

A case study in the use of a mechanical clamp on a non-typical joint

4 March 2021

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A presentation by Wood.

wood.



The problem

Background

Minor seepage detected in a gas pipeline around a monolithic isolation joint.

30" (773.7mm OD) Carbon Steel API 5L X65, 28.6mm wall thickness

Design Pressure	-	189.6 barg
Operating Pressure	-	Min 115 barg Max 172.4 barg
Design Temperature	-	-20°C to 50°C

Sour Service

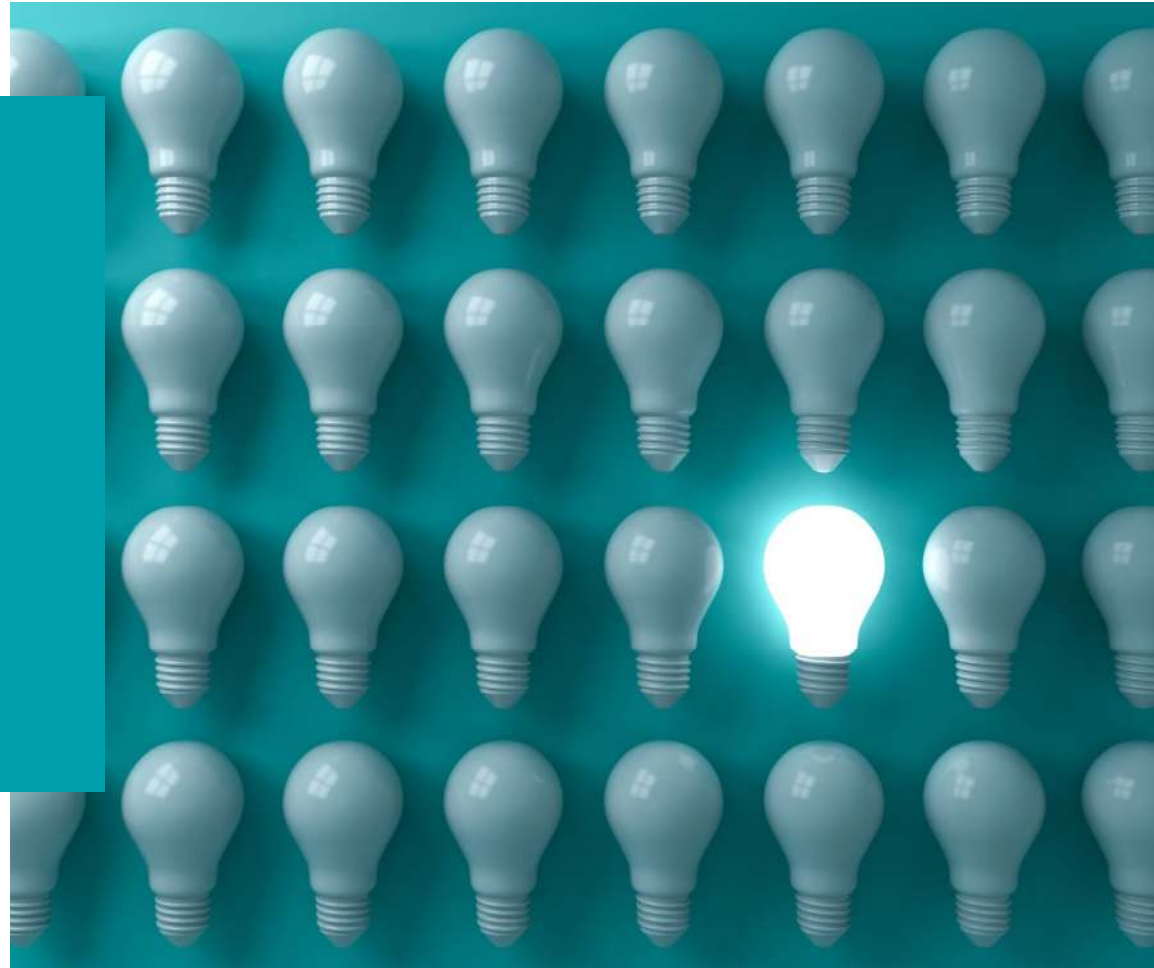
Review of available solutions

Requirements of the solution:

