

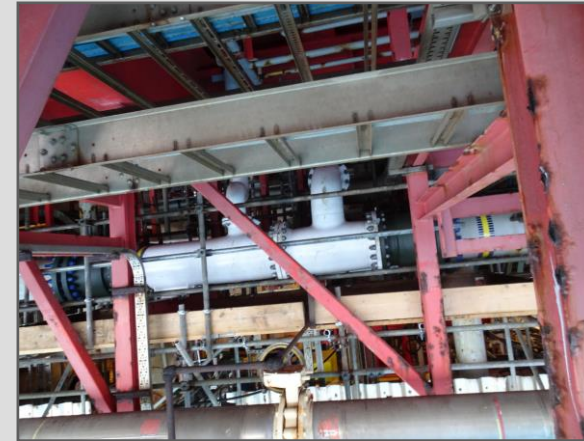


Mechanical Connectors Facilitate Safe And Cost-Effective Flare System Replacement In The North Sea

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The Challenge

- The North Everest Platform had experienced multiple integrity issues with flare pipework from the main 20” header.
- Existing Composite enabled the continuation of production until a permanent repair in the form of pipework replacement could be completed.
- The quantity, location and size of some of these repairs were extremely challenging due to the system being fully welded.
- An extend shutdown over three times the original planned duration (30 days to circa 135 days) would be required to complete all works due to SIMOPS.
- Inspected wall thickness loss meant extending the replacement to the next suitable cut point, making repairs more complex.
- Harbour Energy used 7 x 20” STATS flanged connectors and 9 x 10” STATS flanged connectors during the scope to remove more than 30 safety critical integrity issues.



Collaboration for Solution Development

- FEED confirmed that a fully welded solution wasn't feasible as a standalone option.
- Harbour Energy had to look towards an alternative solution, with mechanical connectors proving the most viable option.
- STATS were engaged at every stage of the project from design, engineering and offshore construction support.
- Any internal concerns were addressed fully including ovality, wall thickness and installation location access.

Why Did Harbour Choose STATS Connectors?

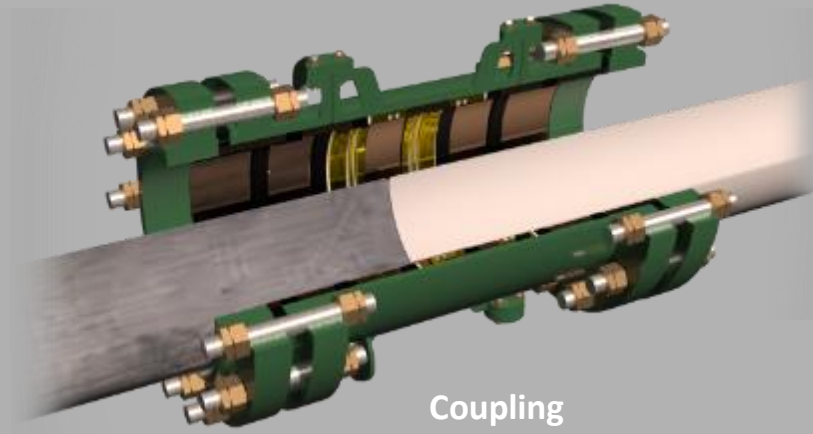
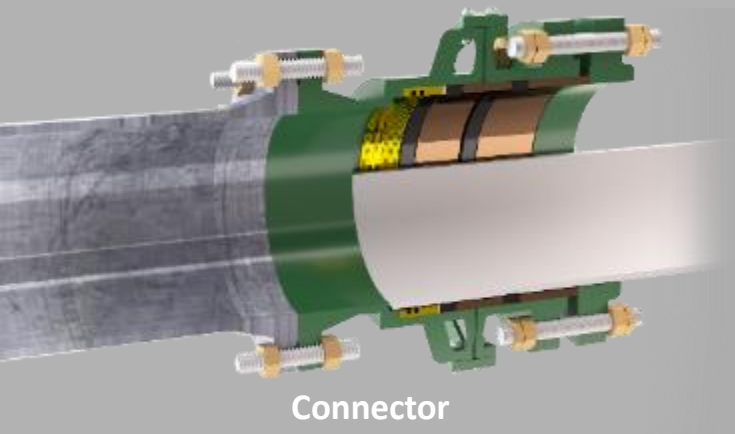
- STATS provide a variety of different sizes and mechanical connector type
- The mechanical connectors are DNV approved and met all our specifications for a flare system
- STATS have a proven track record using their connectors on platforms around the world
- The installation of the connectors does not require any specialist tooling or heavy machinery
- During installation, the connectors can be continually adjusted to ensure alignment is correct
- The connectors can be tested and then monitored at any time using the internal test ports
- The connectors do not require any additional external coatings or sealants to be used
- If the connectors are removed from service, they can be recovered for re-use elsewhere after some minor maintenance
- The overall duration for installing the connectors is greatly reduced as to that of a standard mechanical connector or welding solution.



