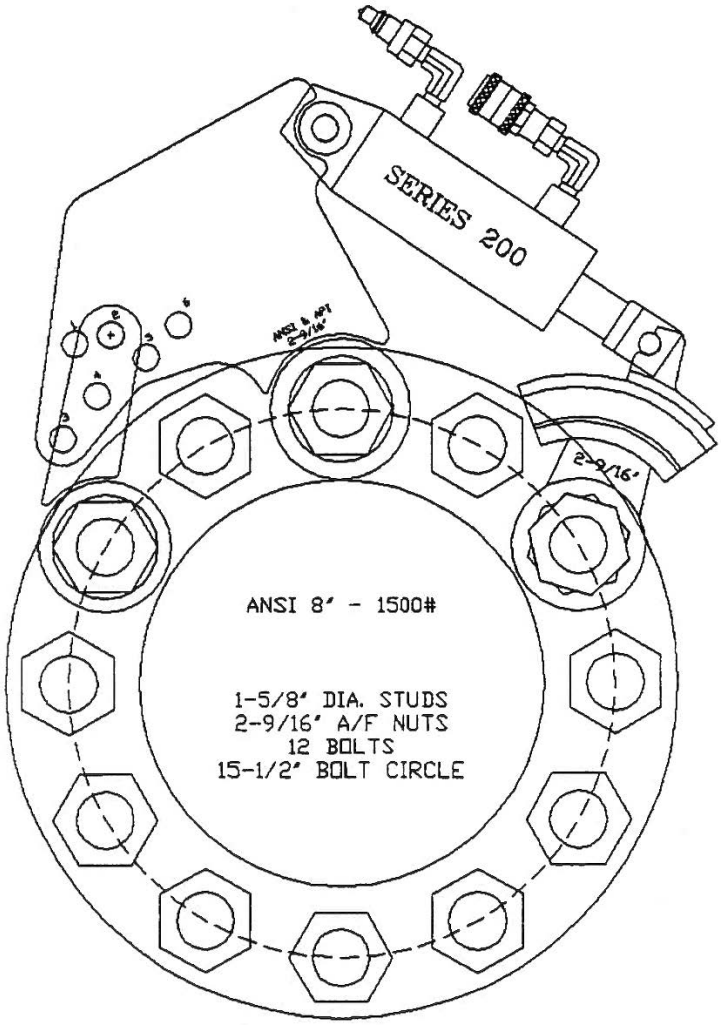
# ThinLINE
# TLH206-6




**Suggested Torque: 2,278 Ft Lb**
**Pressure Setting: 1,450 PSI**

**FASTORQ® provides Layout Drawings of all ANSI & API Standard Flanges with ThinLINE orders.**

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# AutoTORQ Ratchet Wrenches

**Inline and Square Drive**

## IU-XL

- **Require Minimum Clearance**
- **Breakthrough design**
- **Fits almost any application**
- **Ratcheting capacities from 100 to 50,000 ft/lb torque**


## SU-XL

- **Patented, time-tested, proven design**
- **Cost-effective**
- **No pinch points, lighter weight**
- **Wide range of applications**
- **Ratcheting capacities from 100 to 60,000 ft/lb torque**


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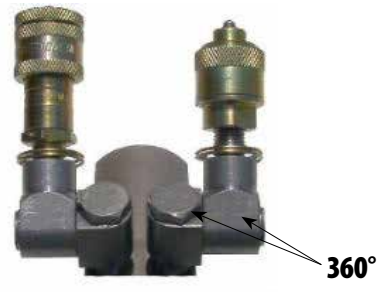
# IU-XL Series
# Inline Ratchet Wrench

Inline ratcheting wrenches require minimum clearance, while applying torque on the same plane as the nut, providing a marked improvement over square drive socket wrenches. Our patented design breakthrough reduced the overall dimensions of the inline ratcheting head, allowing it to fit almost every application. Our IU-XL Series tool capacities range from 100 to 50,000 foot pounds of torque, using a 10,000 PSI hydraulic pump.

- **Inline Ratchet** – Standard fractional head sizes from 3/4" nuts across the flats. Metric and special sizes available.
- **Precision Machined** – Increases accuracy, durability and repeatability.
- **Unibody** – Eliminates "Pinch Points"
- **360° Swivel Fittings** – Patented fittings allow hose movement without hose binding. Stainless steel with fewer moving parts - a great improvement over competitors' delicate design. See single plane swivel fittings shown on the wrench illustrated above.
- **Slotted Piston Rod** – Maintains 90o relationship between piston rod and nut. Increases accuracy. Reduces number of moving parts.
- **Cylinder** – Made of TLT-6 durable, high-strength, lightweight aircraft alloy with the same sturdy, dependable and accurate design (as steel cylinder).
- **Reaction Pad** – Reacts against adjacent nut. No reaction member necessary.
- **Drive Pin Design (patented)** – Reduces overall dimensions of hex head, including a thinner "nose" radius. Fits more applications, including all 57 API flanges.
- **Coated** – All exposed parts to resist corrosion.
- **Light/Ergonomic** – Reduces operator fatigue.
- **Calibrated** – Every tool is tested and calibrated to +/- .03 accuracy, traceable to N.I.S.T.
- **Warranty** – IU-XL Series wrenches come with a 3 Year - 2 Tier Warranty, which is the best standard warranty on the market today.

*Extra light, dependable, and fits where others cannot.*




***Dual Plane Swivel Fittings*** *Available Upon Request*

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# IU-XL Series Inline Ratchet Wrench

| IU-XL Series | Max Ft. Lbs. @ 10,000 PSI | Length | Height | Body Width | Head Width | Range | Weight w/ head |
|---|---|---|---|---|---|---|---|
| IU-1XL | 1,350 | 6.250″ | 4.00″ | 1.100″ | .950″ | 3/4″ – 2″ | 7.25 lbs. |
| IU-3XL | 3,300 | 7.000″ | 5.750″ | 1.450″ | *1.075″ or •1.200″ | 1-1/4″ – 2-15/16″ | 9.25 lbs. |
| IU-7XL | 7,200 | 9.750″ | 6.250″ | 1.500″ | 1.500″ | 2″ – 3-7/8″ | 14.00 lbs. |
| IU-10XL | 10,600 | 9.250″ | 8.000″ | 1.950″ | 1.950″ | 2-3/8″ – 4-1/4″ | 24.50 lbs. |
| IU-17XL | 17,100 | 11.250″ | 9.250″ | 1.950″ | 2.450″ | 2-3/4″ – 5-3/8″ | 42.00 lbs. |
| IU-25XL | 25,600 | 11.250″ | 9.250″ | 2.900″ | 2.950″ | 3-1/2″ – 5-3/4″ | 57.00 lbs. |
| IU-50XL | 50,000 | 15.375″ | 10.500″ | 2.900″ | 2.950″ | 4-5/8″ – 7-1/4″ | 85.00 lbs. |

**Steel Cylinders Only** *** 1-1/4 to 2″ Heads** **• 2-3/16″ to 2-15/16″ Heads**

| IU-1XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 3/4″ | 1.07″ | 0.41″ |
| 1-1/16″ | 1.18″ | 0.34″ |
| 1-1/4″ | 1.29″ | 0.34″ |
| 1-7/16″ | 1.40″ | 0.34″ |
| 1-5/8″ | 1.51″ | 0.34″ |
| 1- 13/16″ | 1.61″ | 0.34″ |
| 2″ | 1.72″ | 0.34″ |

| IU-3XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 1-1/4″ | 1.38″ | 0.35″ |
| 1-7/16″ | 1.46″ | 0.35″ |
| 1-5/8″ | 1.57″ | 0.35″ |
| 1- 13/16″ | 1.70″ | 0.40″ |
| 1-7/8″ | 1.79″ | 0.46″ |
| 2″ | 1.79″ | 0.40″ |
| 2-3/16″ | 1.90″ | 0.40″ |
| 2-3/8″ | 1.97″ | 0.40″ |
| 2-9/16″ | 2.12″ | 0.46″ |
| 2-3/4″ | 2.24″ | 0.46″ |
| 2- 15/16″ | 2.36″ | 0.46″ |

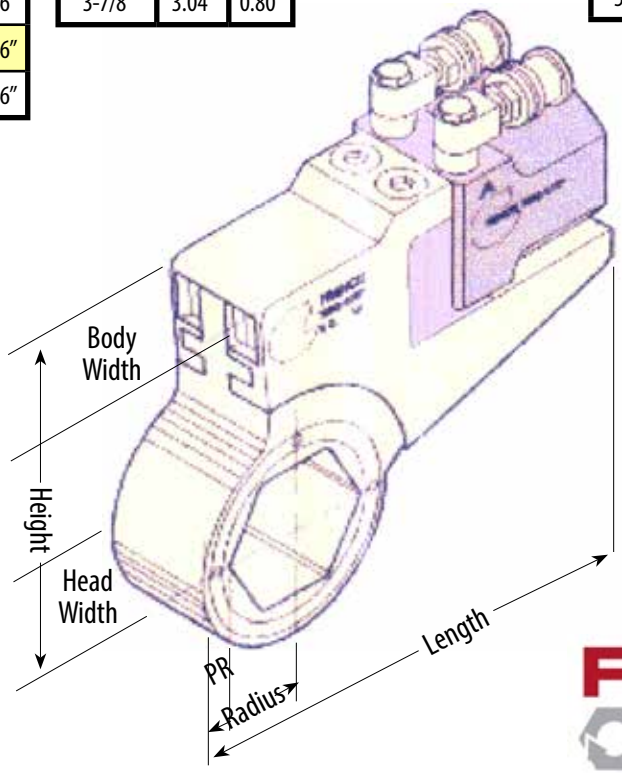
| IU-7XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 2″ | 1.80″ | 0.47″ |
| 2-3/16″ | 1.88″ | 0.47″ |
| 2-3/8″ | 2.02″ | 0.47″ |
| 2-9/16″ | 2.15″ | 0.47″ |
| 2-3/4″ | 2.40″ | 0.55″ |
| 2- 15/16″ | 2.55″ | 0.50″ |
| 3-1/8″ | 2.62″ | 0.55″ |
| 3-1/2″ | 2.85″ | 0.85″ |
| 3-7/8″ | 3.04″ | 0.80″ |

| IU-10XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 2-3/8″ | 2.02″ | 0.45″ |
| 2-9/16″ | 2.15″ | 0.47″ |
| 2-3/4″ | 2.40″ | 0.55″ |
| 2- 15/16″ | 2.55″ | 0.50″ |
| 3-1/8″ | 2.62″ | 0.55″ |
| 3-1/2″ | 2.85″ | 0.85″ |
| 3-7/8″ | 3.07″ | 0.85″ |
| 4-1/4″ | 3.26″ | 0.85″ |

| IU-17XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 2-3/4″ | 2.50″ | 0.90″ |
| 2- 15/16″ | 2.62″ | 0.90″ |
| 3-1/8″ | 2.70″ | 0.90″ |
| 3-1/2″ | 2.90″ | 0.90″ |
| 3-7/8″ | 3.18″ | 0.95″ |
| 4-1/4″ | 3.35″ | 0.96″ |
| 4-5/8″ | 3.58″ | 0.96″ |
| 5″ | 3.90″ | 1.00″ |
| 5-3/8″ | 4.10″ | 1.00″ |

| IU-25XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 3-1/2″ | 2.90″ | 0.87″ |
| 3-7/8″ | 3.18″ | 0.95″ |
| 4-1/4″ | 3.35″ | 0.90″ |
| 4-5/8″ | 3.58″ | 0.90″ |
| 5″ | 3.85″ | 0.96″ |
| 5-3/8″ | 4.10″ | 1.00″ |
| 5-3/4″ | 4.32″ | 1.02″ |

| IU-50XL Heads | | |
|---|---|---|
| ATF | Rad. | P/R |
| 4-5/8″ | 3.92″ | 1.25″ |
| 5″ | 4.13″ | 1.25″ |
| 5-3/8″ | 4.35″ | 1.25″ |
| 5-3/4″ | 4.57″ | 1.25″ |
| 6-1/8″ | 4.78″ | 1.25″ |
| 6-1/2″ | 5.00″ | 1.25″ |
| 6-7/8″ | 5.22″ | 1.25″ |
| 7-1/4″ | 5.43″ | 1.25″ |

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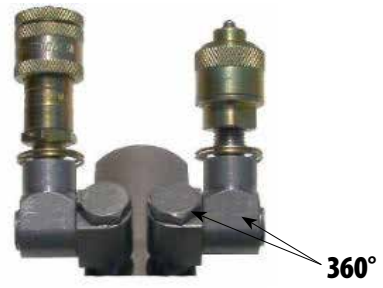
# SU-XL Series
# Square Drive Ratchet Wrench

A time tested and proven tool design, square drive ratchets offer a cost efficient option to handle a wide range of bolting make-up and break-out needs. The SU-XL Series ratchet employs a "patented design", which increases accuracy and reduces the number of moving parts. TL T-6 XL Series body encloses the drive train assembly, allowing no pinch points and lighter weight. Our standard SU-XL Series tool capacities range from 100 to 60,000 Ft. Lbs. of torque, using a 10,000 PSI hydraulic pump.

- Square Drive - For use with all standard size square drive impact sockets. Easily shifts from makeup to break-out without disassembly.
- TL T-6 - XL Series bodies made of durable, highstrength, lightweight aircraft alloy.
- Unibody - Eliminates "Pinch Points". Reduces side loading. Totally enclosed drive train assembly, allowing nothing in or out of the tool.
- 360 Degree Swivel Fittings - Patented fittings allow hose movement without hose binding, stainless steel with fewer moving parts - a great improvement over competitors' delicate design. See single plane swivel fittings shown above on wrench.
- Slotted Piston Rod - Maintains 90o relationship between piston rod and nut. Increases accuracy. Reduces number of moving parts.
- Anti-Reverse Pawl - Holds rotational wind-up to maintain required torque.
- Pawl Release - Anti-reverse pawl release mechanism allows manual release of tool if "binding occurs.
- Reaction Member - 360 degree rotation and made of TL T-6. Increased reaction area. Ratchet can be used without reaction member.
- Coated - All exposed parts to resist corrosion.
- Light/Ergonomic - Reduces operator fatigue.
- Calibrated - Every tool is tested and calibrated to +/- .03 accuracy, traceable to N.I.S.T.
- Warranty - SU-XL Series wrenches come with a 3 Year - 2 Tier Warranty, that is the best standard warranty on the market today.


*Extra light, dependable, and fits where others cannot.*

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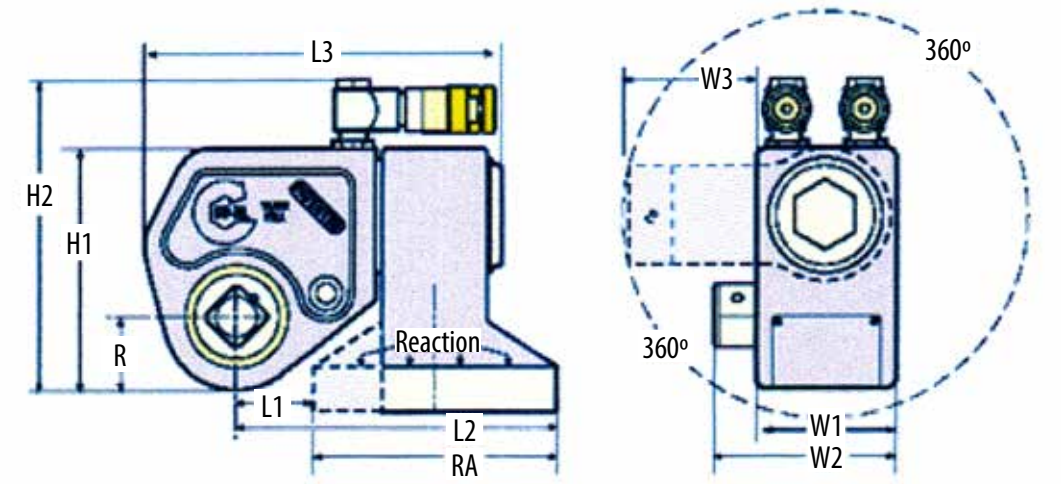
# SU-XL Series
# Square Drive Ratchet Wrench




| SU-XL Series | Square Drive | Max ft. lbs.@ 10,000 PSI | Weight* | Reaction Area- RA | Length L1 | Length L2 | Length L3 | Radius R | Height H1 | Height H2 | Width W1 | Width W2 | Width W3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SU-1XL** | 3/4″ | 1,400 | 5.25 lbs | 3.685″ | 1.567″ | 5.252″ | 5.978″ | 1.200″ | 4.100″ | 5.725″ | 1.980″ | 2.730″ | 2.200″ |
| **SU-3XL** | 1″ | 3,300 | 11.25 lbs | 5.335″ | 1.865″ | 7.200″ | 7.970″ | 1.260″ | 4.870″ | 6.520″ | 2.775″ | 3.600″ | 3.172″ |
| **SU-6XL** | 1-1/2″ | 6,000 | 17.20 lbs | 5.460″ | 2.150″ | 7.610″ | 8.410″ | 1.953″ | 6.250″ | 7.850″ | 3.000″ | 4.475″ | 3.501″ |
| **SU-11XL** | 1-1/2″ | 11,300 | 29.90 lbs | 6.500″ | 2.245″ | 8.745″ | 9.500″ | 2.062″ | 7.375″ | 9.125″ | 3.900″ | 5.350″ | 4.982″ |
| **SU-20XL** | 2-1/2″ | 20,100 | 62.00 lbs | 7.525″ | 3.460″ | 10.375″ | 11.600″ | 3.000″ | 9.184″ | 10.784″ | 4.950″ | 7.450″ | 5.557″ |
| **SU-30XL** | 2-1/2″ | 30,200 | 75.00 lbs | 7.525″ | 3.460″ | 10.875″ | 11.725″ | 3.125″ | 9.777″ | 11.377″ | 5.875″ | 8.375″ | 5.555″ |

*** Weight includes tool, reaction member and square drive.**

| SU-XL Series | Square Drive | Max ft. lbs.@ 10,000 PSI | Weight* | Reaction Area- RA | Length L1 | Length L2 | Length L3 | Radius R | Height H1 | Height H2 | Width W1 | Width W2 | Width W3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SU-45** | 2-1/2″ | 46,200 | 145.00 lbs | 7.425″ | 7.337″ | 12.537″ | 13.312″ | 3.000″ | 11.000″ | 12.600″ | 5.750″ | 8.250″ | 5.500″ |
| **SU-60** | 2-1/2″ | 60,000 | 295.00 lbs | 8.781″ | 5.887″ | 14.668″ | 16.000″ | 3.750″ | 14.000″ | 15.600″ | 7.250″ | 9.750″ | 5.750″ |

*** Steel Casting**

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# Power Units

- **More speed, power and durability**
- **Versatile units, power a wide variety of wrenches and tools**
- **Every unit tested by FASTORQ technicians**
- **Every unit complete with hoses, controllers, quick disconnects**
- **Electric, air, hydraulic and manual models to meet every need**

FASTORQ TOTAL ASSURANCE GUARANTEE

ALL POWER UNITS 1-YEAR WARRANTY

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# Power Units Comparison Chart

| Motor Type | Model No. | Use For | Power Rqmt. | Max Pressure (psi) | Oil Delivery (Cubic In./Min) | | Motor Size (HP) | Reservoir Capacity (Gallons) | Dimensions (Inches) | | | | Valve Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | @ no Load | @ full Pressure | | | Length Depth | Width | Height | Weight (w/oil) lbs. | |
| AIR | 105A | AutoSPLITTER | 40 psi to 120 psi | 10,000 psi | 68 | 4 | 1/4 | 1 | 10 | 5 | 7.75 | 20 | 2 Way |
| | 205A | Torque Wrenches AutoSPLITTER Flange Puller | 50 cfm @90 psi | 10,000 psi | 400 | 50 | 1.5 | 2 | 25.44 | 16.75 | 20.5 | 100 | 4 Way |
| | 603A | SpinTORQ | 150 cipm @100 psi | 3,000 psi | 10 gpm | 4 gpm @1500 psi | 6 | 2.5 | 21 | 19 | 51 | 205 | 4 Way |
| | ST-CU | SpinTORQ Control Unit for use with customer's power unit. | | | | | | | 15 | 8 | 16 | 25 | 4 Way |
| | 610A | Torque Wrenches AutoSPLITTER Flange Puller | 150 cfm @100 psi | 10,000 psi | 550 | 150 | 6 | 2 | 21 | 19 | 51 | 205 | 4 Way |
| ELECTRIC | 115E | AutoSPLITTER | 110/220 Volts AC Single Ph. 50/60hz | 10,000 psi | 400 | 20 | .5 | 2 | 12.25 | 12.25 | 19 | 64 | Dump |
| | 210E | Torque Wrenches AutoSPLITTER | 115 Volts A/C | 10,000 psi | 400 | 20 | .5 | 1 | 11.31 | 7.88 | 18.56 | 80 | 4 Way |
| | 215E | Torque Wrenches AutoSPLITTER Flange Puller | 115 Volts A/C | 10,000 psi | 400 | 50 | 1.5 | 2 | 12.25 | 12.25 | 19.03 | 95 | 4 Way |
| Manual Two Speed | HTP-40H | Stud Tensioners | Hand Powered | 40,000 psi | Per Stroke .99 @ 200 psi | Per Stroke .037@ 40K psi | n/a | 60 cu in | 22 | 4.74 | 9 | 14 | Manual |
| AIR | HTP 1000 | Stud Tensioners | 75 cfm @ 100 psi | 30,000 psi | 36 | 28 | 1.5 | 5 | 20 | 20 | 20 | 120 | Manual |
| | HTP 2000 | Stud Tensioners | 75 cfm @ 100 psi | 30,000 psi | 29 | 17 | 1.5 | 5 | 20 | 20 | 20 | 130 | Manual |
| Manual Two Speed | 150F 150F2 | AutoSPLITTER AutoSPREADER | Foot Powered | 10,000 psi | Per Stroke .662 @ 325 psi | Per Stroke .16 @ 10K psi | n/a | 152 cu in | 22.75 | 3.75 | 6 | 26.2 | Manual |
| | 150H 150H2 | AutoSPLITTER AutoSPREADER | Hand Powered | 10,000 psi | Per Stroke .662 @ 325 psi | Per Stroke .16 @ 10K psi | n/a | 152 cu in | 22.75 | 3.75 | 6 | 26.2 | Manual |
| Manual One Speed | 100H 100H2 | AutoSPLITTER AutoSPREADER | Hand Powered | 10,000 psi | Per Stroke .662 @ 325 psi | Per Stroke .16 @ 10K psi | n/a | 55 cu in | 23.0 | 4.75 | 6 | 15.8 | Manual |

## Standard Accessories

**Models 100H, 105A, 115E, 150H & 150F** include 12 ft hydraulic hose and fittings **Models 100H2, 150H2, 150F2** same specs as 100H, 150H & 150F includes pair of 12 ft hydraulic hoses, tee block, load lowering valve & fittings **Models 603A & 610A** include 25 ft hydraulic hose and fittings, 25 ft remote control, filter, regulator, lubricator and liquid filled hydraulic pressure gauge, rugged welded framework protects components - **Model 205A** includes the same, but with 20 ft remote control.

**Models 210E** and **215E** include 25 ft hydraulic hose and fittings, 20 ft remote control cable and liquid filled hydraulic gauge, rugged welded framework protects components **Model HTP1000 & HTP2000** includes liquid filled hydraulic gauge, rugged welded framework protects components, hoses and fittings sold separately **Model HTP2000** includes air-operated suction return pump for fast retraction of stud tensioners **Model HTP-40H** includes 30,000 PSI pressure gauge and fittings.

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# Impact Sockets & Hammer Wrenches

- **Sockets made from high strength alloy steel**
- **Heat treated for strength, impact resistance**
- **Available in standard, deep and thinwall types**
- **Wide variety of accessories available**
- **Custom sizes to meet your needs**
- **Wrenches forged from high tensile alloy**
- **Chamber openings for easy positioning**
- **Coated to prevent rusting**
- **Larger striking area**



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# Impact Sockets & Hammer Wrenches

## FASTORQ® Impact Sockets & Hammer Wrenches are specially designed for heavy-duty impact and torque wrench requirements.

- **Available in Standard, Deep and Thinwall socket types**
- **From 3/8" to 3-1/2" square drive**
- **Castellated Sockets and Anchor Adapters**
- **#5 Spline drive Sockets**
- **Hex and 12 point**
- **Square and 8 Point**
- **Fractional and Metric Sizes**
- **Stack Sockets**
- **Wide variety of Accessories**

**CALL FOR A QUOTE**

*The FASTORQ® Profile is provided on the square drives as well as on the hexagon end of Impact Sockets from 1/2" square drive and above.*

**Conventional Profile:**
*High stress areas on the corner point of contact.*

**FASTORQ® Profile:**
*Distributed surface loads relieves high stress area. Contact points are away from corner of the fastener.*

**Our standard sockets don't fit your application?**

**Talk to us!**

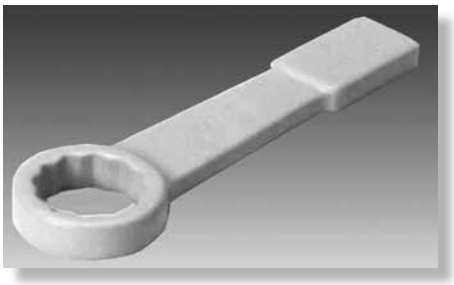
**We make custom sockets for every task.**

## UNIQUE FEATURES AND BENEFITS:

### Impact Sockets

- FASTORQ® Impact Sockets (from 1/2" square drive and above) feature the FASTORQ® Profile.
- All Impact Sockets are made from high strength alloy steel.
- All Impact Sockets are heat treated for the best combination of strength and impact resistance.
- All Impact Sockets have an optimum wall thickness for strength and accessibility on fasteners having restrictions.
- The depth of the Hex openings is designed to accommodate the full standard fastener head.
- All Impact Sockets have chamfered openings for ease of engagement with the drive tool and the fastener.
- Concentric openings and large clearance holes to meet industrial specifications.
- All Impact Sockets have a Ring-N-Pin arrangement for securing them to the drive.
- Plated and black oxidized coated for increased protection from rusting.

### Slugging Wrenches – 12 Point



- Greater sectional area for longer life.
- Larger striking area to increase safety in use.
- Greater offset height allows clear hammering in offset Slugging Wrenches.
- Drop forged from high tensile alloy Heat treated for optimum impact resistance.
- Chamfered openings for easy positioning on nuts/bolts.
- Plated and black oxidized coated for increased protection from rusting.

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# AutoTORQ PW Series

## Hydraulic Chain Pipe Wrench

- **Tightens and Loosens Tubular Threaded Joints**
- **Utilizes rig hydraulics**
- **Has a wide range of tubular sizes**
- **Delivers controlled torque to threaded joints**
- **Fully portable**

FASTORQ TOTAL ASSURANCE GUARANTEE

CHAIN PIPE WRENCH 1-YEAR WARRANTY

LEADING PROVIDER OF BOLT LOADING & REMOVAL SOLUTIONS

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# AutoTORQ PW Series
# Hydraulic Chain Pipe Wrench

## Tightens and Loosens Tubular Threaded Joints

- **Utilizes rig hydraulics**
- **Has a wide range of tubular sizes**
- **Delivers controlled torque to threaded joints**
- **Fully portable**

## Available Sizes

**PW150 100 - 408**
Working Pipe Diameters: 1" to 4-1/2" O.D.

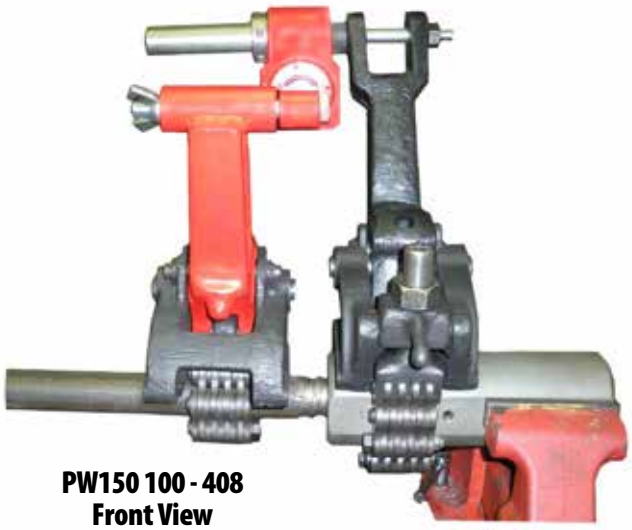
**PW200 204 - 500**
Working Pipe Diameters: 2-1/8" to 5" O.D.

