SAFE ISOLATION OF PLANTS AND EQUIPMENT

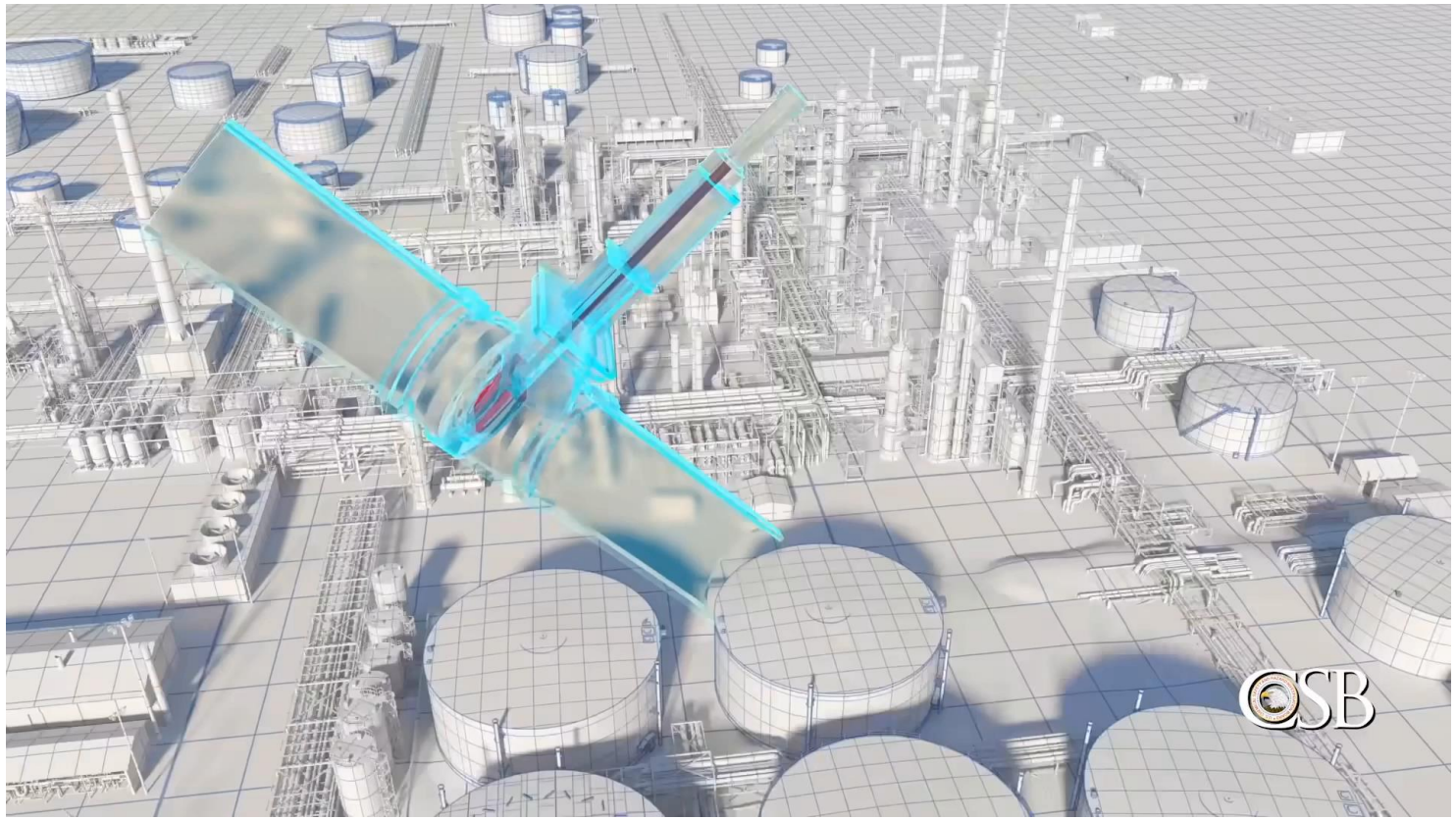
APGA - 2023

Speaker: Charly Ribeiro, ONIS Line Blind

STUDY CASES – INCIDENTS

- Brazil, 2006
- Pneumatic pressure test for the pipe
- Tank pressure built up due to passing valves (no blinds)