Technical Solution

DNV type approved Mechanical Connectors provide a permanent pipe to pipe or pipe to flange connection where welded or hot work options may be undesirable.

The slipover design and external gripping assembly enables quick and efficient installation, providing cost effective piping repair, tie-in or capping of redundant pipework.



TYPE APPROVAL CERTIFICATE

This is to certify:

That the mechanical connectors and couplings

with type designation(s)
LC series

Issued to

STATS UK Ltd

ABERDEENSHIRE, United Kingdom

is found to comply with

DNV-OS-F101 Submarine Pipeline Systems (2013)

DNV-RP-F113 Pipeline Subsea Repair (2007)

and with DNV GL's current understanding and interpretation of the ASME BPVC.VIII.1-2015 and ASME B31.3-2014.

Application :

The connectors and couplings approved by this certificate are accepted for installation on steel pipelines for utilities, oil and gas transport.

Conditions and limitations are given below and in reference documents.

Design to follow approved design documentation and test procedures given in the reference documents.

Temperature range: -40 to +300°C

Max. working press.: 51.1barg

Sizes: 2" to 36"



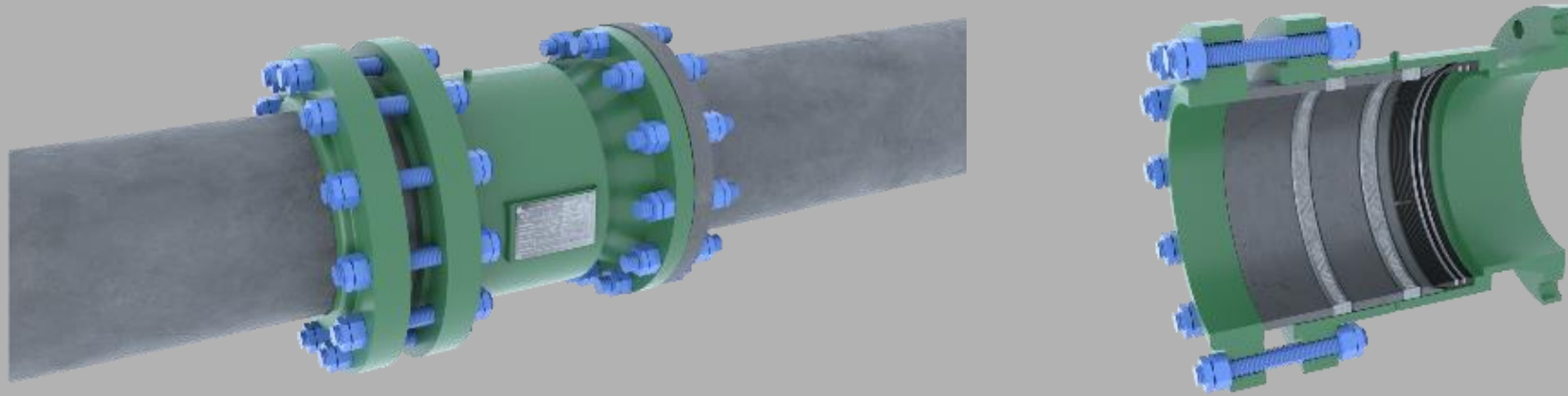
**14" Connector
Equinor Mongstad**

Weldless Connector Key Features

- Standard sizes 2” to 36” – RF / RTJ Flange Options
- Standard MAOP: Up to 51 bar / 741 psi – Higher Pressures available
- Standard temperature range: -40°C to +300°C
- Fire Tested to comply with API 6 FA
- Design strength verified to ASME B31.3, B31.4 and B31.8
- Designed to fit standard pipe specification (ASME B36.10 & B36.19, API 5L)
- Testing and verification port to carry out leak testing and seal monitoring
- Xylan 1425 coated internal and external as standard (Other coatings available on request)
- Carbon steel applications as standard (Duplex and SS on request)
- Manufactured to the applicable PER category for pressure & service



