



# Shale Applications



**Connect**  
with our experience  
in **Shale**

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## Challenges

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Optimize **reliability**,  
**cost efficiency**, and  
**minimize running time**  
with the right solutions for  
your **Shale operations**.

Shale/Tight oil and gas wells have their own unique challenges that require experienced partners to provide guidance on the available solutions. Requirements are individually analyzed, driven by lessons learned, while keeping reliability, efficiency, user-friendliness and integrated services at the heart of each project.

Vallourec people, products and services provide solutions for all your unconventional wells.



## Your challenges in Shale Applications

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### → Increased well integrity

- › Increased reliability with fit-for-purpose test program based on the latest international standards (API RP5C5 / ISO 13679)

### → Deeper wells

- › High tension on the vertical
- › High compression to assist and install your production string

### → Longer laterals

- › High Torque resistance for the lateral
- › Needs of clearance to reach extended lateral sections

### → Enhanced fatigue

- › Additional rotation required for installation of the string at the target depth
- › High cyclical loads generated by multiple stage hydraulic fracturing

### → Multiple well pads

- › More complex geometry with need for Well design service offer
- › Trajectory of the outer wells inducing high stresses on pipe & connection

# Connect with our experience in Shale

Conventional energy resources are decreasing, the pursuit of energy independence and implementation of new technologies are driving many countries to operate their reserves of “unconventional” hydrocarbons - including Shale/Tight oil and gas.

Vallourec’s premium tubes and connections are optimally designed to operate under the harsh conditions of extraction in deviated wells combined with high internal pressure coming from hydraulic fracturing. To respond to the increasing demand in the United States, Vallourec has built a small diameter tubes manufacturing plant located in Youngstown, Ohio in the Marcellus and Utica shale plays, from which the first deliveries were made at the end of 2012.

## → Experience

- › Worldwide manufacturing know-how.
- › Field running experience, including track records, on-site support, and running recommendations.
- › Long experience in Shale applications, partnering with operators from planning phase to operations since the first wells drilled in the Barnett Shale.

## → R&D and innovation

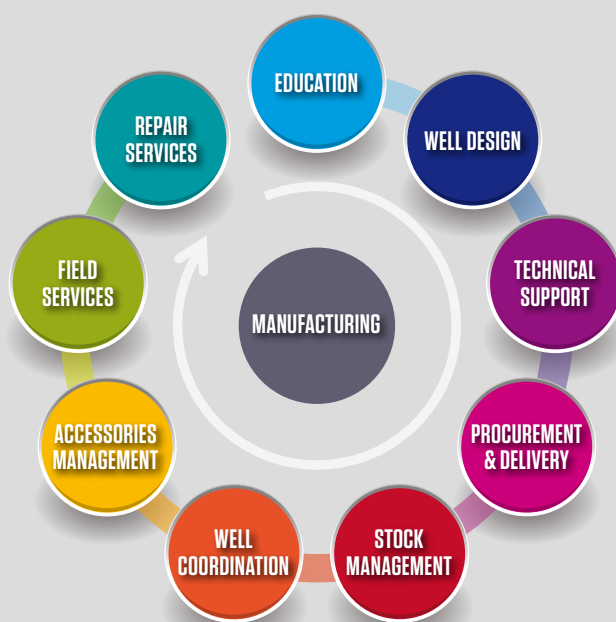
- › State of the art facilities, including combined load test frames to ensure Fit-for-Purpose testing.
- › Structural integrity, sealability and Make & Break qualified to ISO 13679 standard, 2002 and 2011 versions.
- › Constant R&D investments to enhance our products performances, including High Torque and bending resistance.

## → Close to our customers

- › Meet your real needs.
- › Provide reliable, user-friendly connections and accessories to ensure cost-efficient operations.
- › All services provided to support you in meeting Shale applications challenges, from planning phase to running operations.