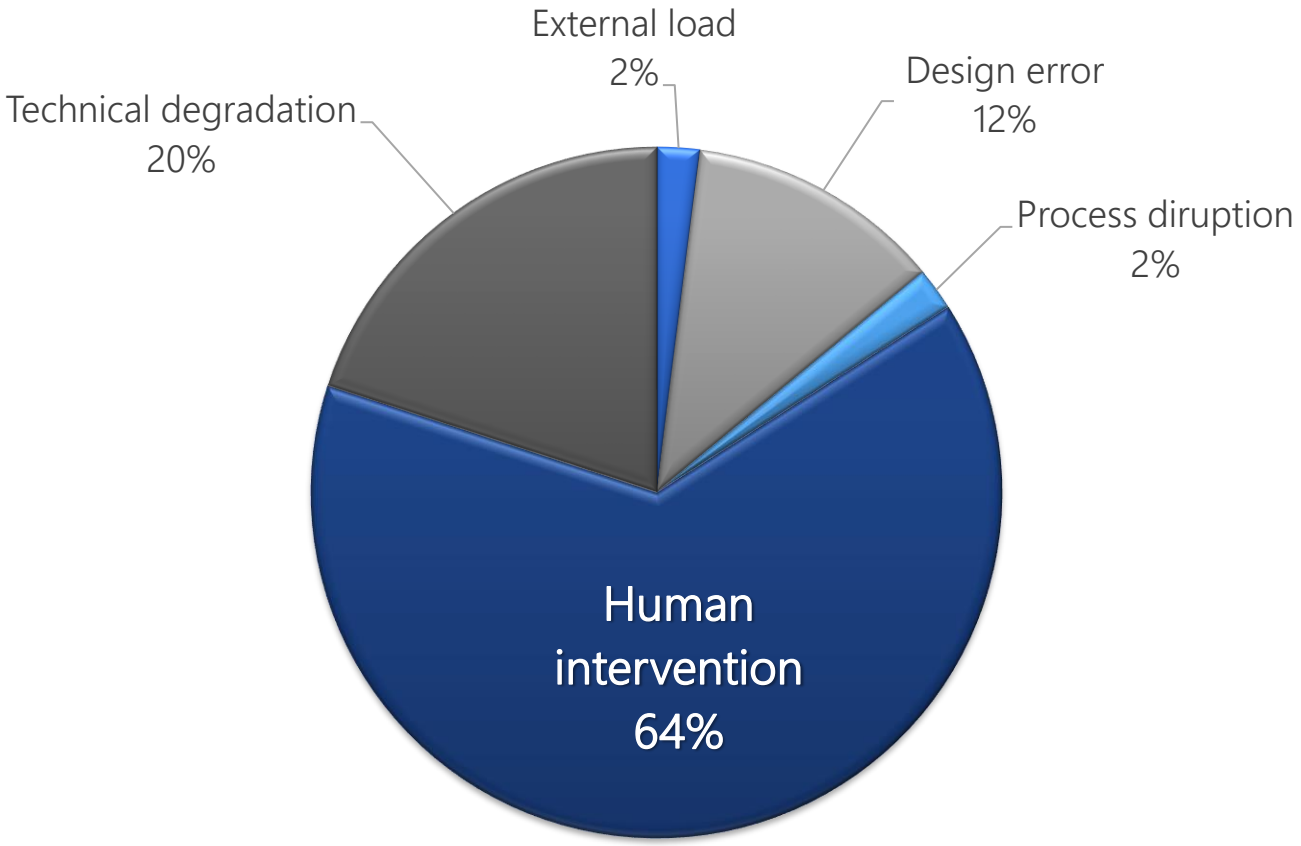
STUDY CASES – INCIDENTS



- Husky Energy Oil Refinery, Superior, USA, 2018
- Passing valve (erosion) let to mix of hydrocarbons and hot air at FCC
- US Chemical Safety Board: "a valve might not be the best design for serving to stop to create a barrier during a shutdown"

HYDROCARBONS – WASTE & LEAKS

In Oil and Gas Plants, 64% of the leaks are due to human intervention



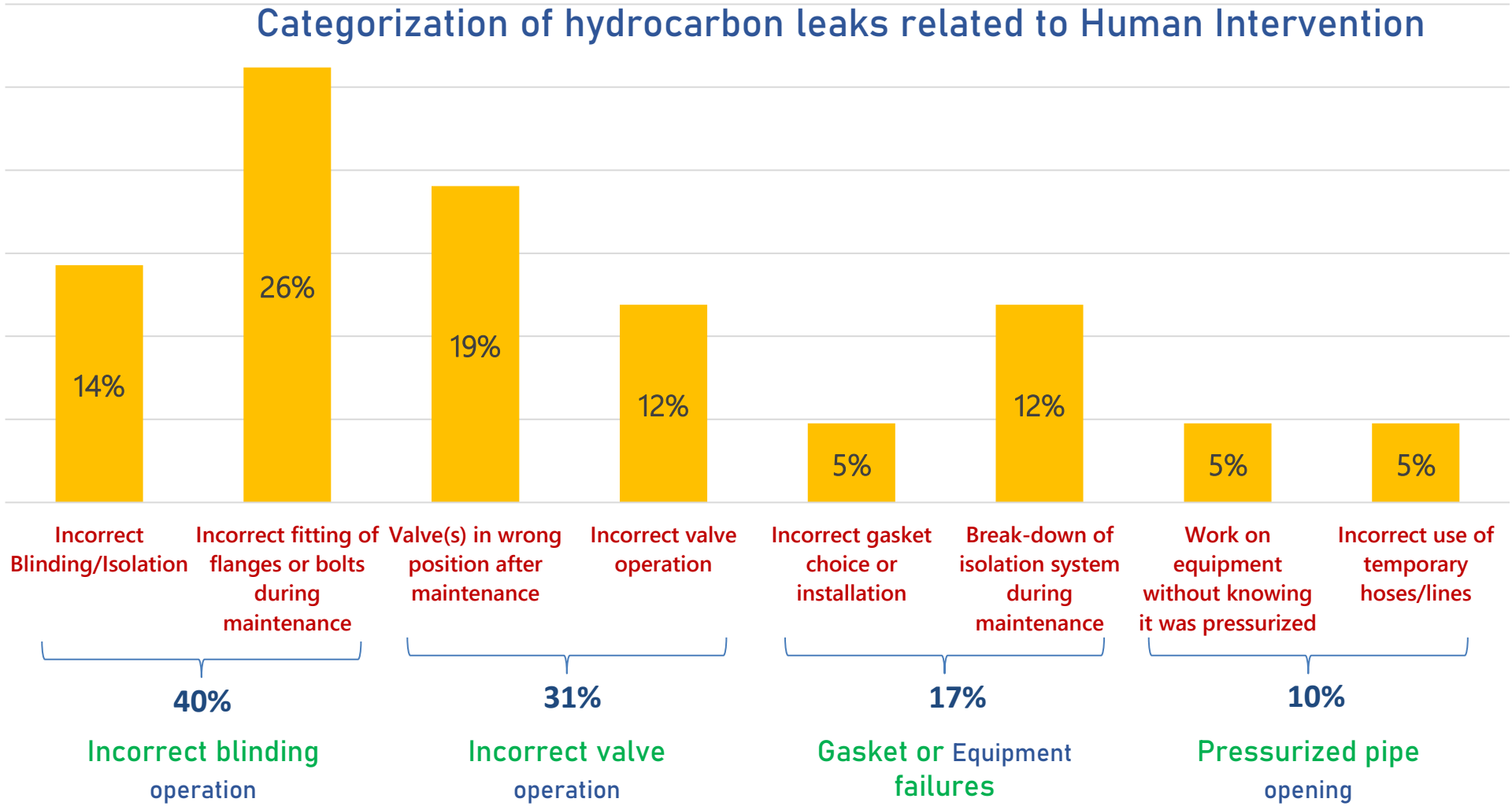
Categorization of hydrocarbon leaks larger than 0,1kg/s