- Contain pressure
- Maintain electrical isolation
- Not impose additional load or moments into the monolithic isolation joint
- Ability to Monitor and Measure
- Maintainable
- Removable without damaging pipeline
- Lend itself to future intervention / plan B

Options Shortlisted

Value Analysis and Failure Mode Effect Analysis conducted on shortlisted options



Discounted solutions

Welded Options

Complete Shutdown of the SAGE and Beryl pipelines

- Not practical, time and disruption
- 100s of kilometres of pipeline would require to be shut down and made gas free

Isolation via existing valves

- Gas free isolation not guaranteed
- Being worked over during shutdown

Isolation plug

- Bespoke tool required on long lead time
- Challenges sealing on previous valve rectification scope

Selected solution - TEAM clamp

Design

- Size and weight
- Seals
- Electrical Isolation
- Injection vs / monitoring
- Valve design impact protection vs / valve design sophistication

Loading

- Inability to define acceptable loads
- How to support

Testing

- Energising the seals

Inspection

- FAT
- SAT

Installation

Long term inspection



Loading and support - TEAM clamp

Installed Weight – 16,075 KG

No load to be transferred to Monolithic Isolation Joint

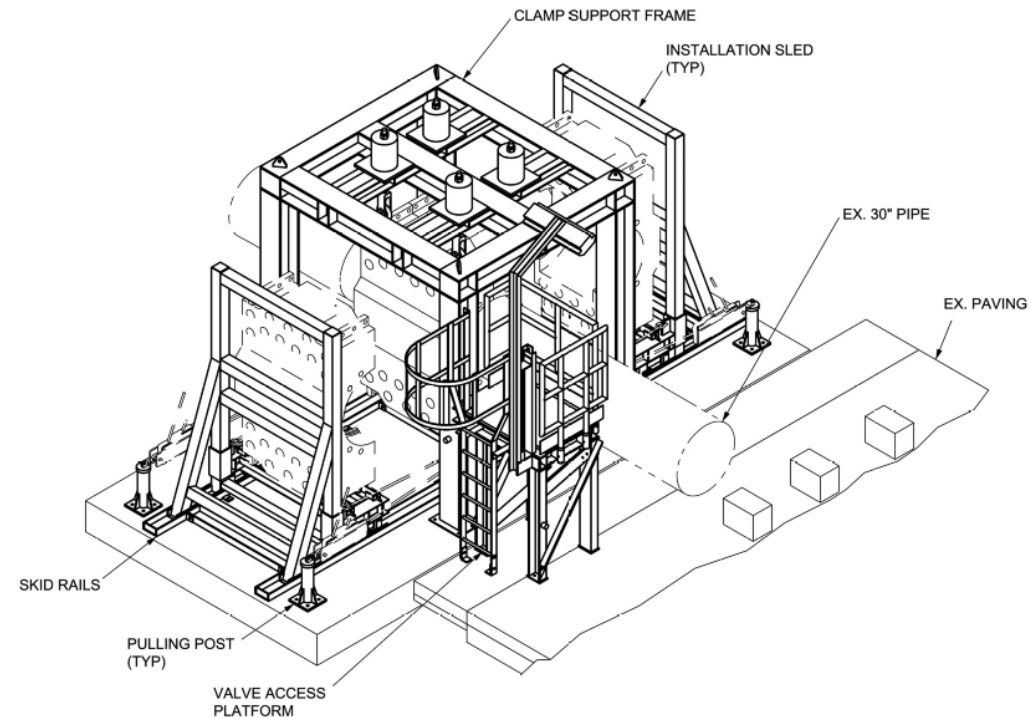
The design and condition of the Monolithic Isolation Joint makes it impossible to define an acceptable load. Particularly axial and moments