**PW200 312 - 804**
Working Pipe Diameters: 3-3/4" to 8-1/4" O.D.

**PW250 412 - 1012**
Working Pipe Diameters: 4-3/4" to 10-3/4" O.D.

**PW325 802 - 1400**
Working Pipe Diameters: 8-1/8" to 14" O.D.

**PW150 100 - 408**
**Left View**



**PW150 100 - 408**
**Front View**

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# AutoTORQ PW Series
# Hydraulic Chain Pipe Wrench

## Chain Pipe Wrench Loads

| PW150 100-408 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cylinder Area Sq. In. | Pressure (PSI) | Force/lbs | Pipe OD | Lever Arm | Torque Ft. Lbs. | Pipe OD | Lever Arm | Torque Ft. Lbs. |
| 1.767 | 3000 | 5,301 | 1″ | 9″ | 3,975 | 4-1/2″ | 12″ | 5,301 |

| PW200 202-500 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cylinder Area Sq. In. | Pressure (PSI) | Force/lbs | Pipe OD | Lever Arm | Torque Ft. Lbs. | Pipe OD | Lever Arm | Torque Ft. Lbs. |
| 2.00 | 3000 | 6,000 | 2-1/8″ | 12-1/2″ | 6,240 | 5″ | 14-1/5″ | 7,200 |
| 2.00 | 6000 | 12,000 | 2-1/8″ | 12-1/2″ | 12,480 | 5″ | 14-1/5″ | 14,400 |

| PW200 312-804 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cylinder Area Sq. In. | Pressure (PSI) | Force/lbs | Pipe OD | Lever Arm | Torque Ft. Lbs. | Pipe OD | Lever Arm | Torque Ft. Lbs. |
| 2.00 | 3000 | 6,000 | 3-3/4″ | 13″ | 6,480 | 8-1/4″ | 17″ | 8,460 |
| 2.00 | 6000 | 12,000 | 3-3/4″ | 13″ | 12,960 | 8-1/4″ | 17″ | 16,920 |

| PW250 412-1012 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cylinder Area Sq. In. | Pressure (PSI) | Force/lbs | Pipe OD | Lever Arm | Torque Ft. Lbs. | Pipe OD | Lever Arm | Torque Ft. Lbs. |
| 4.90 | 3000 | 14,700 | 4-3/4″ | 14″ | 17,052 | 10-3/4″ | 18″ | 22,050 |
| 4.90 | 6000 | 29,400 | 4-3/4″ | 14″ | 34,104 | 10-3/4″ | 18″ | 44,100 |

| PW325 802-1400 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cylinder Area Sq. In. | Pressure (PSI) | Force/lbs | Pipe OD | Lever Arm | Torque Ft. Lbs. | Pipe OD | Lever Arm | Torque Ft. Lbs. |
| 8.30 | 3000 | 24,900 | 8-1/8″ | 17″ | 35,109 | 14″ | 20″ | 41,334 |
| 8.30 | 6000 | 49,800 | 8-1/8″ | 17″ | 70,218 | 14″ | 20″ | 82,668 |

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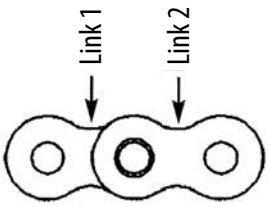
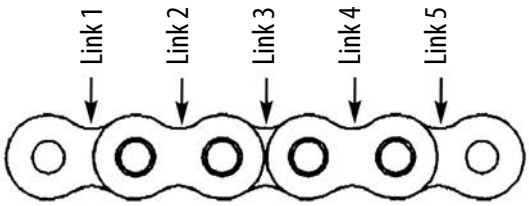
# Chain Identification Guide

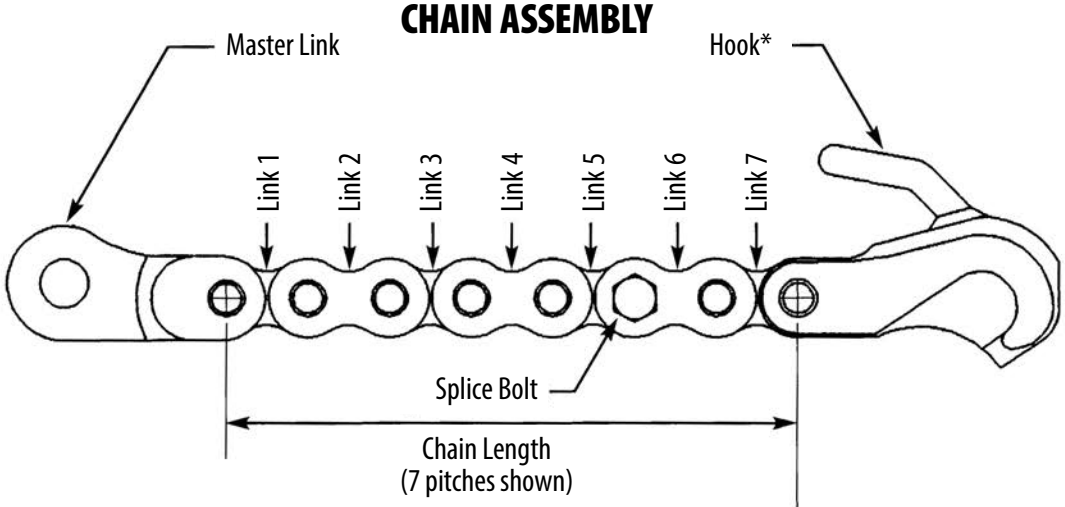
## 2 LINK SECTION



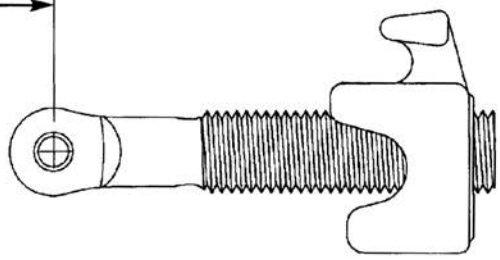

## 5 LINK SECTION




## CHAIN ASSEMBLY




*Chains for Drill Pipe Tongs, Friction Tongs, Tongvises and Visetongs have a chain screw and nut latching component instead of a chain hook.



## THIS IS WHAT A CHAIN PART NUMBER TELLS YOU

161 – 45 – 07 L 4500

**Chain Size**
131
151
161
181
201

**Chain Combination**
22
34
44
45
56

**Chain Length (pitches)**
(see above)

**Tong Type**
B = Bukup Tong
D = Drill Pipe Tong
D7 = Drill Pipe Tong (DA6184 only)
F = Friction Tong
L = Bull Tong
M = Machine Tong
T = Tongvise/Visetong

**Hook Length**

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# AutoTORQ Power Units

## Power Units for Torque Wrenches

### Speed

FASTORQ® Power Units offer more speed, power and durability than any other power unit in the industry.

### Accuracy and Ease

Set the torque and with the touch of a button, FASTORQ® Power Units power the torque wrench to the desired level.

### Versatility

All FASTORQ® Power Units provide power and control to a complete range of hydraulic torque wrenches, from 150 to 150,000 ft./lbs.

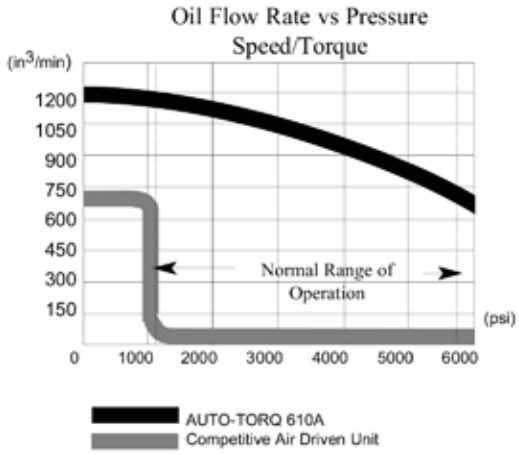
### Reliability

Every power unit is fully tested by FASTORQ® technicians and is delivered ready for operation complete with the necessary hoses, controllers and quick disconnects.

### The Difference

Competitive power units utilize 2-stage pumps. The first stage provides a high flow rate (speed) up to 1,000 psi (10% of torque capacity). When the torque requirement exceeds 10% (1,000 psi), the second stage takes over and the flow rate (speed) is reduced to one tenth (see chart).

For example, at full pressure the AutoTORQ 610A unit generates 650 cubic inches per minute (in.3/min.) creating enough output to operate a torquing tool nearly 1000% faster than competitive power units, at the same pressure (torque). When low flow rate (lack of speed) at higher pressures limits your productivity, FASTORQ® AutoTORQ power units are the answer.


*The AutoTORQ power units maintain higher speeds all across the torque range. The competitive pump delivers high speed at 10% of torque then drops to one-tenth of the AutoTORQ speed and stays there across the torque range.*

*Maximum oil flow rate allows the 610A to run up to 10 times faster for top torquing performance. Standard equipment includes spin-on 10 micron oil filter, air filter/regulator/lubricator, liquid-filled stainless steel hydraulic pressure gauge, sight gauge for easy oil level and temperature control, 25 ft. remote control hoses and 25 ft. oil-filled hydraulic hoses with quick disconnect fittings and safety locks. The 610A is mounted on a two-wheeled cart for portability.*

*FASTORQ Model 610A Power Unit provides 10,000 psi operation.*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# AutoTORQ 10K Power Unit

## MODEL 610A

**Super high-speed hydraulic torque wrench pump suited for demanding turnaround and shutdown maintenance operations.**

## Features:

- 6 HP Air Motor
- Positive displacement reciprocating fluid end
- 10,000 psi Operation
- CIM Flow Data: 550 @ 0 psi; 380 @ 5,000 psi; & 150 @10,000 psi
- Precision Valve for torque and pressure control adjustment
- Glycerin filled easy to read pressure gauge
- Air Inlet filter, regulator, lubricator assembly
- 3-gallon hydraulic reservoir
- Spin-On 10-micron oil filter
- Oil Gauge
- Temperature Gauge
- Self Cooled
- Low maintenance
- Rugged
- Hand held 2-button remote control pendant with 25' color-coded lines
- All mounted on a 2-wheel mobile hand truck for maximum portability
- Optionally available mounted in a ridged steel frame
- Optionally available with 4 hydraulic ports for the simultaneous operation of up to 4 torque wrenches

## Safety Features:

- If the button of the remote control is released or the remote control is dropped, the pump and torque wrench will come to an immediate stop
- Equipped with twin air exhaust valves

## Air Requirement:

- Requires 150 cfm air volume @ 100 psi for optimum performance


**Model 610A High Speed Pump**

FASTORQ TOTAL ASSURANCE GUARANTEE
ALL POWER UNITS 1-YEAR WARRANTY

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# Stud Tensioners


- **Simultaneously tensions multiple bolts**
- **All parts feature corrosion protection**
- **Features a captive nut rotator**
- **Eliminates costly and time-consuming work**
- **Provides reliable, low-friction seals**
- **Gives accurate bolt tension**
- **Available in inches and metric sizes**
- **Custom designs available for special applications**

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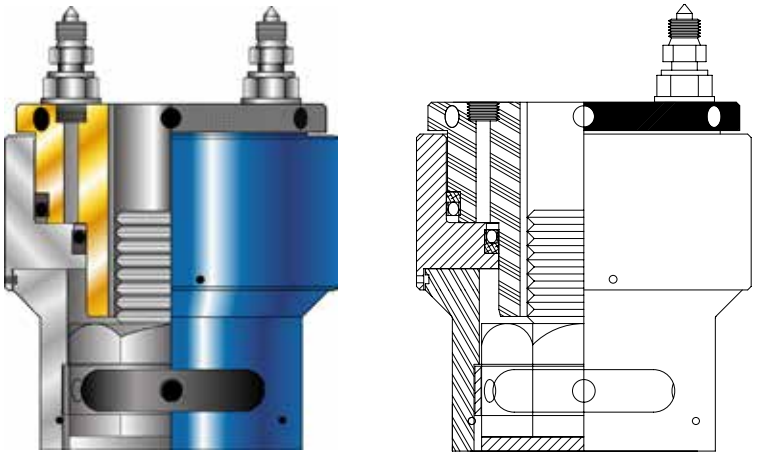
# Hydraulic Stud Tensioners

## FASTORQ® Stud Tensioners

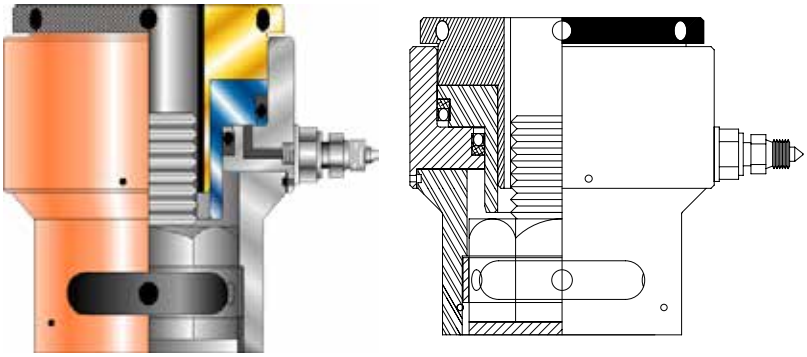
The quick, safe and accurate method of simultaneously loading multiple threaded fasteners is with FASTORQ Stud Tensioners. A bolted joint is clamped together by the permanent load applied to its optimum specification. If the bolt is loaded (tensioned) improperly, it will not do the job or it will not last on the job. Either way, the bolt fails. Accurate bolt tensioning is critical to the integrity of the joint. FASTORQ reduces the variable risk in critical bolting situations by allowing quick, safe and accurate tensioning.

FASTORQ Stud Tensioners are available in several models. FASTORQ offers traditional models, fixed or variable and the exclusive ZipTENSIONER featuring ZipNut® Double Zip® technology, all designed for applications such as reactors, flanges, vessel closures, heat exchangers, compressors, turbines, pipelines, clamp-type connectors, subsea and nuclear applications. ZipTENSIONER is especially suited for subsea and nuclear applications or when fast turnaround is required. FASTORQ also offers the ZipNut® Double Zip® technology as a retro-fit for existing stud tensioners.

Match FASTORQ Stud Tensioners with FASTORQ Power Units for optimum performance. For the fastest turn around possible on the job, FASTORQ recommends the Model HTP-2000 power unit featuring a power return pump.



**FIXED Model**



**VARIABLE Model**

## Features:

- Simulate bolt tension independent of coefficient of friction and notorsional loading of fastener
- Reliable, low-friction seals
- Captive nut rotator
- Two hydraulic ports
- Overstroke indicator
- AutoTENSIONER allows for 100% coverage from one side
- Available in inches and metric sizing
- Custom designs for special applications



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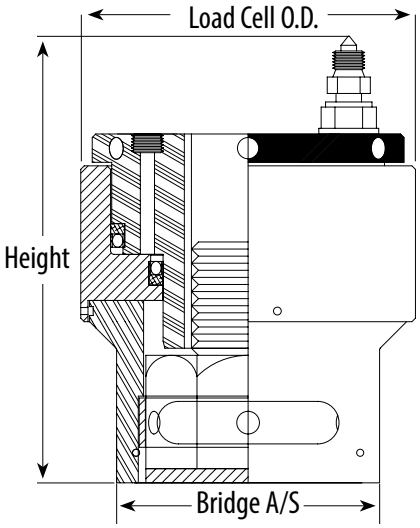
# Stud Tensioner
# Fixed Model Dimensions

## Features:

- Self-lubricating seals provide unlimited shelf life
- Seals are high-performance polymers, FDA approved for food industry specifications
- Operating pressure up to 22,000 psi and temperatures from -400°F to +500°F
- Low coefficient of friction - 0.04
- Longer life seals provide better performance, fewer replacements
- Spring-energized seals provide permanent elasticity
- Variable models feature interchangeable components, affording greater coverage at lower cost
- Metric Sizes available

**FIXED Model**




| FIXED MODELS | | | | | | |
|---|---|---|---|---|---|---|
| **Part Number** | **Stud Diameter (Inches)** | **Maximum Initial Load[1] *(Lbs.)** | **Hydraulic Area (Inches²)** | **Height (Inches)** | **Bridge A/S (Inches)** | **Load Cell OD (Inches)** |
| **F012** | 3/4 | 43,472 | 1.976 | 6.125 | 2.600 | 2.198 |
| **F014** | 7/8 | 54,714 | 2.488 | 6.250 | 2.600 | 2.474 |
| **F100** | 1 | 63,360 | 2.880 | 6.375 | 2.600 | 2.762 |
| **F102** | 1-1/8 | 86,086 | 3.913 | 6.625 | 3.050 | 3.196 |
| **F104** | 1-1/4 | 107,008 | 4.864 | 6.750 | 3.150 | 3.481 |
| **F106** | 1-3/8 | 120,186 | 5.463 | 6.875 | 3.500 | 3.836 |
| **F108** | 1-1/2 | 139,480 | 6.340 | 7.000 | 3.625 | 4.152 |
| **F110** | 1-5/8 | 182,050 | 8.275 | 7.250 | 3.750 | 4.581 |
| **F112** | 1-3/4 | 230,230 | 10.465 | 7.375 | 4.375 | 5.045 |
| **F114** | 1-7/8 | 234,674 | 10.667 | 7.500 | 4.750 | 5.238 |
| **F200** | 2 | 286,176 | 13.008 | 7.625 | 4.812 | 5.660 |
| **F204** | 2-1/4 | 287,452 | 13.066 | 8.125 | 5.500 | 6.304 |
| **F208** | 2-1/2 | 324,632 | 14.756 | 8.500 | 5.625 | 6.805 |
| **F212** | 2-3/4 | 401,214 | 18.237 | 9.375 | 6.250 | 7.404 |
| **F300** | 3 | 507,584 | 23.072 | 9.500 | 6.375 | 8.056 |
| **F304** | 3-1/4 | 561,638 | 25.529 | 9.750 | 6.560 | 8.709 |
| **F308** | 3-1/2 | 690,976 | 31.408 | 10.375 | 7.250 | 9.431 |
| **F312** | 3-3/4 | 823,740 | 37.445 | 11.000 | 8.900 | 10.100 |
| **F400** | 4 | 922,086 | 41.913 | 11.500 | 9.100 | 10.500 |

**[1] Maximum initial load is based on maximum operating pressure of 22,000 psi. Specifications may change without notice.**

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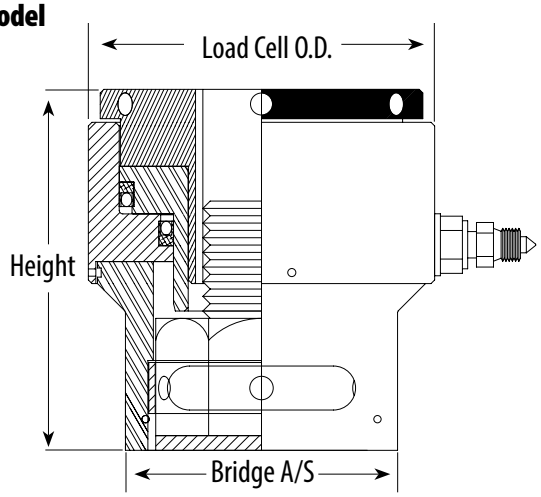
# Stud Tensioner
# Variable Model Dimensions

## Features:

- Self-lubricating seals provide unlimited shelf life
- Seals are high-performance polymers, FDA approved for food industry specifications
- Operating pressure up to 22,000 psi and temperatures from -400°F to +500°F
- Low coefficient of friction - 0.04
- Longer life seals provide better performance, fewer replacements
- Spring-energized seals provide permanent elasticity
- Variable models feature interchangeable components, affording greater coverage at lower cost
- Metric Sizes available

**VARIABLE Model**




| VARIABLE MODELS | | | | | | |
|---|---|---|---|---|---|---|
| **Part Number** | **Stud Diameter (Inches)** | **Maximum Initial Load[1] *(Lbs.)** | **Hydraulic Area (Inches²)** | **Height (Inches)** | **Bridge A/S (Inches)** | **Load Cell OD (Inches)** |
| **V012** | 3/4 | 42,240 | 1.920 | 4.500 | 2.600 | 3.700 |
| **V014** | 7/8 | 42,240 | 1.920 | 4.625 | 2.600 | 3.700 |
| **V100** | 1 | 42,240 | 1.920 | 4.750 | 2.600 | 3.700 |
| **V102** | 1-1/8 | 77,330 | 3.515 | 4.875 | 3.050 | 4.300 |
| **V104** | 1-1/4 | 77,330 | 3.515 | 5.032 | 3.150 | 4.300 |
| **V106** | 1-3/8 | 145,244 | 6.602 | 5.312 | 3.500 | 4.705 |
| **V108** | 1-1/2 | 145,244 | 6.602 | 5.437 | 3.625 | 4.705 |
| **V110** | 1-5/8 | 145,244 | 6.602 | 5.562 | 3.750 | 4.705 |
| **V112** | 1-3/4 | 250,338 | 11.379 | 5.687 | 4.375 | 5.905 |
| **V114** | 1-7/8 | 250,338 | 11.379 | 5.813 | 4.756 | 5.905 |
| **V200** | 2 | 250,338 | 11.379 | 5.938 | 4.812 | 5.905 |
| **V204** | 2-1/4 | 259,072 | 11.776 | 6.844 | 5.500 | 6.937 |
| **V208** | 2-1/2 | 259,072 | 11.776 | 6.969 | 5.625 | 6.937 |
| **V212** | 2-3/4 | 475,640 | 21.620 | 7.347 | 6.250 | 8.250 |
| **V300** | 3 | 475,640 | 21.620 | 8.032 | 6.375 | 8.250 |
| **V304** | 3-1/4 | 603,922 | 27.451 | 8.187 | 6.560 | 9.400 |
| **V308** | 3-1/2 | 603,922 | 27.451 | 8.312 | 7.250 | 9.400 |
| **V312** | 3-3/4 | 772,200 | 35.100 | 8.500 | 8.900 | 10.950 |
| **V400** | 4 | 772,200 | 35.100 | 8.687 | 9.100 | 10.950 |

**[1] Maximum initial load is based on maximum operating pressure of 22,000 psi. Specifications may change without notice.**

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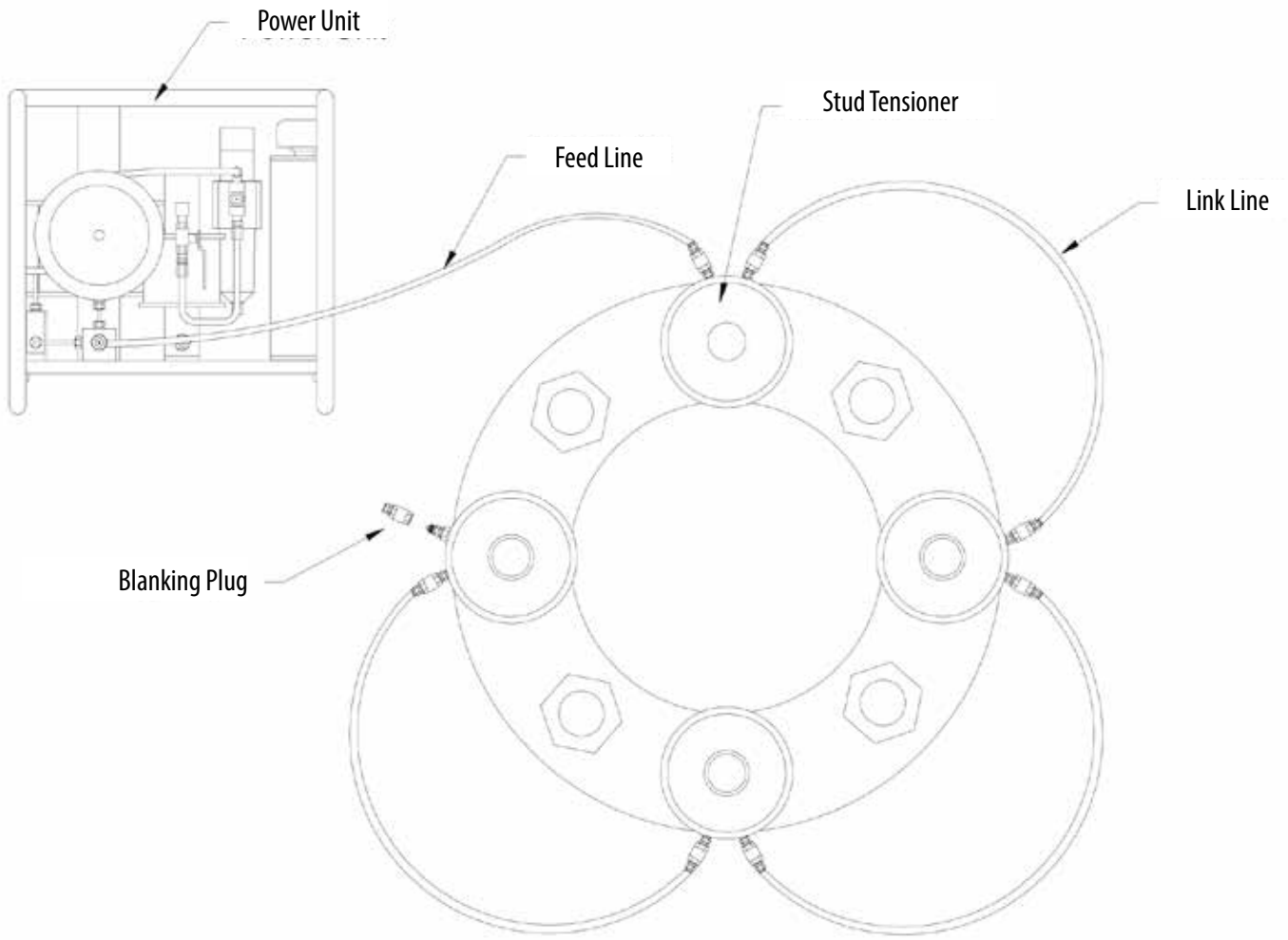
# Stud Tensioner
# Typical Application




## When ordering a stud tensioner system, the following accessories are required:

- One 20,000 psi hydraulic power unit
- One feed line to run from the power unit to the first tensioner
- As many link lines as required to connect all of the tensioners together LESS ONE. For example, if you order 10 tensioners, you will require 9 link lines.

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# ZipTENSIONER

## Stud Tensioner


- **For Subsea, Nuclear, Wind and other specialty applications**
- **Simultaneously tensions multiple fasteners**
- **Half the time required by conventional tensioners**
- **One piece installation**
- **Compact and light weight**
- **Ideal for wind turbine, subsea and nuclear**
- **Available in fixed and variable styles**

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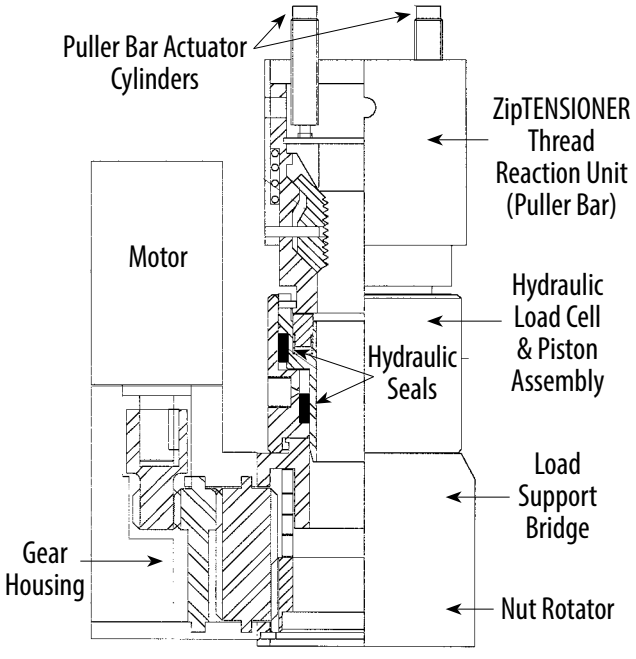
# ZipTENSIONER Stud Tensioners

Designed to provide subsea, nuclear, and wind industries with the latest technology and flexibility.

- Incorporates the ZipNut® Double Zip® technology.
- The ZipNut® Double Zip® spring loaded thread segments allow the tensioner to slide over the protruding stud threads, eliminating the time consuming task of threading the puller nut.
- Can be used for all standard tensioning operations.
- Compact design allows 100% stud coverage from one side of any ANSI or API flange. For example, the body diameter of a 1 5/8" Stud Tensioner is only 3.538" (90mm) thus improving the ability to fit non-standard applications.
- Allows for one piece installation.
- Can be fitted with special hydraulic release mechanism and hydraulic motor driven nut rotator for subsea applications – ROV and diver compatible.
- Ideal for multi-stud tensioning systems.
- All parts are stainless steel, nickel-plated or coated to provide corrosion protection.
- Automatic retraction available with specially equipped FASTORQ® Power Unit Model HTP-2000.
- Lightweight compared to competitor models.
- Also ideal for offshore, petrochemical, steel and mining.

| Stud Dia. (IN) | Metric Diam. | Max. Initial Load[1] (Lbs.) | Max Load (% Yield*) | Hydraulic Area (IN²) | Max Oper. (psi) | Tensioner OD (IN) |
|---|---|---|---|---|---|---|
| 3/4 | M18 | 26.3 | 75 | 1.013 | 26,000 | 1.855 |
| 7/8 | M22 | 36.4 | 75 | 1.399 | 26,000 | 2.142 |
| 1 | M24 | 47.4 | 75 | 1.823 | 26,000 | 2.429 |
| 1 1/8 | M27 | 62.2 | 75 | 2.391 | 26,000 | 2.635 |
| 1 1/4 | M30/33 | 78.8 | 75 | 3.029 | 26,000 | 2.883 |
| 1 3/8 | M36 | 97.1 | 75 | 3.736 | 26,000 | 3.159 |
| 1 1/2 | M39 | 101.4 | 65 | 3.900 | 26,000 | 3.270 |
| 1 5/8 | M42 | 120.9 | 65 | 4.650 | 26,000 | 3.538 |
| 1 3/4 | M45 | 142.1 | 65 | 5.465 | 26,000 | 3.793 |
| 1 7/8 | M48 | 164.7 | 65 | 6.335 | 26,000 | 4.078 |
| 2 | M52 | 189.2 | 65 | 7.275 | 26,000 | 4.356 |
| 2 1/8 | M56 | 215.1 | 65 | 8.273 | 26,000 | 4.632 |
| 2 1/4 | M60 | 242.8 | 65 | 9.338 | 26,000 | 4.912 |
| 2 3/8 | ------ | 272.1 | 65 | 10.465 | 26,000 | 5.189 |
| 2 1/2 | M64 | 253.2 | 60 | 9.738 | 28,000 | 5.178 |
| 2 5/8 | ------ | 303.9 | 60 | 11.688 | 28,000 | 5.57 |
| 2 3/4 | M72 | 309.0 | 60 | 11.036 | 28,000 | 5.643 |
| 2 7/8 | ------ | 339.3 | 60 | 12.118 | 28,000 | 5.904 |
| 3 | M76 | 370.8 | 60 | 13.243 | 28,000 | 6.159 |
| 3 1/8 | M80 | 403.7 | 60 | 14.419 | 28,000 | 6.457 |
| 3 1/4 | M85 | 438.0 | 60 | 15.643 | 28,000 | 6.68 |
| 3 3/8 | ------ | 473.8 | 60 | 16.920 | 28,000 | 6.947 |
| 3 1/2 | M90 | 510.9 | 60 | 18.246 | 28,000 | 7.195 |
| 3 5/8 | ------ | 549.4 | 60 | 19.620 | 28,000 | 7.448 |
| 3 3/4 | M95 | 589.2 | 60 | 21.043 | 28,000 | 7.709 |
| 3 7/8 | ------ | 630.6 | 60 | 22.521 | 28,000 | 7.97 |
| 4 | M100 | 673.2 | 60 | 24.043 | 28,000 | 8.231 |

***Bolt load as a percentage of yield is based on the minimum yield strength of ASTM A193, B7 bolt material. [1] Maximum load x 1,000 lbs.**




*ZipTENSIONER Subsea Stud Tensioner with remote operated nut rotator and release.*

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# ZipTENSIONER

## Reaction Nuts

FASTORQ® Reaction Nuts with ZipNut® Double Zip® action is a direct fit replacement part and can be retro-fitted to existing tensioners with minimal modifications.

