Double Block & Bleed Isolation

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STATS GROUP
STATS Group is a specialist engineering company and service provider which focuses on piping and pipeline integrity, maintenance and online modifications.

Headquartered in Aberdeen, Scotland we provide a comprehensive range of products and pipeline engineering services enabling piping isolation, intervention, repair, subsea and shutdown services.

- Enhancing safety & environmental performance
- Reducing system or plant downtime
- Extending the life of the facility
PRODUCTS & SERVICES

STATS operate on process piping facilities, on infield and trunk pipelines, (surface & subsea) and on processing and distribution terminal facilities.

Supplying a comprehensive range of products & services:
- Pipeline intervention & isolation
- Process & pipeline repair
- Weldless connection
- Localised pipework testing
PROJECT MANAGEMENT
STATS possesses full project engineering & design capabilities:
- Pipeline contingency
- Isolation feasibility studies
- Turnaround scope management
- Decommissioning & abandonment studies
- Bespoke design & engineering solutions
- Emergency pipeline repair systems (EPRS)
- 3D modelling & FEA
- Full trialing / verification services including full scale test facilities to match client system
Double Block & Bleed Isolation
Double Block & Bleed Isolation

“Double Block and Bleed” is mostly used to define a level of isolation provided by valves in a pipeline or process system.

The term is used to describe a safe method of isolation from a pressurised or hazardous medium to facilitate breaching of the pressure system for maintenance and modifications.

This terminology is utilised to identify the relative integrity of temporary isolation systems.

The UK Health and Safety Executive guidance document, The Safe Isolation of Plant and Equipment, defines double block and bleed (DBB) as “an isolation method consisting of an arrangement of two block valves with a bleed valve located in between.”
Double Block & Bleed Isolation

DBB Isolation Integrity Test (Two Valves)

Key

V1  First (upstream) isolation valve from live system.
M1  Live side monitoring point (pressure gauge or vent/drain).
V2  Second (downstream) isolation valve from live system.
M2  Monitoring point between valves and break point (pressure gauge or vent/drain).
B   Bleed point between the isolation valves.
Double Block & Bleed Isolation

DBB Isolation Integrity Test
(BP – approved Double Sealed, Single Valve)

Key
M1  Live (upstream) side monitoring point.
M2  Monitoring point between valve and break point (downstream).
C   Cavity drain (between seals).
Double Block & Bleed Isolation

Testing and monitoring the effectiveness of the Isolation is specified in this guidance document which states (ref. article 165):

“Prove the integrity of all isolation points of an isolation scheme before proceeding with intrusive work (unless your risk assessment has indicated that the use of non-proved isolation is acceptable):

• Each part of the isolation should be proved separately, e.g. prove each valve in a double block and bleed scheme;
• Each part should be proved to the highest pressure which can be expected within the system during the work activity
• Where possible, each part of the isolation should be proved in the direction of the expected pressure differential”

BP – Guidance on Practice for Safe Isolation and Reinstatement of Plant specifies Double Block and Bleed as:

“Double Block and Bleed consists of the closure of two block valves in series with an intermediate bleed valve. The integrity of both valves shall be tested separately and the bleed valve will then be left in the closed position between periodic integrity checks.”
Double Block & Bleed Isolation

The most alarming use of the term “double block and bleed” is where it is used for ambient isolation tooling.

- Commonly used in USA / Canada with reference to tooling inserted inside open pipes to provide an ambient pressure vapour barrier for welding.
- These tools are often relocated to locally pressure test welds.
- These tools have two seals against the pipe wall, which have a pressure test capability to confirm leak tight sealing.
- This pressure test does not prove the isolation against any upstream pressure for either seal.
Double Block & Bleed Isolation - Definition

The baseline definition for incumbent valves is two valves, tested and proven to full line pressure in a direction consistent with the required isolation with the void between them vented and monitored for pressure rise.

The intent of this level of isolation is that no single failure can invalidate the isolation.

- Failure of primary valve would only allow pressure to enter the bled zone between the valves. The second valve would prevent any hydrocarbons from affecting the worksite.