2013/2017, Source : Norsk olje&gass

Best practice for isolation when working in hydrocarbon equipment : planning, isolation and reinstatement

HYDROCARBONS – WASTE & LEAKS

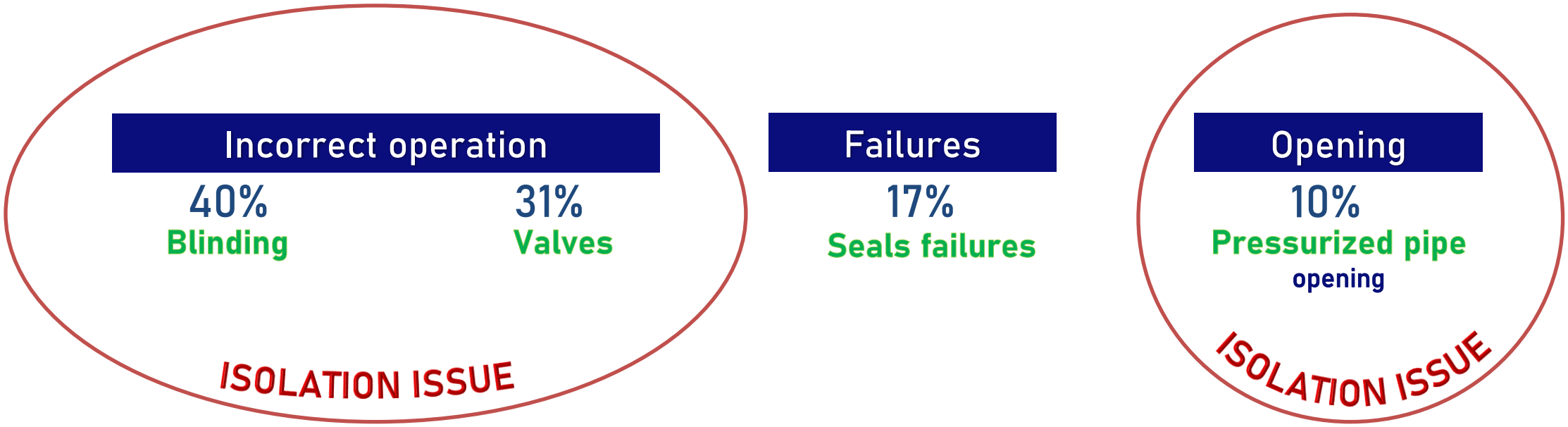
In Oil and Gas Plants, 64% of the leaks are due to human intervention



2%
miscellaneous

Norsk olje&gass

HYDROCARBONS – WASTE & LEAKS



Norsk olje&gass

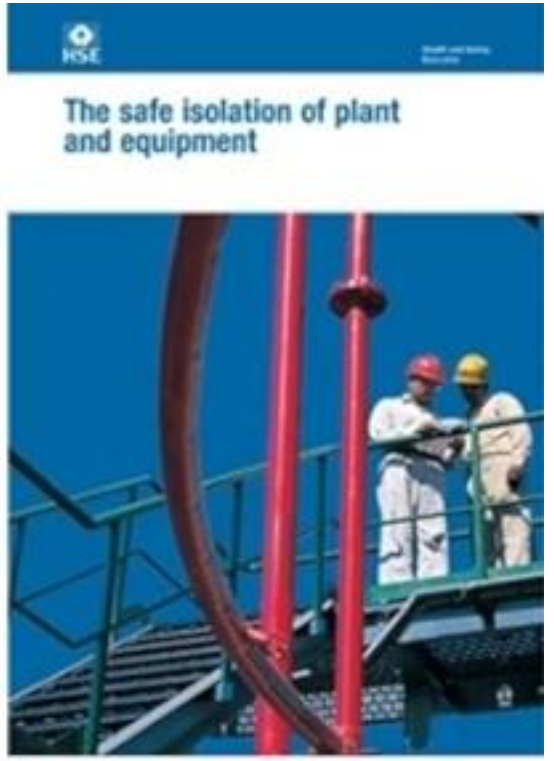
HSG 253 - THE SAFE ISOLATION OF PLANT AND EQUIPMENT

Developed by members from industry, trade union and the Health and Safety Executive.

nationalgrid

bp

Petrofac



- Guidance on the general principles of safe process isolation, reflecting good practices

- Applying to the following industries:
  - 👉 onshore and offshore oil and gas
  - 👉 chemical manufacturing
  - 👉 pipelines associated with these industries

- Main focus: risks to the safety of people, improve environmental protection and reduce business interruption

APGA FOCUS ON HSG 253

COVERED

- 👉 Isolation methods
- 👉 Selection tool
- 👉 Classification of methods/tools

NOT COVERED

Management of isolation: training, roles and responsibilites, monitoring audit and review

Safe systems of work for isolation activities: documentation, controlling changes

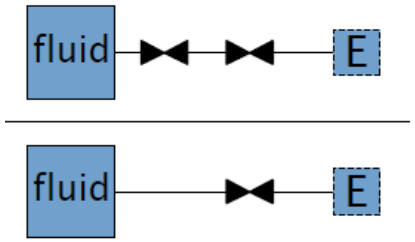
Key stages: hazard identification, risk assessment, draining venting purging flushing, testing and monitoring of the isolation

