OVERCOMING PIPELINE ACCESS CONSTRAINTS

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Introduction

A common access constraint for pipelines is the inability to safely access pipelines via serviceable pig launching and receiving (PLR) facilities.

Lack of access to pipelines results in essential pigging activities being delayed or conducted less frequently than required - or not at all.

Typical Onshore Pig Receiver

Access Constraints – Causes and Consequences

Pipeline / PLR access constraints can

- Prevent pigging entirely
- Require production shutdown to install and remove pigs
- Lead to acceptance of unsafe operations - loading and removing pigs with inadequate isolation

Causes

- Launchers / receivers (PLRs) not installed (dashed lines on many P&IDs and iso's)
- The lack of adequate isolation valves for PLR installation
- Degradation of existing PLR isolation valves (poor valve maintenance)

Consequences

- Inability to pig the pipeline
- Essential pigging activities delayed or done less frequently
- Build-up of sand, wax, water or scale
- Flow assurance challenges, reduced production, corrosion issues
- Lack of inspection data - increasing integrity risk

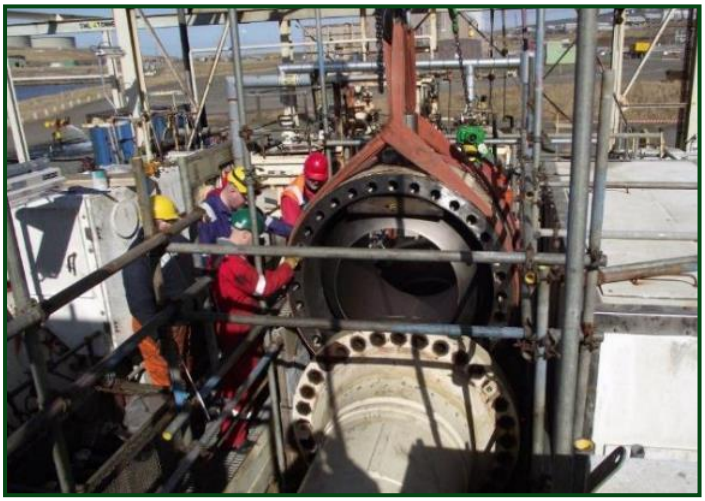
- Exposure to unsafe PLR operations – pressure release or loss of containment safety incident “live gas operations!”

Removing Access Constraints

This presentation will explain how appropriate intervention or isolation methods can be used to create or restore access to pipelines, so pig loading and removal operations can be done regularly and safely.

PLR Operations – Pig Loading

Restoring or creating safe access typically requires, valve replacement, valve repair or valve installation.



PLR Isolation Valve, In-Situ Repair

This paper will now present methods to show how this can be done; without depressurising the pipeline and often without affecting production.

Intervention and Isolation Methods

Sealant Injection - temporarily restores valve isolation

Temporary Isolation Plugs

- Double Block and Bleed Inline Isolation Plug (Tecno Plug®)
  - Umbilical/ Tether controlled
  - Remote (through wall) controlled

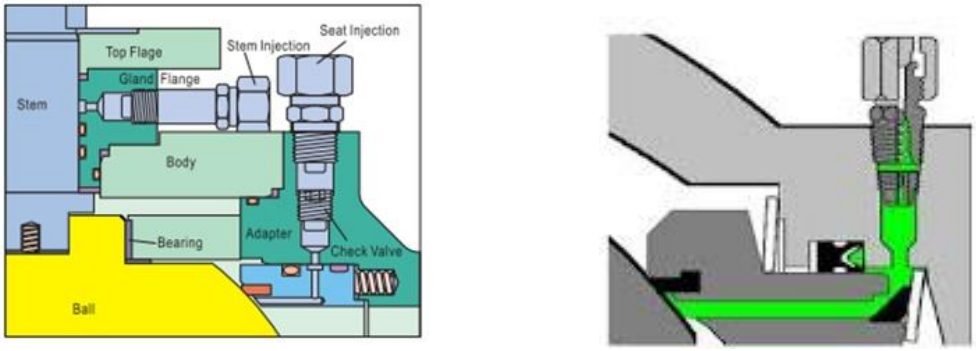
- Branch Installed DBB Isolation Plug (BISEP®)

Various Hot Tapping Techniques

- For sealant injection
- To facilitate venting and bleeding for isolation valve barrier testing
- Creating full bore access - for isolation plug installation

Sealant Injection

Injecting sealant into valves can provide sufficient, temporary isolation to enable pig loading and removal.