No solid base to support from

- Piling discounted
- Settlement will occur

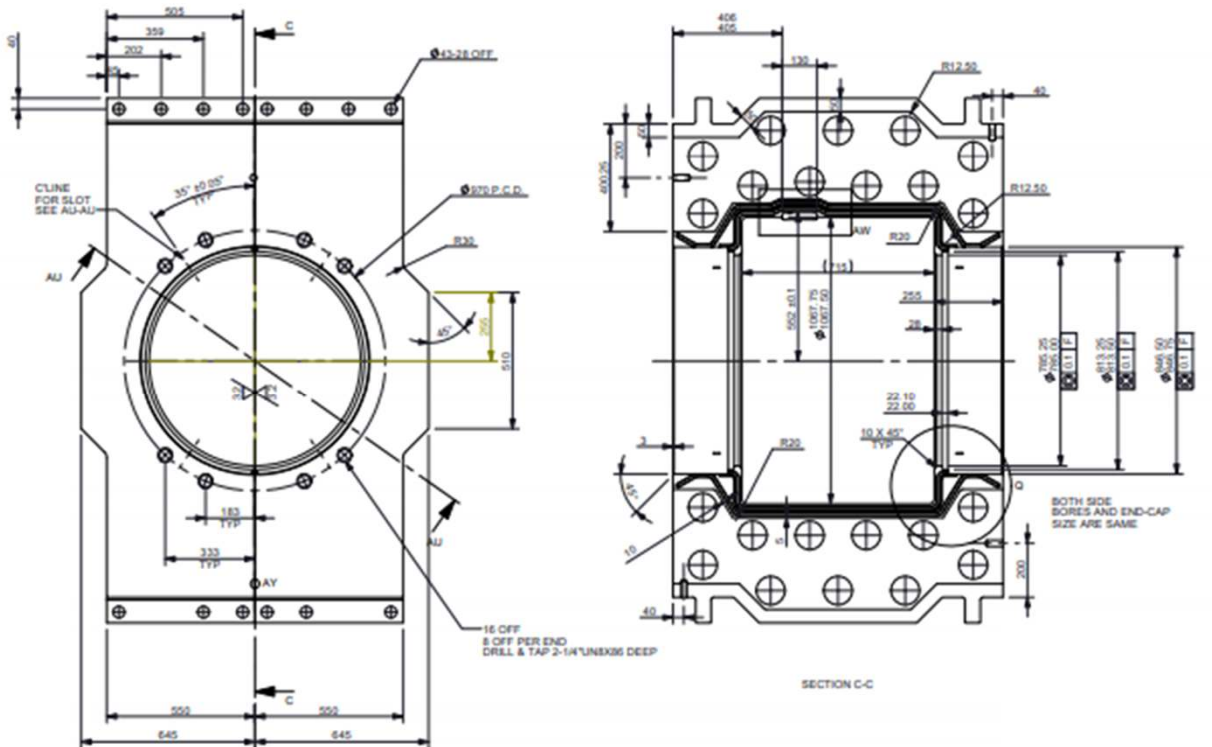
Selected support design

- Spring Support – Variable Type
- Load cells
 - Monitor installation load transfer
 - Monitor settlement