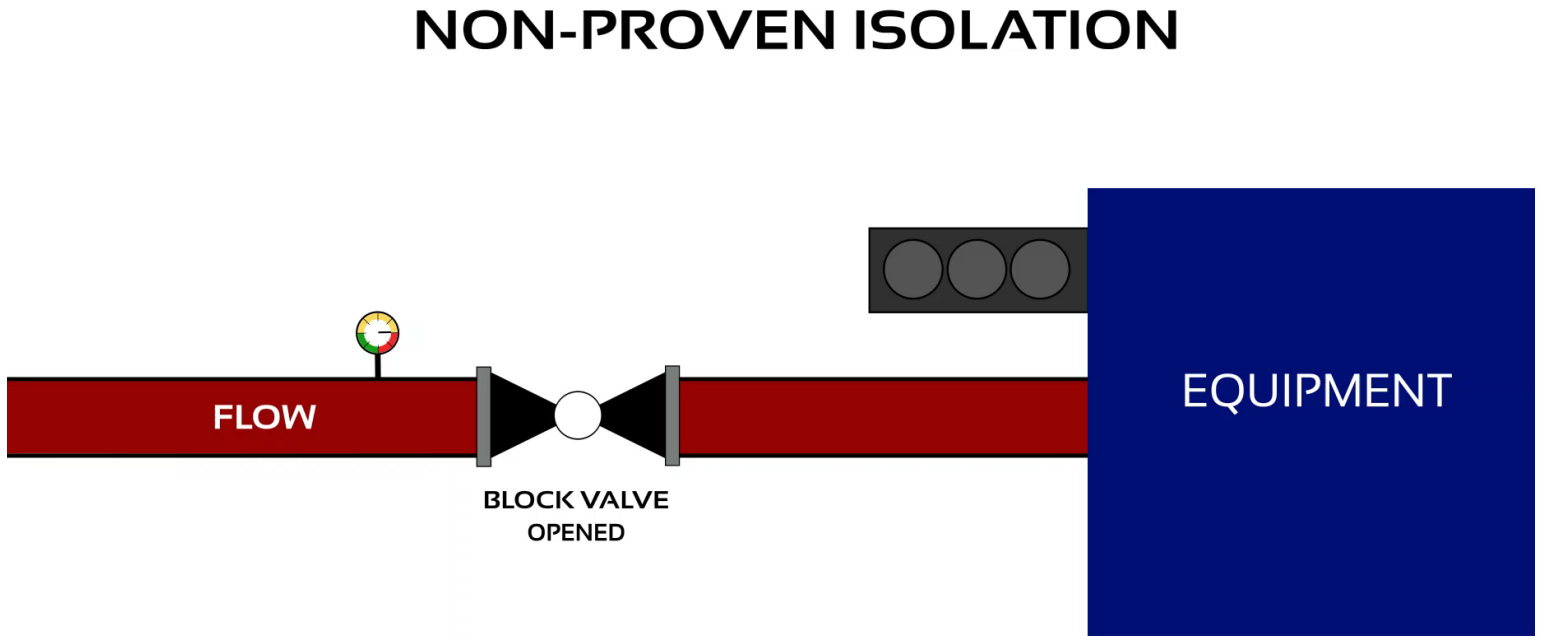
FINAL ISOLATION METHODS: NON-PROVED ISOLATION

III – NON PROVED ISOLATION

Features

<u>Valved isolation</u>
No provision to confirm effectiveness of valve closure prior to breaking into system





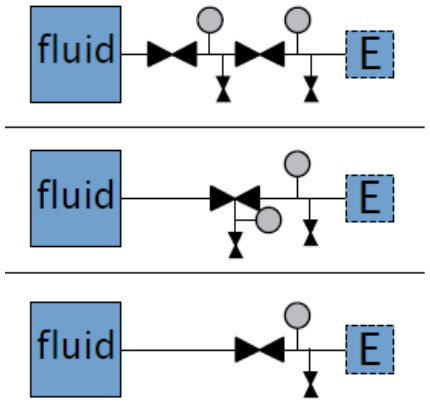
Method
Double valve / Single valve

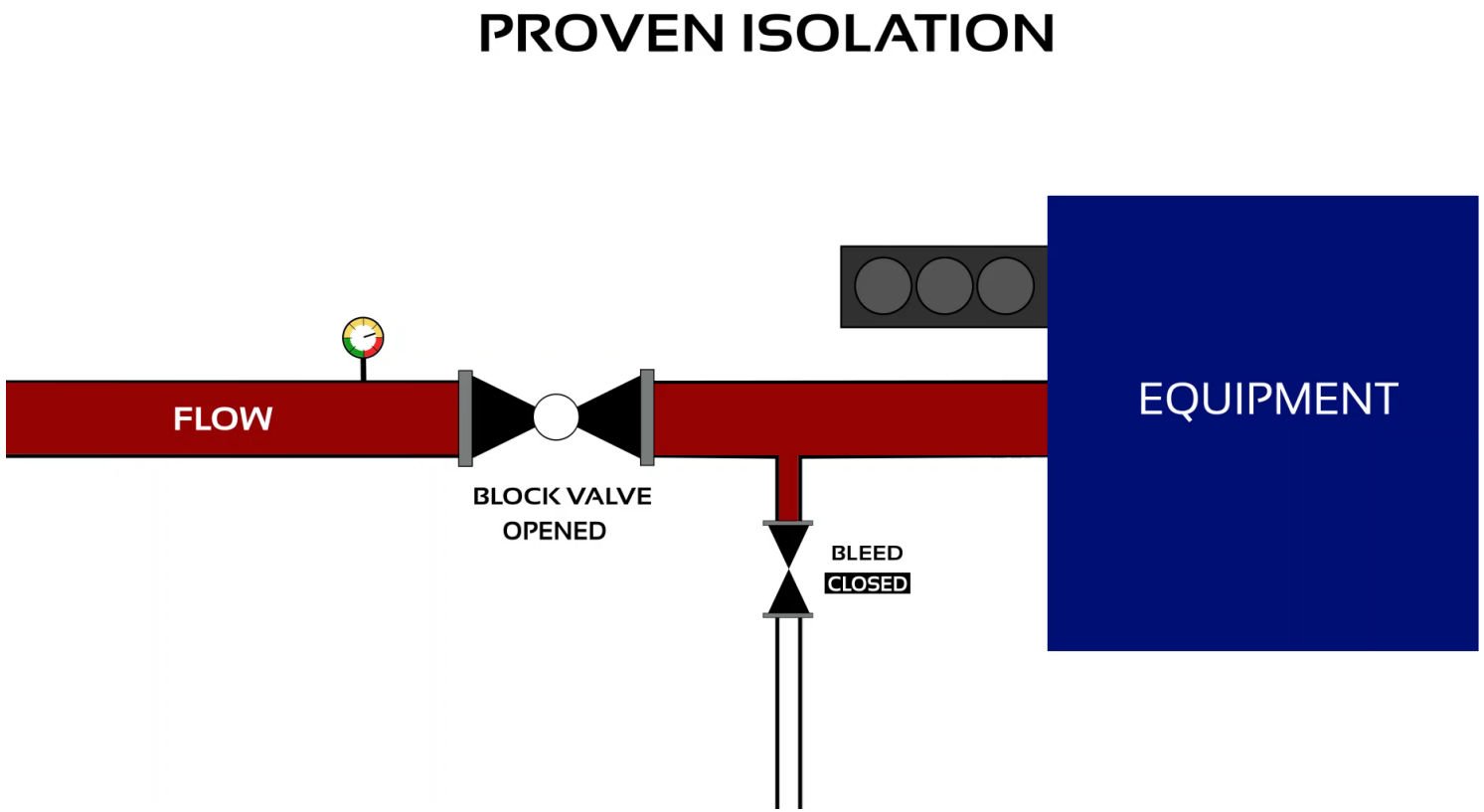
FINAL ISOLATION METHODS: PROVED ISOLATION