Sealant System Cross Sections

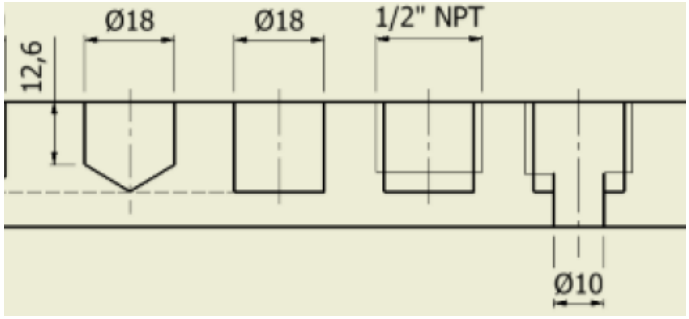
Often the ports required to inject sealant into the correct region of the valves are not available.

Injecting sealant is not a long-term fix. The action of injecting sealant grease through sealant injection fittings increases risks of further damage to the valve seats by attracting more debris.

Pressure Controlled Penetration – for Sealant Injection

If sealant injection ports are not available, ports can be created by doing a small-bore hot tap into the valve body. This method can also be used for venting and bleeding between two barriers.

To ensure this method is done safely it is important to confirm the valve body thickness and material grade. UT measurements are done to confirm body thickness, then design checks and calculations are done to define the dimensions and specification for each stage of the small bore hot tapping procedure.



Stage - Dimensions and Specification Defined

Stages for safe pressure controlled, small-bore hot tapping

1. Drill initial hole to specified depth

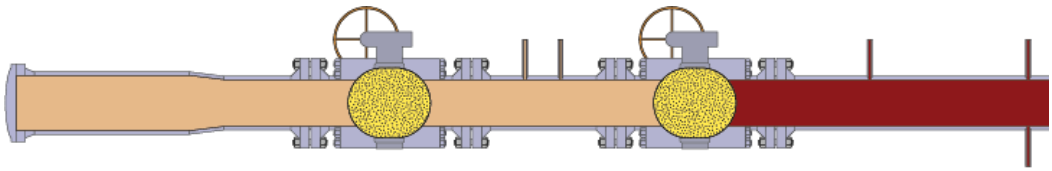
2. Drill wider hole

3. Manually tap to cut the thread into the hole

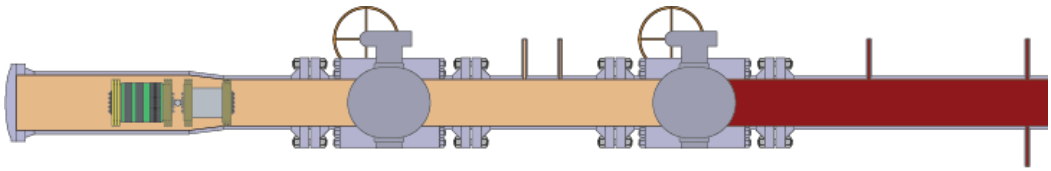
4. Fit valve and small-bore hot tap machine to the tapped connection – leak test entire assembly
5. Drill through final section of valve body