- Failure of secondary valve would only open the ambient void to the work site offering no direct risk. The primary valve would prevent any hydrocarbons from affecting the worksite.
Double Block & Bleed Isolation - Definition

- Requirement for secondary valve to be tested to verify isolation capacity is key to ensuring that any bypass of the primary valve is retained.
- Requirement for void between valves to be vented to ambient - ensures pressure build up from a passing primary valve is detected and vented to a safe area, whilst being retained by the secondary valve. Preventing any hydrocarbons or pressure from affecting the worksite.

This is a simple concept which is complicated by the reality of plant design and valve wear. The result is that most of the time two leak tight valves are not available.
Assessing Isolation Integrity

When assessing the integrity of an isolation, the following needs to be considered:

- Two independent barriers
- Ability to test both barriers in the correct direction to verify the isolation integrity
- Any single failure modes are understood and addressed. E.g. single bulkheads such as in double block and bleed valves
- Bleed limitations
- Monitoring capability
- Seal integrity
- Restraint integrity
- Exposure to single seal
- Stability of isolation under unstable loading from pressure fluctuations
- Effect on the piping system
Temporary Isolation Techniques

Temporary pipeline isolation has been performed by a variety of methods to various degrees of integrity for decades.

Some examples include:
- Mud Pack Isolation
- Freeze Plug
- Line Stop Tool with Gas Bag
- Mechanical Plugs
- Tethered Isolation Plugs
- Remote Isolation Plugs
- BISEP™
Piggable Mechanical Plugs – Single Seal

The earliest configurations of this plug design provided a single compression seal and used a high sealing pigging disc as the secondary seal.

- Void between compression seal end and pigging disc was vented and monitored for pressure build-up
- This would not pass a modern interpretation of double block and bleed isolation as the secondary seal was not pressure rated to the full pipeline pressure
Piggable Mechanical Plugs – Dual Seal

The second generation of this plug design added a second compression seal between the primary seal and the lock bowl.

- The two compression seals are separated by an annulus ring which is ported through the hydraulic tether to offer a bleed and monitor capability
- Both seals are fully energised by the pipeline pressure as well as the hydraulic activation
- Over time these plugs have been split into separate modules to assist pigging
Tecno Plug™

A major advance in this technology is the fail safe features.

Self Energisation:

- Self-energisation feature maintains safe isolation while differential pressure exists across the tool
- Load acts in same orientation as hydraulic actuation system
- Compression seal is supported by the lock & lock bowl assembly
- Both seals fully energised by pressure – rubber pressure 1½ times greater than pipeline pressure.
- Ejection load further energises lock teeth into pipe wall
Tecno Plug™

Passive Unset:
- Isolation tool designed to passively unset upon pressure equalisation to ensure plug recovery in the event of control system failure.
- Hydraulic system override releases the tool setting mechanism when pressure is equalised.

Remote Tecno Plug™ - Unset
Tecno Plug™ Seal Verification Cycle

Secondary Seal Integrity Test
Leak Off Test (LOT)

Slightly >100% Pipeline Operating Pressure

Locks Proven Secure at Total Δ P

Primary Seal Integrity Test
Leak Off Test (LOT)

≈ 0 Barg

Constant Lock Grip With Total Δ P

Primary Seal Test (PBU) Total Δ P

Secondary Seal Remains Fully Energised

Pipeline Operating Pressure

0 Barg
Comparing Tecno Plug™ To DBB Criteria

- Primary and secondary seals are capable and tested to the pipeline pressure in the correct direction during the deployment
- Annulus between the seals is vented and locked in minimizing exposure from loss of secondary seal integrity
- Effect of loading on the pipe is well understood and engineered for the application
- All plugs are tested in equivalent pipe to hydrotest pressure
Comparing Tecno Plug™ To DBB Criteria

- Both seals and the locks are fully activated by the differential pressure and by hydraulic activation pressure. Two totally independent actuation systems
- Control system locked from inadvertent operation
- Automatic monitor of outboard pressure, inboard pressure, annulus pressure, hydraulic set pressure, hydraulic unset pressure. These sensors would give advance notice of any change of status in the system. There is the ability to intervene in a controlled manner if required
Remote Tecno Plug™

In the late 90’s remote control systems were introduced to remove the limitations of hydraulic tethers.