## Vallourec Global Solutions: from Conception to Completion

Vallourec offers a comprehensive range of innovative solutions in addition to premium OCTG products. These solutions are designed to meet your most challenging needs, from technical support to supply chain management and field services.



# Solutions for your Well Architecture

## VAM<sup>®</sup> EDGE SF

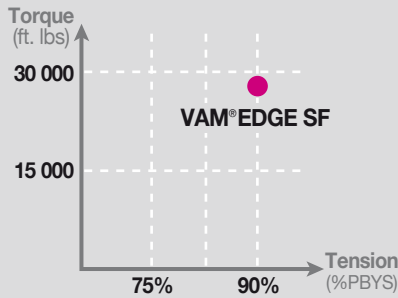


### Premium Semi-flush

5" - 5 1/2" OD  
ISO 13679  
CAL II - 2011  
Fit for purpose testing  
Carbon steel,  
95 - 125 ksi

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The next generation  
High Torque semi-flush connection  
→ A single premium solution for the full string length with enhanced torque and tension  
→ For extended lateral sections



## VAM<sup>®</sup> SG

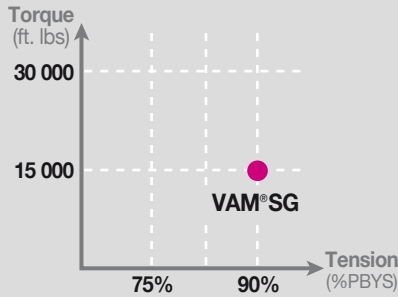


### Premium Semi-flush

4 1/2" - 5 1/2" OD  
ISO 13679  
CAL II - 2011  
Fit for purpose testing  
Carbon steel,  
95 - 125 ksi

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Brings the complete package to your Shale needs  
→ Enhanced torque & tension resistance compare to current semi flush connections  
→ A single premium solution for the full string length