Inline Isolation Plug – Valve Replacement

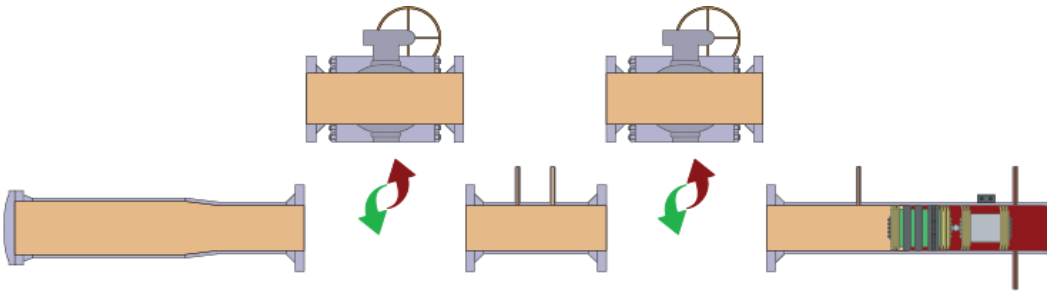
Remote Tecno Plug®



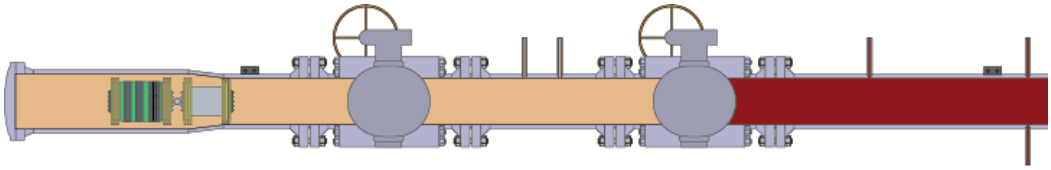
Once the valves are sealing, it is safe to open the launcher door



Isolation plug is then loaded into the PLR

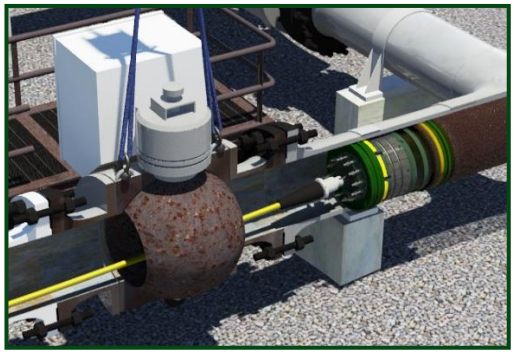


Isolation plug deployed and Double Block isolation proved
Damaged valves removed
New valves installed
All new or disturbed flange connections leak tested



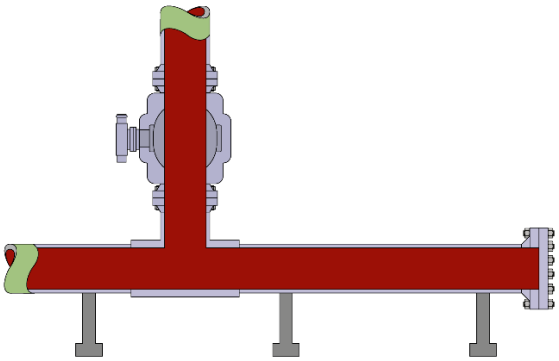
Isolation plug unset and recovered
New valves isolating PLR