**ISOMETRIC VIEW ON ENCLOSURE CLAMP SUPPORT
& INSTALLATION STEELWORK**

Seals & electrical Isolation - TEAM clamp



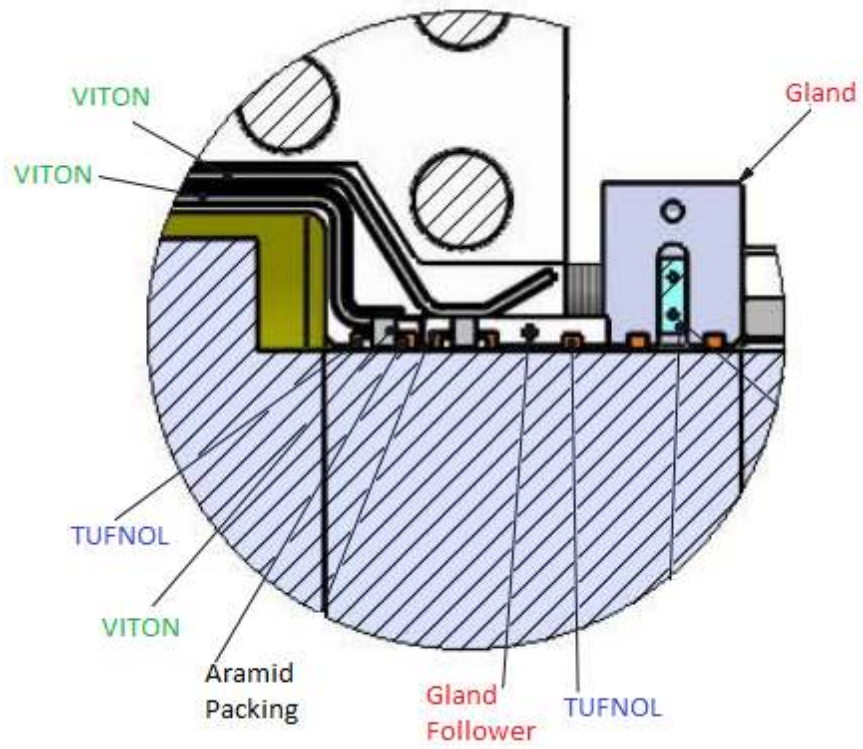
Design

- Non standard seals due to electrical isolation requirement
 - Larger aperture
 - Different grade Viton mc616 non- carbon

Electrical Isolation

- Tufnol 10G/40 rings to provide separation
- Isolation test
 - 2000V, 50Hz for minimum 1 minute no flash over or breakdown
- Resistance test
 - 500V dc isolation tester, resistance shall exceed 50 Mohm
- Failed first FAT
- Capacitive effect

Seals & electrical isolation - TEAM clamp



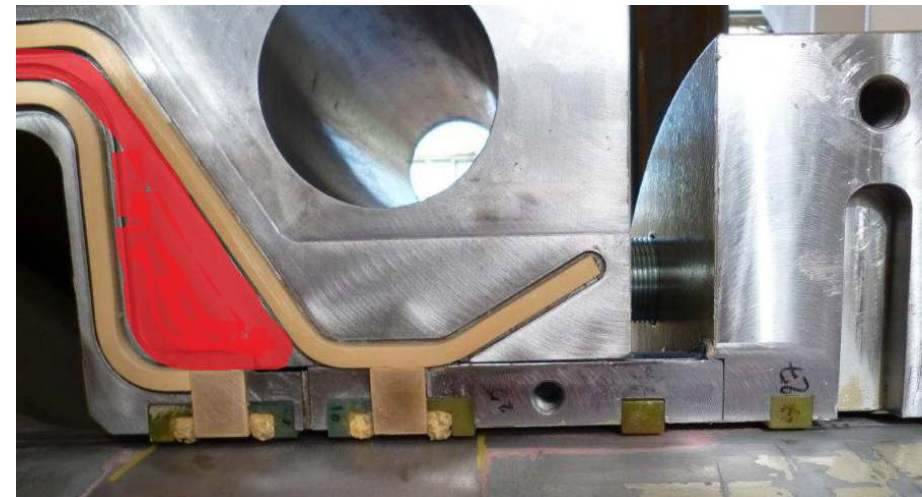
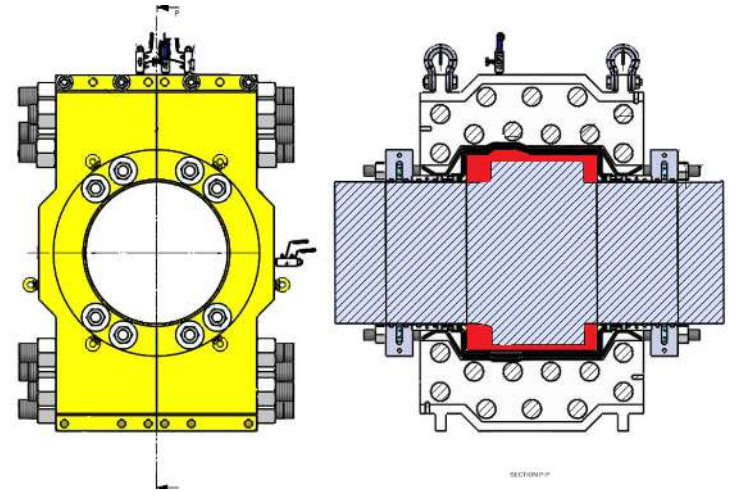
Injection vs monitoring & valve design - TEAM clamp