- Directly replaces the thread-on puller bars of multi-stud tensioner systems built for steam generator manways.
- Reduces maintenance crew time and fatigue is avoided when overhead installation of tensioners is required.
- "Push on, pull off" technology zips on rusty or damaged threads, tensions the stud and zips off.
- Simple and fast, no twisting or turning.

## ZipNut

The push on threaded nut is ASTM A194 Grade 2H equivalent and measures one wrench size larger across the flats than standard heavy hex nuts.

- Eliminates tedious turning, turning and turning.
- Eliminates cross threading.
- Fits standard bolts - available in sizes 1/2" - 1".
- Replaces heavy hex nuts.

## Power Units

For optimum performance and fast turnaround, power FASTORQ Stud Tensioners with a FASTORQ power unit.

**Model HTP-2000**

- 30,000 psi air-driven
- Filter, regulator and lubricator
- Rugged steel cage
- Power fluid return pump

**Model HTP-1000**

- Same as Model HTP-2000, includes drain port for fluid return.
  Link Line: 4:1 Safety burst ratio - Quick disconnect couplers



*Fastorq Model HTP-2000 is powering 28 ZipTENSIONER Stud Tensioners, size 2 1/2".*

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# Power Unit
# HTP-2000

## Reduces Tensioning Time By Up To 50%

| Model Number | HTP2000 |
|---|---|
| Type | Air |
| Requirement | 75cfm @100psi |
| Maximum Pressure (psi) | 30,000psi |
| Oil Delivery (Cubic Inches/Min.)<br>@ No Load<br>@Full Pressure<br>Per Stroke ci | <br>32<br>16<br>.123 |
| Motor Size (Hp) | 1.5 |
| Air Piston Diameter | 7" |
| Stroke | 2.5" |
| Hydraulic Piston Diameter | .25" |
| Reservoir Capacity (Gallons) | 2.5 |
| Dimensions (Inches)<br>Length<br>Width<br>Height<br>Weight (With Oil) Lbs. | <br>19.5<br>19.5<br>19.5<br>120 |
| Valve Type | Manual |

## Features:

**HTP-2000** dual hydraulic power unit, air operated, complete with air driven vacuum return pump.

Includes: filter, regulator, lubricator, 30,000 psi gauge, 2.5 gallon reservoir, pressure control needle valve and features an air driven vacuum return pump.

All contained in a rugged stainless steel tubular frame for maximum component protection.

For use with all variable, fixed and multiple tensioner systems.

FASTORQ TOTAL ASSURANCE GUARANTEE
ALL POWER UNITS 1-YEAR WARRANTY

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# Power Unit
# HTP-1000

## Reduces Tensioning Time By Up To 50%

| Model Number | HTP2000 |
|---|---|
| Type | Air |
| Requirement | 75cfm @100psi |
| Maximum Pressure (psi) | 30,000psi |
| Oil Delivery (Cubic Inches/Min.)<br>@ No Load<br>@Full Pressure<br>Per Stroke ci | <br>32<br>16<br>.123 |
| Motor Size (Hp) | 1.5 |
| Air Piston Diameter | 7" |
| Stroke | 2.5" |
| Hydraulic Piston Diameter | .25" |
| Reservoir Capacity (Gallons) | 2.5 |
| Dimensions (Inches)<br>Length<br>Width<br>Height<br>Weight (With Oil) Lbs. | <br>19.5<br>19.5<br>19.5<br>120 |
| Valve Type | Manual |

## Features:

**HTP-1000** dual hydraulic power unit, air operated.

Includes: filter, regulator, lubricator, 30,000 psi gauge, 2.5 gallon reservoir and pressure control needle valve.

All contained in a rugged stainless steel tubular frame for maximum component protection.

For use with all variable, fixed and multiple tensioner systems.


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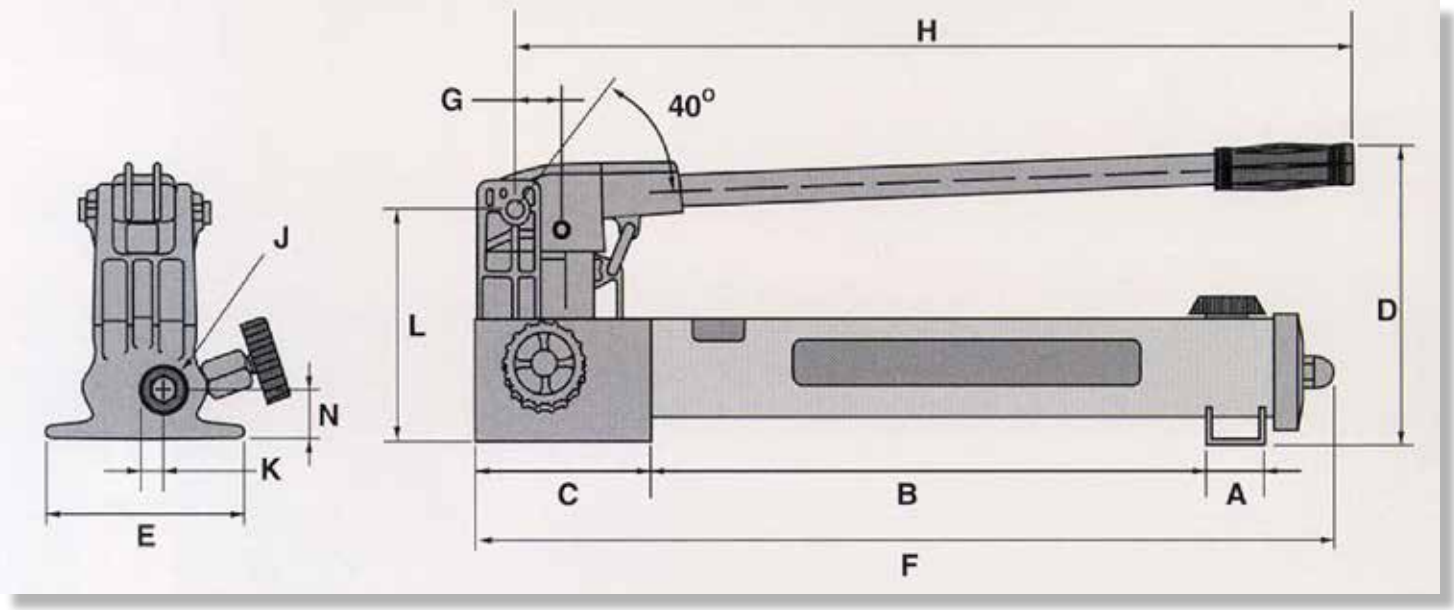
# Hand Power Unit
# HTP–40H

- 40,000 PSI Pressure Capability – for specialized ultra high pressure applications
- Two–Speed Operation – reduces cycle time for increased productivity
- Durable Glass Filled Nylon Reservoir and Encapsulated Pump Head – resists corrosion
- Large Release Valve – better control of pressure release

**Shipped with 30,000 PSI Pressure Gauge and Fittings**

FASTORQ TOTAL ASSURANCE GUARANTEE — ALL POWER UNITS 1-YEAR WARRANTY

**New two-speed operation and pumping chamber design make it fast and easy to use, while reducing handle effort at 40,000 PSI.**




## DIMENSION CHART INCHES (Metric)

| Model Number | A | B | C | D | E | F | G | H | J | K | L | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HTP – 40H | 1.4 (35,5) | 13.6 (345) | 5.25 (133) | 9.00 (229) | 4.74 (120) | 22.00 (559) | 1.16 (29.5) | 20.75 (527) | ¾ - 16 CONE PORT | 0.49 (12.4) | 5.49 (139) | 1.24 (31,5) |

## SELECTION CHART

| Model Number | Pump Speed | Max. Pressure Rating* | Oil Volume Per Stroke | Reservoir Capacity | Piston Diameter | Piston Stroke | Weight |
|---|---|---|---|---|---|---|---|
| HTP – 40H | 2 Speed | 1st Stage – 200 PSI | .99 $in^3$ | 60 $in^3$ (.983L) | 1.123 in | 1.00 in. | 14 lbs. |
| | | 2nd Stage – 40,000 PSI | .037 $in^3$ | | .218 in | | |

**Note: Pump is not equipped with an internal relief valve. A pressure gauge must be used to prevent over-pressurization.**

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# ZipTENSIONER Wind Turbine

## Foundation Stud Tensioners



FASTORQ TOTAL ASSURANCE GUARANTEE

ZIPTENSIONER 3-YEAR WARRANTY

- **Quick, safe and accurate tool**
- **Simultaneous loading of multiple threaded studs and bolts**
- **Available with ZipNut Technology**
- **Long working stroke (.625") standard**
- **Captive nut rotator, two hyrdraulic ports**
- **Over-stroke indicator**
- **Models to provide maximum tension from 86,800 pounds at 10,000 PSI to 134,573 pounds at 9,600 PSI hydraulic pressure**

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# ZipTENSIONER
# F61-10-32MM-10K Stud Tensioner


## Wind Turbine Tensioners

The **F61-10-32MM-10K** Stud Tensioner is designed to tension 34MM Williams #10 Grade 75 Bar foundation bolts on wind turbine towers.

The piston area of the tensioner is 8.68 square inches. This area provides a maximum tension of 86,800 pounds at 10,000 PSI hydraulic pressure. The tensioner has a 1 inch stroke, therefore, full elongation of the foundation bolts is accomplished with just one pull.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension.

The **F61-10-32MM-10K** utilizes a puller bar, which is threaded down on the foundation bolt. This allows the **F61-10-32MM-10K** to be used on foundation bolts with at least 7-1/2 inches protruding above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 8,680 |
| 2,000 | 17,360 |
| 3,000 | 26,040 |
| 4,000 | 34,720 |
| 5,000 | 43,400 |
| 6,000 | 52,080 |
| 7,000 | 60,760 |
| 8,000 | 69,440 |
| 9,000 | 78,120 |
| 10,000 | 86,800 |

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# ZipTENSIONER
# F61-11-35MM-10K Stud Tensioner


## Wind Turbine Tensioners

The **F61-11-35MM-10K** Stud Tensioner is designed to tension 35MM Williams #11 Grade 75 Bar foundation bolts on wind turbine towers.

The piston area of the tensioner is 9.988 square inches. This area provides a maximum tension of 99,880 pounds at 10,000 PSI hydraulic pressure. The tensioner has a one inch stroke, therefore, full elongation of the foundation bolts is accomplished with just two pulls.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension.

The tensioner is double acting, so the piston is returned hydraulically.

The **F61-11-35MM-10K** utilizes a puller bar, which is threaded down on the foundation bolt. This allows the **F61-11-35MM-10K** to be used on foundation bolts with at least 9 inches protruding above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 9,988 |
| 2,000 | 19,976 |
| 3,000 | 29,964 |
| 4,000 | 39,952 |
| 5,000 | 49,940 |
| 6,000 | 59,928 |
| 7,000 | 69,916 |
| 8,000 | 79,904 |
| 9,000 | 89,892 |
| 10,000 | 99,880 |

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# ZipTENSIONER
# F71-11-36MM-10K Stud Tensioner


## Wind Turbine Tensioners

The **F71-11-36MM-10K** Stud Tensioner is designed to tension 36MM Williams #11 Grade 150 Bar foundation bolts on wind turbine towers.

The piston area of the tensioner is 14.018 square inches. This area provides a maximum tension of 134,573 pounds at 9,600 PSI hydraulic pressure. The tensioner has a .5 inch stroke, therefore, full elongation of the foundation bolts is accomplished with just two pulls.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension.

The **F71-11-36MM-10K** utilizes a puller bar, which is threaded down on the foundation bolt. This allows the **F71-11-36MM-10K** to be used on foundation bolts with a minimum of 9 inches protruding above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 14,018 |
| 2,000 | 28,036 |
| 3,000 | 42,054 |
| 4,000 | 56,072 |
| 5,000 | 70,090 |
| 6,000 | 84,108 |
| 7,000 | 98,126 |
| 8,000 | 112,144 |
| 9,000 | 126,162 |
| 10,000 | 134,573 |

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# ZipTENSIONER
# DZF61-10-32MM-10K Double Zip® Stud Tensioner


## Wind Turbine Tensioners

The Model **DZF61-10-32MM-10K** Stud Tensioner is designed to tension foundation bolts on wind turbine towers. The Double-Zip Nut mechanism allows the tensioner to slide down over the foundation bolts without rotating a retaining nut. When the tensioner piston is extended, the Double-ZipNut mechanism automatically engages the foundation bolt and pulls it into tension.

The piston area of the tensioner is 8.68 square inches. This area provides a maximum tension of 86,800 pounds at 10,000 PSI hydraulic pressure. The tensioner has a one inch stroke, therefore, full elongation of the foundation bolts is accomplished with just one pull.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension. The tensioner is double-acting, so the piston is returned hydraulically. The Double- Zip Nut mechanism is automatically released when the piston is returned. The **DZF61-10-32MM-10K** requires the foundation bolt to extend a minimum of 10-½" above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 8,680 |
| 2,000 | 17,360 |
| 3,000 | 26,040 |
| 4,000 | 34,720 |
| 5,000 | 43,400 |
| 6,000 | 52,080 |
| 7,000 | 60,760 |
| 8,000 | 69,440 |
| 9,000 | 78,120 |
| 10,000 | 86,800 |

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# ZipTENSIONER
# DZF61-11-35MM-10K Stud Tensioner


## Wind Turbine Tensioners

The **DZF61-11-35MM-10K** Stud Tensioner is designed to tension 35MM Williams #11 Grade 75 Bar foundation bolts on wind turbine towers.

The piston area of the tensioner is 9.988 square inches. This area provides a maximum tension of 99,880 pounds at 10,000 PSI hydraulic pressure. The tensioner has a one inch stroke, therefore, full elongation of the foundation bolts is accomplished with just two pulls.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension.

The tensioner is double acting, so the piston is returned hydraulically.

The **DZF61-11-35MM-10K** utilizes a puller bar, which is threaded down on the foundation bolt. This allows the **DZF61-11-35MM-10K** to be used on foundation bolts with at least 12-1/2" inches protruding above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 9,988 |
| 2,000 | 19,976 |
| 3,000 | 29,964 |
| 4,000 | 39,952 |
| 5,000 | 49,940 |
| 6,000 | 59,928 |
| 7,000 | 69,916 |
| 8,000 | 79,904 |
| 9,000 | 89,892 |
| 10,000 | 99,880 |

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# ZipTENSIONER
# DZF71-11-36MM-10K Stud Tensioner


## Wind Turbine Tensioners

The **DZF71-11-36MM-10K** Stud Tensioner is designed to tension 36MM Williams #11 Grade 150 Bar foundation bolts on wind turbine towers.

The piston area of the tensioner is 14.018 square inches. This area provides a maximum tension of 134,573 pounds at 9,600 PSI hydraulic pressure. The tensioner has a 7/8 inch stroke, therefore, full elongation of the foundation bolts is accomplished with just two pulls.

When the bolt is pulled into tension, the nut rotator is turned with a tommy bar to turn the service nut down and lock the bolt in tension.

The **DZF71-11-36MM-10K** utilizes a puller bar, which is threaded down on the foundation bolt. This allows the **DZF71-11-36MM-10K** to be used on foundation bolts with a minimum of 11 inches protruding above the foundation.

| Pump Pressure PSI | Tensioner Load Foot Pounds |
|---|---|
| 1,000 | 14,018 |
| 2,000 | 28,036 |
| 3,000 | 42,054 |
| 4,000 | 56,072 |
| 5,000 | 70,090 |
| 6,000 | 84,108 |
| 7,000 | 98,126 |
| 8,000 | 112,144 |
| 9,000 | 126,162 |
| 10,000 | 134,573 |

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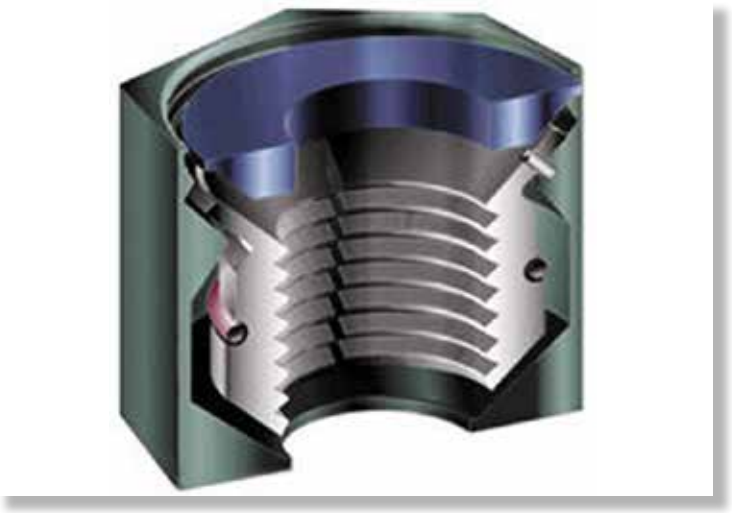
# Zip Technology

## ZipNut® and ZipCONNECTOR



- **Revolutionarily and reliable design**
- **ASTM A 194/ 2H certified**
- **Eliminates repetitious turning & cross threading**
- **Fits standard bolts**
- **Available in different sizes and materials**

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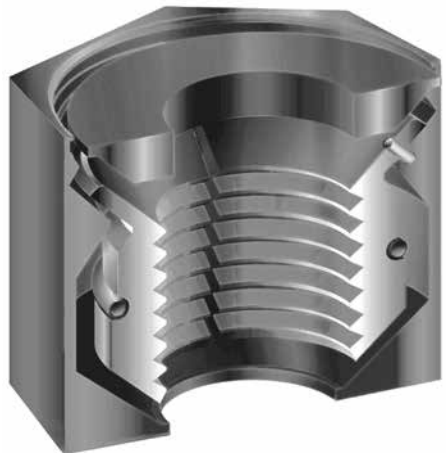
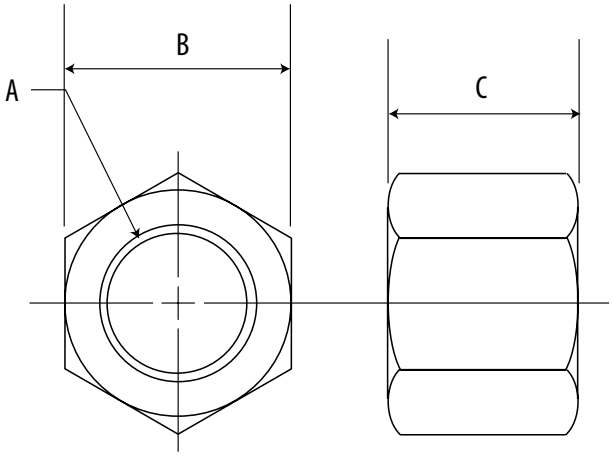
# ZipNut®
# The Push-on Threaded Nut

- Torque it or Tension it - equivalent to ASTM A194-2H nuts
- Use it wherever heavy hex nuts are utilized
- No tedious turning. . . turning. . .
- Runs down over damaged or corroded threads
- Eliminates cross-threading
- Fits standard bolts
- Measures one wrench size larger across the flats than standard heavy hex nuts
- Available in either inch or metric sizes; and in a variety of materials






| Part Number | A<br>Bolt Diameter | B<br>Across the Flats | C<br>Nut Height |
|---|---|---|---|
| **ZN008** | 1/2″ - 13 | 15/16″ | 11/16″ |
| **ZN010** | 5/8″ - 11 | 1-1/4″ | 1″ |
| **ZN012** | 3/4″ - 10 | 1-7/16″ | 1-1/8″ |
| **ZN014** | 7/8″ - 9 | 1-5/8″ | 1-1/4″ |
| **ZN016** | 1″ - 8 | 1-13/16″ | 1-3/8″ |

**All ZipNuts Quoted Upon Request • Size & Material Must Be Specified**

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# ZipCONNECTOR
# Load Connector

## New Load Connector Concept with Advanced Technology
## Available only at Fastorq

The ZipCONNECTOR uses Double-Zip® Technology to provide a means of robotically connecting and disconnecting heavy loads to lifting devices so that the loads can be placed or retrieved.

The ZipCONNECTOR is currently being used at the Oak Ridge National Laboratory in Tennessee where it picks up, moves, and sets heavy loads in a radioactive environment where human intervention is not possible.

The technology is based on a unique threaded nut that is cut in three segments, allowing it to open up while it is being positioned on a threaded rod, then closed on the mating threads of the rod. The thread segments are locked on the rod with the weight of the load, and will not release until the load is set down. Once the load is set down, the thread segments are released, thus allowing the ZipCONNECTOR to be disengaged from the load.

Hydraulic, electric or pneumatic cylinders (if the application allows) can also be integrated into the system to release the thread segments. The segmented design also prevents cross threading and assures full engagement of the ZipCONNECTOR to the threaded rod. Perhaps the most significant innovation is the mating of the threads without rotation.

The ZipCONNECTOR provides a simple and reliable mechanism for positioning and retrieving loads robotically in a subsea environment, either topside or subsea, where it is unsafe for humans to be present.

- ZipCONNECTOR provides a means of robotically connecting and disconnecting heavy loads to lifting devices
- ROV and diver friendly
- Eliminates the difficult use of shackels and pins, when using ROV's
- Provides a positive connection that is easy to connect and release
- Incorporates the ZipNut® Double Zip Technology, enabling the ZipCONNECTOR to operate as one unit
- Double Zip thread segments allow the ZipCONNECTOR to slide over the protruding stud threads, eliminating time consuming turning
- Can be used for all standard lifting operations, including subsea and nuclear projects
- Eliminates concern for damaged or rusty threads – simply pushes on and pulls off, no twisting, no turning
- Can be fitted with special hydraulic release mechanism for subsea applications
- Ideal for multi-point lifting applications
- All parts are stainless steel, nickel-plated or coated to provide corrosion protection

*With ZipCONNECTOR, a standard threaded lifting eye can be used to retrieve or abandon objects of various sizes & weights.*



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FASTORQ TOTAL ASSURANCE GUARANTEE
ZipCONNECTOR 1-Year Warranty

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# ZipCONNECTOR
# Load Connector

| Model Number | Bolt Diameter (In) | Maximum Load* (Lbs) | Maximum Load* Using 4-Pt. Lift (Lbs) | OD (In) |
|---|---|---|---|---|
| **ZL-012** | 3/4 | 35,118 | 140,472 | 1.855 |
| **ZL-014** | 7/8 | 48,482 | 193,928 | 2.142 |
| **ZL-100** | 1 | 63,603 | 254,412 | 2.489 |
| **ZL-102** | 1-1/8 | 82,997 | 331,988 | 2.635 |
| **ZL-104** | 1-1/4 | 104,969 | 419,876 | 2.883 |
| **ZL-106** | 1-3/8 | 129,517 | 518,068 | 3.159 |
| **ZL-108** | 1-1/2 | 156,643 | 626,572 | 3.27 |
| **ZL-110** | 1-5/8 | 186,346 | 745,384 | 3.538 |
| **ZL-112** | 1-3/4 | 218,626 | 874,504 | 3.793 |
| **ZL-114** | 1-7/8 | 253,483 | 1,013,932 | 4.078 |
| **ZL-200** | 2 | 290,917 | 1,163,668 | 4.356 |
| **ZL-204** | 2-1/4 | 373,516 | 1,494,064 | 4.912 |
| **ZL-208** | 2-1/2 | 422,003 | 1,688,012 | 5.178 |

*** Maximum load is based on minimum yield strength of ASTM A193-B7 bolt material. Divide this amount for your required safety factor. Additional sizes available upon request. Specifications are subject to change without notice.**

**ZipCONNECTORS can be custom built in size and mode of operation.**

**ZipCONNECTOR Load Connector**
***Hydraulic***

***Pneumatic***

***Electric***

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# ZipCONNECTOR

## Robotic Load Connector / Crane Grapple

The **problem** of deploying and retrieving equipment such as well heads and blowout preventers in an underwater environment has become greater as exploration and production programs are carried out in ever greater water depths.

If a blowout preventer is accidentally separated from a drilling riser in water depth greater than 1000 feet; a system is required to robotically connect lifting lines from the surface to pad eyes on the BOP. The connection must be made using ROV capabilities.

If a well head loses power on the sea bottom; a system is required to robotically connect lines to the collet rods so the well head may be released from the well and lifted to the surface.

Standard clevis and pin arrangements are very difficult for an ROV to connect to a pad eye and impossible to connect to a threaded collet rod. A system is required that connects lines to collet rods or threaded lifting eyes using ROV manipulators.

The solution to the problem is the ZipCONNECTOR Robotic Load Connector with a female threaded connector that pushes on to a male threaded rod without needing rotation. The connector closes on the male threads and will not release until the load is set down with slack in the line and the release mechanism is actuated.

*Figure 1 shows a photo of the 60 ton ZipCONNECTOR Robotic Load Connector.* *Figure 1*

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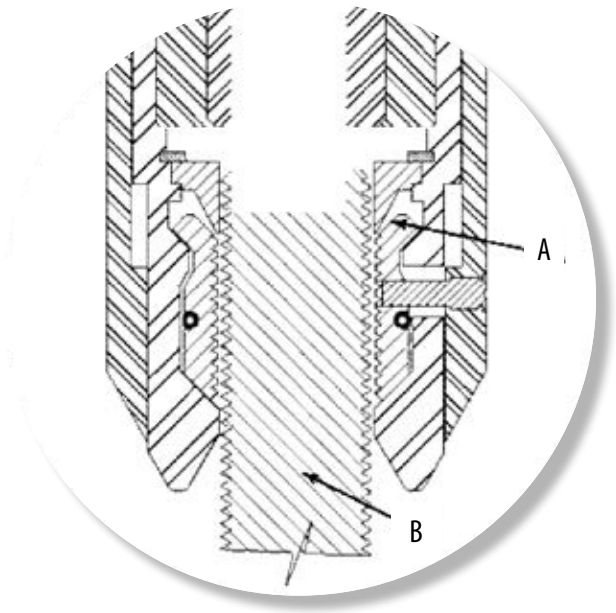
**Figure 2** is a cross section of this connector with the female thread segments (A) in the open position and pushed over the male threaded rod (B).



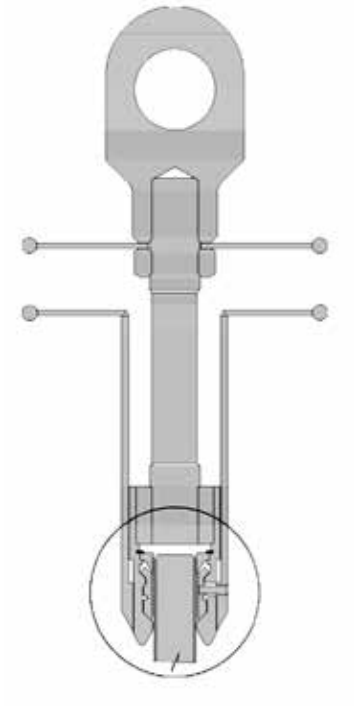
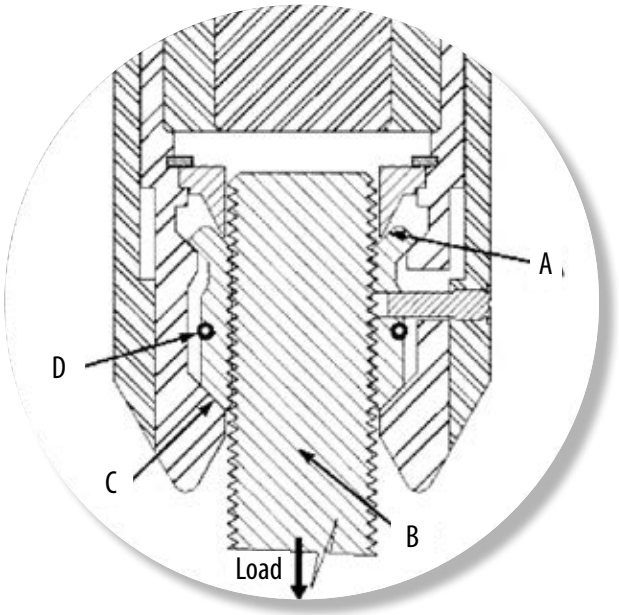



*Figure 2*

**Figure 3** is a cross section showing the female thread segments (A) closed on the male threaded rod (B). The female thread segments close on the male threaded rod as the segments engage the internal taper of the housing (C) as load is applied to the rod (B). A coiled garter spring (D) urges the segments into engagement.



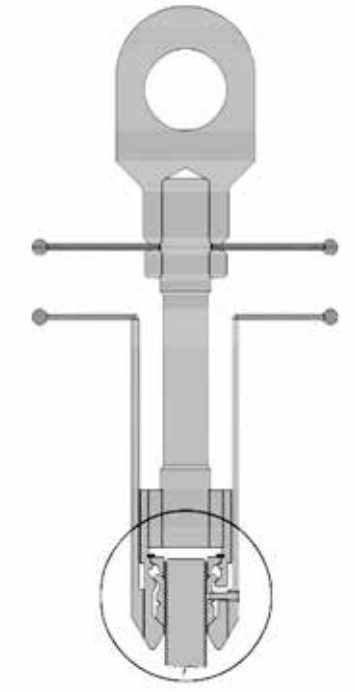



*Figure 3*

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# ZipCONNECTOR

**Figure 4** shows the ZipCONNECTOR Robotic Load Connector in the open position. Plates (E) & (F) are squeezed toward each other, lifting the outer housing (G) and causing the pins(H) to lift the segments (A) into contact with the taper on the top cap (I). This motion opens the segments (A) and allows disengagement from the threaded rod (B). The disengagement cannot happen unless the load has been set down and slack put in the line.