Tethered Tecno Plug®

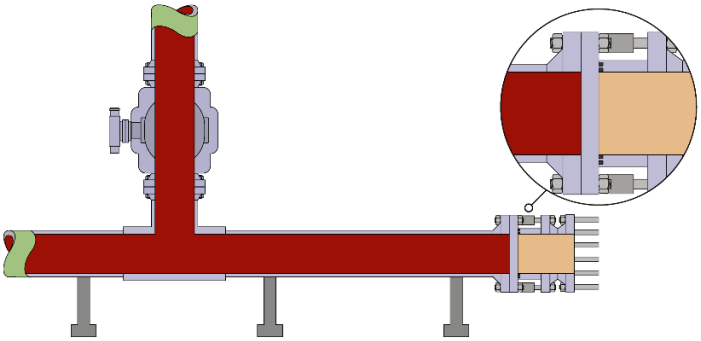


In-Situ Repair Using a Tethered DBB Tecno Plug - Production Unaffected

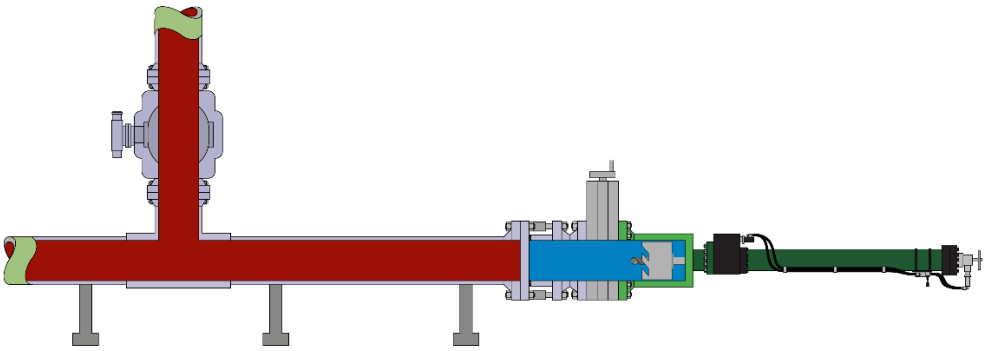
Constraint: No Valves - Just a Blind



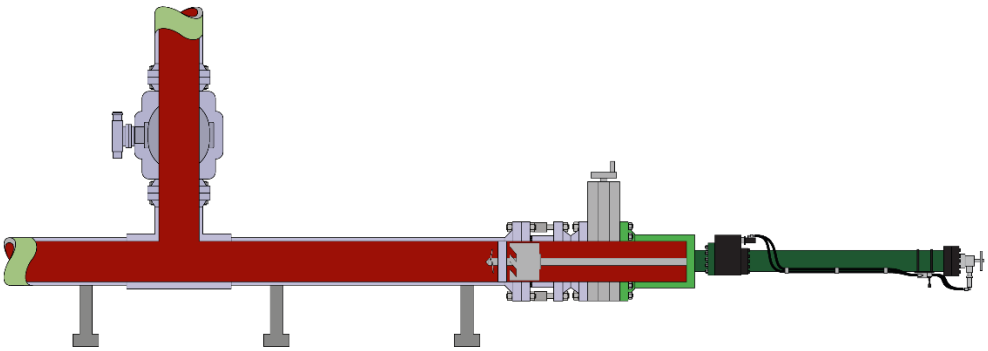
Constrained access. No isolation valves or PLR. Just a blind flange



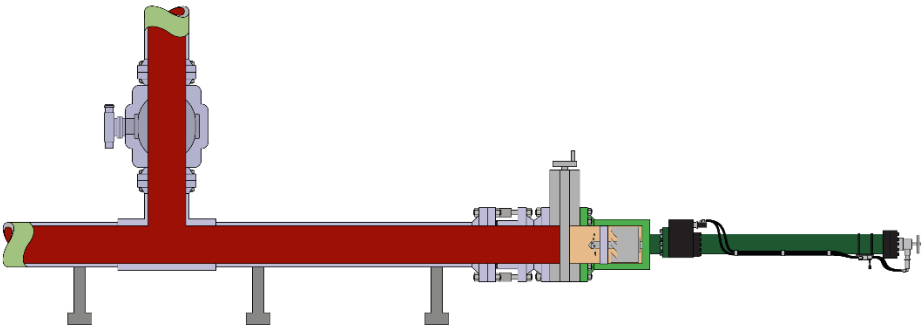
Install dual sealed flange adaptor on to blind flange. *May need to hot bolt to replace studs with longer ones or add additional studding with barrel nuts.*
Use test port to test face seals
Proving the outer seal at 1.1x design pressure in the correct direction