- Increased the range of the isolation plugs which had previously been limited to pipe end activities
- Removed a pressure limitation which was based on the stuffing box restriction
Operator Benefits

- De-commissioning (bleeding down) and re-commissioning (refilling / re-pressurizing) of pipelines minimized or eliminated, saving time and reducing costs
- Production continued during pipeline maintenance or modifications
- No flaring of gas or displacement of pipeline inventory
- No emissions of gas / hydrocarbon vapour to atmosphere during blow down
- No danger of accidentally flooding offshore pipelines during construction
- No need to dispose of hydrates, chemicals and contaminated water
- Isolates short sections of pipeline anywhere in the pipeline system – tie in
- Emergency preparedness and operational readiness (EPRS)
- Use EPRS for quick recovery of production
Tecno Plug™ Examples

38in Remote Tecno Plug™ | Ras Laffan Facility, Doha, Qatar
> Gas pipeline isolation facilitates removal of 2” bypass branch connected to a 38” ESDV

2 off 36in Remote Tecno Plugs™ | MLNG-Dua, Bintulu, East Malaysia
> Pipeline isolation operations facilitates Kumang Cluster onshore tie-in project

36in Remote Tecno Plug™ | Dol 2 Platform, North Field, Qatar
> Double-block isolation facilitates 36” valve maintenance activities

24in Remote Tecno Plug™ | Dunlin Alpha Platform, North Sea, UK
> Double-block isolation facilitates valve change out activities

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Remote Techno Plug for Wye Installation

- 2 x Remote Techno plug train launched
- Plugs split with water or MEG or similar in between
- Set plug modules – Cut pipe – insert wye
The BISEP™ is a Double Block and Bleed line stop tool which has been developed and patented by STATS

It uses Tecno Plug™ seals mounted on a spherical head to provide the dual barrier isolation.
BISEP™

The BISEP™ offers the following dual seal features:

- The pressure head, primary seal annulus ring and secondary seal operate in a similar manner to the Tecno Plug™
- BISEP™ is installed through a hot tap penetration so instead of the taper locks, it is restrained by two solid clevis arms, each of which can resist full test pressure
- Secondary leak tight pressure head mounted to the rear of the secondary seal
- Permanent hydraulic connection through the launcher
- Can accommodate back pressure to test completed pipework
- Can be utilised in conjunction with a Tecno Plug™ to allow hot tap fittings to be removed, therefore removing the hazard of welding onto live lines and the long term security of split welded fittings
BISEP™ & Tecno Plug™ Compression Seals

The BISEP™ and Tecno Plug™ seals are rated for leak tight operation.

The picture below shows a BISEP™ head where the seals were set on hot tap swarf and attained a leak tight seal. The swarf can clearly be seen on the BISEP™ seals.
**BISEP™ Examples**

30in BISEP™ | Cassia A Platform, Trinidad  
> Isolation allows replacement of 30” ESD Valve

18in BISEP™ | Sullom Voe Terminal, Shetland, UK  
> Isolation of 18” bypass line allows removal of dead leg

Two 14in BISEP™ | Galeota Point Terminal Facility, Trinidad  
> Crude oil pipeline isolation allows piping spool tie-in

10in BISEP™ | Brent Bravo & Delta Platforms, North Sea, UK  
> Thirty-two cell fill line replacements within utility shaft of platforms

3in BISEP™ | Piper Bravo Platform, North Sea, UK  
> Isolation facilitates replacement of piping system

18in BISEP™ Isolating Pipeline  
Dead Leg Cut Away
BISEP™ Summary

- Hot tap deployed double block and bleed isolation tool
- Revolutionising market – technology significantly advanced of competition
- Sealing technology based on Tecno Plug™ sealing – extensive track record
- Back pressure capability for pressure testing the reinstated pipework
- Leak tight sealing
- Deployed upstream of fitting – vent and purge operations can be performed through launcher
- Fail-safe: Self energised sealing
- Monitor capability during isolation

BISEP™ Load Diagram
Tecno Plug™ Summary

- Robust compact design, enables Tecno Plug™ to be set in short sections of pipeline
- Annular bleed proves / monitors seal integrity
- Seal annulus bleed provides Zero Energy Zone
- Self Energisation of seals maintains isolation integrity independent of hydraulic control circuit
- Compression seals more compliant / higher success rate in pitted pipework
Thank you for your attention

Come and see us in Hall 9 Stand 9088

BISEP™ and Tecno Plug™ are trade marks of STATS (UK) Ltd