Clamp cavity injection

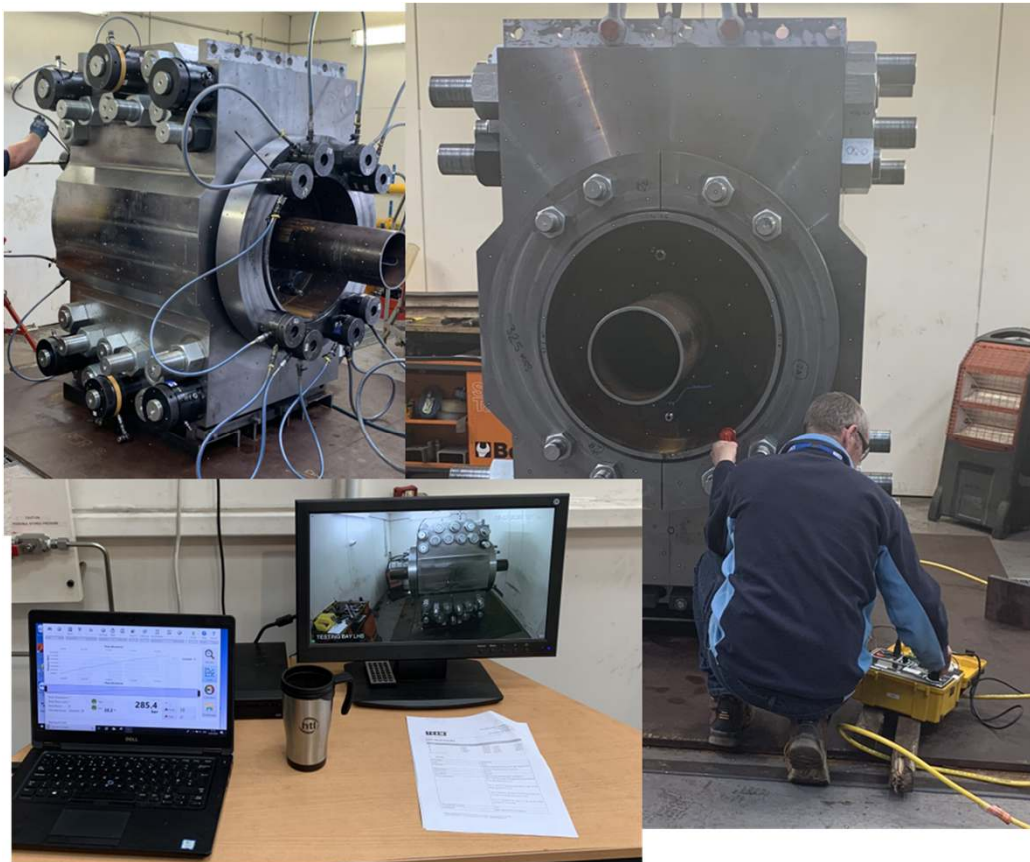
- Facility provided via tapping & DBB valves
- Would aid sealing
- Removes monitoring ability