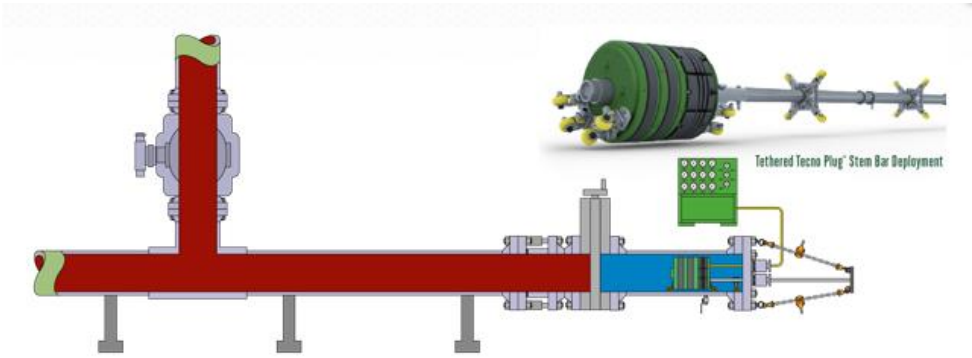
Fit hot tapping valve and hot tap machine. Leak test assembly



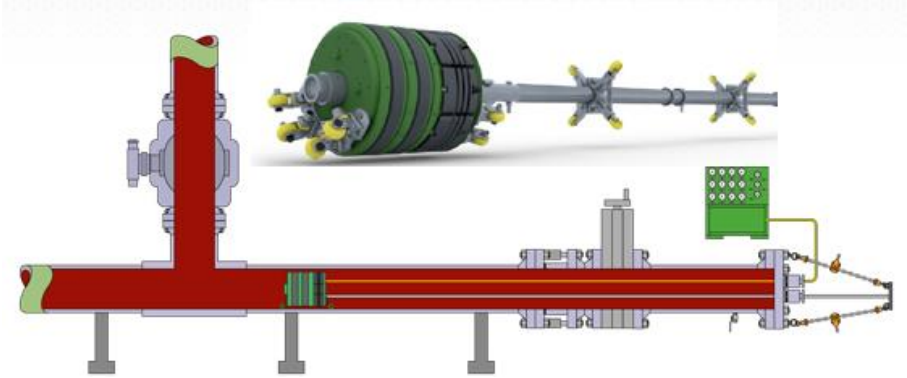
Perform hot tap through blind flange. *The cutter is specially designed for trepanning through the blind*



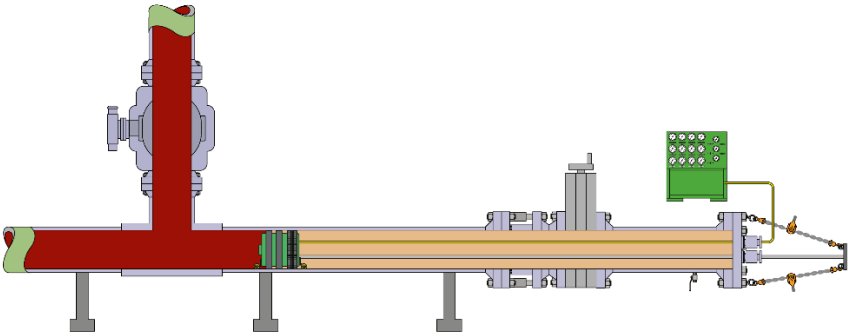
Retract hot tap cutter - and cut out coupon
Close hot tapping valve, perform DBB valve isolation tests
Flush and purge hot tap machine, remove hot tap machine