II – PROVED ISOLATION

Features

Valved isolation
Effectiveness of valve closure can be confirmed via vent/bleed ports before intrusive work commences

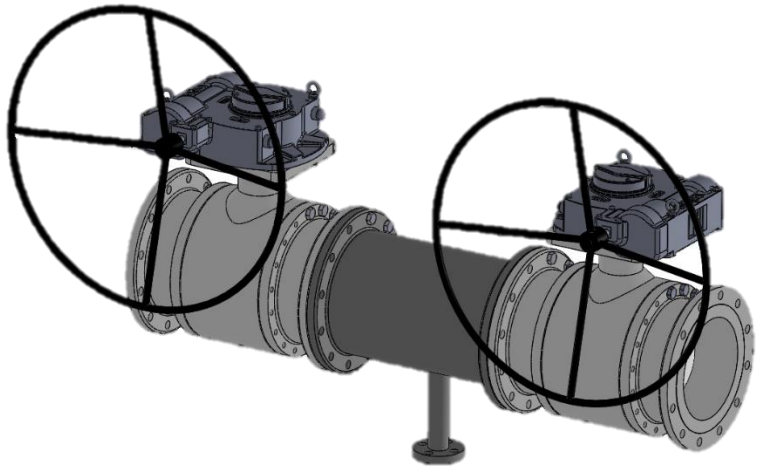


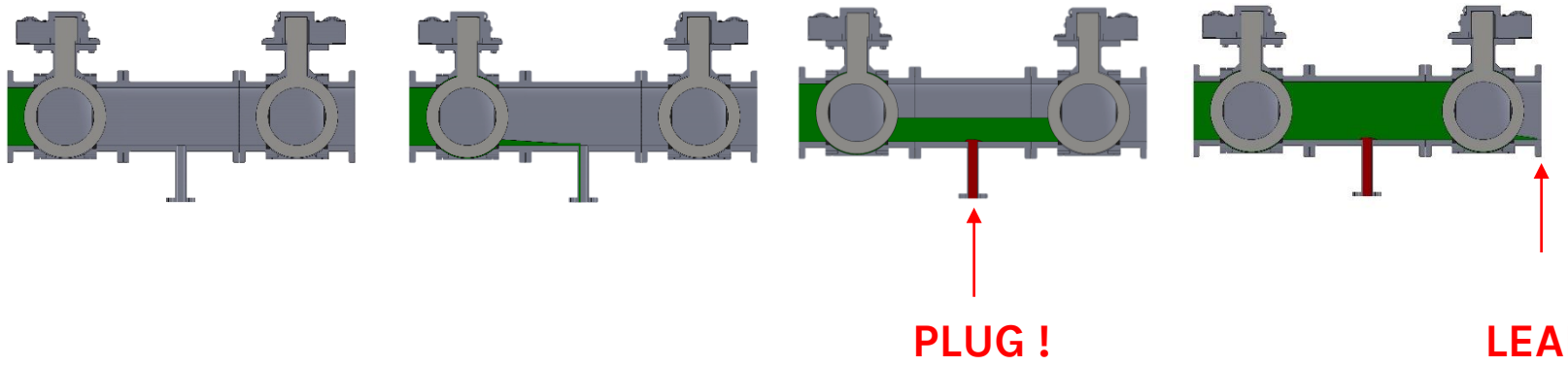


Method
Double Block and Bleed – DBB / Single Block and Bleed - SBB

FINAL ISOLATION METHODS: PROVED ISOLATION

II – PROVED ISOLATION





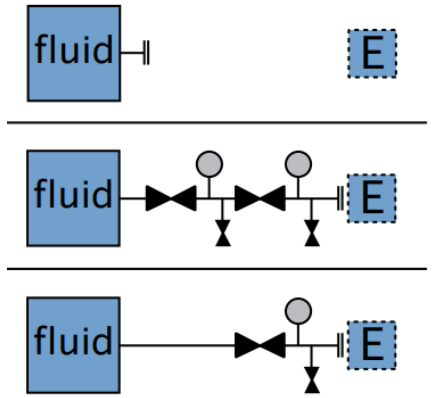
Why Double Block and Bleed is not a leak free isolation method?