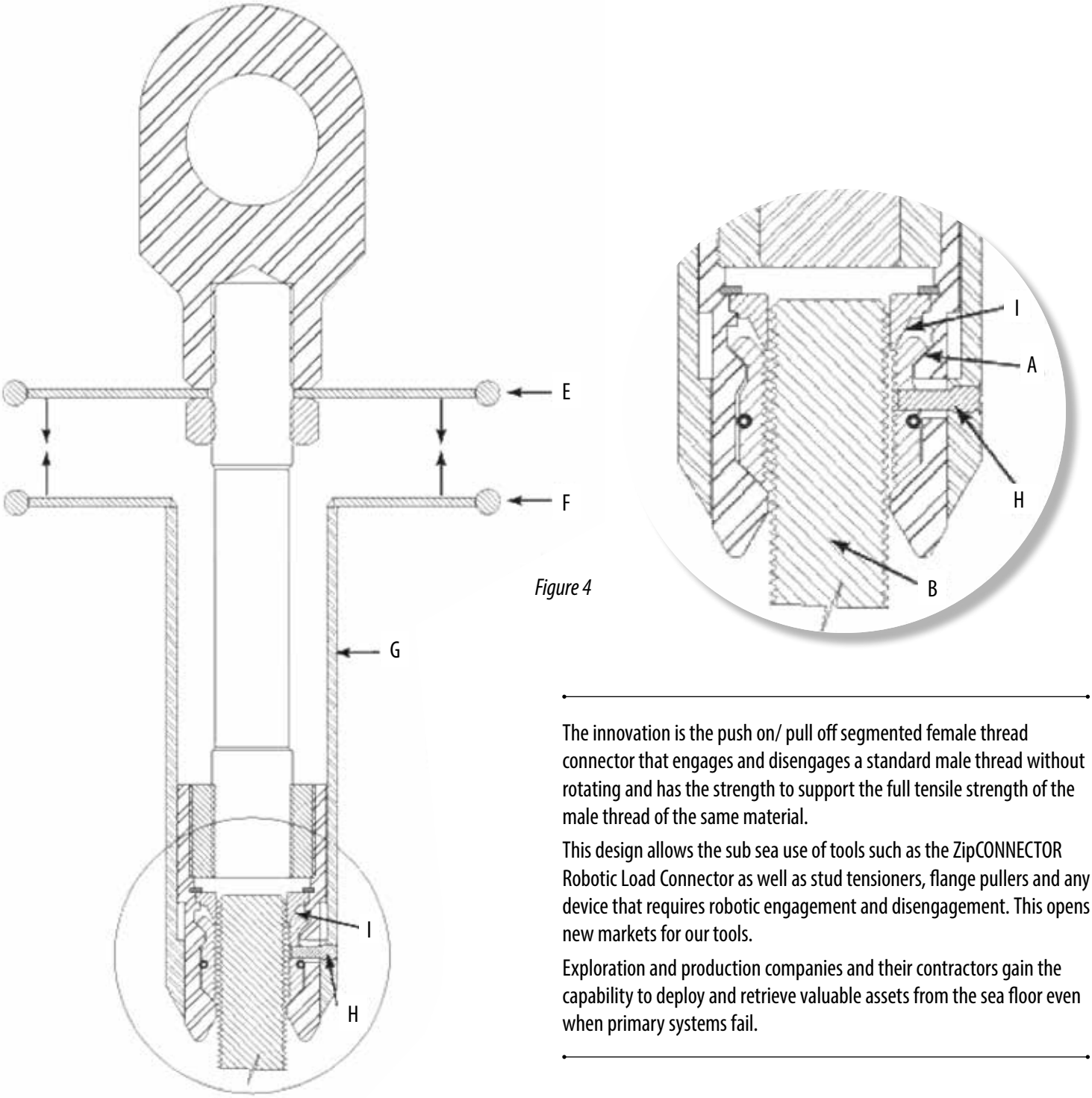


*Figure 4*

The innovation is the push on/ pull off segmented female thread connector that engages and disengages a standard male thread without rotating and has the strength to support the full tensile strength of the male thread of the same material.

This design allows the sub sea use of tools such as the ZipCONNECTOR Robotic Load Connector as well as stud tensioners, flange pullers and any device that requires robotic engagement and disengagement. This opens new markets for our tools.

Exploration and production companies and their contractors gain the capability to deploy and retrieve valuable assets from the sea floor even when primary systems fail.

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# ZipPULLER

## Subsea Flange Puller

- **Fast and easy way to pull, align or mate flanges**
- **LARGEST load capacity pulling system in the industry**
- **ZipNut® holds the load as the cylinder retracts**
- **Hydraulic powered, 10,000 PSI working pressure**
- **Versatile for ROV's, Hard Suits or Divers**
- **Available in 30-Ton 6" and 60-Ton 5" stroke models**
- **Designed to use in multiple units with a single pump**

FASTORQ TOTAL ASSURANCE GUARANTEE

ZIPPULLER 1-YEAR WARRANTY

LEADING PROVIDER OF BOLT LOADING & REMOVAL SOLUTIONS

Products and Prices are subject to updates and changes. Please contact us for current quote.

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# ZipPULLER
# Subsea Hydraulic Flange Puller

*Largest Load Capacity Pulling System on the Market*

## Ideal for…

- **Subsea flange pulling and alignment**
- **Heavy Equipment Positioning & Maneuvering**

The largest load capacity pulling system on the market.

Versatility and a compact design allows the puller to fit a wide range of flange sizes.

The system utilizes a double acting hollow cylinder and a high tesile threaded draw bar, that passes through the hydraulic cylinder and the element to be pulled.

A multiple number of units can be used for desired load and a controlled, even pull.

## Features & Benefits

- Full Automatic Operation - the ZipNut® Double Zip® thread segments allow the puller to slide over the threaded rod during the retraction process, eliminating the time consuming task of tightening nuts and bolts
- All parts are stainless steel, nickel-plated or coated to provide corrosion protection
- Designed for use in multiple units with a single pump to provide uniform flange positioning
- 10,000 PSI working pressure
- Diver or remote operation
- ROV and Hardsuit compatible

## FASTORQ® ZipPULLER Flange Pullers are available in TWO STANDARD MODELS

| | | |
|---|---|---|
| **Model #FP3006Z104** | **30 Ton Capacity** | **6" Stroke** |
| **Model #FP6005Z114** | **60 Ton Capacity** | **5" Stroke** |

***Custom Configurations Available***

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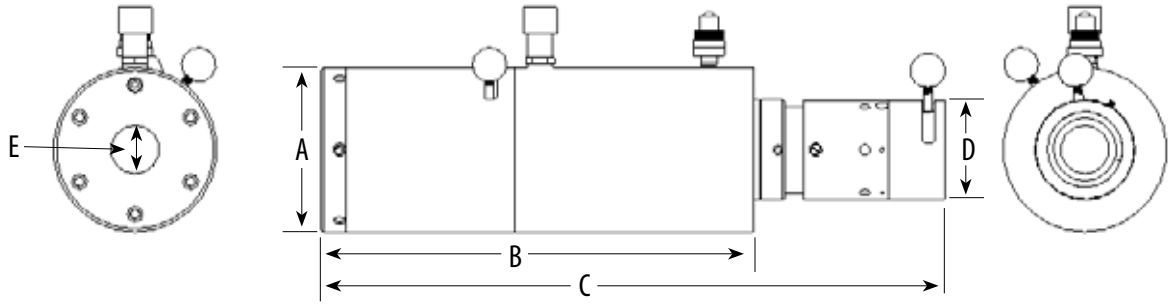
# ZipPULLER
# Subsea Hydraulic Flange Puller

## Technical Specifications




| Model | | A | B | C | D | E | Stroke | Weight | Pull Capacity |
|---|---|---|---|---|---|---|---|---|---|
| FP3006Z104 | Imperial | 4.75″ | 18.00″ | 25.00″ | 2.65″ | 1.30″ | 6.00″ | 65 Lb | 30 Ton |
| | Metric | 12.06 cm | 45.72 cm | 63.50 cm | 6.71 cm | 3.30 cm | 15.24 cm | 29.5 Kg | |
| FP6005Z114 | Imperial | 6.50″ | 17.25″ | 25.0″ | 4.00″ | 2.00″ | 5.00″ | 100 Lb | 60 Ton |
| | Metric | 16.51 cm | 43.81 cm | 63.50 cm | 10.16 cm | 5.08 cm | 12.7 cm | 45.3 Kg | |

## Power Units

ZipPULLER Subsea Flange Pullers can be operated with portable, hydraulic 10,000 psi power units.

FASTORQ® Air Model 205A or Electric Model 215E will provide an ideal combination of pressure and flow.

Standard equipment includes filter, regulator, lubricator, fittings and safety locks on quick disconnects, pressure gauge, remote controlled hoses and hydraulic hoses.

Air Model 205A

Electric Model 215E

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ALL POWER UNITS 1-YEAR WARRANTY

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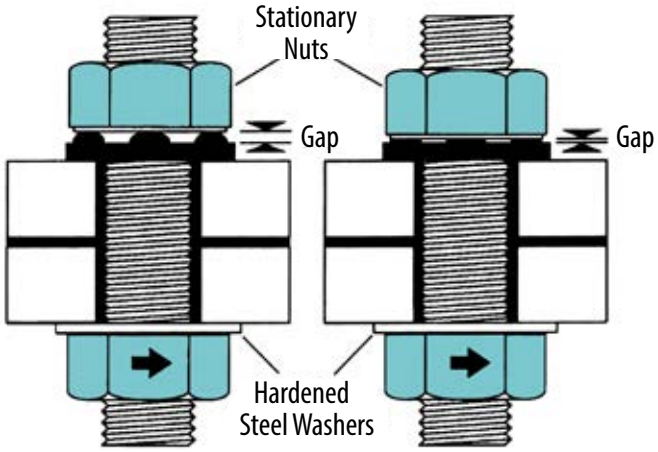
# DTI's

## Direct Tension Indicators




**Before Tensioning** **After Tensioning**

- **Patented bolt load measuring technology**
- **Eliminates fugitive emissions**
- **Verifies correct tension for secure joints**
- **Bolt load achieved regardless of bolt condition and torque applied**
- **Simple to install and inspect with standard tools, no special training**
- **Low cost alternative to ultrasonic measuring**

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# DTI's

## Correct Tension for Secure Joints

A bolted joint obtains its superior characteristics through proper clamping force on the gasket contact surfaces. The clamping force, or bolt load is caused by correctly tensioned bolts. If the bolts have not reached required tension, there is insufficient clamping force and the joint is not up to specification. If excessive clamping force is used, the bolt, gasket, and/or the flange may be damaged. In either case, a leak is the probable result. Therefore, it is imperative that the proper clamping force is achieved. Direct Tension Indicators provide the means to measure bolt tension (bolt load).

## Correct Tension for Secure Joints

- **Accuracy –** The bolt is tightened to a specified DTI gap which has been achieved directly by clamping force, or tension. This means you are measuring the actual outcome of your efforts instead of work input. Accuracy is not affected by bolt grip length.
- **Consistency –** Direct Tension Indicators are manufactured in small lots, and each lot is tested for consistency. A test report is kept and its lot number is marked on each DTI. In use, if the DTI's are compressed to the gap specified, each bolt is proved to be tensioned over the minimum, and under the maximum load.
- **Cost Savings –** Inspection is cost effective with Direct Tension Indicators because they are in use as long as the fastener is, do not required any special training to use or to inspect, and they help prevent rework.
- **Versatility –** The DTI can be used under the bolt head or at the nut end with a hardened washer, and it will take up to a 1:20 bevel (see figure 4).
- **Simplicity and Ease of Installation –** DTI's are easy to install with standard tools – proper clamping force is unmistakable.
- **Ease of Inspection –** The Direct Tension Indicator provides immediate visual proof that the bolt has been correctly tensioned. All you need is a feeler gauge.
- **Standardization –** Direct Tension Indicators are made to fit bolts manufactured to ASTM A193-B7 and B16, as well as equivalent metric sizes and specifications. DTI's can be manufactured and tested for use with customer specified bolt materials.

**Figure 1**

## *Direct Tension Indicators measure clamping forces (bolt load)*

*The Direct Tension Indicator (DTI) is a specially hardened washer with protrusions on one face (see figure 1). The DTI is placed under the bolt head or nut, and the protrusions create a gap. As the bolt is tensioned, the clamping force flattens the protrusions, reducing the gap (see figure 2).*

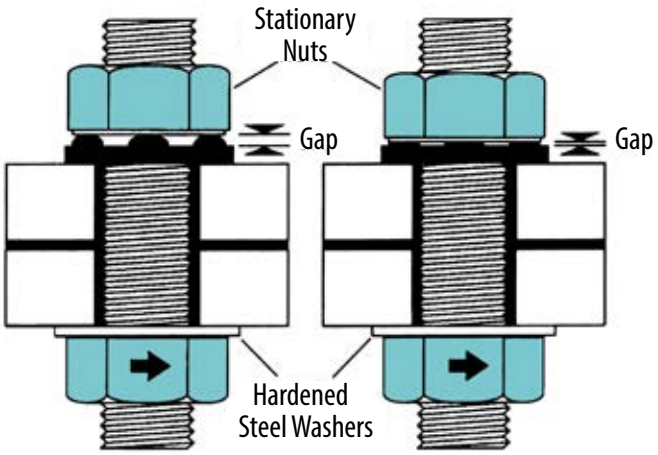


**Figure 2**

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# DTI's

## What Could be Simpler?

Correct bolt tension is evaluated by simply observing the remaining gap. A "no-go" feeler gauge is used to insure that minimum specified bolt tension is achieved. A "go" feeler gauge is used to insure that maximum specified bolt tension is not exceeded. DTI's stay on the job, providing permanent visual and measurable proof that the bolt is correctly tensioned to specification. Gap corresponds to bolt load verified by a test certificate traceable to NIST.

**Tests on four 1 1/4" diameter B7 Bolts**

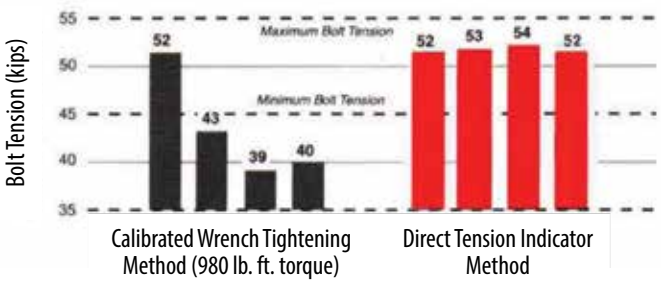



**Figure 3**

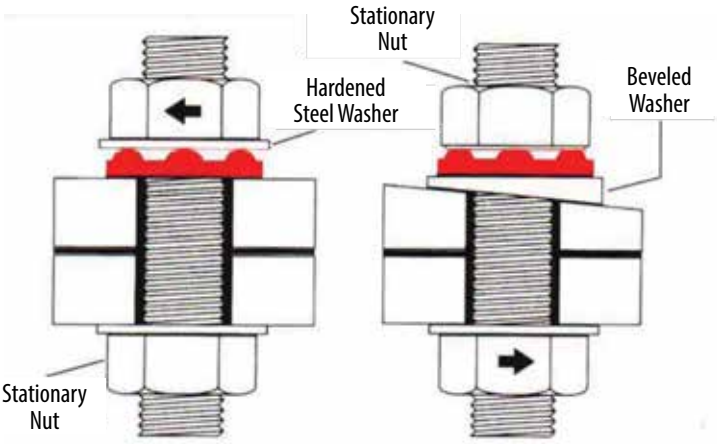
## For Example:

A 1 1/4" diameter B7 bolt loaded to 50% of minimum yield will have a clamping force (tension) of 52,500 pounds. A DTI for this 1 1/4" B7 bolt will have a remaining gap of .039" at 52,500 pounds of load. A "no-go" feeler gauge .039" thick will indicate 52,500 pounds load when it is refused at one half or more of the openings between protrusions. A "go" feeler gauge .002" thinner, or .037" thick, when it is accepted at one half or more of the openings, will indicate that excessive load has not been applied. A test certificate relating gap to bolt load is provided with each lot of DTI's manufactred. Test certificates are also available relating customer specified load to gap.

Figure 3 shows the variation in bolt load (tension) on four 1 1/4" bolts which were all torqed to 980 ft. lbs. without using Direct Tension Indicators. Four more 1 1/4" bolts from the same lot were tightened using DTI's to a .039" gap. The variation in bolt load using DTI's was far less. With uniform bolt load, your fastened joint is more reliable.

## DTI's provide precise measurement of clamping forces regardless of bolt condition.

Broadly defined, torque is the force, or work, required to tension a bolt. This is measured by calibrated wrenches. But the amount of work, or torque, required to properly tension bolts is significantly affected by the condition of the threads. As friction between nut and bolt threads increases, the amount of work required to install a bolt to a specific tension increases. The Direct Tension Indicators measure the resulting tension (bolt load). Input torque or procedures may change, but the bolt load indicated by the Direct Tension Indicators will be accurate.




*When the DTI is installed under the nut being turned, a hardened steel washer must be used betweeen the nut and the DTI.*

*DTI's can be used with bevel washers to accomodate over a 1:20 bevel.*

**Figure 4**

## DTI's measure bolt load achieved – regardless of bolt condition or torque applied.

Most installation problems in the field are caused by bolt conditions. *Corrosion and dirt* – bolts that have been exposed to atmospheric conditions and weather in the field require extra work to tighten to the specified tension because of corrosion and dirt that has accumulated in the bolt threads. Therefore the mechanic may need to use a wrench of greater torque capacity.

Another way of overcoming the extra work caused by thread corrosion and dirt is by using clean, lubricated nuts and bolts. For example, lubricants such as moly or nickel paste can reduce the coefficient of friction by as much as 50 percent.

Given a wrench of sufficient capacity, and fasteners that are clean and lubricated, the time taken to properly install the bolt should be greatly reduced.

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# DTI's
# Questions and Answers

| QUESTION | ANSWER |
|---|---|
| Will using DTI's change my torque or tension requirements? | **No.** Direct Tension Indicators measure bolt load, but do not change requirements. |
| If there are great temperature fluctuations in the joint: Will DTI's cause relaxation in the bolt load? | **No.** If the fasteners are tensioned according to specification, temperature creep may still occur but DTI's neither increase or decrease it. |
| If the stud/bolt is over-tensioned can I back the nut off and use the same DTI again? | **No.** Once the protrusions on the DTI's are compressed past the designated amount, a new DTI must be used. |
| If enough clamping force has not been achieved when the gap is measured, do we need to start from the beginning again? | **No.** If the "no-go" gauge still fits in the gap, simply create more tension (and therefore more clamping force) until the "no-go" gauge does not fit but the "go" gauge still does fit. |
| Is it possible for my company to get a demonstration of the Direct Tension Indicators? | **Yes.** We are happy to provide additional information and demonstrations. We even have a video on DTI's. |
| Has there been any testing to confirm the information on DTI's? | **Yes.** Please refer to the technical reports section of this brochure. Then call (800) 231-1075 or (281) 449-6466 for any reports you would like to receive. |

## FACTS:

**Torquing** a stud or bolt creates tension
**Tension** in the stud/bolt creates clamping force on the joint
**Clamping** force (also referred to as bolt load) on the joint, in the correct amounts, holds the gasket properly and creates a secure critical joint.

## Stress relaxation and fatigue

Stress relaxation tests conducted over long periods on cold worked steel show that no measurable cold creep is experienced at temperatures below 302°F (150°C). This is confirmed by tests on Direct Tension Indicators which, after bolting up to indicated load at ambient temperature, show no relaxation in bolt tension after 2,700,000 cycles. The load tests conducted were from 0 to 0.6 times proof load on bolts tightened to proof load with DTI's.

## Technical reports

The Direct Tension Indicator has been thoroughly tested. A comprehensive study entitled "Bolt Tension Control with a Direct Tension Indicator", was conducted in August 1972 by J.H.A. Stuick, A.O. Oyeledun, and J.W. Fisher of the Fritz Engineering Laboratory, Lehigh University, Bethlehem Pennsylvania. The description and results of this and other tests are available in the following series of technical reports and may be obtained on request.

- #23 Corrosion-Exposed Structures
- #24 Unloading and Reloading
- #25 Stress Relaxation
- #26 Fatigue
- #29 A490 Tightening
- #30 Time Trials of Tightening Methods

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# DTI's Technical Report #23

## Accelerated corrosion tests on high strength bolts & 'Coronet' Load Indicators

### Introduction

A feature of the 'Coronet' Load Indicator, as describes in Leaflet 61/1A, is the gap left between the underside of the bolt head and the face of the Indicator to permit the insertion of a feeler gage. The correct bolt tension is produced when the gap is reduced to an average of 1.015" in exposed positions there appeared to be a possibility that moisture would enter through the gap and corrode the bolt and plates.

An independent Laboratory undertook to investigate the susceptibility of the assembly to corrosion.

### Preparation

A number of specimens were prepared, each comprising two Mild Steel plates 6" x 6" x ¾" thick, shot blasted and drilled with four 15/16" holes for 7/8" bolts with centers 1-1/2" from each edge. The plates were clamped together with 7/8" black High Strength Bolts using the following bolt and washer assemblies:

(a) Pairs 1 and 2. Plain hardened washer under the bolt heads and tightened to 480 ft-lbs. On a torque wrench.

(b) Pairs 4 and 5.'Coronet' Load Indicators and tightened to give an average gap of 0.015"

(c) Pair 6. 'Coronet' Load Indicators and tightened to give an average gap of .015".

The edges of the plates were then sealed with waterproof Denso tape to prevent moisture entering between them, and in order to observe the effect of painting, some specimens were given different treatment on each quarter:

| | |
|---|---|
| 1st quarter | No paint. |
| 2nd quarter | 1 coat Red Lead. |
| 3rd quarter | 2 coats Red Lead. |
| 4th quarter | 2 coats Red Lead. 2 coats Micaseous Iron Oxide. |

### Test procedure

The specimens were exposed for 2 months in an atmosphere of 100% humidity at 40° - 45°C. into which for 5 days a week sulphur dioxide was introduced for one hour, to simulate industrial atmospheres. For a further 7 months, the specimens were left in an enclosed space, high humidity being maintained by the presence of an open topped water reservoir. Temperature and humidity were allowed to fluctuate according to prevailing climatic conditions.

This treatment may be expected to reproduce the effects of a 20 year exposure under normal service conditions.

On completion of the test, the plates were dismantled and the condition of each bolt and thread within the joint carefully observed.

### Results

Light rusting was apparent on specimens assembled with 'Coronet' Load Indicators without painting, and on those with only one coat of Red Lead. Specimens with two coats of Red Lead or the full paint treatment showed no sign of corrosion.

### Conclusion

The normal thickness of paint film applied to structural steelwork is sufficient to seal the 0.015" gap of a 'Coronet' Load Indicator and prevent corrosion of the bolt.



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# DTI's Technical Report #24

## Coronet Load Indicators – load/gap relationship on unloading and loading

### Introduction

When tightening a group of bolts in a joint, the tightening of the later bolts may cause flexure of the plies with consequent relaxation of tension in the bolts initially tightened. It is customary to minimize this effect by tightening in a pattern from the center of the joint outwards and if necessary, repeating the sequence to obtain even tension in all bolts. These tests investigate whether load relaxation in a high strength bolt results in a measurable increase in Load Indicator gap.

### Summary

It was found that Coronet Load Indicators would show loss of load by a gap increased from the original full load measurement. Re-tightening until the gap was slightly less than the original full load measurement restored the tension.

### Procedure

A 7/8" diameter A325 High Strength Bolt was fitted with Coronet Load indicator under the head and tightened in a Norbar load meter to an average indicator gap of 0.015" then untightened at approximately 4-1/2" kip steps, average gap noted, and finally re-tightened back to the original load.

The test was repeated on two further bolts.



### Results

| Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|
| Load Kips | Gap Inches | Load Kips | Gap Inches | Load Kips | Gap Inches |
| Down | | Down | | Down | |
| 37.4 | 0.015 | 39.6 | 0.015 | 38.0 | 0.015 |
| 34.2 | 0.0152 | 35.2 | 0.0154 | 25.8 | 0.016 |
| 28.7 | 0.0154 | 29.4 | 0.0158 | 21.3 | 0.016 |
| 24.2 | 0.0158 | 25.6 | 0.0162 | 15.7 | 0.0168 |
| 18.8 | 0.0164 | 21.1 | 0.0166 | 11.2 | 0.0176 |
| 14.4 | 0.0166 | 16.4 | 0.017 | 5.2 | 0.0188 |
| 5.8 | 0.0184 | 12.1 | 0.0174 | | |
| | | 2.5 | 0.0194 | | |
| Up | | Up | | Up | |
| 36.8 | 0.0148 | 37.4 | 0.015 | 34.8 | 0.015 |
| 37.7 | 0.0144 | 40.0 | 0.014 | 37.8 | 0.0136 |

N.B.—The Coronet Load indicators used in these tests were calibrated to give a minimum bolt tension of 36.05 kips at 0·015" average gap. ASTM A325 has since increased the required tension to 39.25 kips. Coronet Load Indicators have been modified accordingly.

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# DTI's Technical Report #25

## Stress relaxation test on high strength bolt and Coronet Load Indicator

### Introduction

The design of a high strength bolted joint depends on the maintenance of static tension in the bolts throughout their working life. The test examines relaxation over a number of years.

### Summary

Over a period of eight years there was no measurable loss of tension.

### Procedure

A 7/8" diameter bolt was tightened in a simulated joint with a Coronet Load Indicator under the bolt head and a flat round washer under the nut. Measurements of overall bolt length and Indicator gap were taken at intervals.

### Observations

The slight variations which have occurred throughout these tests will be seen to go up and down and are considered to be due to ambient temperature variation.



### Results Bolt length before tightening – 3.983"

| Date Readings Taken | Duration Hrs. | Length After Bolting | Load Indicator Gap at Each Measuring Point | | | | Average Gap | Bolt Extension |
|---|---|---|---|---|---|---|---|---|
| 7/26/63 | Nil | 3.9920" | .013" | .015" | .016" | .016" | .015" | .0090" |
| 8/16/63 | (500) | 3.9920" | .013" | .013" | .015" | .016" | .0142" | .0090" |
| 11/29/63 | (3000) | 3.9918" | .016" | .016" | .014" | .013" | .0147" | .0088" |
| 9/15/66 | (10000) | 3.9920" | .016" | .016" | .014" | .014" | .015" | .0090" |
| 11/5/66 | (20000) | 3.9923" | .016" | .016" | .014" | .013" | .014" | .0093" |
| 12/29/66 | (30000) | 3.9922" | .015" | .014" | .016" | .013" | .014" | .0090" |
| 6/8/71 | (8 years) | 3.9923" | .016" | .016" | .014" | .013" | .014" | .0093" |

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# DTI's Technical Report #26

## Fatigue test on high strength bolts and 'Coronet' Load Indicators

### Introduction

It was desired to investigate the effect of vibration and axail load reversals on High Strength Bolts tightened to proof load using "Coronet" Load Indicators to register axail tension. ASTM A325 ¼" diameter Bolts were used, together with the appropriate Load Indicators. The "Specification for Structural Joints using ASTM A325 or A490 bolts" limits the applied tension in A325 bolts to 36,000 p.s.i. and 40,000 p.s.i. for bridges and buildings respectively. The maximum applied load of 17 kips used in this test gives stress of 39,000 p.s.i. which is in excess of the 36,000 p.s.i. limit for bridges where fatigue conditions are involved.

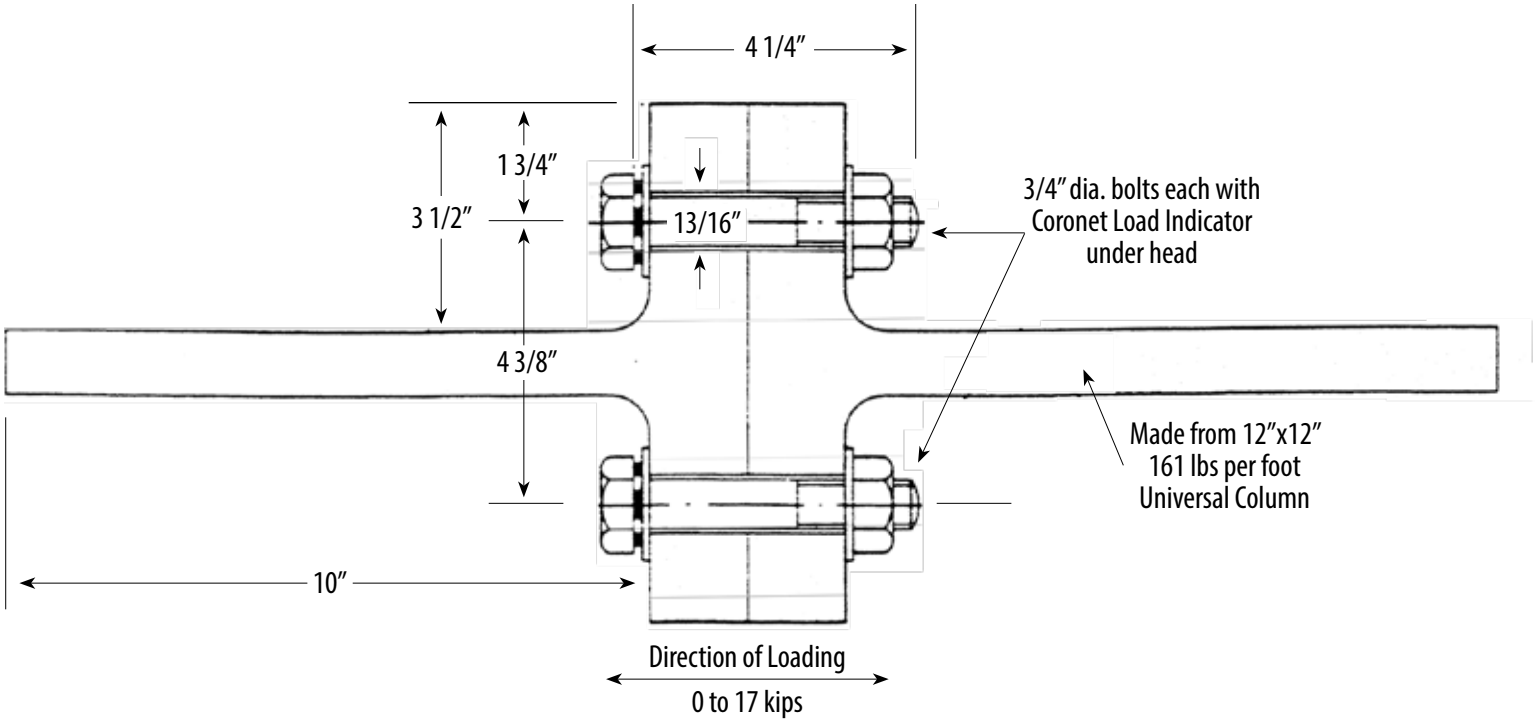
### Summary

The assembly was subjected to 2,718,600 stress cycles between 0 and 0.6 x proof load without fracture. No change of bolt length was recorded.