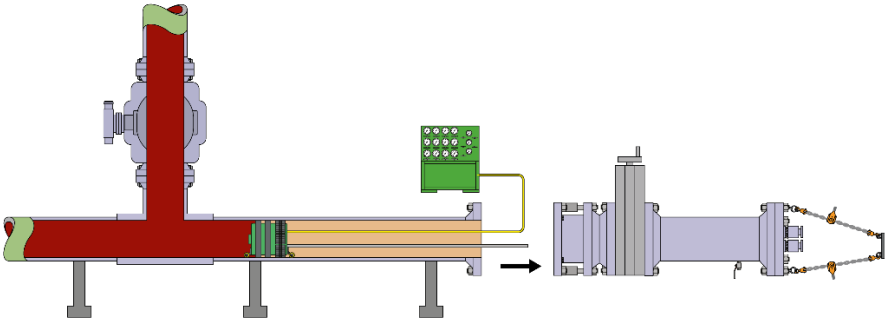
Fit temporary launcher with Tethered Tecno Plug. Leak test joints



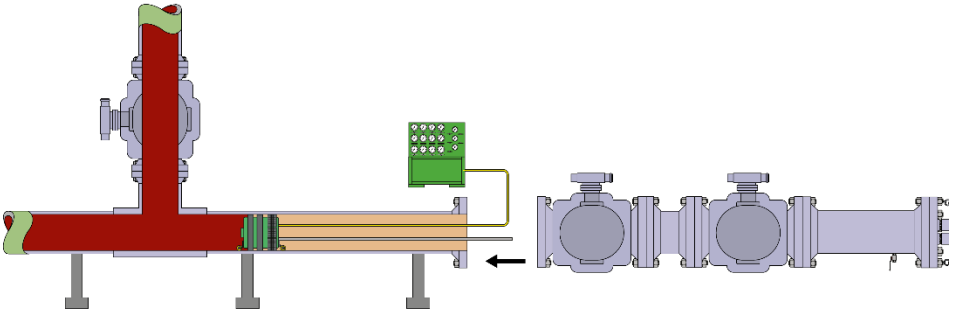
Open slab valve. Deploy Tethered Tecno Plug to isolation location



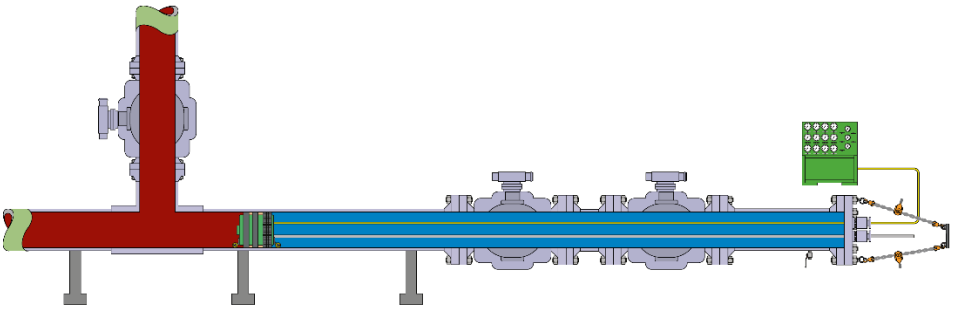
Set plug and prove Double Block isolation. *Testing both seals with full pipeline pressure*



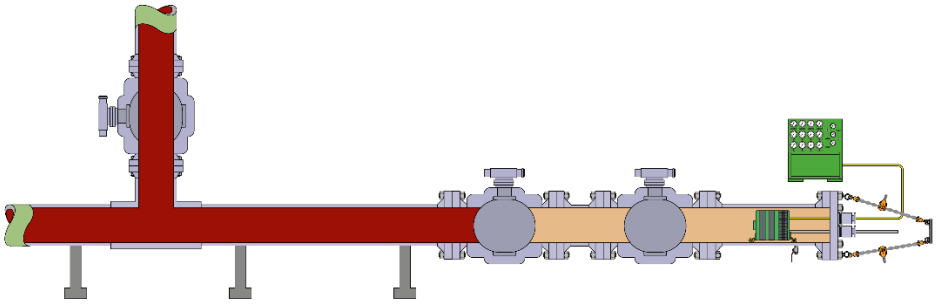
Disconnect and remove; blind ring, adaptor flange, slab valve and temporary launcher
Isolation is continuously monitored – by proceduralised tether management



