TenarisHydril Wedge XPTM connection
Agenda

TenarisHydrl Wedge XP™ Connection

- Solutions for Today’s Shales Operations
- Introducing the Product
- Product Features and Operational Benefits
- Design Validation
- Featured cases
- Rig Direct™
- Summary
Shale operations in North America

- Shale Plays
- Manufacturing Centers
- Service Centers
- Commercial Offices

- Grande Prairie
- Nisku
- Red Deer
- Calgary
- Fort McMurray
- Fort Saskatchewan
- Red Deer
- Calgary
- Prudential
- Bienfait
- AlgomaTubes

- Duverney
- Cardium
- Montney
- Liard
- Horn River
- Bakken
- Niobrara
- Denver
- Oklahoma City
- Woodford
- Conroe
- Haynesville
- Fort McMurrary
- Fort Saskatchewan

- Bakersfield
- Midland
- Permian Basin
- Hickman
- Oklahoma City
- Conroe
- Woodford
- Haynesville
- Eagle Ford
- Reynosa
- Westwego
- Freeport
- Houston

- Tenaris
- AlgomaTubes
- Pittsburgh
- Toronto
- Utica
- Marcellus
- Montney
- Haynesville
- Woodford
- Marcellus
- Fayetteville
- Utica
- Niobrara
- Bakken

- Grande Prairie
- Nisku
- Red Deer
- Calgary
- Prudential
- Bienfait
- AlgomaTubes

- Duverney
- Cardium
- Montney
- Liard
- Horn River
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- Woodford
- Conroe
- Haynesville
- Eagle Ford
- Reynosa
- Westwego
- Freeport
- Houston
Technical Challenges

Challenges for tubulars in unconventional shales

- Installation
- Stimulation
- Production

_Trend to longer laterals and more fracturing stages_

- **Surface Casing**
  - Tension induced by Temperature – Fracturing
  - Burst by low external pressure during fracturing
  - Compression induced by Temperature - Production

- **Intermediate Casing**
  - Gas sealability – Depending on Application
  - Burst / Collapse – Fracturing / Erosion

- **Production Casing**
  - Loads during running (compression, torque)
Tenaris Product Portfolio

Tenaris Connections

API
- STC
- LTC
- BTC

Semi-Premium
- TXP BTC
- TSH WEDGE XP

Premium

Wedge Series
- TSH WEDGE 563
- TSH WEDGE 511
- TSH WEDGE 513
- TSH WEDGE 521
- TSH WEDGE 523
- TSH WEDGE 623
- TSH WEDGE 625

Blue Series
- TSH BLUE
- TSH BLUE MAX
- TSH BLUE HW
- TSH BLUE RISER
- TSH BLUE NF

Not pictured: Legacy connections & some Wedge Series variations
TenarisHydril Wedge XPTM connection 4 1/2” to 5 1/2”

- The make-up indicator allows for visual confirmation of appropriate make-up, even with operating torque.
- Easy make up: no need for a Torque vs. Turns chart.

- Pins provide extra torque capacity when subjected to incremented torque resulting in pin to pin contact.

- Exceptional torque capability and compression efficiency developed through the simultaneous engagement of opposing flanks of the dovetail thread.
- Unrivaled running reliability and robustness given by the TenarisHydril Wedge thread.
TenarisHydril Wedge XP™ connection

Main Features

• TenarisHydril Wedge thread profile providing extra over torque capacity to manage longer laterals.

• Pin-to-Pin back up mechanism granting additional torque capability to handle rotation.

• Lower threads per inch profile (3.4 vs. 5 TPI of a typical BTC modified), rugged coarse thread design, and deep stabbing allow for speed of installation, enhancing the performance of an industrial drilling approach. 15 secs/jt spinning time.