### Procedure

The test specimen comprised of two tee sections as shown in the diagram which were assembled with two ¾" diameter High Strength Bolts and 'Coronet' Load Indicators. The bolts were tightened until the average Indicator gap was 0.015" which corresponds to the proof load of 28.4 kips. The assembly was set up in a Losenhauser-U.H.S. 60 fatigue testing machine at the Laboratories of the British Welding Research Association at Abingdon Hall, Cambridge, England. Measurements of Indicator gaps and bolt lengths were taken at intervals during the test.






**Fatigue Test Assembly**

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# DTI's Technical Report #26 Cont.

## Fatigue test on high strength bolts and 'Coronet' Load Indicators

**Results** Test load 0 to 17 kips

| Cycles | Bolt #1 | | | | | | Bolt #2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Bolt Length Inches | | | | | | Bolt Length Inches |
| | | | | | Before Tightening: | 4.733 | | | | | Before Tightening: | 4.728 |
| | | | | | After Tightening: | 4.741 | | | | | After Tightening: | 4.738 |
| | Load Indicator Gaps – Inches | | | | | | Load Indicator Gaps – Inches | | | | | |
| | 1 | 2 | 3 | 4 | Avg. | | 1 | 2 | 3 | 4 | Avg. | |
| 0 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 55500 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 698200 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 1253600 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 1887500 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 2381900 | .009 | .017 | .020 | .012 | .0145 | 4.741 | .022 | .010 | .006 | .019 | .0142 | 4.735 |
| 2718600 | .010 | .018 | .020 | .012 | .015 | 4.741 | .022 | .010 | .007 | .020 | .0147 | 4.735 |

**Bolt Extension Inches**
**Before Test: .008**
**After Test: .008**

**Bolt Extension Inches**
**Before Test: .007**
**After Test: .007**

**Cycles endured – 2,718,6000**
**No fractures observed.**

## Discussion of Results

There is a small increase of 0.0005" in the average Indicator gap on both bolts at 2,718,600 cycles. However it is too small to effect any measurable change in the bolt lengths and is likely to be due to some very slight seating.

The test shows that High Strength Bolts with 'Coronet' Load Indicators will safely withstand the maximum designed fatigue loading permitted by "The Specification for Structural Joints using ASTM A325 or A490 bolts."



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# DTI's Technical Report #27

## Independent Laboratory Tests on 'Coronet' Load Indicators and High Strength Bolts.

Messrs. Sandberg, the consulting inspecting and testing engineers of 40, Grosvenor Gardens, London, S.W.1., carried out a series of tests on 'Coronet' Load Indicators and High Strength Bolts. The tests were supervised by Mr. G.K. Wood, M.I. Mech.E., M.T. Loco. E. of Messrs. Sandberg, whose report as follow:

## Introduction

The bolts, nuts and load indicator washers were selected at random from the warehouse of Cooper & Turner Ltd.., by our inspector and were submitted to us in sealed bags. It was requested that a series of loading tests be carried out on the load indicator washers and also a series of mechanical tests be carried out on the bolts.

The following materials were available:
27--3-3/4" long x 7/8" dia. Bolts with nuts representative of 4000 identical sized bolts. 3--5-1/2" long x 7/8" dia. Bolts with nuts representative of 2000 identical sized bolts. 54-load indicators for 7/8" dia. bolts representative of 7000 identical sized indicators. The twenty-seven bolts had been divided into three lots with three tests per lo tobe carried out. The fifty-four load indicator washers had been divided into three lots with a series of three test to be carried out on each lot. Thus six washers were available for each test with only the first one to be tested. However, if this one washer failed, the remaining five were to be tested.

## Load Indicator Test Method of Testing

A North Bar Load Meter No. 2, supplied by Cooper & Turner Ltd., was used for the load test measurements. This was calibrated prior to and after testing, against our Universal Tensile Testing Machine (Grade A) and the readings obtained are tabulated below:

The method of testing was to place a bolt, fitted with a load indicator washer, through the Load Meter and to tighten a nut on the other side by means of a ratchet wrench. The gap between the washer and the underside of the bolt head was measured at the four positions by means of feeler gauges until an estimated average gap of 0.015" was reached. The Load Meter readings were taken and recorded against the gap between the load washer and the bolt head. In some cases the load was increased until the gap was reduced to nil.

## Explanatory Notes

The hysteresis effect of the calibration of the Load Meter "Prior to Test" is caused by the sluggish operation of the hydraulic system after standing idle. This is largely mitigated by thorough exercising of the instrument before use, and is confined by the calibration figures taken:"After Test", which show an almost negotiable hysteresis effect, and confirm the degree of accuracy of the instrument. It will be noted that even after allowing for maximum hysteresis, all interpolated test loads fall within the specified load range for each Load Indicator.



## North Bar Load Meter No. 2

| Universal Tensile Machine (Load in Kips) | Prior to Test Ascending Load – Decending Load | | After Test Ascending Load – Decending Load | |
|---|---|---|---|---|
| | (in Kips) | (in Kips) | (in Kips) | (in Kips) |
| 11.2 | 10.3 | 11.9 | 10.07 | 11.04 |
| 22.4 | 21.2 | 23.6 | 22.0 | 22.06 |
| 33.6 | 32.0 | 35.3 | 33.2 | 34.0 |
| 44.8 | 42.8 | 46.6 | 44.5 | 45.1 |
| 56.0 | 53.8 | | 55.5 | |

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# DTI's Technical Report #27 Cont.

## Results 'Coronet' Load Indicators

Since these test were carried out, ASTM A325 had revised the minimum tension for 7/8" from 36.05 kips to 39.25 kips. 'Coronet' Load Indicators have been modified accordingly.

### LOT NO. 1

| Test # | Load Meter Reading | GAP | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Average |
| 1 | 37.0 kips | 0.015" | 0.017" | 0.017" | 0.012" | 0.01525" |
| | 38.2 kips | 0.015" | 0.018" | 0.015" | 0.010" | 0.0145" |
| Interpolated load for gap of 0.015" = 37.6 kips | | | | | | |
| 2 | 39.2 kips | 0.013" | 0.017" | 0.019" | 0.017" | 0.0165" |
| | 40.6 kips | 0.010" | 0.013" | 0.016" | 0.015" | 0.0135" |
| Interpolated load for gap of 0.015" = 39.5 kips | | | | | | |
| 3 | 39.2 kips | 0.017" | 0.014" | 0.015" | 0.018" | 0.016" |
| | 40.0 kips | 0.016" | 0.012" | 0.013" | 0.017" | 0.0145" |
| Interpolated load for gap of 0.015" = 39.6 kips | | | | | | |
| Nil gap 52.4 kips | | | | | | |

### LOT NO. 2

| Test # | Load Meter Reading | GAP | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Average |
| 1 | 39.0 kips | 0.018" | 0.011" | 0.010" | 0.018" | 0.0125" |
| Nil gap 50.3 kips | | | | | | |
| 2 | 36.1 kips | 0.015" | 0.019" | 0.023" | 0.018" | 0.01875" |
| | 38.4 kips | 0.010" | 0.016" | 0.018" | 0.012" | 0.014" |
| Interpolated load 0.015" gap = 39.4 kips | | | | | | |
| 3 | 39.1 kips | 0.017" | 0.017" | 0.015" | 0.015" | 0.016" |
| | 39.5 kips | 0.016" | 0.016" | 0.014" | 0.014" | 0.015" |
| Load at 0.015" gap = 39.4 kips | | | | | | |

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# DTI's Technical Report #27 Cont.

## Results 'Coronet' Load Indicators

Since these test were carried out, ASTM A325 had revised the minimum tension for 7/8" from 36.05 kips to 39.25 kips. 'Coronet' Load Indicators have been modified accordingly.

### LOT NO. 3

| Test # | Load Meter Reading | GAP | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Average |
| 1 | 38.0 kips | 0.017" | 0.017" | 0.012" | 0.017" | 0.0145" |
| 2 | 39.4 kips | 0.016" | 0.015" | 0.015" | 0.015" | 0.01525" |
| | 40.0 kips | 0.016" | 0.014" | 0.015" | 0.015" | 0.015" |
| Load Indicator 0.015" gap = 40.0 kips | | | | | | |
| 3 | 38.6 kips | 0.014" | 0.016" | 0.018" | 0.016" | 0.016" |
| | 39.4 kips | 0.011" | 0.015" | 0.016" | 0.014" | 0.014" |
| Interpolated load for gap of 0.015" = 39.0 kips | | | | | | |

**Bolt Tests** Proof load and ultimate load test were carried out on six bolts. The results obtained are tabulated below:

| | Proof Load | Initial Length of Bolt | Length of Bolt After Test |
|---|---|---|---|
| **Bolt #1** | 36.0 kips | 5.843" | 5.843" |
| **Bolt #2** | 36.0 kips | 5.845" | 5.845" |
| **Bolt #3** | 36.0 kips | 5.840" | 5.840" |

| | Ultimate Load | Position of Failure | |
|---|---|---|---|
| **Bolt #4** | 67.0 kips | Failed in Threads | |
| **Bolt #5** | 67.5 kips | Failed in Threads | |
| **Bolt #6** | 68.4 kips | Failed in Threads | |
| **B.S.3139** | 53.1 kips | | |

Elongation and reduction of area tests were carried out on three of the bolts.
The three specimens were prepared and tested in accordance with standard procedures.

| | Elongation (percent) | Reduction of Area (percent) | |
|---|---|---|---|
| **Specimen # 1** | 19.0 | 49.5 | |
| **Specimen # 2** | 17.8 | 51.8 | |
| **Specimen # 3** | 19.3 | 46.8 | |
| **A325** | 14 min. | 35 min. | |

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# DTI's Technical Report #28

## 'Coronet' Load Indicator tests on out of parallel faces.

### Introduction

The Specification for Structural Joints Using A325 or A490 Bolts allow a surface slope of 1 :20. This test examines the effect of taper on the 'Coronet' Load Indicator when fitted under the head.

### Summary

The permitted flange taper does not affect the performance of the 'Coronet' Load Indicator, which registers the required minimum bolt tension at an average gap of 0.015".

### Procedure

A 7/8" diameter A325 bolt was assembled with a load indicator and a 2! bevel washer under the head to simulate the out-of –parallel condition. The assembly was tightened in a Norbar Load Meter until an average indicator gap of 0.015" was reached, and the load read.

The test was repeated for five additional bolts.

| Test # | Load Indicator Gaps Thousandths of an Inch | Average Gap Inches | Bolt Load Kips |
|---|---|---|---|
| **1** | 3, 7, 17, 27, 22 | 0.0152 | 38.4 |
| **2** | 3, 6, 16, 29, 21 | 0.0150 | 37.6 |
| **3** | 5, 5, 12, 28, 25 | 0.0150 | 37.4 |
| **4** | 4, 7, 24, 20, 18 | 0.0146 | 38.1 |
| **5** | 10, 9, 25, 25, 6 | 0.0150 | 37.6 |
| **6** | 15, 25, 29, 6, 2 | 0.0154 | 37.4 |

Required minimum bolt tension 36 kips.*out on three of the bolts.

### Discussion of Results

In practice, it has been found that the protrusions of the Load Indicator rarely close down equally around the Indicator circumference under applied load. Even with flat surfaces there is likely to be some lack of alignment due to rolling tolerances and the practical difficulty of drilling the hole exactly normal to the surface, The tests show that the 'Coronet' Load Indicator is able to accommodate these variations in alignment and at an average gap of 0.015", the minimum bolt tension will be achieved.

*Since these tests were carried out, A325 has revised the minimum bolt tension from 36 to 39.25 kips. 'Coronet' Load indicators have been modified accordingly.



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# DTI's Technical Report #29

## Tests on the tightening of A490 bolts.

## Introduction

The tests investigate the Turn-of-Nut and 'Coronet' Load indicator methods of tightening A490 bolts and compare the resulting tensions with the required minimum bolt tensions. Tightening was continued and note taken of the further rotation of the nut to produce bolt failure.

## Summary

The 'Coronet' Load Indicator provides a more accurate register of A490 bolt tension than the Turn-of- Nut Method and leaves adequate safety margin between load at specified gap and ultimate.

## Procedure

Twelve 3-3/4" x 7/8" A490 bolts were machined on the head and shank end to permit accurate measurement of overall length.

Specification requirements are:
Min. Bolt Tension 51.7 kips
Min. Ultimate Load 69.3 kips

Sample details:
Bolt Lot No. 7117/1
C.L.I. Lot No. 8004/5

## (i) Turn-of-Nut Method

A bolt was set up in a solid steel bar rigidly fixed to a column. The assembly included flat round washers under the head and nut such that there was ¼" of thread protruding from the nut. The overall length was measured and preliminary tightening carried out with spud wrench and a mark made across the nut and bolt shank end. The nut was then tightened half a turn relative to the bolt, and the overall length again measured.

The bolt was transferred to a load meter and tightened until the overall length recorded was the same as had been shown under a half turn in the solid steel bar. This method eliminated any inaccuracy that might have been introduced by the compression of the load meter capsule. The load meter reading was recorded.

To avoid damage to the load meter, the bolt was returned to the solid bar to continue the test to failure. After tightening to the loaded length previously obtained after half a turn, the further rotation of the nut to breaking point was observed.

The test was repeated on an additional five bolts.

## Turn-of-Nut Method Results

| Sample | Initial Length Inches | Length Under 1/4" turn Inches | Extension Inches | Load Meter Reading Kips | Further turn of nut to Failure |
|---|---|---|---|---|---|
| 1 | 4.283 | 4.323 | .040 | 61.6 | ¾ |
| 2 | 4.260 | 4.294 | .034 | 65.0 | ½ |
| 3 | 4.289 | 4.323 | .034 | 66.4 | ½ |
| 4 | 4.264 | 4.309 | .045 | 68.4 | ½ |
| 5 | 4.277 | 4.311 | .034 | 66.0 | ½ |
| 6 | 4.281 | 4.322 | .041 | 62.8 | ½ |



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# DTI's Technical Report #29 Cont.

## Tests on the tightening of A490 bolts.

### (ii) 'Coronet' Load Indicator Method

A bolt was set up in the load meter with a Load Indicator under the head in place of a flat round washer and 3/16" of bolt protruding from the nut. The initial length was recorded and the bolt tightened until a 0.015" average gap was measured (See Cooper & Turner Leaflet 61/1A for measuring procedure) Note was taken of the load meter reading. After unloading, the overall length was checked to confirm that the 0.2% proof stress had not been exceeded. The bolt was then transferred to the solid bar and tightened with a fresh load indicator under the head to the 0.015" average gap condition. Nut and bolt ends were marked and the further rotation of the nut to failure noted.

The test was repeated on an additional five bolts.

### 'Coronet' Load Indicator Method Results

| Sample | Initial Length Inches | C.L.I. Average Gap x 1000 Inches | Load Meter Reading Kips | Length after Unloading Inches | Extension Inches |
|---|---|---|---|---|---|
| **7** | 4.3514 | 15.5 | 15.0 | 4.3525 | 0.0011 |
| **8** | 4.3400 | 15.0 | 57.4 | 4.3430 | 0.0030 |
| **9** | 4.3235 | 15.5 | 58.8 | 4.3240 | 0.0005 |
| **10** | 4.3535 | 15.5 | 57.5 | 4.3545 | 0.0010 |
| **11** | 4.3590 | 15.5 | 58.3 | 4.3595 | 0.0005 |
| **12** | 4.3470 | 15.5 | 56.0 | 4.3475 | 0.0005 |

### Reloading

| Sample | C.L.I. Average Gap x 1000 Inches | Turns to obtain Average Gap* | Further turns to Failure |
|---|---|---|---|
| **7** | 15.0 | ¾ | 1-1/4 |
| **8** | 15.2 | ¾ | 1-1/4 |
| **9** | 12.7 | ¾ | 1 |
| **10** | 15.1 | ¾ | 2 |
| **11** | 14.1 | ¾ | 1 |
| **12** | 12.5 | ¾ | 1-1/4 |

*This rotation of nut also includes the amount required to compress the C.L.I. protrusions.

### Discussion of results

It has been shown that the Turn-of-Nut method on A490 bolts produces bolt tensions close to the minimum ultimate load.

The 'Coronet' Load Indicator can be depended upon to give a consistently safe proper tension in A490 bolts.



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# DTI's Technical Report #30

## Comparison of tightening methods for high strength bolts.

W.S. Atkins & Partners, Consulting engineers P.A. Management Consultants Ltd. (Product Research and Development department)

## Introduction

Customer response suggested that many users of high strength bolting systems believe that there is a time-saving factor in the use of Coronet Load Indicators.

Cooper & Turner decided to establish whether this had any validity and this reports sets down the method and results of a series of controlled tests carried out with the co-operation of the British Steel Corporation during August, 1970. The time study was undertaken by P.A. Management Consultants Ltd., Product Research & Development Department, and the tests were supervised by W.S. Atkins & Partners, Consulting Engineers.

## Summary

Three basic systems of bolting were compared: (1) The torque or calibrated wrench method:

(2) The Turn-of-Nut method: (3) The Coronet Load Indicator method.

Timings were made of each step. A minimum time saving of 13% was shown by the Coronet Load Indicator method compared with the other two systems. This savings was increased to 33% with the omission of initial spud wrench tightening.

## Procedure

A test piece as shown in Fig. 1 was prepared, into which could be inserted 72 – ¼" dia. Bolts through 13/16" dia. holes. The plate was divided into three equal areas of 24 holes and all three systems were used during any one particular sequence. For each sequence the separate elements of preliminary tightening, final tightening and checking were completed for all the systems before passing on to the next element. In order to minimize the effects of operator fatigue or familiarity, which might slow down or quicken the tightening times, the positions of each group were cycled and tightening was always carried out starting from the same side and proceeding in the same order.

The tightening technique for each system was as follows:

## 1) Torque or Calibrated Wrench method

(a) All bolts were inserted by hand and nuts snugged with a spud wrench.

(b) The pneumatic impact wrench was calibrated by use of a load cell to cut out when a bolt tension 10% higher than the minimum specified was achieved.

(c) The bolts were tightened with the calibrated impact wrench.

(d) A normal torque wrench was calibrated in the load cell to indicate a torque 5% above that necessary to obtain the minimum tension.

(e) The manual torque wrench was used for inspection testing of the tightened bolts.

## 2) Turn-of-Nut Method

(a) All bolts were inserted by hand and nuts snugged with a spud wrench.

(b) The nuts were checked for adequate preliminary tightening and the necessary mark made on the nut and protruding thread with a chisel.

(c) The bolts were tightened to half turn of the nut using the pneumatic impact wrench.

(d) The marks were visually inspected to ensure the required rotation of the nut.

## 3) Coronet Load Indicator method

(a) The Coronet Load Indicators were placed under the heads of the bolts and the bolts were inserted by hand. Nuts were then snugged with a spud wrench.

(b) The bolts were tightened to the required 0.015" average Indicator gap using the pneumatic impact wrench.

(c) The gap was checked.

The tests were repeated five times and the results are shown in appendix 1. Tests 1 to 3 follow precisely the methods described above. In practice there will be occasions where the plies are sufficiently well drawn together by fitting-up bolts to make preliminary tightening with a spud wrench unnecessary in the torque control and Coronet Load Indicator methods: tests 4 and 5 were therefore carried out with the spud wrench tightening eliminated from these methods. An impact wrench was used for the Turn-of-Nut initial tightening.

# DTI's Technical Report #30 Cont.

## Comparison of tightening methods for high strength bolts.

### Results

Average results for each test series were as follows: Key: **T** – torque (calibrated wrench) **N** – turn-of-nut **C** – Coronet (Time is in minutes per 24 bolts)

| | Tests 1–3 | | | Tests 4–5 | | |
|---|---|---|---|---|---|---|
| | T | N | C | T | N | C |
| **Hand place & hand tighten** | 6.25 | 6.70 | 6.52 | – | – | – |
| **Hand place only** | – | – | – | 3.56 | 3.58 | 4.86 |
| **Spud tighten** | 2.39 | 3.02 | 3.22 | – | 5.37 | – |
| **Final tighten** | 6.75 | 6.52 | 5.32 | 13.49 | 5.14 | 3.99 |
| **Inspect** | 9.17 | 2.24 | 1.22 | 8.11 | 1.69 | 1.65 |
| **Total** | 25.10 | 18.78 | 16.28 | 25.26 | 15.78 | 10.50 |

It will be appreciated that the testing was carried out in ideal shop conditions and these figures may not be achievable on site. However, the comparison of the results will in no way be affected by this consideration. It will be seen that the Coronet Load indicator method was the quickest of the three methods, both with or without initial spud wrench tightening, the comparison being:

### Time saved by Coronet Load Indicator:

| Compared with | Tests 1 – 3 | Tests 4 – 5 |
|---|---|---|
| **Turn-of-Nut** | 13% | 33% |
| **Torque Control** | 35% | 58% |

### Appendix 1 –Individual test results

Key: **T** – torque (calibrated wrench) **N** – turn-of-nut **C** – Coronet

| TEST # | Place Bolts by Hand | | | Spud Tighten | | | Final Tighten | | | Inspect | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | N | C | T | N | C | T | N | C | T | N | C |
| **1** | 7.31 | 8.01 | 7.66 | 2.93 | 3.64 | 3.93 | 8.19 | 7.81 | 5.18 | 6.82 | 3.07 | 1.28 |
| **2** | 5.87 | 6.69 | 6.28 | 2.23 | 2.56 | 2.56 | 6.90 | 6.07 | 5.67 | 9.47 | 2.27 | 1.44 |
| **3** | 5.69 | 6.23 | 5.60 | 2.03 | 2.88 | 3.19 | 5.02 | 5.70 | 5.11 | 12.73 | 1.39 | .93 |
| **Average** | 6.25 | 6.70 | 6.52 | 2.39 | 3.02 | 3.19 | 6.75 | 6.52 | 5.32 | 9.17 | 2.24 | 1.22 |
| **4** | 3.79 | 3.14 | 5.17 | – | 4.63 | – | 12.00 | 5.08 | 4.46 | 9.39 | 1.59 | .96 |
| **5** | 3.32 | 4.01 | 4.54 | – | 6.10 | – | 14.98 | 5.20 | 3.52 | 6.83 | 1.80 | 2.34 |
| **Average** | 3.56 | 3.58 | 4.86 | – | 5.36 | – | 13.49 | 5.14 | 3.99 | 8.11 | 1.69 | 1.65 |

| TEST # | TOTAL TIME (Times are minutes per 24 Bolts) | | |
|---|---|---|---|
| | T | N | C |
| **1** | 25.25 | 22.53 | 18.05 |
| **2** | 24.47 | 17.59 | 15.95 |
| **3** | 25.47 | 16.20 | 14.83 |
| **Average** | 25.10 | 18.78 | 16.28 |
| **4** | 25.18 | 14.44 | 10.59 |
| **5** | 25.13 | 17.11 | 10.40 |
| **Average** | 25.26 | 15.78 | 10.50 |



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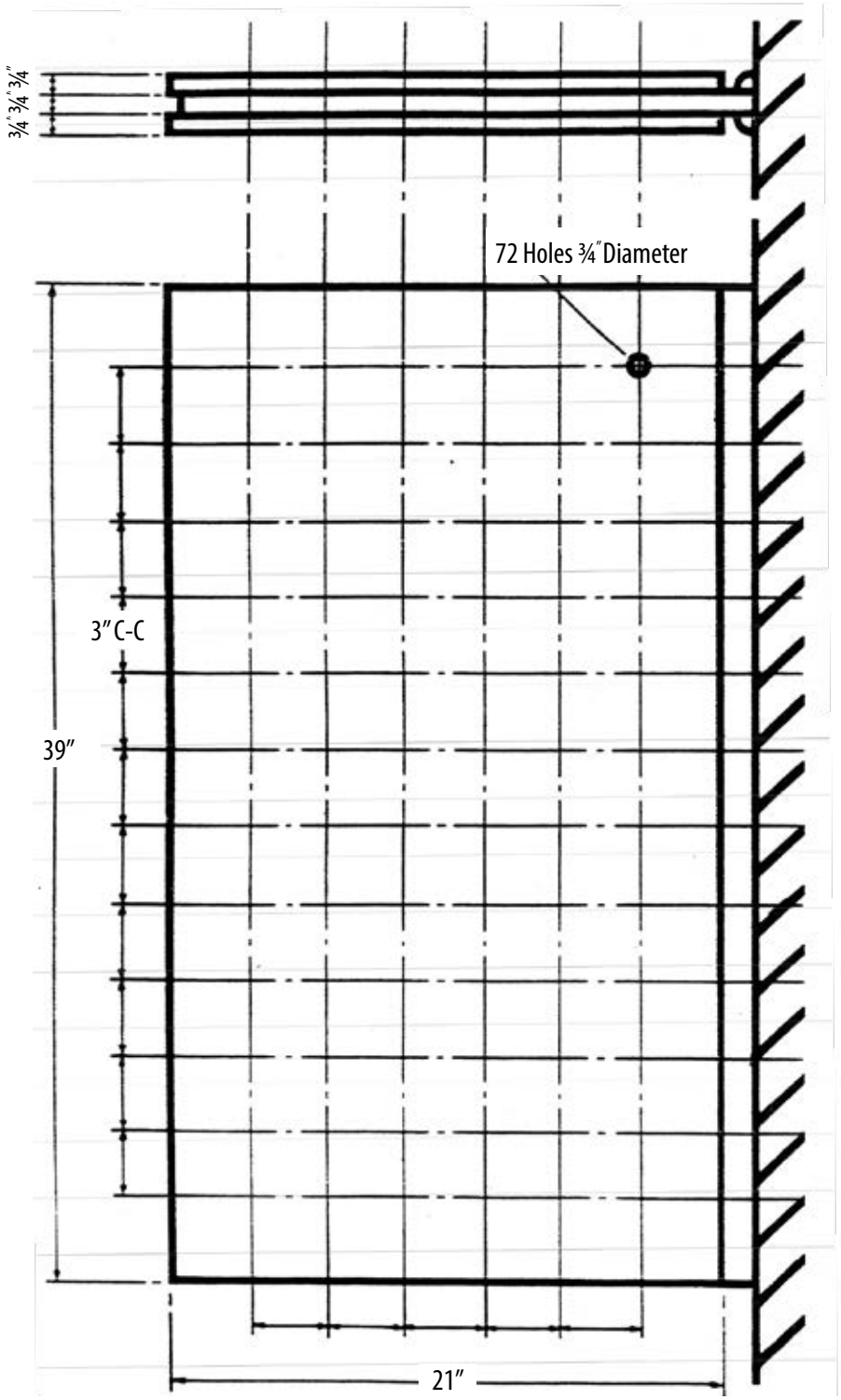
# DTI's
# Technical Report #30 Cont.

## Comparison of tightening methods for high strength bolts.

Fig. 1
Test Piece

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# FastLUBE
# Bolting Lubricants


- **Anti-Galling**
- **Reduced Friction**
- **Rust & Corrosion Prevention**
- **High Pressure Applications**
- **High Temperature Stability**
- **Thread Sealant**

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# FastLUBE
# Designed to Make Bolting Better

## FastLUBE AG
### Stops Galling – Great Sealant
Superior lubricant for eliminating galling on stainless steel threaded connections and achieving metal-to-metal seal. AG lowers torque requirements, reduces friction under pressure and is equally effective on other gall-susceptible materials, ferrous alloys, and more common types of carbon steel. AG contains a high percentage of PTFE flakes that will seal off a leak path, prevent the passage of fugitive emissions at pressures up to 20,000 psi, and eliminates the need for Teflon tape.

## FastLUBE RS18
### Stops Galling – Smooth Application
A film-forming lubricant with strong polar attraction, applies readily to threads and other machined parts that are subjected to heavy loads and fictional heat. Eliminates wear and gall on stainless and other threaded connections. Completely water-insoluble, recommended for shafts and other gall-susceptible mechanisms. No stirring needed.

## FastLUBE 70+
### High-Pressure Threading
Provides smooth make-up and breakout and prevents rust and corrosion plus an H2S inhibitor! Contains over 70% pure molybdenum disulfide (more than any other moly-paste.) Perfect for general use on threaded connections and press fits and ideal for use on nut splitter chisels. Use for wear-in applications and a variety of jobs where sliding friction is present.

## FastLUBE 444
### Waterproof Lubricant
Get excellent protection from wear and grinding pressures of slow-moving machinery with 444. Contains a 40% blend of lubricating solids and ideal for use on open gears and in heavy duty applications where resistance to water is important. Provides long-term rust and corrosion protection, also contains additives to prevent damage from salt and other corrosives. Performs well on splines, u-joints, chucks, pillow block bearings, and most high-impact surfaces and heavily loaded mechanisms.


**Available in Convenient Sizes to Meet Job Needs**

Purchase by single container or by case.

| Lubricant Function | AG | RS18 | 444 | 70+ |
|---|---|---|---|---|
| Anti-Galling | E* | E* | G | G |
| Water Resistance | F | G | E* | G* |
| Chemical Resistance | G | G | G | G |
| Rust/Corrosion Prevention | F | F | E* | E* |
| Heat Stability | F | F | G | G |
| Sealing | E* | N | N | N |

**E=Excellent; G=Good; F=Fair; N=Not Applicable**
*** Indicates that this feature is the lubricant's primary feature**

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# FastLUBE
# Lubricant Fundamentals

The purpose of any lubricant is to reduce friction between moving surfaces, which come in contact with each other. The reduction of friction depends largely on two factors: (1) the speed at which the surfaces are moving relative to one another, and; (2) how much pressure is being exerted between sur-faces at the point of contact. Ambient conditions such as extreme heat or salt water may also be determining factors.