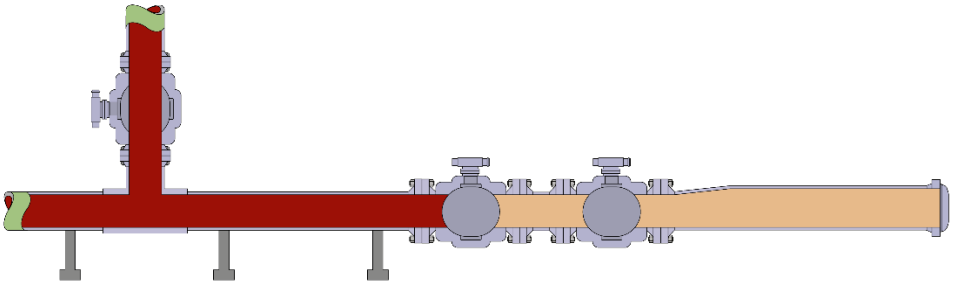
New PLR isolation valves manoeuvred into position



Install PLR isolation valves
- Outboard valve is connected directly to pipeline termination flange
Leak test new joints



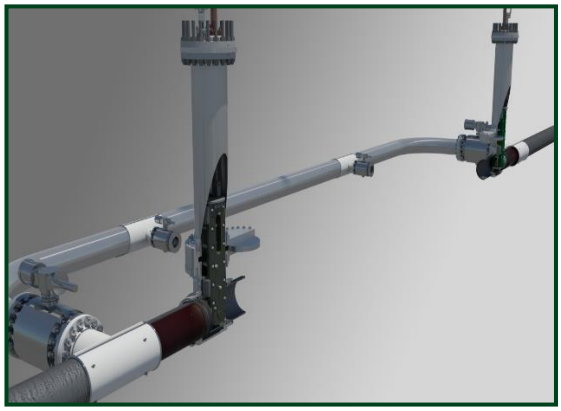
Equalise and unset Tethered Tecno Plug. Recover plug into temporary launcher
Close new PLR isolation valve and prove DBB isolation



Remove temporary launcher. Install new permanent PLR

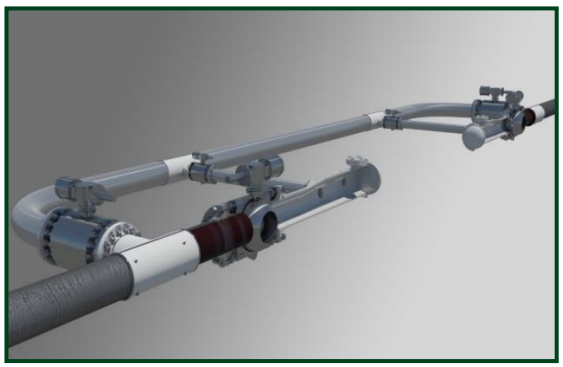
Regular and Safe pigging operations enabled

Installing PLRs Midline



- Fit hot tap tees for bypass and BISEPs
- Install bypass / kicker line
- Set BISEP isolation plugs
- Remove section between

- Install temporary launcher with Tethered Tecno Plugs
- Recover BISEPs
- Deploy Tethered Tecno Plugs



- Install valves
- Fit temporary launcher
- Unset and remove Tecno Plugs
- Install PLRs and tie-in kicker line

Temporary Isolation Devices - Proved Double Block and Bleed / Monitored Isolation

Industry guidance on pressure isolation safety specifies that a proved double block and bleed / monitor (DBB / DBM) isolation only exists when the sealing integrity of two separate isolation barriers is proved to be providing a secure barrier from the pressure threat before the isolation is relied upon.

Proving of the isolation barriers must be done in-situ (at the isolation location) where each isolation barrier is proved separately at the full isolated pressure with the isolated pressure differential being applied in the correct direction.

During the isolation period the void between the barrier seals should be monitored and should be maintained as a “zero-energy zone” where the inter-seal volume and pressure is minimised.

This level of isolation ensures that no single isolation barrier failure will endanger the worksite during the breaking containment activities.