Valve design

- Flanged / hub / threaded ends
- Double block and bleed
- Light weight in place of sophistication of design



Testing & Inspection - TEAM clamp



FAT

- Mirror site installation
- Test Piece – Dimensionally Identical
- Particularly thorough due to site testing limitations
- Hydrostatic and Pneumatic Testing
 - Acceptance rates
 - Duration
 - Energising the seals
 - Sequence
- Electrical Tests
 - Resistance test
 - Isolation test
 - Acceptance criteria
 - Investigation of Failures

SAT

- Limitation on testing at site
 - Electrical Breakdown
- What can be done safely
- Pneumatic / hydrostatic Testing
- How to protect the Isolation Joint

Installation part 1 - TEAM clamp

Preparing the pipeline

- Removing weld seam
- Removing Cathodic Protection Lugs
- Removing Paint

Lifting

- Avoiding upending (transport upright)
- Land in Support Frame

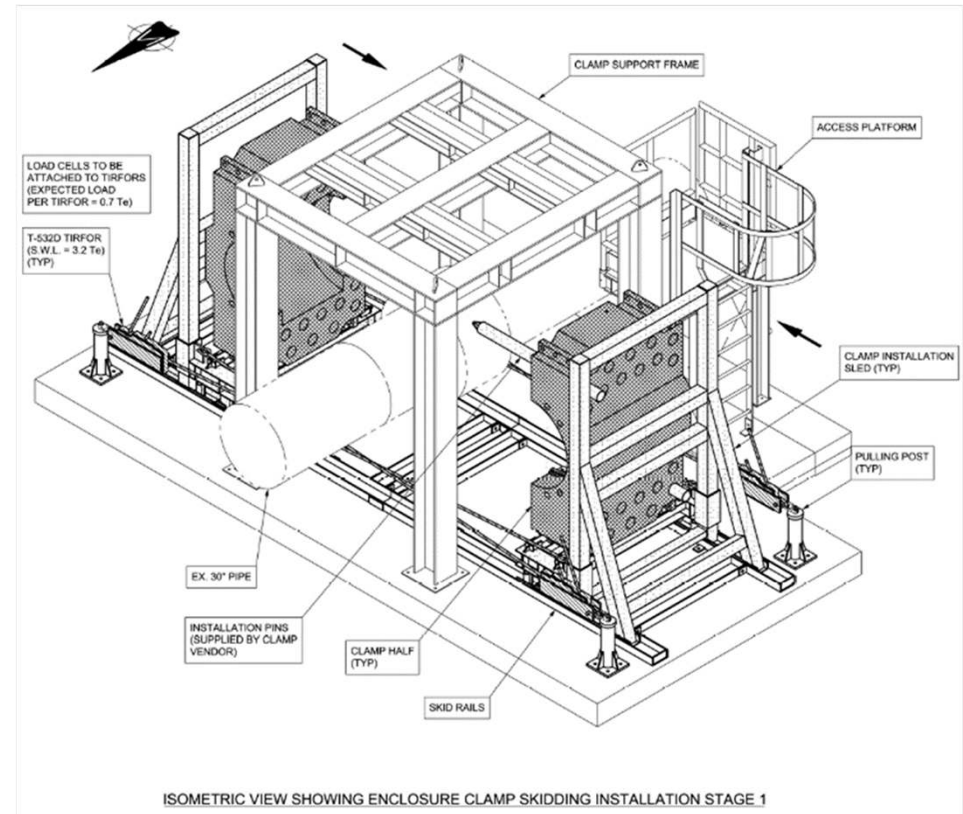
Bring clamp together under control

- Jacking clamp halves together
- Constant monitoring
- PTFE guide rods
- PTFE stops
- Final adjustment via bolts and dowels