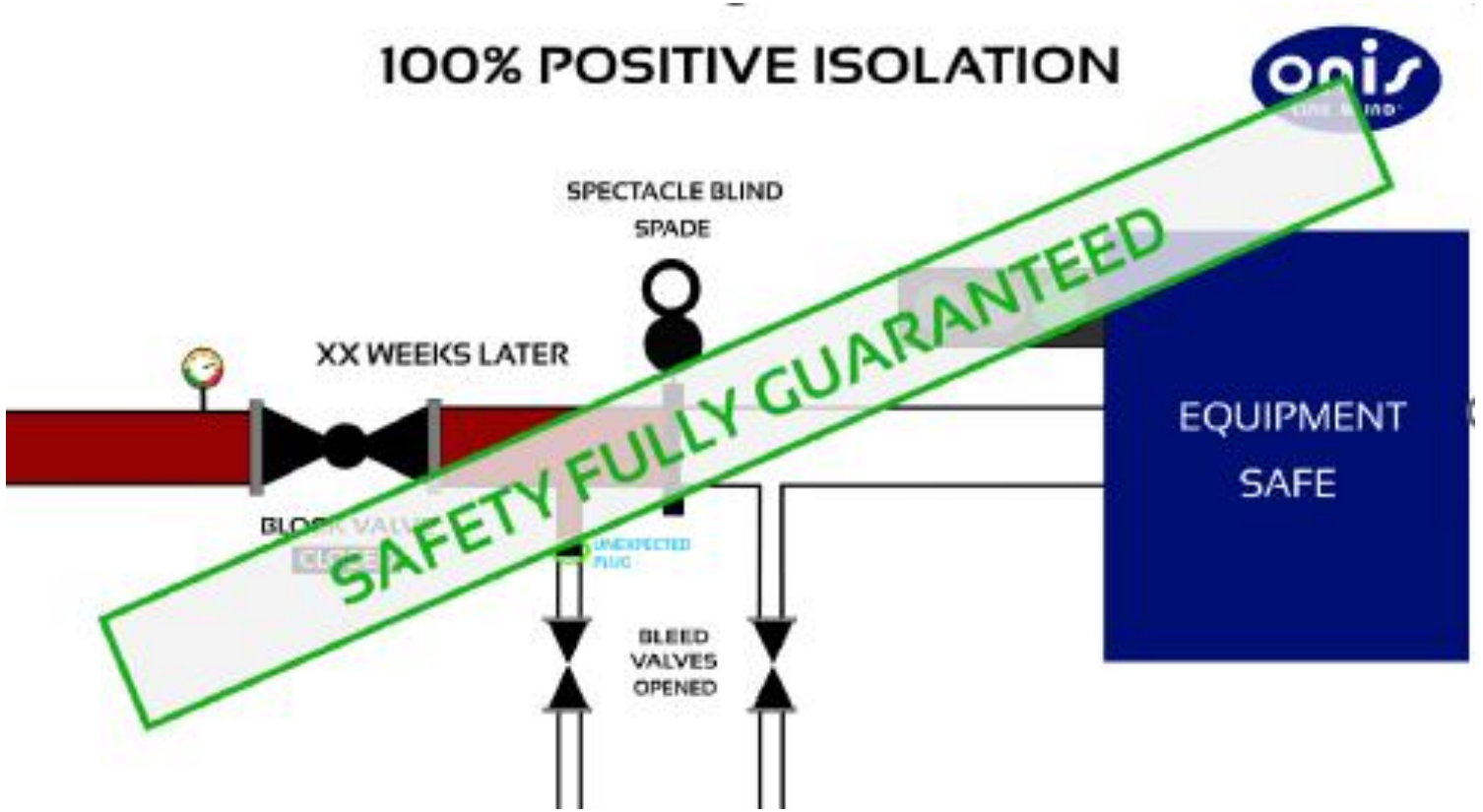
FINAL ISOLATION METHODS: POSITIVE ISOLATION

I – POSITIVE ISOLATION

Features

Complete separation of the plant/equipment to be worked on from other part of the system





Method
Spool removal
Double Block, Bleed and Spade
Single Block, Bleed and Spade

Note: Valved isolation of an appropriate standard is required during the installation of positive isolation

ISOLATION IMPLEMENTATION

HSE
Health & Safety Executive

DESIGN PRINCIPLES

- At early stage, specification of intentions for normal/alternative mode of operation and equipment maintenance strategy

- Positive isolation requirements: Design of new plant should include positive isolations:
  - for vessel entry
  - for isolation of toxic fluids
  - to control segregation of parts of the plant

- Easier for new plant, but HSG 253 advises to improve the isolation facilities at the first available opportunity if the initial isolation method is failing

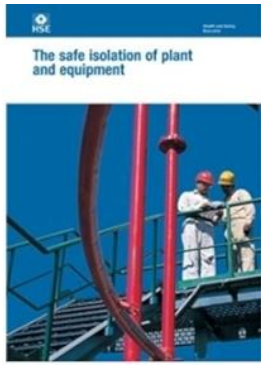
- Pipeline isolation:
  - Positive isolation for whole pipe isolation (at end point)
  - Proved isolation for localised isolation

HSG 253 proposes a tool to give the baseline isolation standard for plants

SELECTION TOOL FOR FINAL ISOLATION METHOD

Determine your isolation level in 5 steps

- **Step 1: Substance category**
  Toxic, Flammable, Corrosive, …



HSE
Health & Safety Executive

Category	Description (CHIP classification, where appropriate)	
1	Very toxic (T+) Toxic (T) Carcinogenic, mutagenic, toxic for reproduction Sensitising	
2	Extremely flammable (F+) Highly flammable (F) Flammable gases (R10) Flammable liquids (R10) Petroleum products* Oxidising (O) Explosive (E) Steam Pressurised gases >250 bar.l, with pressure of 0.5 bar or higher Flashing fluids Asphyxiants	- unless included in category 4 - unless included in category 4 - consider whether category 1 is appropriate
3	Corrosive (C) Harmful (Xn) Irritant (Xi)	
4	Flammable liquids stored below flashpoint, and below flash point following release (R10)	
5	Non-classified and not stored in a potentially harmful state	

Table C Substance category

TOXIC

FLAMMABLE

CORROSIVE

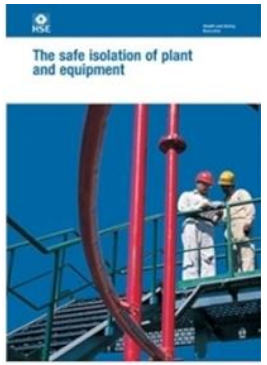
SELECTION TOOL FOR FINAL ISOLATION METHOD

Determine your isolation level in 5 steps

- **Step 2: Release factor**
  Relects potential rate of release: High, Medium, Low