There are several types of isolation tools that provide DBB or DBM level of isolation. The type of isolation plug required is dependent on access options - into the pressurised pipeline.

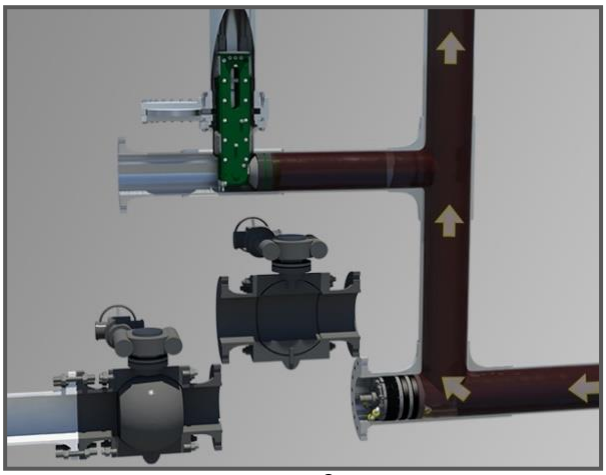
If full bore access is available (e.g. pig launcher, receiver, removable blind or spool) then a piggable inline isolation tool such as the Type Approved Tecno Plug® can be used.

Remote Control Tecno Plug® In Pigging Configuration

The Tecno Plug is normally deployed with a remote-control system housed inside the control module that is installed into the pipeline and pigged to the isolation location. The plug is then commanded, via it’s through-wall Extremely Low Frequency (ELF) communication system, to set itself in the pipeline before the double block seals are proved.

The level of isolation provided by the remote-controlled plug is defined as a proved Double Block and Monitor (DBM) isolation - with a managed bleed facility. To comply with the designation of Double Block and Bleed (DBB) the isolation needs to have a facility to vent or bleed off any pressure build-up in the annulus void between the seals - without affecting the worksite.

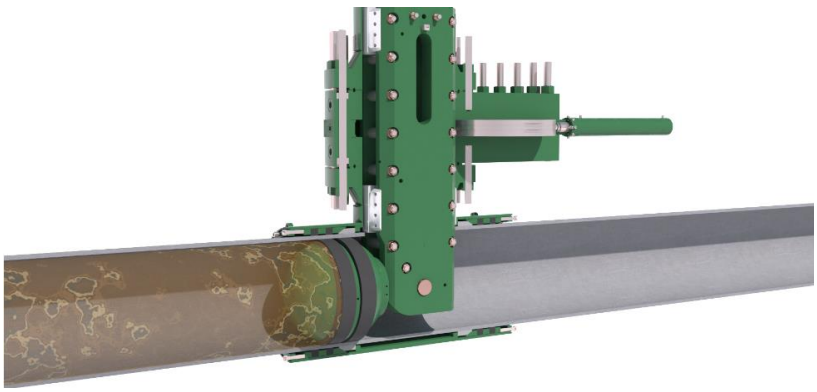
In some cases, the Tecno Plug is deployed with a control umbilical connected to the plug - without the remote-control module. This is normally required where there isn't enough space for the control module at the isolation location, such as in the "to scale" scenario - illustrated below.



Tethered Tecno Plug® - Umbilical control

For tethered isolations the control umbilical is managed through the pressure boundary via two stuffing boxes (strippers) installed to a modified blind or launcher / receiver door. If modifying the launcher / receiver door is not feasible in the project delivery timescale a double-block and bleed door plug is installed into the major barrel of the launcher. The level of isolation provided by the tethered plug is designated as a proved DBB isolation.

When full bore access into the pipeline is not available, then a different type of isolation tool is needed. Such as the BISEP, this type of plug is installed into the pipeline via a physical intervention through the pressurised pipe wall; i.e. a hot tap is performed - to create access into the pipeline. The level of isolation provided by the BISEP is designated as a proved DBB isolation.



BISEP® - Double Block and Bleed Isolation