Lubrication of threaded connections (nuts and bolts, pipe and fittings, etc.) is a good example of a low speed/extreme pressure application. This is what thread compounds like FastLUBE AG, RS18 and 70+ are designed to do. FastLUBE 444 can also be used as a thread compound, but it was formulated primarily for open gears - another heavily loaded, low speed mechanism.

To maintain a smooth bearing surface for flanks of threads or heavily loaded gears to slide against, solid lubricants are required. Oil or grease alone will squeeze out under pressure, leaving the contact area essentially dry. Fastorq thread compounds contain between 50 and 72% lubricating solids. The heavier concentration of solids means that the mechanical barrier which Fastorq lubricants provide remains in place more effectively; and that the required torque values are lower and more consistent. Another factor considered in the formulation of our solids packages is that the specific combinations of materials will be very smooth and slippery under pressure.

All of these solids are very soft compared to the metal surfaces they lubricate. As the pressure between these surfaces increases, the mechanical barrier finally wears away. At this point, while some of the lubricant particles have been literally ground into the metal, there is little left to prevent a sharp increase in direct "rubbing together" of the metal causing wear, tearing and galling. Heat from this friction activates a chemical barrier. Additives are included in the lubricant, which react chemically with the metal surfaces. Very small wear particles resulting from this reaction contribute to the lubricating barrier between contact surfaces. In this way, the wear process is controlled so that welding cannot occur.

## Lubricant Q&A

**Why should I use lubricant?**

Friction between mating threads and between nut face and flange absorbs about 90% of the energy used to torque (tighten) a threaded fastener (bolt), 10% of the energy creates bolt pre-load. Reducing friction by using a better lubricant reduces the amount of energy (work) required by a factor of ten to one.

**How can I prevent bolts and nuts from freezing up (galling) when tightening or taking them apart?**

Threads gall due to metal to metal contact between thread sur-faces. To avoid galling use a lubricant with a high percentage of solids which will remain on the threads during the service life of the system. Choose a lubricant with a temperature rating higher than the temperature experienced by the bolt in service.

**Is tighter always better?**

No - Threaded fasteners are designed to apply clamping force within a range dictated by the minimum yield strength of the bolt material and the clamping force required to secure the two or more parts in an assembly.

**If the lubricant is too slippery- won't the nut loosen more easily?**

No, a low coefficient of friction of the lubricant by itself will not cause loosening unless dynamic forces are present which momentarily reduce the preload and subsequently the friction in the bolt and allow the nut and bolt to turn relative to each other. Dynamic forces may be created by vibration or temperature change among others. If preload is greater than the loads creat ed by the dynamic forces, bolt load loss (loosening) will be avoided or at least minimized.

**How much torque should I put on an 'X' sized bolt?**

The amount of torque depends on a large number of factors. The following is a list of the most common factors required to determine torque.

1. What lubricant is being used?
2. What is the diameter and thread pitch of the bolt?
3. What is the minimum yield strength of the bolt material?
4. What is the bolt material? i.e. ASTM A193 B7, SAE J429 Grade 8, etc.
5. What temperature are the bolts when being lubricated and tightened?
6. What bolt load (tension) do you want to achieve?

Are there critical factors involved such as the maximum compression load allowed on a gasket or sealing surface?

If a torque value is specified for the job you are doing; check the factors involved to insure you are getting the result the designer intended.

**Why is it required to use a "star" or "criss-cross" pattern and two or three passes when tightening bolts in a pattern?**

These methods are used to apply uniform bolt load in each bolt. The designer has specified the size and number of bolts to secure the parts of an assembly. If some bolts are tightened to a greater bolt load than others; they may carry a greater load in operation, causing a bolt failure.

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# FastLUBE AG

AG thread lubricant is proven to eliminate galling on stainless steel threaded connections. It performs as an excel-lent sealant and lowers torque requirements, as proper make-up is achieved quickly with minimum torque.

In addition to eliminating galling on stainless steel threads, AG is equally effective on other gall-susceptible materials, as well as ferrous alloys and may also be used on more common types of carbon steel. It has passed both the "Shrimp Test" (drilling fluid toxicity test) and the Static Sheen Test in accordance with EPA standards.

AG contains a high percentage of PTFE flake that will seal off a leak path and prevent the passage of fugitive emissions at pres-sures up to 20,000 PSI. The need for Teflon tape is eliminated. AG contains no metals or other ingredients which may be hygienically or environmentally harmful.

AG is an excellent lubricant for reducing friction. With the use of this superior lubricant, a connection can be tightened until a metal to metal seal is achieved - without galling. This reduced friction under pressure means that proper make-up can be achieved quicker and with less torque. AG is recommended for use as a thread compound in applications such as bolted joints, pipe and fittings, and for temperatures not exceeding 550°F.

*AG Demonstrated: The threads of a stainless steel bolt have been distorted or flattened by hammering. Normally, the threads would be ruined and the bolt discarded. FASTORQ A/G was applied to the damaged threads. A nut was run down over the bolt and the threads were reformed to their original shape. The mating surfaces were once again smooth and even. In another demonstration, a 316 stainless bolt was used to chase new threads in an aluminum block.*

| Information | FastLUBE AG |
|---|---|
| Classification | Paste |
| Appearance | Bright yellow, grainy |
| Solids Decription | PTFE and a synergistic blend of other lubricating solids |
| Solids Content | 72% by weight |
| Temperature Range | -30°F to 550°F |
| Fluid Description | Synthetic and natural oils |
| Oil Viscosity, SUS | 60 |
| Evaporation Rate | None |
| Solubility | Nil |
| Thickener | Complex Soap |

American Fastener Journal

*"Based on these test results, I believe this compound [Fastorq AG] can probably provide an effective solution to many, if not all, of the routinely occurring stainless steel thread galling problems."*

*- Joe Greenslade*
*"New Companud Overcomes Stainless Bolt and Nut Thread Galling"*
*January/February 2003 edition*

# FastLUBE RS18

| Information | FastLUBE RS18 |
|---|---|
| NLGI Grade | 2 |
| Primary Functions | Extreme pressure, anti-galling |
| Appearance | Yellow, smooth |
| Solids Content | 50% |
| Temperature Range | 0°F to 300°F |
| Oil Description | Synthetic |
| Viscosity, SUS @ 100°F | 730 |
| Evaporation Rate | None |
| Solubility | Nil |
| Thickener | Inorganic |

RS18 is an excellent thread lubricant that at also eliminates galling on stainless or other gall-susceptible threaded connections. The smooth consistency makes it easy to apply. RS18 does not reduce torque requirements to levels below those of other compounds. This is an important feature for applications involving rotary shouldered connections or in other situations where over-torquing is a concern.

RS18 is also recommended for lubrication of shafts or other gall-susceptible mechanisms, which would normally be lubricated with smooth extreme pressure grease. It is intended for use at temperatures ranging from zero to 300°F. In addition, it is completely water-insoluble.

RS18 is a film forming lubricant. It has a strong polar attraction to metal surfaces and applies readily to threads or other machined parts. During use, a thin resilient coating is formed on areas subject to heavy loading and frictional heat. This thin layer helps prevent further abrasive contact between surfaces. No stirring is needed prior to use.

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# FastLUBE 70+

70+ is a thread compound formulated to provide smooth make-up and breakout of threaded connections. Another primary function is the prevention of rust and corrosion.

70+ contains well over 70% pure molybdenum disulfide, more than any other moly paste. For decades, moly has been recog-nized for its lubricity under pressure and its ability to pack solidly and smoothly into the pores of metal surfaces. It is also noted for its chemi-cal stability at temperatures below 750°F. It contains a sig-nificant concentration of rust and corrosion inhibitors. An H2S inhibitor is also included.

70+ is recommended for general use on threaded connections and press fits, and performs well as a lubricant for nut splitter chisels. It can also be used on seal rings and as a dressing for packing and o-rings.

70+ works well as a wear-in lubricant and a variety of other applications where sliding friction is present. It is recommended for use at temperatures not exceeding 750°F.

| Information | FastLUBE AG |
|---|---|
| Classification | Paste |
| Appearance | Dark gray, smooth |
| Solids Decription | Pure moludbenum disulfide |
| Solids Content | Over 70% by weight |
| Oxidation of Solids | Begins at 750°F |
| Oil Description | Mixture: petroleum & synthetic oils |
| Viscosity, SUS | Not determined |
| Evaporation Rate | None |
| Solubility | Nil |
| Thickener | Complex Soap |
| 5% Salt Spray (ASTM B117) | 90 Days, Pass (No Rust) |
| Humidity Cabinet (ASTM D1748) | 90 Days, Pass (No Rust) |

| Information | FastLUBE 444 |
|---|---|
| NLGI Grade | 4 |
| Primary Functions | EP/anti-wear, corrosion protection |
| Appearance | Brown, slightly grainy |
| Solids Content | 40% |
| Temperature Range | 30°F to 300°F |
| Oil Description | Synthetic |
| Viscosity, SUS @ 100°F | 2000 |
| Evaporation Rate | None |
| Solubility | Nil |
| Thickener | Inorganic |

# FastLUBE 444

444 contains a 40% blend of lubricating solids, which provide excellent protection from wear and grinding pressures of slow moving heavy machinery. This grease is primarily intended for use on open gears. It may also be used as a heavy-duty thread compound, especially where resistance to water washout is important.

444 offers the added advantage of long term rust and corrosion protection. It is not only waterproof but also contains additives specifically designed to prevent the damaging effects of salt and other corrosive elements.

444 may be used in other applications that involve splines, u-joints, chucks, pillow block bearings and most high impact surfaces & other heavily loaded, slow moving mechanisms. It can also be used in freezing temperatures, or at temperatures as high as 300°F.

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# FastLUBE
# Application Table

| Product / Application | Features | Temperature Range | Appearance |
|---|---|---|---|
| **FastLUBE AG**<br>***Stops Galling - Great Sealant***<br>1. Eliminates galling on stainless steel threads<br>2. Provide high pressure sealing to 20,000 PSI eliminates teflon tape<br>3. Protect tooling on cold forging & swaging, reduce scrap rate<br>4. Reduce torque requirements on bolts and threaded fittings | 1. Solids content allows threads to reform<br>2. PTFE flake content seals leak paths<br>3. Reduced friction under pressure prevents galling on tooling and parts<br>4. "K" factor of .11 reduces friction, thereby reducing torque requirement | - 30°F to 550°F | Bright Yellow Grainy Paste |
| **FastLUBE RS18**<br>***Stops Galling, Smooth Application***<br>1. Eliminates wear and galling on stainless steel threads<br>2. Provide extreme pressure lubrication on shafts and threads<br>3. Rotary shoulder connections such as drill pipe and oilfield tubulars | 1. Smooth combination of solids prevents galling<br>2. Film forming lubricant with strong polar attraction to metals<br>3. No solid flakes or granules, therefore no "stand off" at shoulder | 0°F to 300°F | Bright Yellow Smooth Paste |
| **FastLUBE 70+**<br>***High Pressure Threading***<br>1. Extreme load thread lubricant<br>2. Prevents rust and corrosion on threads, shafts and gears<br>3. Nut Splitter chisel lubricant<br>4. 5% Salt spray ASTM B117<br>5. Humidity Cabinet ASTM D1748 | 1. Contains 70% pure molybdenum disulfide, more than any competitor<br>2. Contains a high concentration of rust, corrosion and H2S inhibitors<br>3. Excellent lubricity at high sliding friction<br>4. 90 days pass, no rust<br>5. 90 days pass, no rust | Up to 750°F | Dark Gray Smooth Paste |
| **FastLUBE 444**<br>***Waterproof Lubricant***<br>1. Lubrication of slow moving gears and machinery such as u-joint, fifth wheels, rack and pinions<br>2. Prevention of rust and corrosion on surfaces exposed to sea water and salt spray | 1. Water proof – will not wash out with rain or salt water<br>2. Contains an additional package designed to prevent corrosion | 30°F to 300°F | Brown Thick Paste |

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# FastLUBE in the Media

## New Compound Overcomes Stainless Bolt and Nut Thread Galling

by Joe Greenslade

Several times each year I receive calls from suppliers who have sold stainless steel bolts and nuts to a customer who is encountering thread galling problems during assembly at the time of their call. Stainless steel fastener users usually jump to the conclusion that the bolt threads are out of specification. Evaluation of the bolt and nut threads usually indicates that the threads are within specification and that is not the root cause of the problem.

For reasons not completely understood, some stainless steel bolts and nuts gall and seize in the threads while being assembled, even before the bearing surfaces come in contact with the assembly components. It is felt by many that thread roughness on either or both the internal and external thread is at least one of the factors contributing to thread galling.

Several years ago I wrote an article about this subject and stated that there are three possible solutions to stainless steel thread galling:

- Add a lubricant to the bolt.
- Slow the driver speed if the fasteners are being installed with a power driver.
- Mismatch the grades of stainless (make the bolts of 302 stainless and the nuts of 316 stainless) if possible.

All of these are still valid suggestions, but none of them is a fool-proof solution. Those having a galling problem might have to try all three approaches to find the one that resolves their particular situation. The addition of some type of lubricant is probably the most commonly utilized solution.

Since writing the previous article on the subject of stainless steel thread galling, I have continued to seek even more dependable solutions to suggest for solving this troublesome problem. Recently a supplier told me of a new anti-galling compound he had tried that provided some amazing results. I was told that this compound could be put on severely nicked stainless bolts threads and that a nut of the same grade of stainless could be completely assembled onto the bolt without thread seizing and galling.

I like to verify performance claims for myself before passing the information on to others. In this case, I obtained some of the anti-galling compound directly from the compound manufacturer and conducted my own test. The pictures in this article are a record of my test.

Stainless steel bolt with intentionally damaged threads.

The threads of a 1/2-13 302 stainless steel bolt were severely damaged by striking them repeatedly with a hammer. It was reasonable to assume that a 302

Anti-galling compound placed on bolt's end threads.

Nut goes entire length of bolt thread without seizing.

*Joe Greenslade has been active in the fastener industry since 1970. He has held positions with major fastener producers in sales engineering, marketing, product design, manufacturing management, and research and development management.*

*Mr. Greenslade holds twelve U.S. patents on various fastener related products. He has authored over 136 trade journal articles on fastener applications, manufacturing and quality issues. He is one of the fastener industry's most frequent speakers at trade association meetings and conferences. He is the youngest person ever inducted to the Fastener Industry Hall of Fame.*

*Mr. Greenslade is active in numerous fastener industry associations and societies holding office in several of them.*

*In addition to guiding the activities of Greenslade & Company, Mr. Greenslade works as a consultant with fastener suppliers and end users on product design, applications engineering, and quality issues. In this capacity he works to resolve fastener applications problems, to help select the best fastening approaches in new product designs, to assist in the standardization of fasteners used within an organization, and to provide training on various aspects of fastening technology and fastener quality assurance. He also serves as Expert Witness in litigation involving fastener related issues. He can be reached at: phone 817-870-8888, fax 817-870-9199 or email: greensladeandcompany@sbcglobal.net.*

***American Fastener Journal*** **article cont.**

stainless steel nut would not go on this bolt without completely seizing on the bolt's thread due to thread galling.

The compound was rubbed on the last three to five threads of the bolt's point end and the nut was started on the bolt. As would be expected, as soon as the nut encountered the bolt's thread nicks the torque required to rotate the nut immediately increased. What was not expected was that the nut could be screwed the full length of the bolt thread without the threads seizing together as a result of galling.

I would never suggest that a user try to use bolts with threads as severely damaged as those in my test. Based on these test results, I believe this compound can probably provide an effective solution to many, if not all, of the routinely occurring stainless steel thread galling problems.

Fastener suppliers who regularly supply stainless steel threaded fasteners should obtain some of this compound and conduct this simple, but dramatic test themselves. If they find the same results I did, they should consider keeping some of this material available for their customers when galling problems occur.

The anti-galling compound used in this test is called ***"Fastorq® A/G."*** This anti-galling compound is manufactured by Fastorq® Bolting Systems. Those wanting more information can contact Fastorq® at 800-231-1075 or go to their website at www.fastorq.com. ■

**KOLLMORGEN**
**Electro-Optical**

7/14/2003

**From:** **Jeff Knox**
**To:**
**Subject:** **Monel/Stainless Galling Tests**

## Background

A large diameter Monel 400 Coupling Ring (7.1875-32 UNS 3B threads) was severely galled after being assembled repeatedly to the 304 stainless mating part (submarine periscope Outer Tube, 7.1875-32 UNS 3A threads). Both materials have significant nickel composition, similar hardness, and an oxide film. These surface properties probably lead to adhesive wear conditions, and with high thread loads generated by very tight fitting class 3 threads, severe adhesive wear (galling)

## Test Objective

The purpose of the test was to rank the galling threshold of material couples simulating the stainless steel/monel combination used on the Outer Tube/Coupling Ring joint. This material couple was then compared to the stainless steel/monel couples using various lubricants. Standard Test Method ASTM G98 provided the procedure for testing. It is “designed to rank material couples in their resistance to the failure mode caused by galling” and further is applicable to “ sliding systems that are slow moving and operate intermittently. The galling and seizure of threaded components is a classic example which this test method most closely simulates”.

## Test Procedure

The test procedure is simple. Half inch diameter monel “buttons” were loaded in compression against a stainless steel block. The button was then rotated through 360 degrees, the material couple was unloaded, separated and checked for evidence of galling. This procedure was repeated for various loads until a transition between galling and no galling was determined. Figures 1-3 show the overall test set-up and an example of a galled material couple.

*Figure 1. Instron Compression Test Machine*

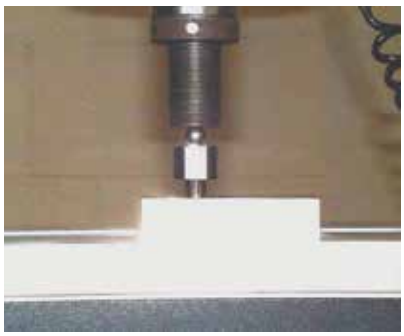


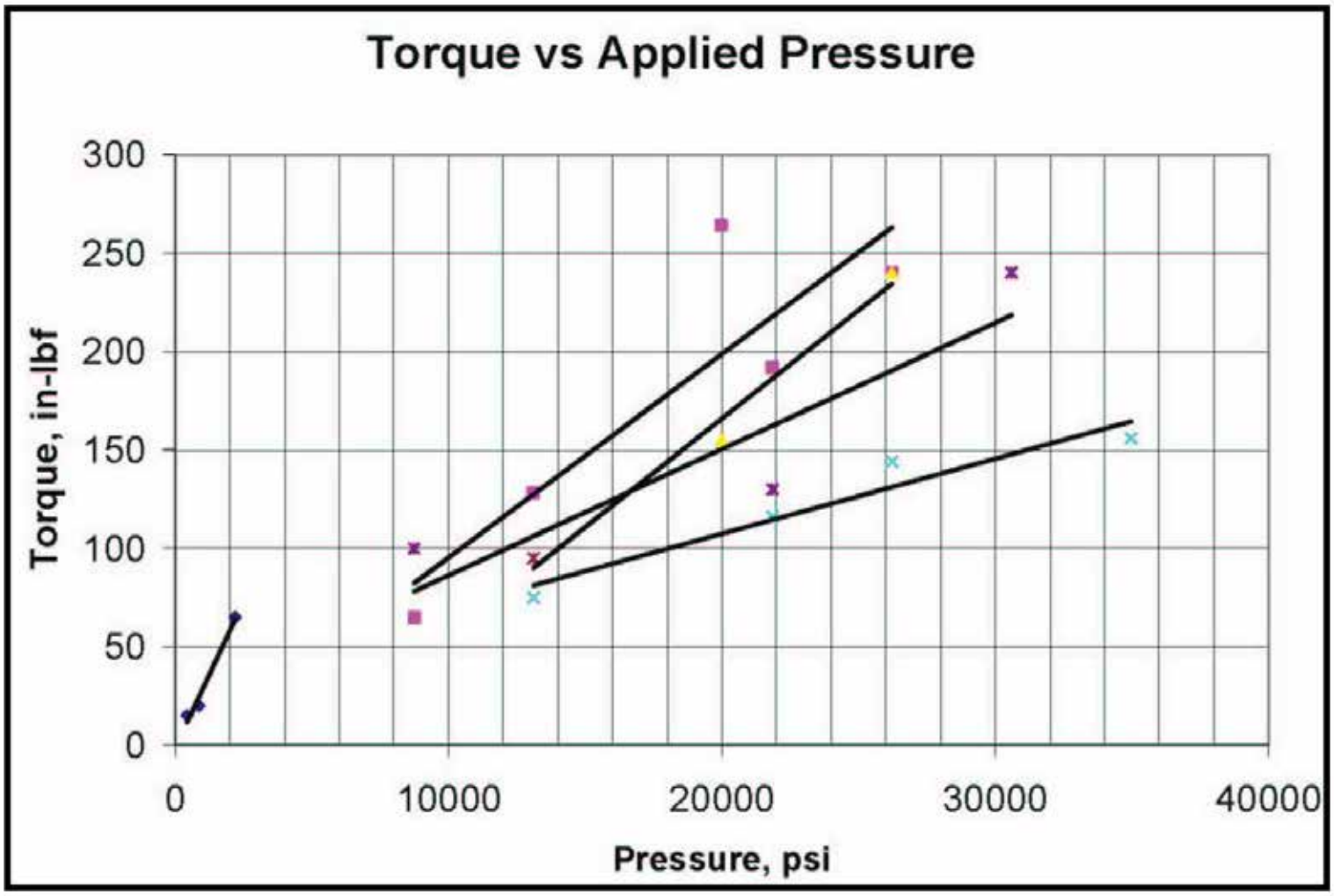
*Figure 2. Monel Test Button and Stainless Steel Block in Test Machine*

*Figure 3. Galled Test Button and Block*

## Test Results

The following graph shows applied load (contact pressure) vs torque required to rotate the test
button through 360 degrees. Torque is an indicator of shear stress at the contact surface and
therefore high torque is a by-product of galling.

***KOLLMORGEN* cont.**

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# FastLUBE Technical Bulletin

**Subject:** **Pipe & Tube Swaging/Upsetting**

**Bulletin #:** **#01-01**

**Lesson Learned:** Use of specialized anti-gall lubricant can substantially reduce friction that causes galling during the swaging/upsetting process. This is true with all materials and especially stainless steel.

**Application:** Specialized anti-gall lubricant can be applied where there is galling or seizing of the mandrel in the tube during the upsetting process.

**Project:** A major pipe and tube swaging/upsetting facility in Houston, Texas

**Experience:** Utilized FastLUBE AG Swaging Compound to keep the mandrel from seizing in the tube during the swaging/upsetting process.

**Details:** During the upsetting process the mandrel has a tendency to gall. This causes it to seize in the tube making it difficult and sometimes impossible to remove. The project experimented with most of the standard lubricants (i.e. Die Plate, Slip Plate #3, MP50, anti-seize) with low success. Fastorq A/G was used to swage 7-5/8" 13 chrome casing with a wall thickness of .812 with a titanium nitrate coated mandrel.

Prior to each swaging operation the FastLUBE AG Swaging Compound was applied at approximately 1/16" thickness to inside of tube (approximately 12" deep) and to the entire surface of the mandrel. Full coverage was critical for proper operation. After several tests it was determined that the swaging process worked best in two steps. Step 1 swaged the tube approximately 1/2 of the required depth, mandrel was removed from tube, mandrel and tube were re-lubricated and the 2nd swaging process swaged tube to full depth. Galling and seizing were reduced to zero.

**Costs & Benefits:** FastLUBE AG Swaging Compound will reduce rework and equipment failure associated with the mandrel seizing in the tube.

**Implementation:** FastLUBE AG Swaging Compound should be specified on the shop work order as the lubricating compound to be used. This will eliminate the need to rely on the equipment operator to identify the need.

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# FastLUBE Technical Bulletin

**Subject:** **Lubrication Theory - Fastorq Lubricants**

**Bulletin #:** **#01-02**

Most fundamentally, the purpose of any lubricant is to reduce friction between moving surfaces which come in contact with each other. How this reduction of friction is to be accomplished depends largely on two factors: (1) the speed at which the surfaces are moving relative to one another and (2) how much pressure is being exerted between surfaces at the point of contact. Ambient conditions such as extreme heat or salt water may also be determining factors.

Lubrication of threaded connections (nuts and bolts, pipe and fittings, etc.) is a good example of a low speed/extreme pressure application. This is what "thread compounds" like FastLUBE AG , FastLUBE 72 and FastLUBE A70+ are designed to do. FastLUBE 444 can also be used as a thread compound but it was formulated primarily for open gears, another heavily loaded, low speed mechanism.

Of course, the question is: HOW FASTORQ LUBRICANTS DO THEIR JOB and WHY THEY DO IT BETTER THAN OTHERS.

To maintain a smooth bearing surface for flanks of threads or heavily loaded gears to slide against, solid lubricants are required. Oil or grease alone will squeeze out under pressure leaving the contact area essentially dry.

Fastorq's three thread compounds each contain a between 50-72% lubricating solids. This heavier concentration of solids means that the "mechanical barrier" which our lubricants provide remains in place more effectively and that our required torque values are lower and more consistent.

Another factor considered in the formulation of our solids packages is that the specific combinations of materials will be very smooth and slippery under pressure. With the exception of the nickel particles in FastLUBE A72, all of these solids are very soft compared to the metal surfaces they lubricate. As the pressure between these surfaces increases the mechanical barrier finally wears away. At this point, while some of the lubricant particles have been literally ground into the metal, there is little left to prevent a sharp increase in direct "rubbing together" of the metal causing wear, tearing and galling. Heat from this friction activates what we call a "chemical barrier." Additives included in the lubricant, react chemically with the metal surfaces. Very small wear particles resulting from this reaction themselves contribute to the lubricating barrier between contact surfaces. In this way, the wear process is controlled so that welding cannot occur.

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# FastLUBE Project Management

**LESSON LEARNED**
**submit to LERA**

**TITLE/SUBJECT:** **Stainless Steel Bolting Technique**

**LESSON LEARNED:** Use of specialized bolt lubricant can substantially reduce galling and lower required torque values for stainless steel bolting applications.

**APPLICATION:** Specialized bolt lubricants can be applied anywhere galling is a problem. This includes bolting and threaded piping applications.

**PROJECT EXPERIENCE:** The Port Arthur Ethylene Expansion utilized a specialized bolt lubricant to allow sufficient tension to be applied to structural connections in cryogenic service.

**DETAILS:** Utilizing a Skidmore bolt tension calibrating tool, it was identified that the stainless steel bolts were yielding due to torsional stress before the appropriate tensile stress could be developed. The 3/4" diameter bolts, fabricated with 100ksi material and designed to be loaded to 28 kips (33 kips yield), were failing when loaded with only 26 kips (79% of yield). The project experimented with most of the standard lubricants (i.e. wax, anti-seize) without success. We contacted our steel fabricator, who in turn had us contact Fastorq. Fastorq was able to provide us with a specialized bolt lubricant which eliminated the friction problem.

**COST & BENEFITS:** Specialized lubricants, when specified, will reduce rework associated with over-torqued bolting applications.

**IMPLEMENTATION:** Specialized bolt lubricants should be specified on the design documents. This will eliminate the need to rely on the constructor to identify the need.

**CATEGORY:** Constructibility

**CONTACTS:** Fastorq, 800-231-1075, New Caney, TX
Originator - KRKimball, E-mail KRKI

**ADDITIONAL DATA:**
**SUBMITTED BY:** KRKimball

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# FastBAK Back-up System


FASTORQ No B.S. GUARANTEE

FastBAK Lifetime Warranty

- **Back-up and quick release reaction arm for hammer wrenches**
- **For use with hammer wrenches from 1-1/16" to 3-1/8" or 30mm to 80mm**
- **Other sizes can be quoted on request**

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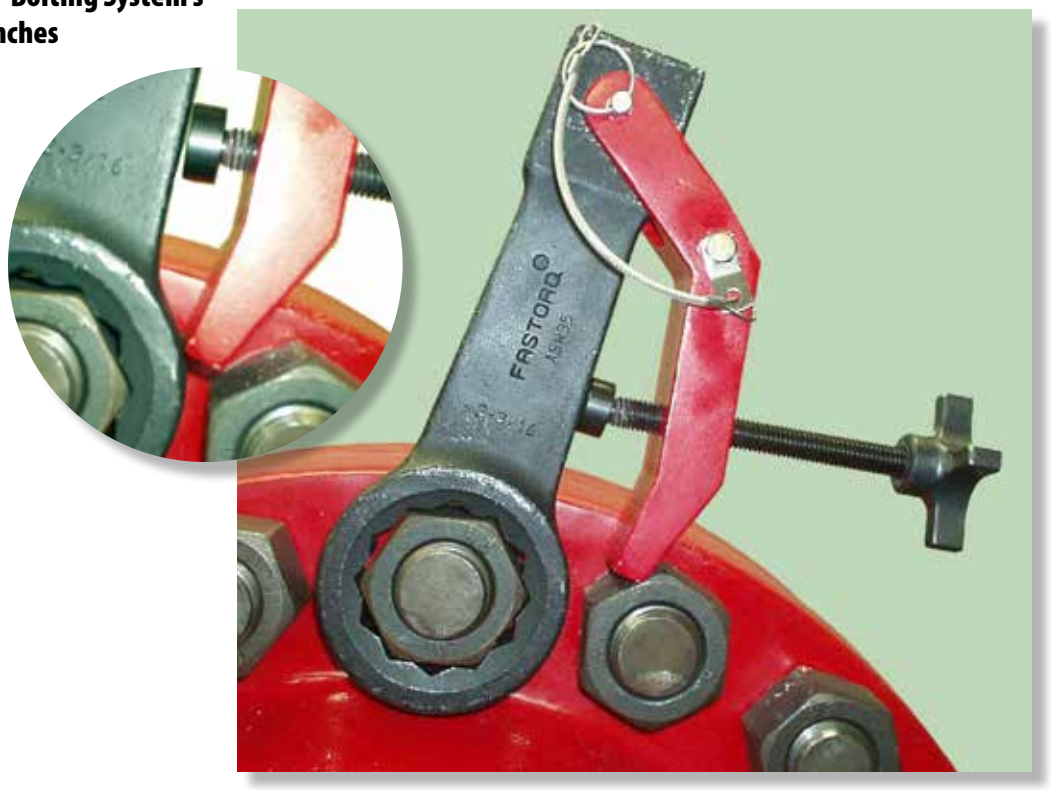
# FastBAK
# Back-up System

## FB200–Set FastBAK Universal Back-up Set
## Fast–Easy–Safe

- **Back-up and Release for Torquing Applications**
- **Designed for use with FASTORQ® Bolting System's 12-Point Straight Hammer Wrenches**

**A full FastBAK set includes:**

- **Quick Release Reaction Arm**
- **Quick Adjustment Jack**
- **Twelve Hammer Wrenches for the following nut sizes:**




| Nut Sizes |
|---|
| 1-1/16″ |
| 1-1/4″ |
| 1-7/16″ |
| 1-5/8″ |
| 1-13/16″ |
| 2″ |
| 2-3/16″ |
| 2-3/8″ |
| 2-9/16″ |
| 2-3/4″ |
| 2-15/16″ |
| 3-1/8″ |

**FasTORQ® offers Metric and Custom Sizes**

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# AutoGRIPPER Stud Extractor/Installer

- **Remove & install studs safely, effectively and fast**
- **Ideal for maintenance, outages, shut-downs & turnarounds**
- **Save critical time, especially important in hazardous conditions**
- **Easy to use – requires minimal training, set-up and support equipment**
- **Designed with a square drive for pneumatic wrench**
- **Minimal damage to the stud being removed**
- **Wide variety of applications**


*Excludes Replacement Jaws

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# AutoGRIPPER (Standard Type)
# Stud Extractor/Installer

## The AutoGRIPPER is the tool of choice for removing or inserting studs in a wide variety of applications:

- Turbines
- Flanges
- Diesel Engines
- Stop Valves
- Compressors
- Manway Covers
- Boiler Feed Pumps
- Heavy Equipment
- Heat Exchangers
- Hydro-Cracker Units
- Pulp Dryers
- Roll Pins

## Fast

Removes studs in a fraction of the time needed for conventional methods, saving critical path hours.