• 100% compression

• 100% tension

• Standard bevel of 20°

• Make up indicator in pin with 24”x1” white locator stripe

Main Applications

• Shales

• Casing while drilling

• Rotating while cementing

• Production casing and liners

Advantages

• Easy make-ups

• TenarisHydril Wedge profile reduces rejects/re-makeups

• Reduced hoop stress
Connection Comparison | 5.5” P110

**Torque (FT.LBS) – 20 PPF**

- **Wedge XP™**
  - Operational Torque: 35,000
  - Yield Torque: 20,000

- **TXP® Buttress**
  - Operational Torque: 30,000
  - Yield Torque: 20,000

- **High Torque Semi Premium**
  - Operational Torque: 25,000
  - Yield Torque: 20,000

**Torque (FT.LBS) – 23 PPF**

- **Wedge XP™**
  - Operational Torque: 40,000
  - Yield Torque: 23,000

- **TXP® Buttress**
  - Operational Torque: 35,000
  - Yield Torque: 20,000

- **High Torque Semi Premium**
  - Operational Torque: 30,000
  - Yield Torque: 20,000
Product features

Make-Up Graph
Product features

Make-Up Graph

- Downhole rotation without Pin-to-Pin contact
- Torque vs Turns Graph Mechanics
  - Yield Torque
  - Operating Torque
  - Safety Margin
  - Extra Torque Capacity
  - Max Make Up Torque
  - Typical Semipremium T&C Operating Torque

- Downhole rotation with Pin-to-Pin contact
Design Verification

- Finite Element Analysis (FEA) program

- Full Scale Testing (FST) program
  - Make-and-breaks validation
  - Sealability test
  - 1st Run in Rig Direct™ Academy
Design Verification

Finite Element Analysis

- Torque-Turn simulation
- Simulation of pin to pin contact
- Hoop stress evaluation
- Sealability and structural capacity

Full Scale Testing (FST) program

- Multiple M&Bs
- Make-up to operating torque with drift verification
- Make-up to yield

Connection after 3rd break-out at high torque
## Design Verification

### Rig Demo in Rig Direct™ Academy

- Running with tongs
- Running with CRT
- Doping conditions
- Misalignment
- Low and high RPM

![Example of over dope](image1.png)

![Example of misalignment](image2.png)
Featured cases | RwC - Noble Energy

Case Profile

**Location:** Niobrara Shale

**Type:** Shale

**Target:** Oil + gas

**Well type:** Development (lateral length 10,500 ft).

**Products:**
TenarisHydril Wedge XP™ connection in:
- 5 1/2” 20.00# P110-IC

Case Highlights

- Max. applied torque to 28,500 ft.lbs for rotating while cementing.
Featured cases | Eagle Ford – IOC

Case Profile

**Location:** Eagle Ford Shale

**Type:** Shale

**Target:** Wet gas condensate

**Well type:** Development (lateral length 3,000 ft).

**Products**

TenarisHydril Wedge 625® connection in:

- 5 1/2” 23.00# P110-S (0’ – 6,500’)
- TenarisHydril Wedge XP™ connection in:
  - 5 1/2” 23.00# P110-S (6,500’ – 15,900’)

**Case Highlights**

- 2 wells: 196 + 199 jts of TSH WEDGE XP installed. RPMs: 25 - 10.
- Averaged 32 joints per hour (vs. 27 jts/hr benchmark)
- Zero rejects, zero breakouts
- Total job – 13.5 hours / 14.0 hours
Oklahoma Service Center

Facility Profile

**Location:** Amber, Oklahoma

**Products:** OCTG, sucker rods, coated line pipe, accessories

**Storage Capacity:** 100 acre facility specializing in pipe storage, inspection and repair. 1600’ rail spur to receive material

**Pipe Management Services**

- OCTG and coated line pipe storage
- Threading and repair
- Inventory and accessories management
- Run Ready
- OCTG and Line Pipe transportation services
- Fleet of 21 over the road tractors and more than 60 trailers, offering 24-hour dispatch
Summary

- TenarisHydril Wedge XP™ is a new threaded and coupled connection with TenarisHydril Wedge thread profile that has been designed to provide exceptional torque capability and robustness for longer laterals. Pin-to-Pin back up mechanism can grant additional torque capability to handle rotation.

- This superior torque capability in conjunction with its simple and fast make-up, not requiring any special equipment, makes TenarisHydril Wedge XP™ an ideal solution for shale applications.

- A detailed design program with several evaluations and full scale tests in laboratories and in the rig resulted in a reliable development.

- Along with its TenarisHydril Wedge XP™ connections, Tenaris offers Rig Direct™. This integrated package of expert services provides many benefits, starting with cost reductions. Tenaris’s local presence is supported by a unique global infrastructure of industrial, R&D and service centers, operating under a single QHSE management system. With the acquisition of Garrett LLC, Tenaris is ready to optimize Midcontinent operations through Rig Direct™.
Thank you for your attention. Questions?