## VAM<sup>®</sup> 21 HT



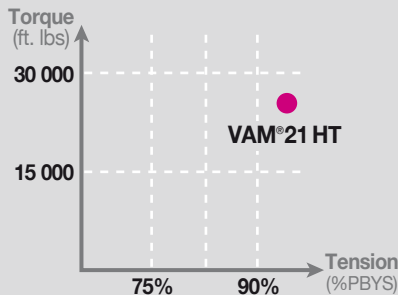
### T&C

5" - 9 5/8" OD  
ISO 13679  
CAL IV - 2011  
Carbon steel,  
80 - 125 ksi

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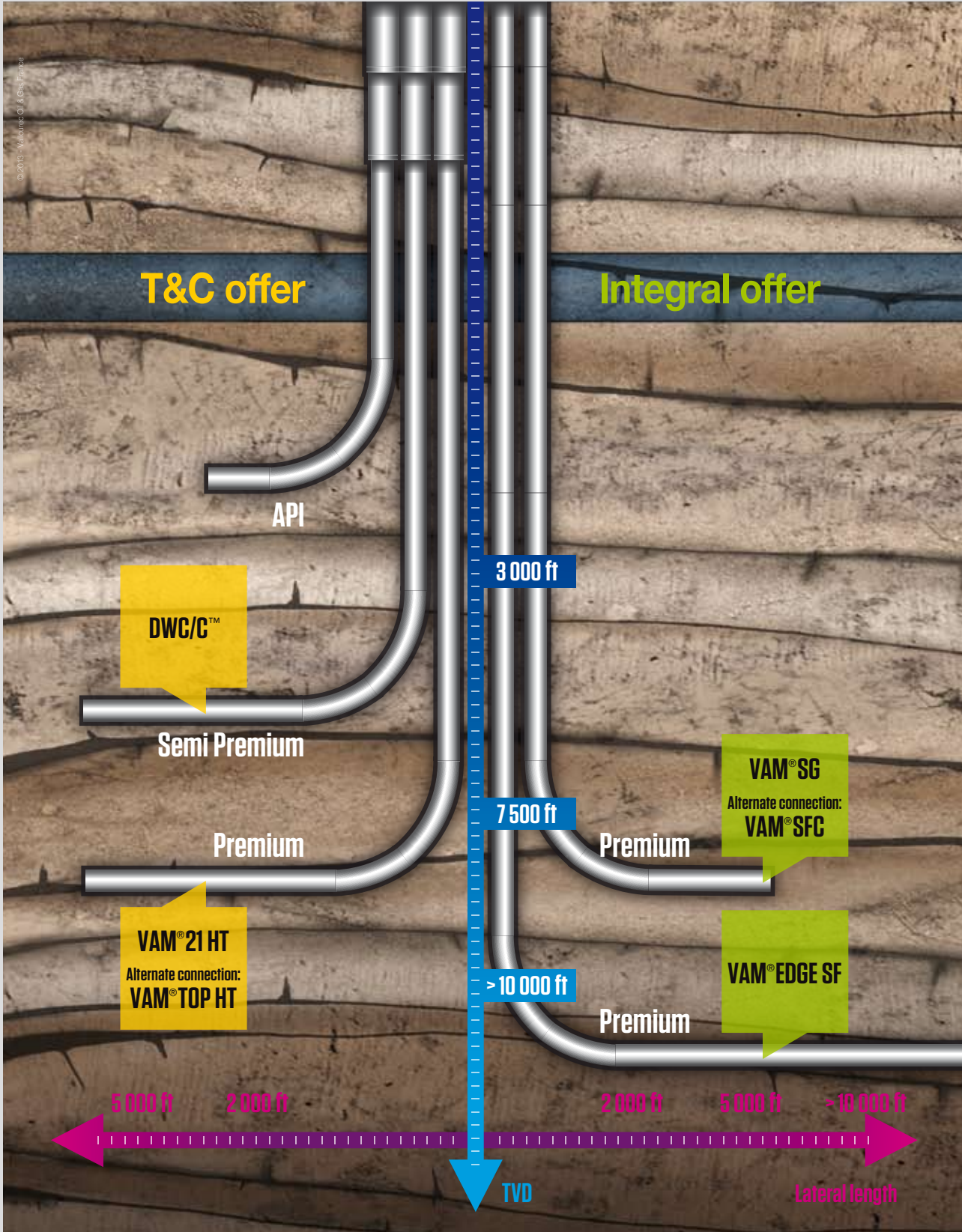
High Performance

Connect with confidence  
→ Excellent resistance to torque, bending, and compression  
→ Simple, reliable, and easy-running  
→ Seal protected from rough handling





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**Testing for purpose** is a key for successful operations, providing you with quality assurance at each step of your project:

**Installation:** fatigue testing simulating rotation at installation

**Fracturing:** multiple internal pressures/tension cycles tested with water

**Production integrity:** following ISO 13679 FDIS 2011 CAL II standard

Vallourec has developed a dedicated fit for purpose testing protocol based on the specificity of the Shale application. This testing protocol simulates the different loads encountered by the string during the different stages of the shale installation / fracturation and production.

### Shale specifics

- › Economics and risks are on a different scale from Deep Water.
- › Shale loads are more focused on cyclical effects.
- › Fatigue plays a key role in the behaviors of the connections.

### Vallourec's shale test program

- › Cyclical fatigue to simulate the rotation of the string during the installation in the lateral section.
- › High pressure internal pressure from Hydraulic fracturing induced fatigue.
- › ISO 13679 FDIS 2011 CAL II test to simulate the production phase.
- › VAM® EDGE SF and VAM® SG have been tested to this fit for purpose test program and any connections used in Shale/Tight plays could be tested according this test protocol.

