Safety Torque Adapter System
Hydraulic Bolt Tensioning Flange Connector

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Traditional Torque Methods

Torque measurement is the traditional method of determining bolt load.

Hand / hammer wrenches and hydraulic torque tools are the most commonly used devices to make up API 6A flanges.

Up to 80% of the energy required to tighten a threaded fastener may be used to overcome friction.
Hydraulic Stud Tensioning

Hydraulic bolt tensioning has gained acceptance over the past two decades as a preferred alternative to standard bolt torquing in the power generation and oil & gas industries.

Common applications include:

- Hydro-electric plants
- Wind turbine base installations
- Catalyst reactors
- Heat exchangers
- Coal and rock grinders
- Mining
Advantages of Stud Tensioning

• Safety – eliminates hammers and other pinch point prone devices especially in confined spaces

• Accuracy & consistency – produces predictable and repetitive results that conform to design specifications

• Time and labor savings – can save hours for each connection as compared to traditional torque methods with fewer technicians on location

• Service life - Increases stud life through uniform loading across the complete connection

• Product damage – significantly reduces stud/nut galling potential

• Eliminates torque sensitive issues – stud/nut surface interface preparation, lubrication, material properties
Limitations of Current Tensioning Technology

- Existing systems employ a number of individual “tensioners” that are arranged in a pre-determined pattern (typically alternating on/off) and placed on the stud to achieve uniform bolt tensioning.
- Each pattern tensioning step requires a significant time/labor component.
- Tensioner tools must be installed correctly and adjusted to fit the exposed nut-to-stud interface.
- Final adjustment on the nut fastener is achieved through a small slot with a special hand tool.
- ‘Miles and miles’ of hydraulic hoses full of fluid.
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The Weatherford Advantage

The Weatherford Safety-Torque-Adapter™ System is the hydraulic bolt tensioning system that:

• Improves Safety – eliminates traditional hand tools

• Minimizes Workspace – requires smaller work area footprint during installation

• Maximizes Design Simplicity – one integrated assembly

• Saves Time - completes flange mating connection and complete bolt pattern tensioning process in a few simple steps as opposed to multiple stages

• Achieves Consistency – load is applied uniformly across all studs in the flange connection with no torsional force or impact loading

• Provides a Standard Industry Connection – fits API 6A standard flange connections and can be designed for other industry flange standards

• Provides Versatility – comes in a variety of sizes and pressures and requires no special tools
How the Safety Torque Adapter Works
How the Safety Torque Adapter (STA) Works

- Applicable in any API 6A flange to flange connection
- Best suited for flange connections that are used repeatedly
- Featured application is a BOP/Drilling Adapter to Wellhead connection (API 6A 11” 10,000 wp)
- Consists of four (4) primary components
  - Housing
  - Lower Stud Assy
  - Seal Nut
  - Upper Piston Stud Assy
How the Safety Torque Adapter Works

- Prior to BOP to Wellhead makeup, STA is NU to BOP

- Lower Stud Assy nuts are removed and STA assembly is stabbed on to wellhead housing and nuts run on handy and snug to flange backface

- BOP/STA is allowed to rest full weight on wellhead housing and BX ring gasket slightly exposed

- Hydraulic handpump is connected to the injection port
How the Safety Torque Adapter Works

- Hydraulic pressure increasing to 12,000 psi (from the pump into the injection port) is applied to each cylinder uniformly via a communication port between cylinders.

- Pressure forces the Upper Stud Piston Assy up while loading the Lower Stud Assy and simultaneously drawing the STA and wellhead housing together.

- Nuts are run on fully and handy on Upper Stud Piston Assy and hydraulic pressure is relieved.
How the Safety Torque Adapter Works

- STA is now fully tensioned and in place - ready for the BOP Assy connection test.
Animation
Calculating the Load

Per API 6A (Controlling authority of flanged wellhead equipment) 19th Edition

Flange Size/WP: 11” 10,000wp

Bolt Size & Qty: 1.750-8UN x 16

STA Bolting Material: SS 17-4PH (for high strength and corrosion resistance)

Yield Strength: 105ksi

(Note: Studs are threaded with presumed friction factor of 0.13 and are not to undergo stress greater than ½ yield strength.)


- Friction factor: 0.13
- Torque: 2,696 ft-lbf (Note: That’s two professional NFL OT’s on a 4 ft wrench)
- Tension Force: 109,313 lbs (Note: FEA and actual application studies indicate that this force is sufficient to adequately crush and load the BX-158 ring gasket to achieve a 10,000 psi pressure test.)

The Weatherford Safety-Torque-Adapter eliminates torque so the per stud axial load is derived from treating each stud as a hydraulic piston. The 12,000 psi hydraulic input pressure across 16 stud/pistons delivers the necessary 1,749,000 lbs of gasket load while each stud remains stressed at or below 52,500 psi giving the STA a designed factor of safety of 2 to 1.
Current Designed Sizes

Safety-Torque-Adapter™ System

Sizes and Working Pressures (API 6A 19th ED)

Flange Size/WP:

- 7 1/16” 3,000/5,000/10,000 wp’s
- 11” 3,000/5,000/10,000 wp’s
- 13 5/8” 3,000/5,000/10,000 wp’s
- 18 3/4” 10,000 wp
Safety-Torque-Adapter™ System Applications

• Drilling Operations
  – BOP Drilling Spool to wellhead connection or as a STA System Drilling Spool Assembly
    • All typical API 6A sizes and working pressures
    • Options include choke manifold outlet(s)
      – Annular BOP to Ram BOP connections
      – Choke & Kill Manifold line connections

• Completion Operations
  – Completion BOP to wellhead connection adapters
  – Frack tree to wellhead connections
Safety-Torque-Adapter™ System Applications

- Field Trial Opportunities

- Q & A
Thank You

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