		Pressure		
Line size		>50 barg	I 50 but >10 barg	<10 barg
	J20cm	H	H	M
	5cm< line<20cm	H	M	L
	I 5cm	M	L	L

Table D Release factor



HSE
Health & Safety Executive

- **Step 3: Evaluate location factor**
  Reflects potential for casualties escalation and damages: High, Medium, Low

Category	Description
H	Any of: Numbers at risk >10; congested equipment; potential for escalation; large fires with potential for damage and multiple fatalities
M	Typically: 3-10 at risk; uncongested plant, storage area or small number of items in open area; minor fire
L	Characterised by: 1-2 at risk; remote single items; easily contained minor fires

Table E Location factor

- **Step 4: Outcome factor**
  Combine the release factor and location factor

		Release factor		
		H	M	L
Location factor	H	A	B	B
	M	B	B	C
	L	B	C	C

Table F Outcome factor

SELECTION TOOL FOR FINAL ISOLATION METHOD

Determine your isolation level in 5 steps

- **Step 5: Determination of baseline isolation standard**
  Cross the outcome factor with the substance category to define the required isolation level of the considered location

		Outcome factor		
		A	B	C
Substance category	1	R	I	I
	2	R	I	II
	3	I	II	II
	4	II	II	II
	5	II	III	III

Table G Baseline standard of isolation

Example

Isolation of a 30 cm methane line at >50 barg for the overhaul of regulator equipment.

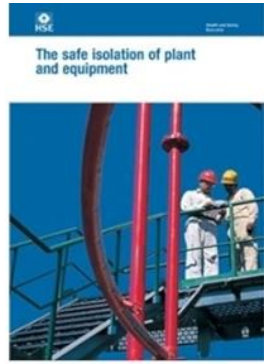
Substance - 2 (CHIP classification)
Release factor - H
Location factor - M
Outcome factor - B

Appropriate isolation standard: 2B = I

Baseline isolation standard is positive isolation. Risk assessment may indicate that for short duration, manned operations it is appropriate to use proved isolation, with appropriate procedural controls.

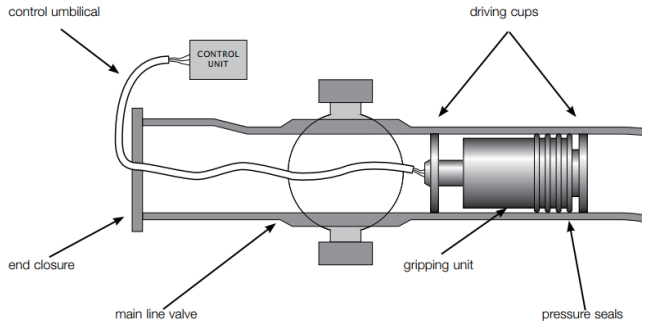
I. Positive isolation
II. Proven isolation
III. Non-proven isolation

HSE
Health & Safety Executive



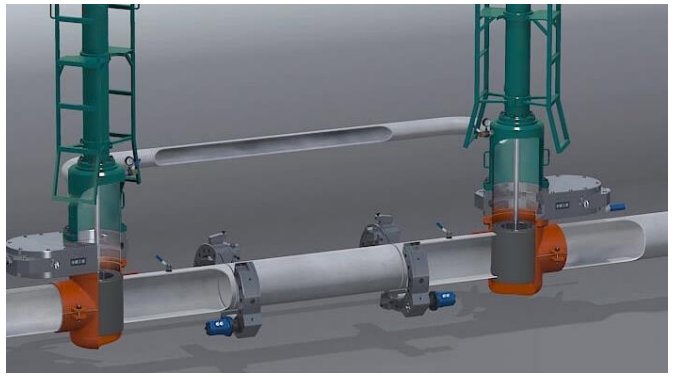
CLASSIFICATION OF ISOLATION METHOD

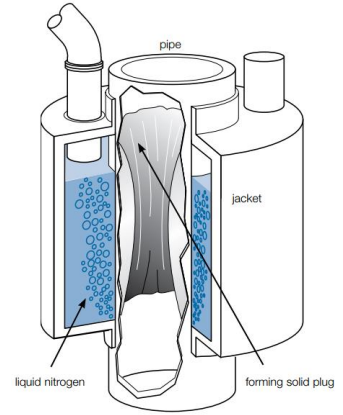
2 categories: primary devices and specialist techniques



Specialist techniques:

- Squeeze off
- Foam Bagging
- Pipe Plugs
- Pipe Stoppers
- Inflatable bags
- Hot tapping and stopping
- Isolation pigs
- Pipe freezing





CLASSIFICATION OF ISOLATION METHOD

Primary devices

HSG 253 proposes a ranking of valves for isolation purpose (3 criteria: Sealing ability, Security, Reliability)

- Ball valves
- Plug valves
- Butterfly valves
- Globe valves
- Gate valves
- Needle valves

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features		Comments, refs to industry codes
Primary devices					
VALVES	he simplest rm of isolation device	■ Standard use for process plant and pipelines ■ Suitable for all fluids at all pressure ranges	■ Does inter pipe haza perf ■ Facil insta iden ■ Isola remo plan ■ No s or m ■ Cont or m usua ■ Low	al of is le, ing off tent d time s are on	Valves to be suitable for service fluid and rated to the maximum differential pressure See: ISO 14313[22] for pipeline valves API 6D