### → Resonant Fatigue testing

- › Test to failure on several samples
- › Varying stress ranges to replicate common dogleg severities
- › Establish fatigue life - cycles to failure

### → Post-Fatigue testing

- › Sample tested to 50% of Fatigue life - simulating rotation during installation
- › Same sample subjected to multiple Pressure / Tension frac cycles
- › Then tested to ISO 13679 Series B test with bending

### → Fracture treatment simulation

- › Multiple High Pressure / Tension cycles
- › Pressure simulating multiple frac cycles
- › Tension simulating temperature induced loads during fracture treatment

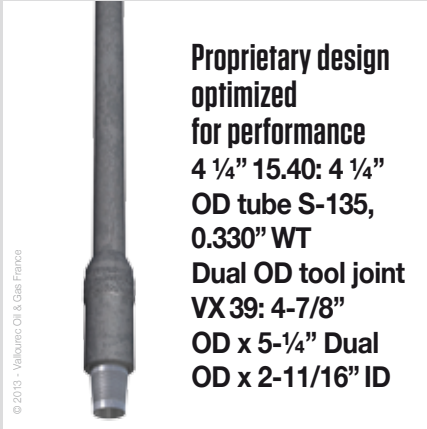
### → Gas Production Cycles following ISO 13679 FDIS 2011 CAL II

- › Series B (2 quadrant) at ambient without Bending
- › Series B at elevated temperature (300 deg. F) with Bending (40 deg. / 100ft)
- › Series B at ambient with Bending
- › Series A (4 quadrant)



# Solutions for your Drilling Operations

## Shale Drill Pipe

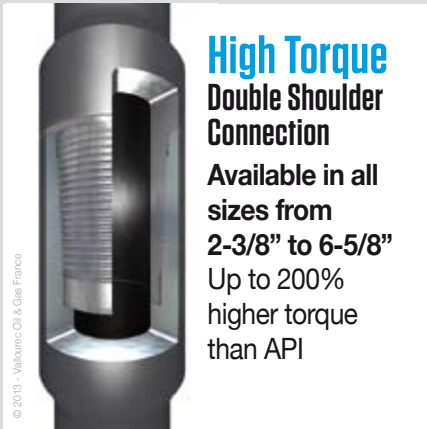


Proprietary design optimized for performance  
4 1/4" 15.40: 4 1/4" OD tube S-135, 0.330" WT  
Dual OD tool joint VX 39: 4-7/8"  
OD x 5-1/4" Dual OD x 2-11/16" ID

### Maximizing Drilling Efficiency and Tubular Life

- Faster ROP due to higher buckling resistance and better transfer of surface WOB
- Efficient hole cleaning and better hydraulics due to increased AV and lower SPP for same flow rates
- Longer service life for drill pipe due to reduced side forces on the tube
- Less risk of stuck pipe due to efficient hydraulics
- › Standard handling & fishing equipment
- › Recommended MUT of 21,200 ft-lbs
- › Premium Tensile Strength of 432,000 lbs
- › Premium Torsional Strength of 37,600 lbs
- › Elevator capacity of 369,000 lbs