Supporting

- Transfer of Load
- Load cells

Sealing end cavity and painting



Installation part 2 - TEAM clamp

Preparing the pipeline

- Removing weld seam
- Removing Cathodic Protection Lugs
- Removing Paint

Lifting

- Avoiding upending (transport upright)
- Land in Support Frame

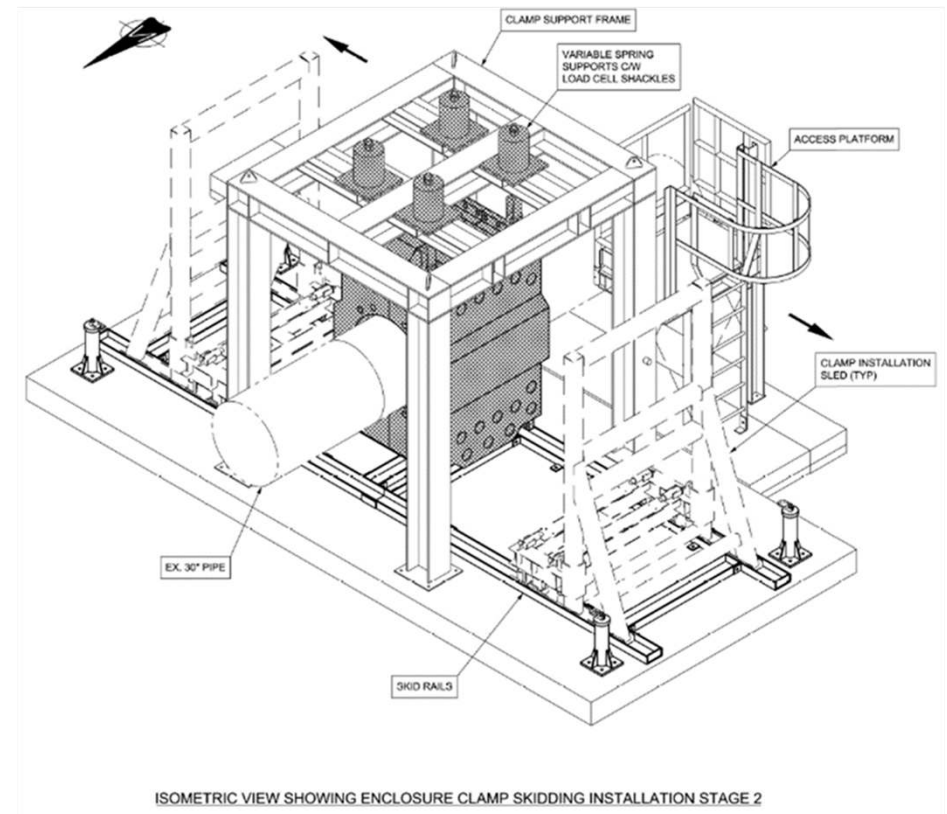
Bring clamp together under control

- Jacking clamp halves together
- Constant monitoring
- PTFE guide rods
- PTFE stops
- Final adjustment via bolts and dowels

Supporting

- Transfer of Load
- Load cells

Sealing end cavity and painting



Installation photos



Installation photos



Post Installation

Inspection:

- Monitoring Sealing
 - Cavity pressure
 - Inter-seal cavity pressure
 - External gas / sniff tests
- Settlement
 - Load Cells
 - Dimensional Survey

Cause of Issue with IJ:

- Without destructive testing not possible to confirm
- Possibly subsidence
- Possible degradation of seals due to aging



Safely installed During August 2020
TAR

- No Safety Incidents
- No Environmental Incidents
- On Budget
- On Schedule



Questions?

wood.