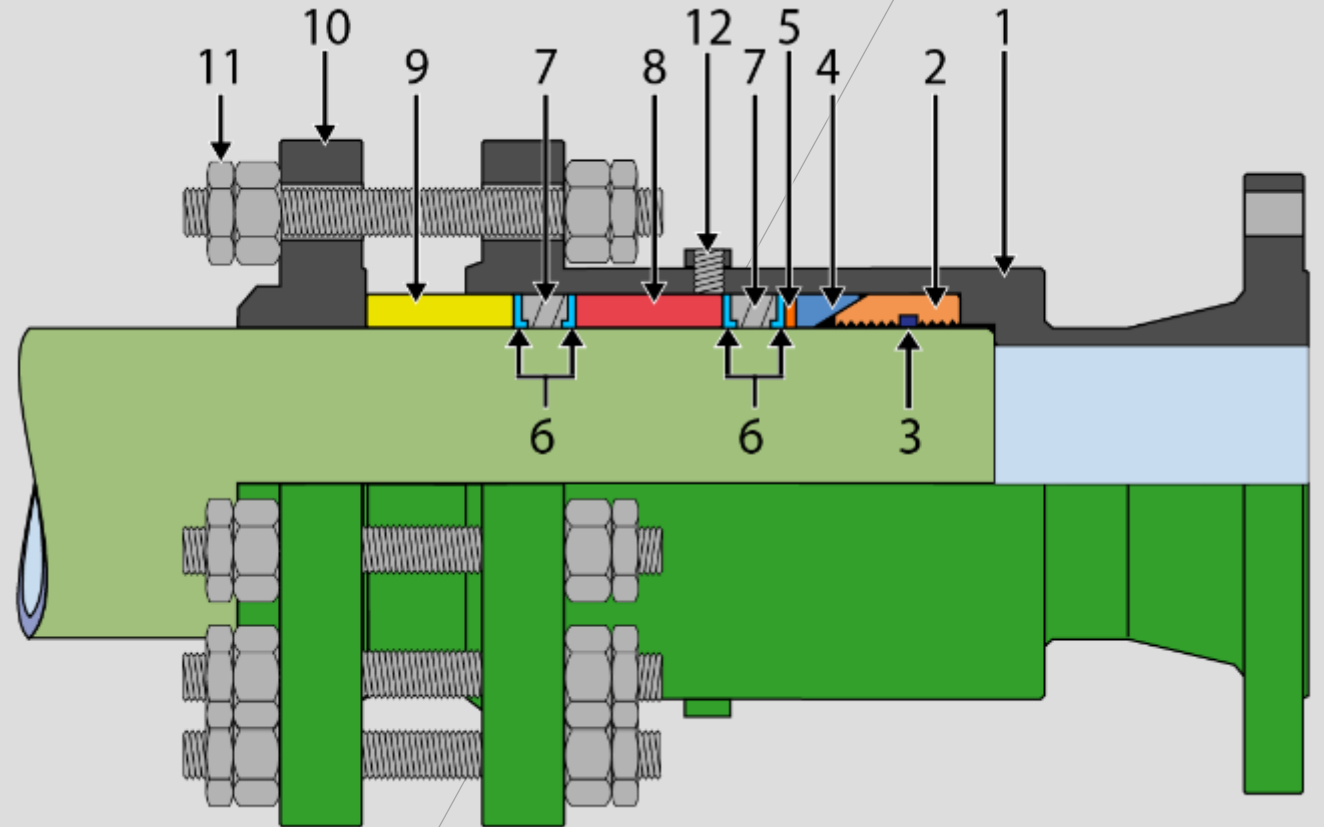
Weldless Connector Benefits



Safety	Eliminates the need for hot work activities
Time	Significantly quicker to install compared to welding
Cost Effective	Eliminates welding equipment, personnel, habitat and personnel resources
Easy to Install	No specialist installation tooling required – Hand tools only No requirement for additional coating once installed
Test and Monitor Facility	Integrated test port to prove connector sealing without additional tooling
Avoids Pipe Deformation	External lock and seal assembly eliminates flow restriction or turbulence. Applies code compliant connection loads into pipe, avoiding any localised material deformation or overstress conditions
Size Range Availability	DNV Type Approved from 2” to 36” on hydrocarbon systems enabling a wide range of repairs

Connector Key Components

Number	Description
1	Connector Body
2	Segmented Locks
3	Lock Retaining Ring
4	Lock Bowl
5	Lock Bowl Backup Ring
6	Anti-Extrusion Rings