## VAM EXPRESS

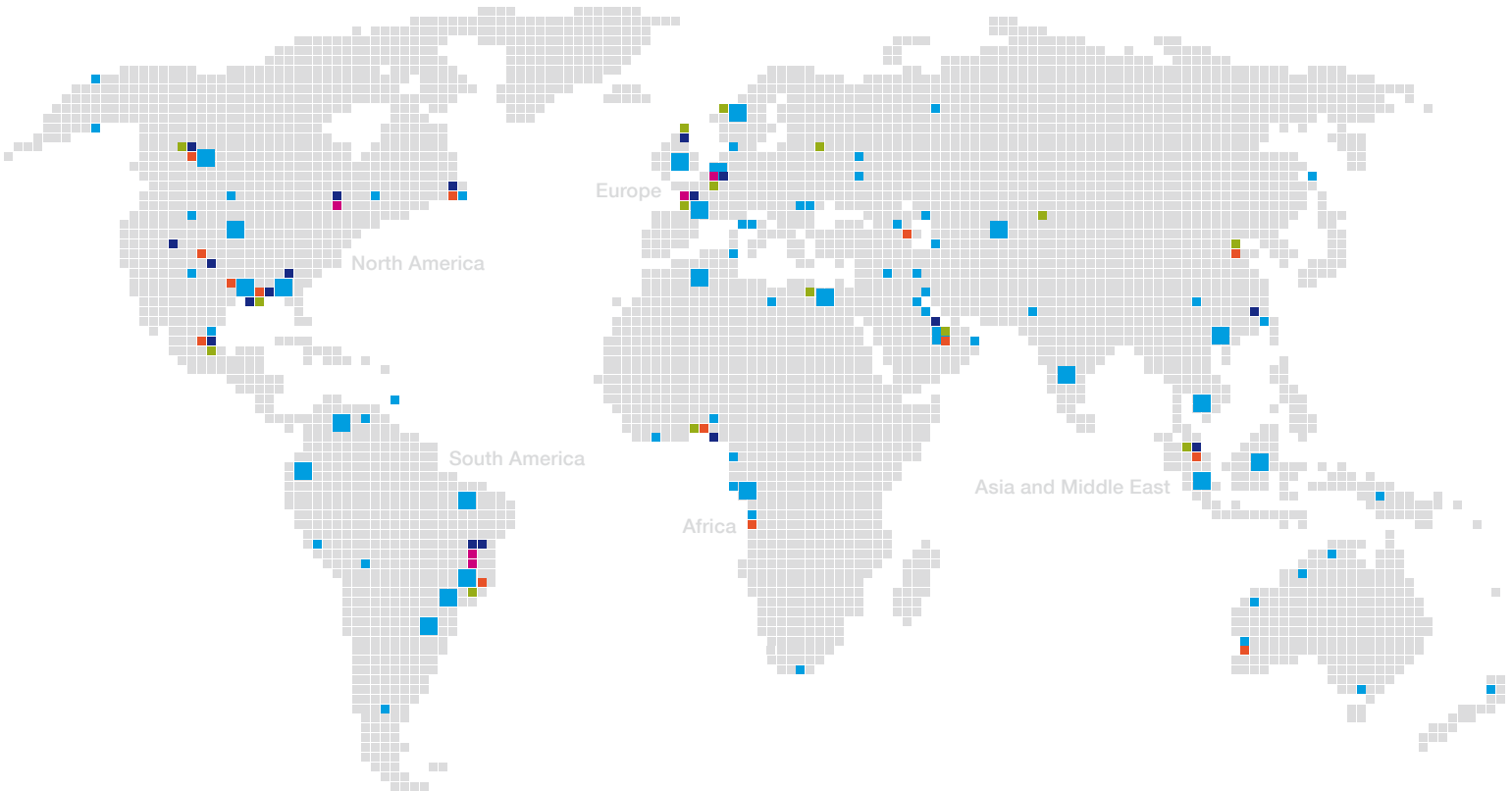


**High Torque Double Shoulder Connection**  
Available in all sizes from 2-3/8" to 6-5/8"  
Up to 200% higher torque than API

### Reducing Total Cost of Ownership

- Ease of use, run as simply as API connections without a stabbing guide
- Reduced trip time due to faster makeup; less than 1/2 number of turns as compared to equivalent connections
- Lower repair and maintenance cost, and less stabbing damage because of proprietary design
- Longer service life due to less material removal during recut
- Up to 5,000 psi gas tightness without the need for a metal-2 metal seal
- › Patented thread profile allowing deep stab
- › Only 6 to 7 turns to full make-up
- › 40° thread stabbing flank and pin nose with shallow chamfer for easy stab
- › 0.065" elliptical thread root radius for maximum fatigue resistance
- › Slim profile for efficient hydraulics

# World Leader in Premium Tubular Solutions



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 ■ Manufacturing Plants   
 ■ Accessories and Repair VAM® Licensee Facilities   
 ■ VAM® Field Service International

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