## Cost Effective

Greatly reduces maintenance and turnaround man-hours, equipment costs and tooling required to remove studs.

## Non-Destructive

Minimal damage to the stud even when gripping on threads.

## Safe

The AutoGRIPPER has the ability to remove studs quickly, greatly reducing crew time and exposure in hazardous or radioactive environments (ALARA).

## Easy

Requires minimal training, set-up and support equipment. The gripping cartridge can be conveniently removed for cleaning and replacement.

For general maintenance, outages, shutdowns or turnarounds, frozen studs cost hundreds of man-hours and thousands of dollars each year. The AutoGRIPPER is a simple, safe and cost-effective tool for removing stubborn fasteners.

The AutoGRIPPER is designed with a square drive to accept the pneumatic impact wrench and houses a one piece gripping cartridge containing the three gripping jaws. The AutoGRIPPER cartridge is the only moving part of the tool.

The end containing the gripping cartridge slides down over the stud to be removed. As the motion of the impact wrench turns the AutoGRIPPER, the three jaws lock on the stud forming a solid link between the wrench and the stud. The tremendous impact force of the wrench is transmitted evenly down the center of the stud causing it to break-free from the threaded imbedment.

Once the stud is unscrewed from it's housing, simply reverse the impact wrench and the stud can be released from the AutoGRIPPER. Routine maintenance of the AutoGRIPPER consists of regular cleaning and lubrication of the gripper cartridge.

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# AutoGRIPPER Sizes


| Standard Extractors | | |
|---|---|---|
| Stud Diameter | Extractor Model # | SQ Drive Size |
| 3/8″ | SR006 | 1/2″ |
| 7/16″ | SR007 | 1/2″ |
| 1/2″ | SR008 | 1/2″ |
| 5/8″ | SR010 | 1/2″ |
| 3/4″ | SR012 | 1/2″ |
| 7/8″ | SR014 | 1″ |
| 1″ | SR100 | 1″ |
| 1-1/8″ | SR102 | 1-1/2″ |
| 1-1/4″ | SR104 | 1-1/2″ |
| 1-3/8″ | SR106 | 1-1/2″ |
| 1-1/2″ | SR108 | 1-1/2″ |
| 1-5/8″ | SR110 | 1-1/2″ |
| 1-3/4″ | SR112 | 1-1/2″ |
| 1-7/8″ | SR114 | 1-1/2″ |
| 2″ | SR200 | 2-1/2″ |
| 2-1/4″ | SR204 | 2-1/2″ |
| 2-1/2″ | SR208 | 2-1/2″ |
| 2-3/4″ | SR212 | 2-1/2″ |
| 3″ | SR300 | 3-1/2″ |
| 3-1/4″ | SR304 | 3-1/2″ |
| 3-1/2″ | SR308 | 3-1/2″ |
| 3-3/4″ | SR312 | 3-1/2″ |
| 4″ | SR400 | 3-1/2″ |
| 4-1/2″ | SR408 | 3-1/2″ |
| 4-7/8″ | SR414 | 3-1/2″ |
| 5″ | SR500 | 3-1/2″ |
| 6″ | SR600 | 4″ |

| Standard Installers | | |
|---|---|---|
| Stud Diameter | Installer Model # | SQ Drive Size |
| 3/8″ | SI006 | 1/2″ |
| 7/16″ | SI007 | 1/2″ |
| 1/2″ | SI008 | 1/2″ |
| 5/8″ | SI010 | 1/2″ |
| 3/4″ | SI012 | 1/2″ |
| 7/8″ | SI014 | 1″ |
| 1″ | SI100 | 1″ |
| 1-1/8″ | SI102 | 1-1/2″ |
| 1-1/4″ | SI104 | 1-1/2″ |
| 1-3/8″ | SI106 | 1-1/2″ |
| 1-1/2″ | SI108 | 1-1/2″ |
| 1-5/8″ | SI110 | 1-1/2″ |
| 1-3/4″ | SI112 | 1-1/2″ |
| 1-7/8″ | SI114 | 1-1/2″ |
| 2″ | SI200 | 2-1/2″ |
| 2-1/4″ | SI204 | 2-1/2″ |
| 2-1/2″ | SI208 | 2-1/2″ |
| 2-3/4″ | SI212 | 2-1/2″ |
| 3″ | SI300 | 3-1/2″ |
| 3-1/4″ | SI304 | 3-1/2″ |
| 3-1/2″ | SI308 | 3-1/2″ |
| 3-3/4″ | SI312 | 3-1/2″ |
| 4″ | SI400 | 3-1/2″ |
| 4-1/2″ | SI408 | 3-1/2″ |
| 4-7/8″ | SI414 | 3-1/2″ |
| 5″ | SI500 | 3-1/2″ |
| 6″ | SI600 | 4″ |

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# Flange Alignment Tool

- **End hammering and prying**
- **Improved safety, productivity and accuracy**
- **Tapered shaft**
- **Durable craftsmanship**
- **Available individually or in sets**

FASTORQ TOTAL ASSURANCE GUARANTEE

Flange Alignment Tool
1-YEAR WARRANTY

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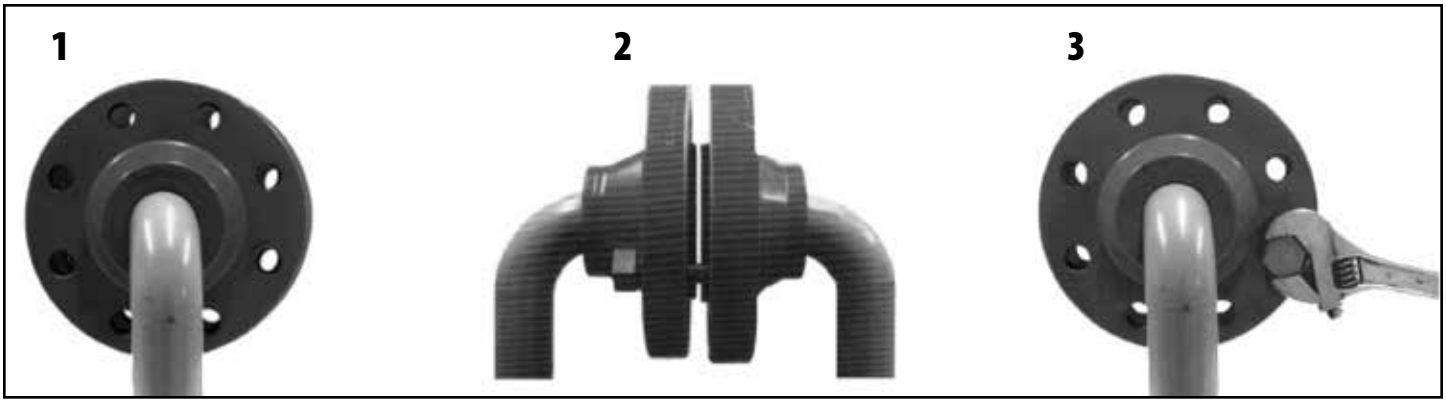
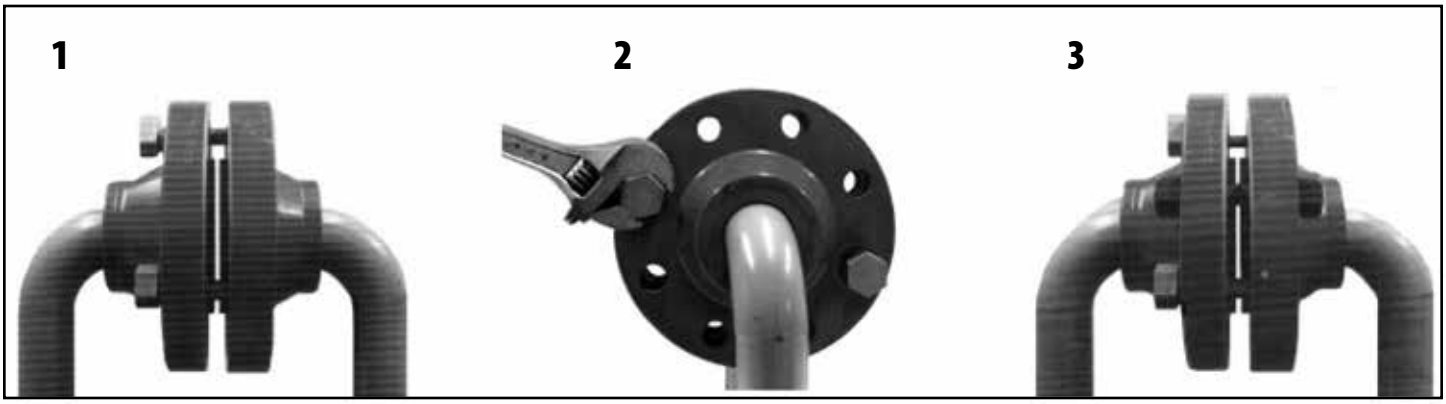
# Flange Alignment Tool

**No Need for Hammering & Prying**
**Line Up Flange Bolt Holes**
**SAFE • FAST • EFFECTIVE**

**Tapered Shaft**




Simply find a bolt hole that is aligned enough for the tapere d shaft to fit through and turn.




If necessary, use a second tool and turn until the bolt holes are in alignment, then insert flange bolts.

**The FASTORQ Flange Alignment Tool is sold individually, or in a set that is packaged in a durable toolbox with custom insert.**

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# HydraPULL Hydraulic Bundle Extractor

- **Economical solution for removing tube bundles from exchangers**
- **Does not require plant air or source of electric power**
- **Designed for maximum flexibility**
- **Completely self-contained, requires no out-side rigging or gantries**
- **Operation by as few as two workers**


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# HydraPULL Model MK1085
# Hydraulic Bundle Extractor

## Low Cost Alternative to traditional chain hoist, crane and other rigging methods for removing tube bundles from shell and tube exchangers.

Regular maintenance is essential to the success of exchanger operations. Periodically, all exchangers will require that bundles be pulled and cleaned. The MK-1085 HydraPULL offers an economical solution over traditional methods of removing tube bundles from exchangers.

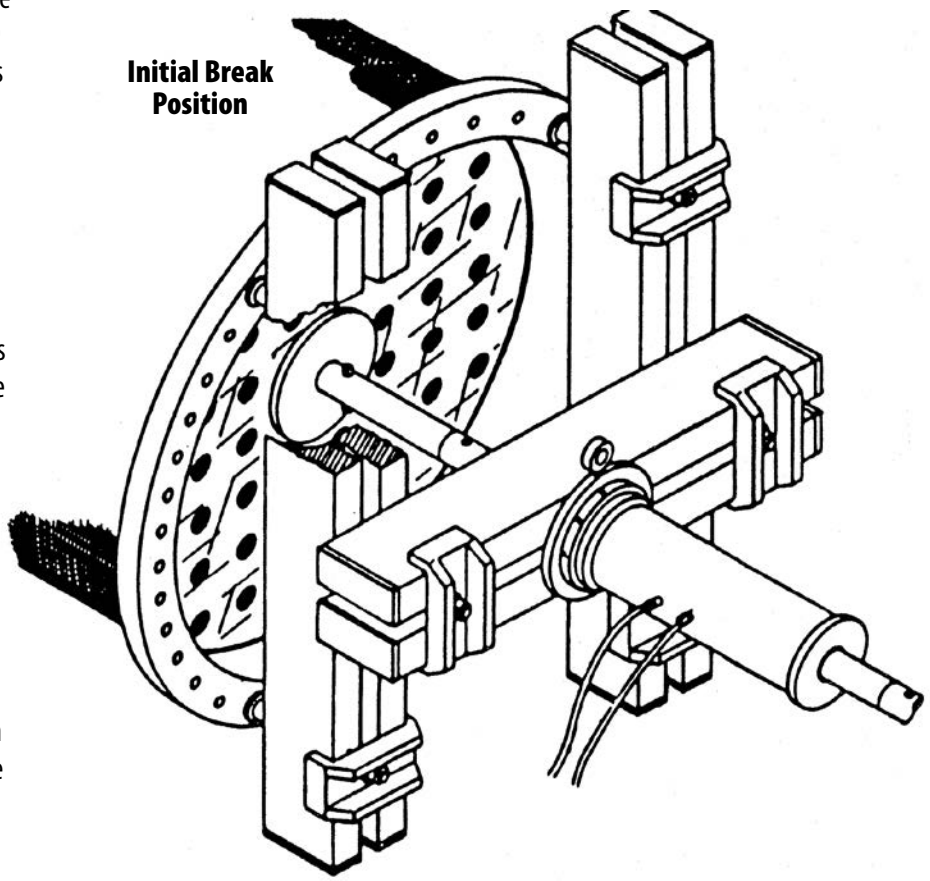
The basic HydraPULL does not require plant air or source of electric power. It is conveniently mobile and can be easily assembled and disassembled at the job site.

Designed for maximum flexibility in an operating process plant, the HydraPULL can be operated by as few as two maintenance personnel after setup. The unit is completely self-contained, and requires no out-side rigging or gantries.

Essentially, the HydraPULL functions as a jack to remove the bundle from an exchanger with a pushing action. Push rod extensions (see figure 2) are added to the hydraulic cylinder at the completion of each stroke series, and the cycle is then repeated as necessary until complete removal of the tube bundle is achieved. The same operation is used with all bundle sizes that are covered by the particular design of the HydraPULL.

To replace a tube bundle, the operation is reversed and a cable is used in lieu of extension rods. The cable is inserted through a tube in the bundle and attached to a pull plate (see figure 3). The opposite cable end is attached to a pull rod and the bundle is pulled back into the exchanger shell with another series of strokes using the hydraulic cylinder and pump. This action is repeated until the tube bundle is completely in place.

Fig. 1




**HydraPULL Model MK-1085**

**For the Safe Removal & Installation of Through-Tube Bundles**

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# HydraPULL Model MK1085
## Hydraulic Bundle Extractor

The basic Hydrapull is built around a 50-ton capacity cylinder for use on exchangers up to twenty (20) feet. Each unit is manufactured to the customer's order according to client designated specifications within the plant to meet their particular exchanger, or range of exchanger requirements.

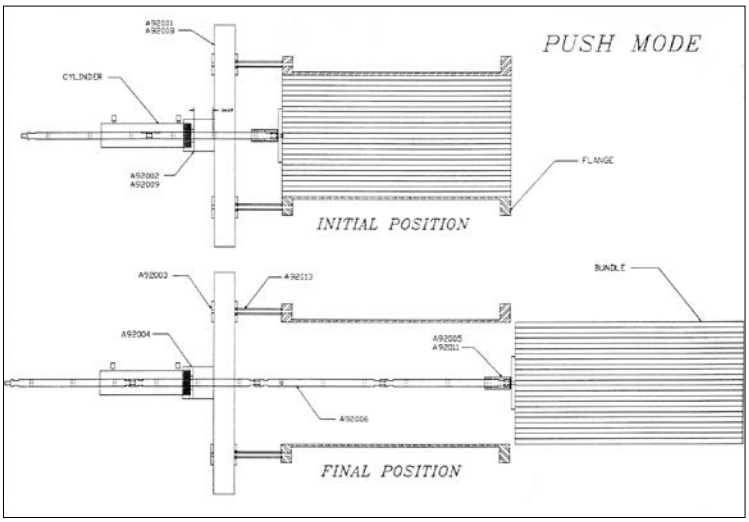
Each unit is furnished with adjustable mounting apparatus consisting of a bridge on which the cylinder is mounted, and to which the bridge extensions are attached. Push rod extensions are supplied in convenient lengths for use on tube bundles from 3 to 20 feet.

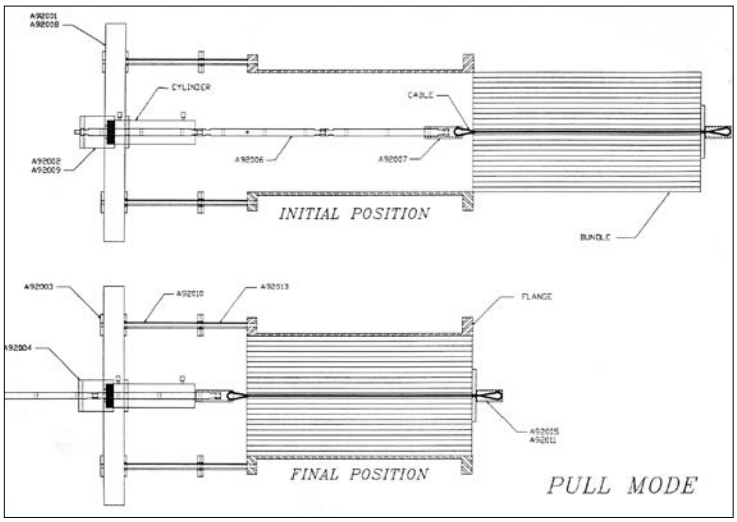
Other standard items furnished include standoff legs, hydraulic hoses with quick connectors, a hand operated two-stage hydraulic pump and all necessary bolting for assembly of the unit to an exchanger.

### Pump Options:

**Model 205A Air/Hydraulic**
**Model 215E Electric/Hydraulic**
(both units include hoses & fittings)

| Capacity of the Basic MK1085 Unit: | | |
|---|---|---|
| Hydraulic Cylinder | 50 tons | 45 tonnes |
| Minimum Exchanger Diameter | 20 inches | 508 millimeters |
| Maximum Exchanger Diameter | 60 inches | 1.52 meters |
| Maximum Exchanger Length | 20 feet | 6.10 meters |
| Maximum Stroke of Cylinder | 6 inches | 152 millimeters |
| Maximum Push/Pull Length | 20 feet | 6.10 meters |

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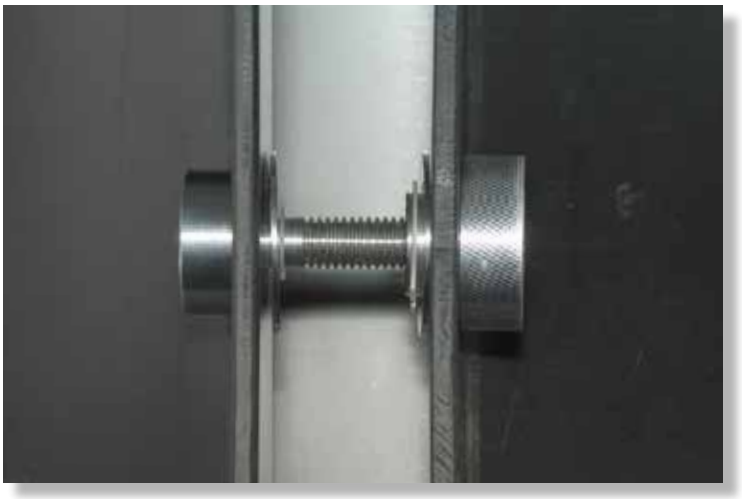
# ZipNut® VIV Fastening Mechanism



- **Compatible with ROV tooling capabilities**
- **Rugged enough to withstand vibration and rotational stresses**
- **Made of material that is corrosion-resistant for 30 years**

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2013

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# ZipNut® Fastening Mechanism for VIV Suppression Fairings

## The Robotic Solution

Vortex Induced Vibration (VIV) occurs when ocean currents flow past the risers that transport well fluids from the sea bottom to the surface/offshore production structures. The vibration is extremely destructive to risers and associated equipment. To counteract VIV, suppression fairings are fastened around the risers. This fastening task is usually carried out with tooling that is mounted on an ROV. One of the challenges encountered is fastening the fairings to the risers once they are in place.

To accomplish this, the fastener must:

a) lend itself to robotic installation using an ROV and its tooling capabilites.

b) allow free movement of the fairing so it can re-orient itself to the ocean currents.

c) not loosen under unpredictable natural forces.

d) stay secure for at least 30 years.

**Standard threaded fasteners DO NOT meet these criteria.**

## The Solution:
## The Fastorq ZipNut Fastening Mechanism

The **FASTORQ ZipNut Fastening Mechanism** follows the same principle of a check valve by allowing movement only in one direction. The design solution incorporates a female fastener with segmented threads which separate slightly to allow entry and engagement of the male fastener as it is pushed into the female segment. No rotation is required!

## The Fastorq Zip-Nut Fastening Mechanism is:

a) compatibility with ROV tooling capabilities.

b) rugged enough to withstand vibration and rotational stresses.

c) made of material that is corrosion-resistant for 30 years.

**This series of photos show the mounting and closing of the faring around the steel riser:**

The ROV would be positioned opposite of the fairing opening. The robotic arms of the ROV push on opposite sides of the fairing flanges to close.

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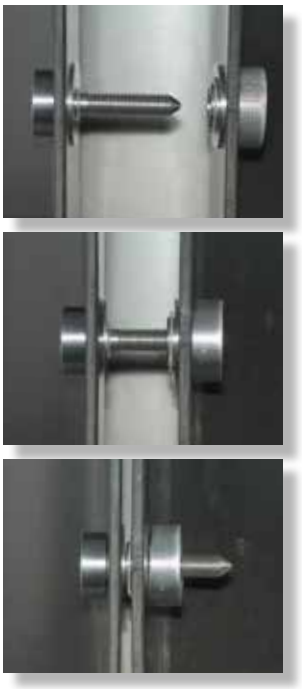
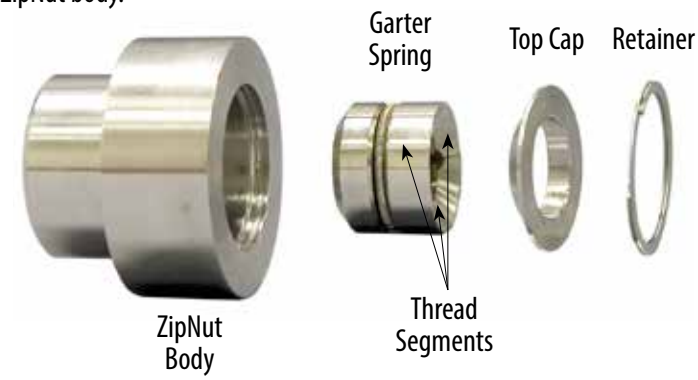
# ZipNut® Fastening Mechanism for VIV Suppression Fairings Cont.

This next set of photos show the engagement of the fastener. Notice the conical tip on to the male component to help alignment for smooth fastening into the female component. Once the ZipNut fasteners engage, the action is irreversible.



The photos below illustrate the special thread design of the fastener components. To prevent loosening due to vibration or rotation, radial grooves cut in the male components replace the helical threads normally used in fasteners.

As you can see in the photo below, the female segmented threads are held together by the garter spring. The garter spring keeps the concentric threaded female segments around the male component. Once inserted, any force pulling the make component will cause the female to clamp tighter due to the chamfered angle cut in the leading end of the male threaded segments and the corresponding cut in the ZipNut body.




Ferralium 255 was selected to provide excellent corrosion resistance.

The specific innovation in mechanical engineering is the use of our exclusive ZipNut technology (segmented threads) coupled with the use of radial grooves to make the connection permanent.

FASTORQ has enhanced the cost-effectiveness of a proven design (ZipNut Technology) with an innovative radial groove design and material selection without having to create an entirely new design that would require extensive and additional R&D, time and cost.

Users have quickly gained the capability to install fairings on risers utilizing ROV tooling at greater speed and reliability. Previous methods have been ineffective, consuming time and resources as well as exposing the workers and the project to catastrophic failure from vortex induced vibration.

The **FASTORQ ZipNut Fastening Mechanism** is currently being used to install fairings on the Uras, Macaroni and Mars projects.

**For more information on the Fastorq ZipNut Fastening Mechanism, contact us at 281.449.6466 or Toll Free at 1.800.231.1075, or drop us an e-mail at sales@fastorq.com.**

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# Pipe Hangers & Piping Loads

- **Comprehensive pipe support service**
- **In-service load determination and testing**
- **Detect non-functioning support members**
- **Weigh and adjust boiler heads and components**
- **Prevent steam leaks and major failures**
- **Detailed analysis and reporting**

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# Load Testing
# Piping Hangers and Systems

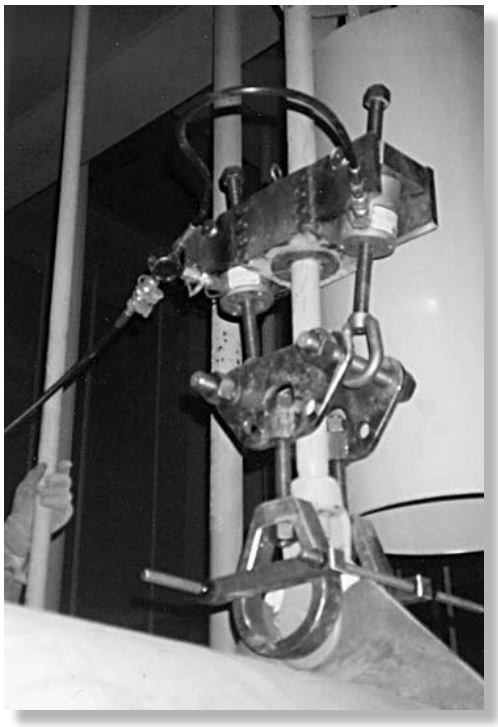
**DO YOU HAVE…**

- Bottomed out spring hangers
- Sagging high temperature steam lines
- Broken hanger components
- High energy steam lines "jumping" during startup/shutdown

**High energy steam piping systems** frequently operate at temperatures in excess of 900°F. These same systems are also typically exposed to variable support loading as a result of unit thermal cycling. The presences of these two items, when coupled with the standard mid-sized constant spring hangers, routinely result in increased system stresses, permanent creep deformation and reduced system operating life, with steam leaks and major failures possible.

**ON-LINE TESTING**

Fastorq has the methods and tooling to measure piping loads and spring hanger loads under plant operating conditions. This load testing will identify present loading conditions and what further evaluations may need to be performed i.e. NDT, "As Exists" stress analysis.



**ON-LINE ADJUSTMENTS**

After proper evaluations have been performed, the hydraulic tooling is used to load, adjust, and monitor field adjustments made to the hanger system. This allows the correct load to be applied at the "HOT" operating travel position.

**ASSOCIATED SYSTEM TESTING**

Fastorq tooling is also used to weigh and adjust boiler headers and components that directly influence piping loads and movement. These problems are frequently associated with symptoms of more severe problems which need exploration through "AS EXISTS" analysis.

An integral part of Fastorq's capability is a close working relationship with our clients and their technical staffs. As a specialty service contractor, we have the unique capability of performing in-service load determination and testing of spring hangers and other support systems. Such testing can also detect non-functional support members that show no outward sign of distress or failure.

**CONTACT US FOR FURTHER INFORMATION ON TECHNIQUES OR FOR A DEMONSTRATION OF TOOL APPLICATION**

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# Piping and Piping Hanger Support Rod Analysis

## Our comprehensive pipe support service offers the following advantages:

1. Measuring both the dead weight of the pipe, and the spring force at each location for comparison. This confirms the accuracy of the pipe hanger, and checks that all moving parts are functioning.
2. Weighing of all pipe supports along a complete steam line provides accurate input data for the analysts and the numerous pipe analyses programs available. (However sophisticated a piping analysis program is, it can only be as good as the input data).
3. Weighing carried out in both the cold condition and while the system is on-line, gives a complete picture of the loading distribution and fluctuation of the piping runs under the two extreme conditions of pressure and temperature.
4. Adjustments of the load, within the allowable range of each support unit, to achieve a satisfactory balance of loading along a piping run.
5. A comprehensive report upon completion of all contracts, commenting upon both the physical condition and loading condition of the pipe supports. Details of any adjustments made with the justification. All reports to include results tables, conclusions and recommendations for any further work that we deem necessary to maintain the system in optimum working condition.
6. An on-site engineering supervisor to work with the plant piping engineer and consulting engineer's, to identify any anomaly that may arise and resolve the situation to the satisfaction of all.

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# Definition of Terms

**WEIGH OPERATION**

Transferring of load between the support hanger and pipe clamp to hydraulic load cells, where the hydraulic pressure is converted to load in lbs.

**HANGER SPRING LOAD**

The load being applied to the pipe while in the working travel range.

**PIPE WEIGHT**

The weight of the piping at the clamp support point. (This is achieved by locking the spring mechanism, in this form the hanger is effectively a ridged rod and the weight recorded will reflect the weight of the pipe).