7	Packing Element (Graphite Seals)
8	Seal Spacer Ring
9	Compression Ring
10	Compression Flange
11	Studbolt c/w Full Nut & Half Nut
12	Integrated Test Port



**Simple Design – Easy to Use
“Torque it, Test it, Leave it”**

Testing & Verification

Testing in accordance with ISO 21329

- Pressure/Bending Test
- Torsion Test
- Pressure Test to Failure
- Bending Test to Failure
- Tensile Test to Failure
- Bending Fatigue Test

Fire Safety Testing

- Jet fired to a temperature of min 761°C



Bending & Torsion Testing

Testing & Verification

Testing Results

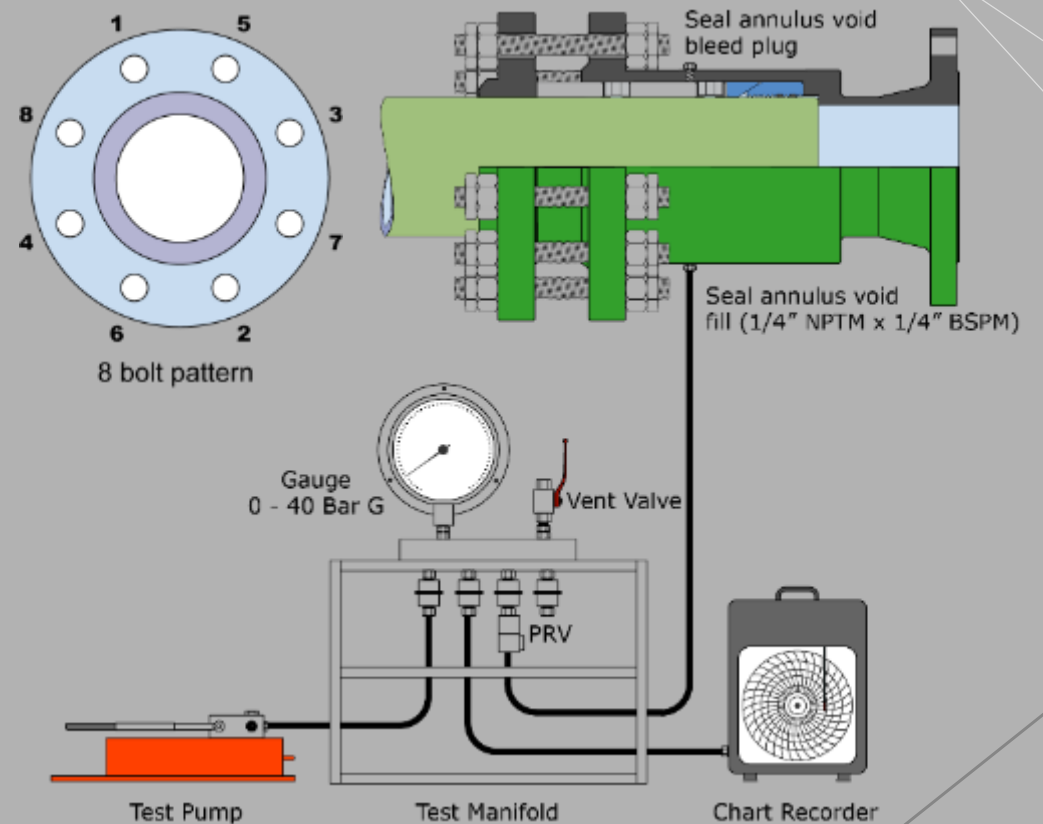
- Connectors / Couplings were pressure tested to 345 Bar where a leakage was detected (Design Pressure 50 Bar)
- Bending moment of 41,000Nm applied with no leakage detected (Test fixture limit)
- Tensile force of 46.2 Tonnes applied with no leakage detected
- Connectors / Couplings were subjected to temperatures of min 761°C for 30mins with no leakage detected (tested over 900 °C)