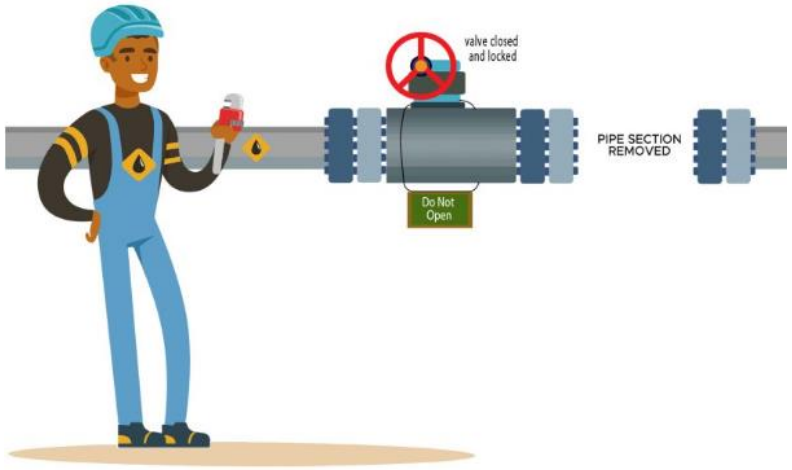
Valves disadvantages

- TIGHTNESS IS NOT GUARANTEED : SEALS DAMAGES
- POSITION INDICATION NOT ALWAYS AVAILABLE
- LOCKING DEVICE REQUIRED TO PREVENT INADVERTENT OPERATION
- ADDITIONAL MAINTENANCE COST (REPLACEMENT)
- NOT ALL VALVE TYPES ARE SUITABLE FOR ISOLATION USE

CLASSIFICATION OF ISOLATION METHOD

Primary devices

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros		omments, fs to dustry odes
Primary devices					
PHYSICAL DISCONNECTION	bool ge (blind)	■ Standard use for process plant and pipelines ■ Suitable for all fluids over a range of pressure ratings ■ Ideal for extended term, infrequent isolation	■ Positive isolation ■ Indication of presence ■ Clear indication of even minor failure ■ No specialist traini or materials requir ■ Continual attendar or monitoring not usually required ■ Blank flanges can incorporate valves etc for bleeding/ venting and monitoring purpos ■ Low component c	pipework, resulting in large inventories beyond the isolation	anks to be mpatible th the rvice fluid d rated to e maximum perating essure



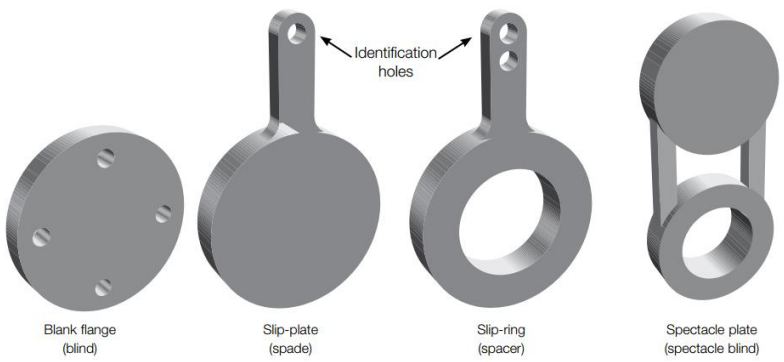
Physical disconnection disadvantages

- REQUIRES OPENING OF THE PROCESS PIPE
- REQUIRES TEMPORARY ISOLATION
- SLOW TO INSTALL
- REPETITIVE AND LABORIOUS WORK IN FUNCTION OF:
  - RATING
  - PIPE STRESS
  - BAD PIPEWORK

CLASSIFICATION OF ISOLATION METHOD

Primary devices

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Comments, refs to industry codes
Primary devices				
SPADE AND SPECTACLE PLATES	A solid plate inserted between flanges See Figure 8	■ Standard use for process plant and pipelines ■ Suitable for all fluids over a range of pressure ratings	■ Positive isolation ■ Clear indication of presence ■ No specialist trainin or materials require ■ Continual attendanc or monitoring not usually required ■ Low component co	Spades and spectacles to be compatible with the service fluid and rated to the maximum operating pressure See notes for Figure 8



in large inventories beyond the isolation

Physical disconnection disadvantages

- REQUIRES OPENING OF THE PROCESS PIPE
- REQUIRES TEMPORARY ISOLATION
- SLOW TO INSTALL
- REPETITIVE AND LABORIOUS WORK IN FUNCTION OF:
  - RATING
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  - BAD PIPEWORK

CLASSIFICATION OF ISOLATION METHOD

Primary devices

Technique	Brief description	Typical u plant or and pres		Comments, refs to industry codes
Primary devices				
QUICK ACTION BLINDS	solid plate serted etween flanges See Figure 8	■ Stan proc pipel ■ Suita fluids rang ratin	on n of ainin ndanc not d nt co in large inventories beyond the isolation	Spades and spectacles to e compatible with the service fluid and rated to he maximum perating ressure See notes for Figure 8

ONIS Quick Blinds Features

- REQUIRES OPENING OF THE PROCESS PIPE
- REQUIRES TEMPORARY ISOLATION
- ALREADY INSTALLED
- FAST OPERATION
- NO TOOLS, ONE OPERATOR

Physical disconnection disadvantages

- REQUIRES OPENING OF THE PROCESS PIPE
- REQUIRES TEMPORARY ISOLATION
- ~~SLOW TO INSTALL~~
- ~~REPETITIVE AND LABORIOUS WORK IN FUNCTION OF:~~
  - ~~RATING~~
  - ~~PIPE STRESS~~
  - ~~BAD PIPEWORK~~

ISOLATION – FOR GAS TRANSPORTATION

Conclusion

- Importance of isolation in plants and pipes
- Different final isolation methods
- HSG tool to select baseline isolation method for plants
- Classification of isolations tools

Positive isolation in gas transportation pipeline

- Isolation of vent
  - Ensure no emissions/leaks at the vent during normal operations vs DBB
  - Positive isolation of the by-pass

ISOLATION – FOR GAS TRANSPORTATION

Positive isolation in gas transportation pipeline

- Isolation of compressors
  - In compression stations, for safe maintenance of compressors
- Isolation of storage stations
  - Upstream and downstream the tank/reservoir during equipment maintenance
- Isolation of pig traps
  - Isolation of the main line and kicker line to keep pigging operations safe

SAFE ISOLATION OF PLANTS AND EQUIPMENT

Q&A

Speaker: Charly Ribeiro, ONIS Line Blind