**BOTTOMED OUT**

When the hanger reaches the limit of its downward travel. (In this condition the hanger becomes a rigid support and will induce stress not only in the pipe support but also into the piping system. The bottomed out load can at worst exceed the design strength of the support members).

**DESIGN LOAD**

The engineering design load for each support point.

**LOAD ADJUSTMENT PERCENTAGE**

The design load of the hanger can be adjusted generally within (ten) or (twenty) percent depending upon manufacture. This is stated in + or – of design hanger load. Should this range of adjustment be insufficient, then the cause of over/under load should be investigated. It will also identify that the hanger may need replacing.

**WEIGHING AND ADJUSTING CONDITIONS**

The operations can be carried out in the operating conditions. (The restraints being ambient temperatures to the personnel). Which slow down the normal activities.

Fastorq can normally weigh and adjust (7) seven to (12) twelve hanger locations per (8) eighthour shift. The crew size is normally a working supervisor and two technicians.

**TOOLING**

Fastorq tooling is sized to weigh support rods through 3 1/2" in diameter and load capacities of 120,000 lbs. (in all cases special tooling can be designed as required for a special application).

**HANGER LOCATIONS**

Fastorq tooling is designed to work at the pipe clamp location and access can be by ladder or scaffolding. If access to the hanger is required (as in the case of adjustments) then scaffolding must be erected as well. Fastorq personnel are provided with their fall protection and safety equipment. Our personnel will work out of customer supplied spider or other baskets.

**LOCKING THE SPRING MECHANISM**

Fastorq provides attachable locking devices in the weighing set of tools. In some cases it is required that a 1" or 7/8" nut be welded to the hanger frame, in most cases the customer will provide a welder.

**HANGER ADJUSTMENTS**

At times the hanger adjusting bolts become frozen in place and will strip out the threads, the hanger can not be adjusted further or at all.

**PLANT SUPPORT**

- Access to hanger locations, ladders and or scaffolding
- Plant air
- Major lighting
- Tool laydown area
- Welding & heating equipment, if required
- Pipe fitter support when major hanger adjustments are required
- Receiving & shipping of equipment container

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# Support Rod Analysis of Piping Hangers and Piping Loads

**by R.M. POTTER**

## INTRODUCTION

Many articles have been written on why high energy piping support loads are critical to the operating performance and safety of the piping system.

This paper will describe a method currently in use that will accurately measure the load that a hanger is applying to the pipe and will also measure the actual pipe load at the location of the hanger.

This method is performed while all components remain in place and can be carried out with the unit in the operating condition or in the cold shut-down condition.

---

*R.M. Potter is an independent bolting technology consultant . . .*

*Based on a paper presented to the ASME B31.1 Code Committee on September 28, 1992.*

---

## SUPPORT ROD ANALYSIS

Support rod analysis is a comprehensive term describing the process of determining the loading in various types of equipment supports, (IE. Boiler support rods, Suspended equipment, Piping hangers, Etc.)

This paper is directed to the various pipe support hangers found in the power and process industries whether the hangers are rigid, variable or constant load type.

The initial effort was in developing tools and techniques to meet the needs of the utilities in the United States that have moved toward more analysis of high energy piping systems to provide accurate load data to replace assumed data in piping analysis programs.

The technology transfers the active load in the support rod or hanger to a precision load monitoring system without changing the configuration or disturbing existing load distribution.

This allows the analysis to be performed on operating systems under actual hot conditions, as well as in the cold maintenance condition.

## THERE ARE THREE LOADS TO BE CONSIDERED

**1) Hanger spring load:** The load being applied to the pipe by the spring mechanism while in its travel range.

**2) Pipe load:** The weight of the pipe at the hanger support point. To determine the pipe load while the spring mechanism is in the operating range, the mechanism must be locked-out by mechanical means while also maintaining its location.

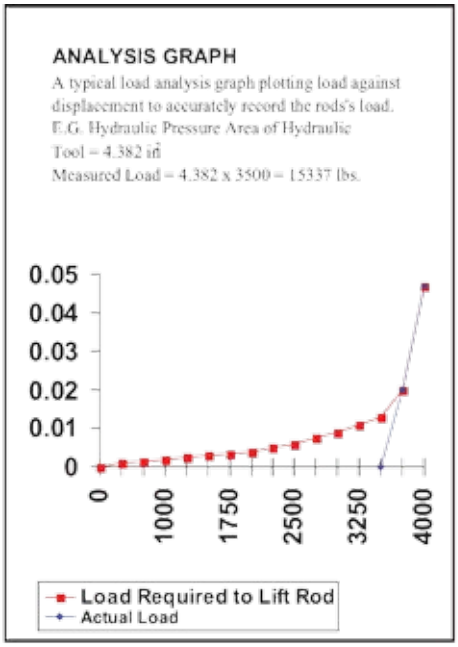


*Figure 1 Load Analysis Graph*

**3) Bottomed-Out loads:** When a hanger has reached its full travel range (in this condition, the hanger has become a rigid support) it will induce stress as the piping system tries to continue moving downwards.

The Bottomed-Out load can at worst exceed the design strength of the hanger or supporting structures.

## EQUIPMENT

The system consists of specialized clamps and adapters designed by Richard Potter to work with hydraulic load cylinders.

The clamps and adapters form a beam onto which two hydraulic cylinders are then attached. Two cylinders are required to maintain balance and eliminate any outside moments.

The tooling design provides economic as well as engineering benefits in that the piping components remain in place. A sufficient number of hangers can be weighed per shift to offset the labor and mobilization costs and, most important, provide accurate and useful data on pipe support mechanism performance.

## WEIGHING THE LOAD

The specialized tooling is attached to the support rod below the hanger

# Support Rod Analysis of Piping Hangers and Piping Loads Cont.

support point and to the pipe clamp. The attachment point at the pipe clamp is the pin or bolt securing the support rod to the clamp.

The hydraulic cylinders are connected to a pump & calibrated gauge.

As pressure is applied, the load transfers into the clamping device and is monitored by gauge pressure. When the gauge pressure stabilizes, the transfer is complete and pressure is converted to load in pounds.

## HANGER SPRING LOADS

On spring mechanisms, the load must be transferred to the measuring system, keeping the spring active within the system.

## PIPE LOADS

Weighing the pipe load uses the same tooling and normally the same tooling set-up, as presented for spring mechanisms. The important difference being the need to lock out the active spring mechanism.

The pipe load can be heavier or lighter that the supporting hanger, due to the pipe not being a free body but a beam.

For those hangers having built-in provisions, it is a somewhat simple process. Older hangers and other types that do not provide for locking (other than the pin provided for hydrostatic testing) must either be locked by some type of external clamp or by wielding a stop between the lever arm frame.

## RIGID HANGER LOADS

It is important to note that rigid supports are found, at times, carrying loads exceeding the design strength of the components. On dual rod supports, rarely is the load evenly distributed between the two support rods.

## HANGER LOAD ADJUSTMENTS

With the same tooling and measurement techniques it is now possible to adjust the applied load of the hanger(s) in the operating condition. I would like to caution that a sufficient piping load analysis be performed by qualified personnel prior to any random load adjustments.

## CONCLUSIONS

The tolling procedures described provide the following benefits for piping industries.

1. To improve operating performance of the various components and support mechanisms.
2. To assist in problem solving.
3. To provide a margin of safety in knowing the piping system is operating as designed.
4. To eliminate the high labor costs associated with removing components for testing.

| Hanger | Hanger Plate Load Stamp | Hanger Load Adj. % Setting | Actual Pipeload | Actual SPG. Load | Delta Percent | | Elevation | |
|---|---|---|---|---|---|---|---|---|
| | | | | | + | - | MM | Inches |
| C19 | 5386 | -15 | 474 | 4636 | | 2 | -9.4 | -0.37 |
| C20 | 11878 | 16 | 133358 | 13468 | | 6.4 | 0.25 | -1.10 |
| C21 | 6406 | 4 | 5630 | 6624 | 15 | -57.6 | -2.26 | -1.50 |
| C22 | 7723 | 15 | 7728 | 7507 | | 3 | -28.0 | -17.0 |
| C23 | 5224 | 0 | 5961 | 5851 | | 2 | -38.0 | -0.62 |
| C24 | 8078 | 4 | 8390 | 8280 | | 1 | -43.7 | 2.87 |
| C25 | 7466 | 8 | 7507 | 7397 | | 1.5 | -15.9 | |
| C26 | 6633 | 10 | *3864 | 6513 | | | 73.1 | |
| C27 | 9808 | 12 | 10377 | 10543 | 1.5 | | | |
| C28E | 5986 | 4 | 6293 | 6070 | | | | |
| C28W | 5986 | 7 | 6514 | 6348 | | | | |
| C28 | | | 12812 | 12420 | | 3 | | |
| C29E | 3986 | 16 | 4526 | 4250 | | | | |
| C26W | 3986 | 14 | 4250 | 4140 | | | | |
| C29 | | | 8776 | 8390 | | 4.3 | -93.0 | -3.60 |
| C30E | N/A | N/A | 9108 | N/A | | | | |
| C30W | N/A | N/A | 8280 | N/A | | | | |
| C30 | | | 17388 | | | | -110.0 | -4.3 |
| **Totals | | | 85286 | 85116 | 16.5 | 16.8 | | |

NOTE: * HANGER IS PARTIALLY TOPPED OUT
** DOES NOT INCLUDE RIGID OR C26

| Hanger | Hanger Plate Load Stamp | Hanger Load Adj. % Setting | Actual Pipeload | Actual SPG. Load | Delta Percent | | Elevation | |
|---|---|---|---|---|---|---|---|---|
| | | | | | + | - | MM | Inches |
| D1 | 6575 | 10 | 7346 | 7452 | <1 | | 56.4 | 2.20 |
| D2 | 10931 | 9 | 12806 | 12364 | | 3.3 | -37.6 | -1.48 |
| D3 | 6670 | 0 | 6734 | 6624 | | -1.5 | 27.6 | -1.08 |
| D4 | 6426 | 0 | **6624 | | | | -1.6 | -0.06 |
| D5 | 4465 | 0 | **6072 | | | | -29.6 | -1.18 |
| D6 | 7017 | 2 | 7176 | 7286 | 1.5 | | -81.0 | -3.18 |
| D7 | 7490 | 4 | 7452 | 7507 | <1 | | -58.6 | -2.30 |
| D8 | 7625 | 10 | 8170 | 8170 | 0 | 0 | -5.1 | -0.20 |
| D9 | 6623 | 12 | 7065 | 7065 | 0 | 0 | -15.1 | -0.59 |
| D10 | 9748 | 14 | 100046 | 10488 | 4 | | | |
| D11E | 5975 | 14 | 6513 | 6513 | | | | |
| D11W | 5975 | 14 | 6513 | 6624 | | | | |
| D11 | | | 13026 | 13137 | <1 | | | |
| D12E | 3972 | 14 | 4140 | 4305 | | | | |
| D12W | 3972 | 14 | 4361 | 4471 | | | | |
| D12 | 7944 | | 8501 | 8776 | 3 | | 60.0 | 2.30 |
| D13S | N/A | N/A | ***8170 | N/A | | | | |
| D13W | N/A | N/A | ***9384 | N/A | | | | |
| D13 | | | 17554 | | | -41.0 | -1.60 | |
| **Totals | | | 88372 | 88869 | 10.5 | 5 | | |

NOTE: * DOES NOT INCLUDE RIGID (D13) OR D4 & D5
** HANGER BOTTOMED OUT, LOAD = PIPE FORCE
*** RIGID SUPPORT

*Figure 2 Typical Report of Loads*

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# FastTORQ in the Media

ASME
SETTING THE STANDARD
1880 2005

## The Need For In-Situ Pipe Support Testing

*by Gerry May*

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Pipe support functionality is critical to the long-term life of piping systems. Spring supports degrade with time due to flexing in the spring and wear in constant support bearings. It is not unusual to measure constant support hangers with resistance 25% to 50% different than the design load. This leads to excessive sustained pipe stress, pipe sag (or uplift), and in high temperature systems, accelerated creep damage. Supports may also not move properly from shut down to full operation, which can create excessive fatigue stress, failed hanger components, and other piping system damage.

In-situ hanger testing is a reliable and cost effective method to determine the functionality of pipe supports. Results are used as input to set revised recommended loads, and to determine if any hangers need to be replaced. This article provides examples of the types of problems that are often found in the field, the method to test, and typical resolutions to maximize the pipe life and minimize the risk of failure.

### Initial Installation Pipe Support Issues

Piping systems are engineered with suitable flexibility to assure pipe stresses are less than ASME code allowable stresses[1,2], and that equipment connections are not overloaded. Variable spring and constant support hangers are used to properly support the pipe, while minimizing thermal displacement pipe stresses and equipment loads.

Figures 1 and 2 are outline sketches of typical constant support and variable spring cans. Variable springs are a helical coiled spring. As the length of the spring is varied by the pipe movement, the load also varies. Typically, variable springs are designed for less than 25% load variation between ambient and operating conditions. Constant support cans also have a helical spring coil, but are attached by lever arms to provide nearly the same support load throughout the travel range. Constant supports are typically installed when the movement results in too great a load variation to use a variable spring.

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Constant support and variable springs should be factory tested to support a design load, but there are a number of variables that can cause this design load to be incorrect, compared to the actual installation:

- Pipe wall thickness greater than or less than nominal.
- Pipe diameter greater than or less than nominal.
- Constant support hanger loads can vary by plus or minus 6% and still be within industry standard requirements.[3]
- Variable spring travel/load scales incorrectly placed and thus do not indicate correct load.
- Insulation thickness and density not the same as assumed.
- Improperly designed support interface between different suppliers on the same piping system. (This sometimes occurs at interfaces between major equipment suppliers, such as between a boiler and balance of plant piping.)
- Incorrect support installed at a location, or incorrect support supplied by hanger supplier.
- Content weight not properly accounted for in the design for all operational conditions.

## Causes of Pipe Support Degradation

As the pipe and pipe supports operate over several years, the following factors may cause an initially well-balanced system to become unbalanced:

- Wear of bearings increases friction and reduces free movement, sometimes to the point of locking a hanger in one position.
- Foreign matter in the spring or bearing increases resistance.
- Spring metal degrades due to corrosion and fatigue, resulting in a modified spring rate.
- Corrosion of bearings and springs increases friction and reduces movement.
- Interference of pipe or pipe support with adjacent equipment transfers loads to the supports in an unexpected manner.
- Damage to hanger components due to dynamic overload or other external factors.

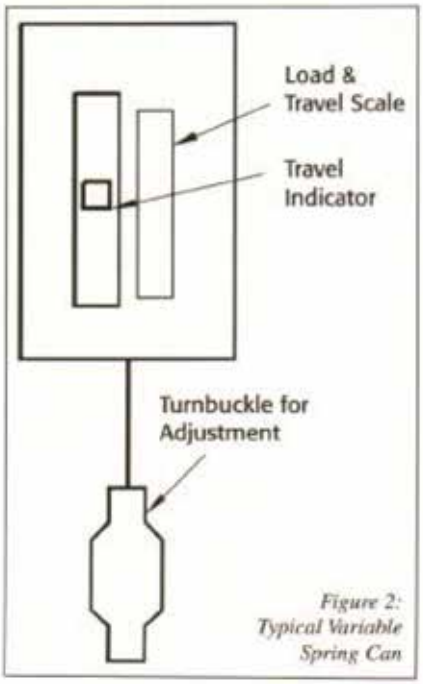

*Figure 2: Typical Variable Spring Can*

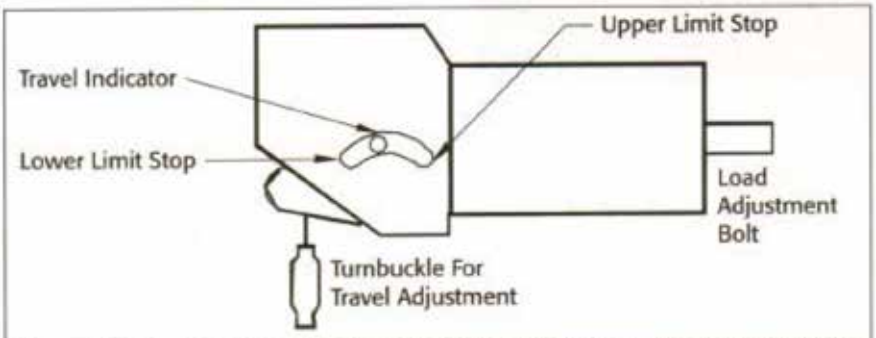

*Figure 1: Constant support can. Arrangement of components varies by style and manufacturer*

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## Pipe Support Initial Evaluation

A visual examination of the pipe and pipe supports in either the operating or shut down condition can often identify improperly balanced systems. Damaged supports, travel indicators bottomed out or topped out, bowed pipe, and sagging pipe are symptoms of some root cause(s). Some of the pipe support root causes are listed above, but there are other potential causes associated with damage to the pipe through operational conditions such as water hammer, steam hammer, erosion, corrosion, creep, and excessive thermal gradients.[4, 5, 6]

A second set of readings at a significantly different temperature from the first visual examination is required to determine actual pipe movements and hanger settings. This data allows comparison of actual movement to the design movement and an experienced field-piping engineer can evaluate probable root causes of any observed symptoms.

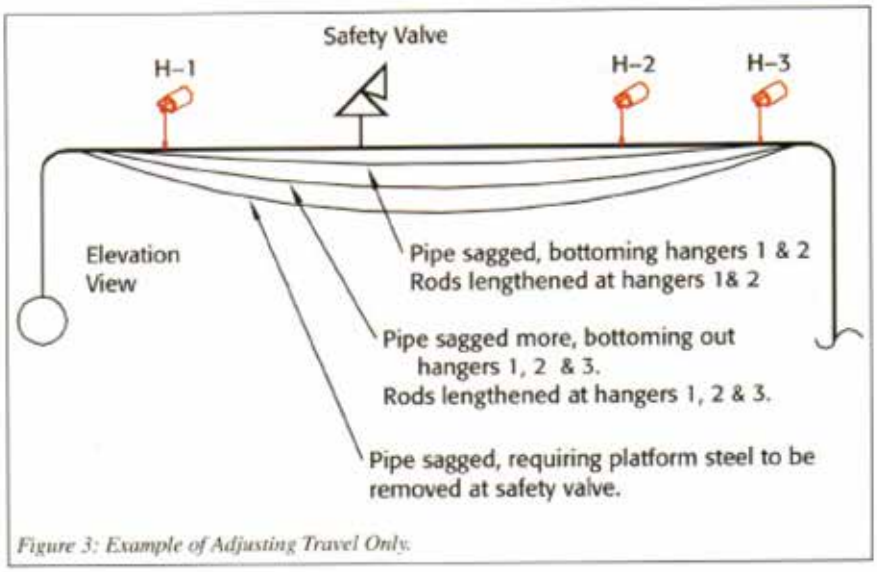

*Figure 3: Example of Adjusting Travel Only.*

A common practice by some owners has been to adjust supports based only on the walk down data. An extreme case at a western U.S. utility involved a main steam line across the top of a boiler. The span between constant support hangers was very long, and the hangers bottomed out (Figure 3). The owner adjusted the travel by making the rods longer. A couple of cycles later, the hangers bottomed out again, and rods were again let out. The process continued for years. Eventually, the steel for an access platform had to be cut out to allow the pipe to drop further. The real problem was that the hangers were designed to support too low a load for the actual pipe weight. A hanger needed to be added; however, by letting the

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pipe sag, a permanent set was put into the pipe requiring an extra drain, and the long-term life of the pipe was reduced.

## In-Situ Pipe Support Load Testing

An approach that allows adjustments to be made based on knowledge of the cause(s) leads to corrective action that maximizes pipe life and avoids creating more problems. Certain contractors have developed methods to measure the load on the hangers, without having to remove the hanger.

One such method is shown in Figure 4. The hanger springs are floating within the travel range. An arrangement is made to bypass a portion of the rigid portion of the hanger assembly, usually at the clamp load bolt. The load is bypassed into hydraulic rams. Knowing the ram pressure and the area of the ram, the load on the rod is calculated. It is important that the hydraulic pressure is recorded just as the load is fully transferred to the rams. If the pipe is actually lifted, then an incorrect load is measured.

## In-Situ Pipe Support Adjustments

The initial testing of the hangers provides data to start evaluation of the actual situation. With verification of the pipe wall thickness, diameter, and insulation thickness, a pipe stress analysis is performed to determine the significance of any deficiencies and develop recommendations. Hanger load and travel adjustments can then be made to attempt to bring the support system to its optimum condition. Support load testing is performed after adjustment to assure the pipe supports are set to the recommended loads.

Usually there are problems that preclude obtaining the optimum load and travel setting. These include:

- Insufficient adjustment remaining in hanger
- Inaccessible load adjustment bolt
- Load bolt will not turn
- Pivot bearings and other components are worn such that the adjustment is not consistent or reliable
- Insufficient rod length to adjust travel to recommended setting
- Rod threads damaged and will not turn

When one or more of these conditions occur, additional pipe stress analysis cases are run to determine if a different set of adjustments can be made that nearly achieve the desired result, without replacing pipe supports. In some cases, hanger replacements are required, but they are made only as a last resort.

## CASE STUDY 1

**Design Conditions: 1015°F, 725 psig: 39.00" O.D. x 2.125" wall pipe, A335 P22 Per ASME B31.[1] maximum allowable sustained stress, 7,300 psi**

Figure 5 (page 23) is an isometric sketch of the piping system. Severe creep damage was found at several girth welds, primarily near the lower WYE fitting, prompting a root cause investigation and repairs.

Of the 19 constant support hangers, the load variations were as follows:

| Percent Load Difference Measured to Design | No. of Constant Support Hangers |
|---|---|
| 0% to 6% | 7 |
| 7% to 15% | 6 |
| 16% to 25% | 3 |
| 26% to 35% | 3 |

In addition, two rigid rod supports were measured to be supporting 80% more load than designed for at each location.

Based on the measured support loads, the maximum sustained stress was calculated at 9,150 psi, more than 25% greater than the allowable stress. The calculated high stresses were at the same locations as the damaged welds. Using the Larson-Miller Parametric curves, minimum time to failure for creep is calculated at 65,000 hours of operation.[7] The major weld damage was discovered at approximately 100,000 hours of operation.

*Figure 4. An example of In-Situ Hanger Test Assembly.*

With corrections made to the pipe support system, the maximum calculated stress in the system is reduced to 4,300 psi. Based on creep damage only, expected life of the pipe is estimated at more than 50 years. It is a reasonable inference that if the hangers had been tested and maintained properly, little or no damage would have been found in the pipe girth welds at 100,000 hours of operation.

## CASE STUDY 2

**Design Conditions: 1015°F, 725 psig: 33.25" O.D. x 1.93" wall pipe, A335 P22 Per ASME B31.[1], maximum allowable sustained stress, 7,300 psi**

The system was evaluated shortly after installation, and it was determined that the weight of the pipe significantly exceeded the design assumptions. (See Figure 6 on page 23 for an isometric of the system.) Constant support hangers were adjusted to a "more optimum" setting by calculating the ratio of the actual pipe weight per foot divided by the design assumed weight per foot, and then turning the load adjustment bolt by the calculated percent change. However, no stress analysis was performed and no tests were performed to confirm the actual load adjustment in the hangers.

After about eight years of operation, it was observed that the pipe was not moving from ambient to operating temperature as expected, and the pipe appeared to sag in the same area that the major hanger adjustments were made. When measured, five of the hangers measured at 10% to 20% different than the expected load. Hanger 10 was more than 50% different than the expected load. Factoring the

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**In-situ hanger testing is a reliable and cost effective method to determine the functionality of pipe supports. Results are used as input to set revised recommended loads, and to determine if any hangers need to be replaced.**

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measured loads back into the analysis, the calculated maximum sustained stress that the pipe had been operating at was 8,030 psi, 10% greater than the allowable. Hangers were then adjusted and re-tested to balance the system and reduce the pipe stress to less than 4000 psi.

This case illustrates that adjusting loads without using a proper pipe stress analysis and actual load measurements can lead to serious errors. If engineering and testing had been performed when the problem was first noticed, significant degradation could have been avoided.

## Conclusions

Pipe supports and the pipe should be considered a maintenance item by plant personnel. Supports degrade with time, and should not be expected to perform for decades without intervention. In many situations, periodic testing and adjustment is sufficient to maintain pipe supports near optimal conditions.

In both the cited cases, and many other documented hanger adjustment programs, properly functioning pipe supports are necessary to minimize pipe stresses. When material creep is a consideration, the life of the pipe may be greatly reduced by excessive stresses, resulting in the need for major repairs, including replacement of portions of the piping system. With proper pipe support design, installation, and maintenance, damage to the pipe should normally not develop for decades. However, improperly designed, adjusted, or maintained pipe supports can create very high pipe stresses resulting in premature damage. This can adversely affect plant safety, reliability, and financial performance.


## Acknowledgements

The methods and tools to perform in-situ testing of pipe supports was developed by Rich Potter of Fastorq. The author gratefully acknowledges Mr. Potter's ability to develop the tools, and to accurately test the pipe supports at operating plants. The author also acknowledges the assistance of Lange Kimball of KBR who performed one of the case studies.


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***NOTE:*** *This paper, POWER2004-52031, was slightly edited from its original format. It was originally published in the Proceedings of ASME Power 2004, March 30-April 1, 2004, Baltimore, Maryland. These proceedings are available from ASME in both digital and print formats; for more details contact infocentral@asme.org. PDFs of individual papers can also be purchased at the ASME Digital Store.*

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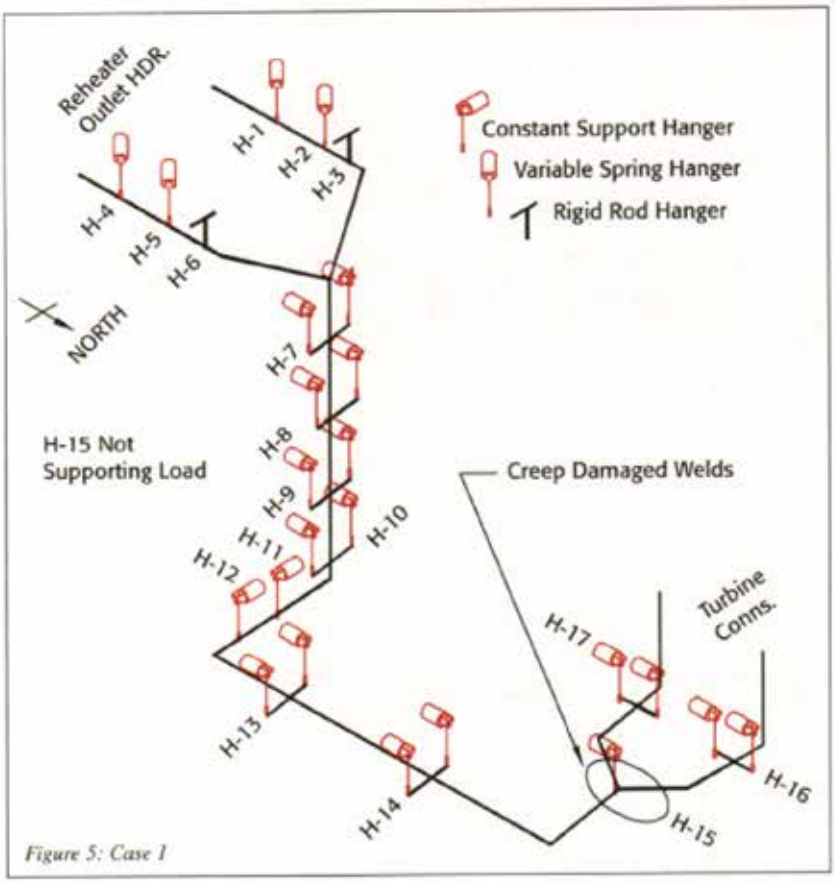


*Figure 5: Case 1*

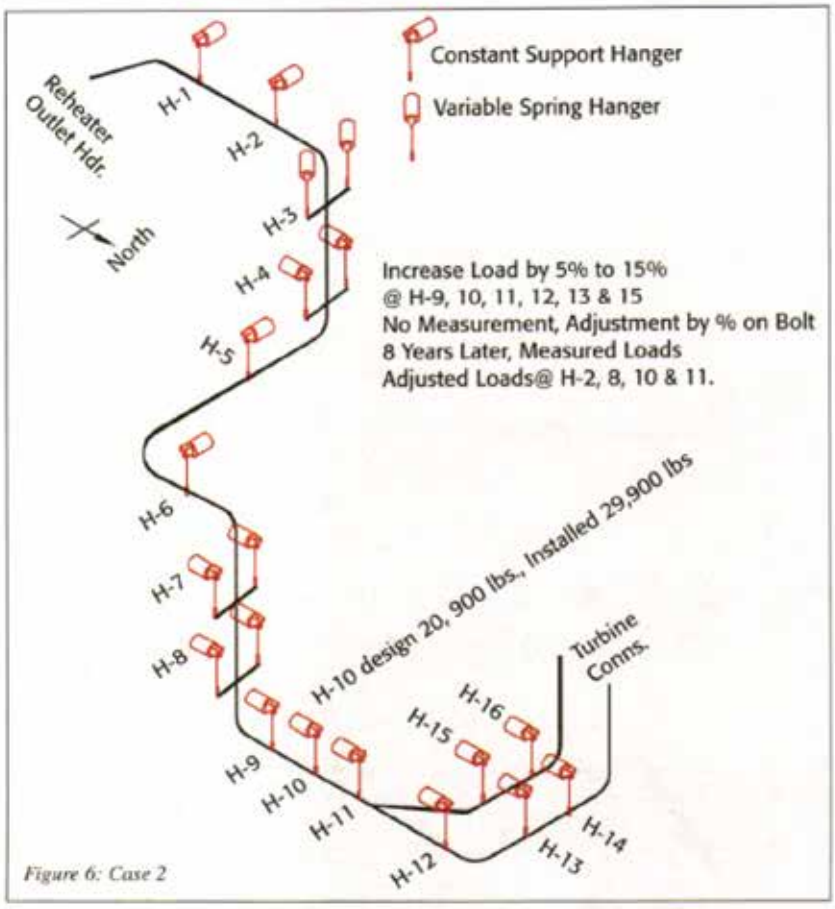


*Figure 6: Case 2*

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