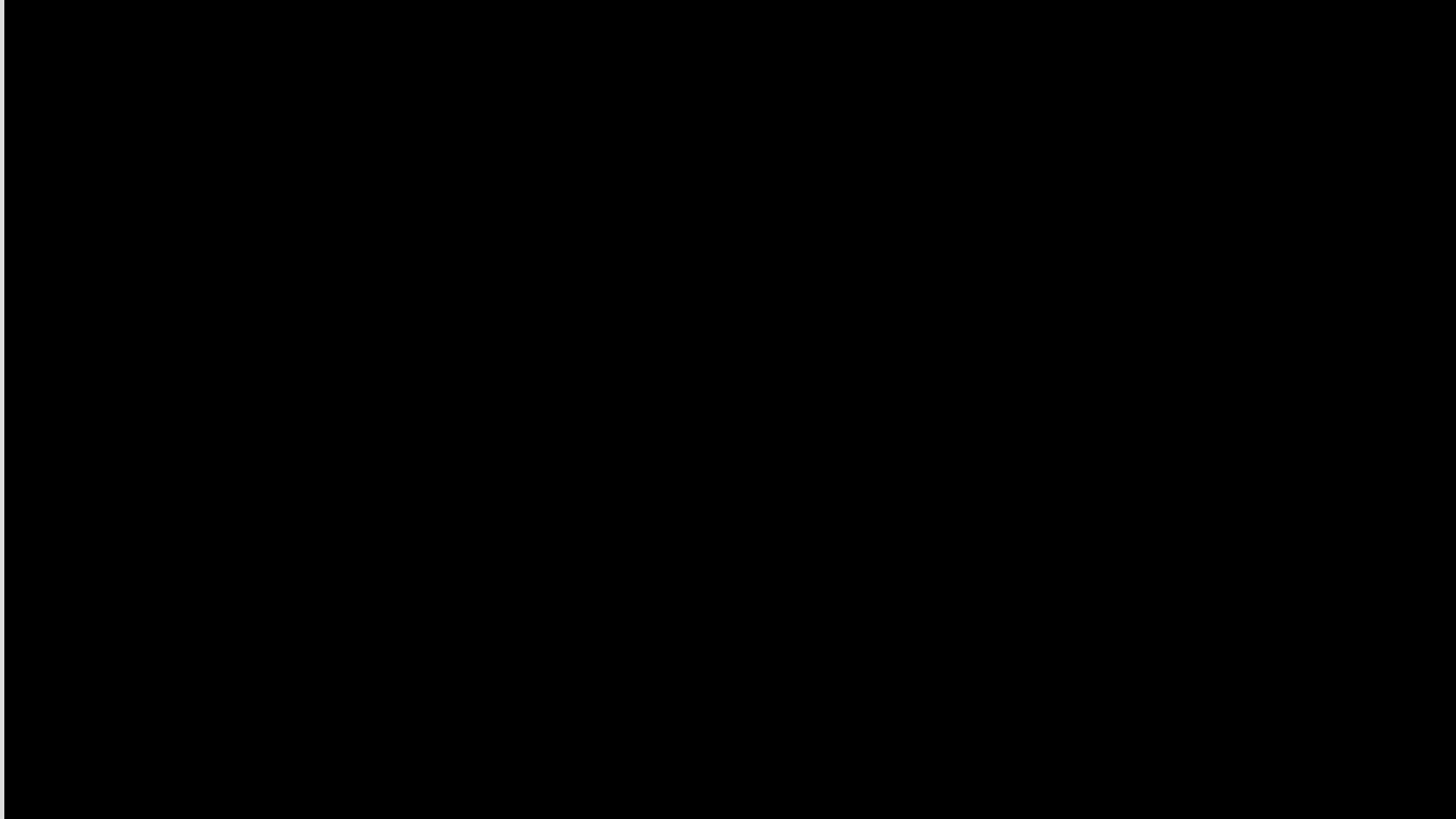
FIRE TEST QUALIFICATION CERTIFICATE		
Score (Europe) Ltd	Item	Pipe Connections (General Assembly)
	Size	4"
	Class	150
	Serial No	LC-01-4-115
	Body Material	A533 Grade 6
	Seal	Graphite (Supergraf Premier)
	Manufactured by	STATS (UK) Ltd
	In accordance with job number	13646 C-04
	In accordance with drawing number	SA 15.0020.00.AA
	<p>The above valve was tested by Score (Europe) Ltd at their Specialised Valve Research and Test Centre, Cowdenbeath, Scotland and the results have been recorded as a PASS, having complied with the minimum performance requirements stated in specification</p>	
Test date	03/12/04	
Other sizes qualified	4" through to 8", 150PSI to 230PSI	
Other pressure ranges qualified	150, 200, 1000N to 1250N	
Tested by	J. O'Hagan / S. Fox / H. Napier	
Witnessed by	W. Turpin G. O'Connell G. O'Connell	
<p>This certificate must be read in conjunction with the full Score Test Report Number 134890-2</p>		

Installation

- All Connectors are issued with size specific installation procedures.
- Preparation of existing pipework includes removal of all existing paint / coatings to expose bare metal. Seam welds should be smoothed.
- Connectors are slipped onto the bare pipe and bolted in the same bolting pattern as a standard flange to the outlined bolt torque setting.
- Seal verification testing is carried out via the integrated test port up to a pressure of 1.1 x Design – 30 min hold period.
- Upon completion test ports are capped, allowing future seal integrity inspections / re-testing.



Installation Animation



Installation Completion



Conclusion

- The use of STATS connectors for this critical scope of work raised some concerns within Harbour Energy.
- Concerns were based on a mis-conception regarding the size and weight of the connectors and introducing flanged / bolted connections into a flare system.
- This large construction project was on the critical path during a major platform shutdown.
- Collaboratively these concerns were addressed, with STATS connectors now accepted as part of Harbour's Defined Life Repair procedure for use as an 'end of field life' connector.
- STATS team worked hand in hand with Harbour Energy, the HSSE and DNV to clarify and address any queries raised which helped streamline the overall execution of the scope.
- The connectors we installed have performed extremely well and continue to operate effectively to this day as per specification.
- Following this project success, STATS connectors are now used, where suitable, across all of Harbour Energy's assets.
- A project is now ongoing for an identical scope on the Lomond Platform, ensuring the plant operates safely for years to come.



Thank You For Your Attention

