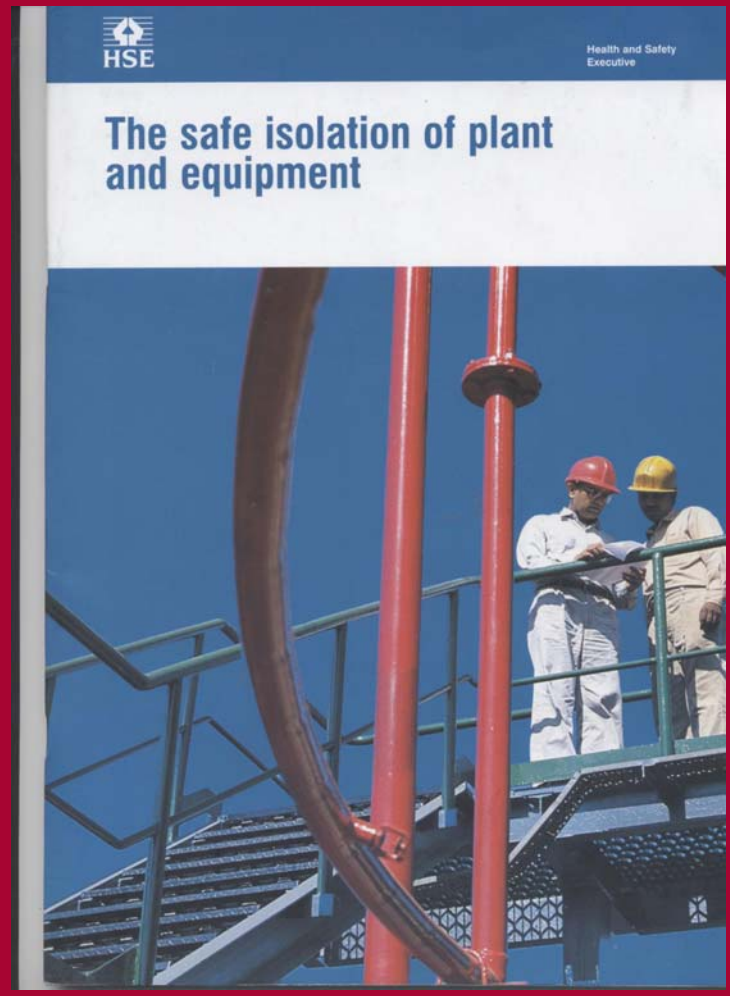
Health and Safety Executive

Key aspects of HS(G) 253



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Human Factors

- Human Failures can be grouped into:

Errors

And

Violations

Errors are not intended

Violations are deliberate

Examples of Human Failures

- Failure to complete or reverse isolations before restarting plant
- Failure to prove and monitor isolated valves
- Poor communication (Shift handover)
- Failure to check P&ID’s against actual plant

Minimising Errors

- Establish adequate understanding of the hazard
- Provide good, clear, concise, available, up to date procedures
- Clear identification of P&E
- Clear system for tagging valves
- Good access and conditions
- Effective checking & supervision

Minimising Violations

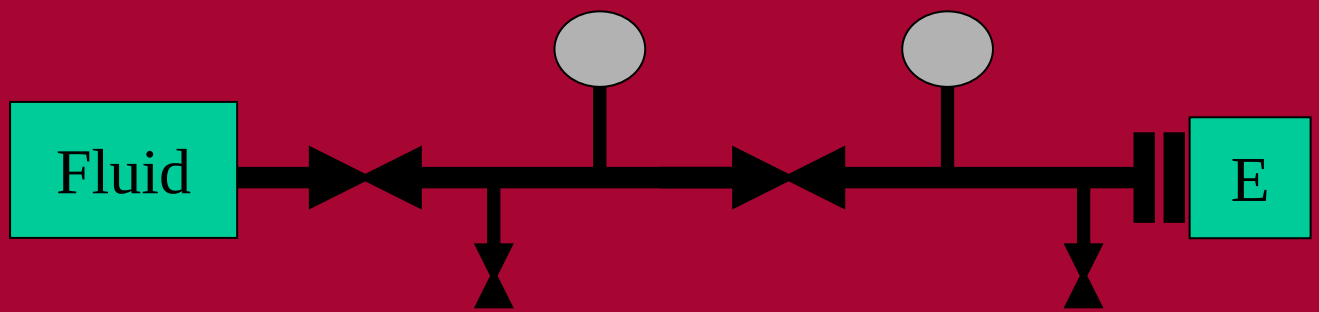
- Establish positive safety culture with clear expectations
- Plan realistic work schedules
- Well designed isolation tasks
- Good staff understanding of procedures
- Effective supervision
- Compliance checking
- Performance monitoring

Design – New Plant

- Isolations should be included within design considerations
- It will be expected that for new plant HS(G) 253 is followed
- For other new plant the selection tool in appendix 6 of HS(G) 253 should be used
- Any proposed deviation from the agreed design basis once plant is operational should be justified by formal risk assessment before new isolation procedures are used

Design – New Plant (2)

- The expected standard for new plant where there is to be entry, into areas containing toxics or where there is a high pressure source is positive isolation, with a suitable valve to allow the isolation to be made



double block & bleed & spade

Design – Existing Plant

- For existing plant the minimum standard is assessed using the tool in appendix 6
- For existing plant where HS(G) 253 cannot be met by current designs an ALARP demonstration should be made and a time bound action plan for improvements agreed

Plant identification

- All items required for safe isolation should be included within an isolation scheme
- Items of plant that are part of the isolation should be clearly marked as such
- Drawings should be produced to show how isolations should be made – these are not P&IDs but it may be suitable to modify P&IDs to clearly show isolation points

Pipework

- Pipework should be designed so as to limit the risk of trapped inventories and allow easy removal of fluids
- Isolation flanges or spool pieces should be easy to remove and replace but remain gas tight in service

See also Energy Institute guidance 'Guidelines for the management of integrity of bolted pipe joints'

www.energyinst.org.uk/index.cfm?PageID=604

Valves

- Valves used for isolation must be designed for the isolation of the fluid involved
- Control valves are not generally suitable for isolations
- The best valves for isolation are ball valves and plug valves. Some needle valves are good if designed for isolation duty
- Valve position must be clearly indicated
- Valves must be capable of being locked in the closed position
- Isolation valves will require maintenance

Blanks and spades

- More leak tight than valves
- Provide positive isolation
- Need to be made to standards
- Need to be clearly marked
- Need to be compatible with fluid
- Need to be properly maintained and inspected before each use
- Need to be properly stored

Expected isolation standards for COMAH sites – **How to work it out**

- Use the tool in appendix 6 of HS(G) 253

1. Substance Category of fluid 1 – 5 very toxic to not harmful
2. Release factor – size of line and pressure
3. Location factor – numbers at risk. **You should include environmental considerations**
4. Outcome factor – combination of release factor and location factor (2 & 3)

OUTPUT:

Use the Baseline Isolation Table using results at 1 (substance category) and 4 (Outcome Factor) above

Assessment output

- R – think again and see if you can do the job another way
- I – Positive isolation
- II – Proved isolation
- III – Non-proved isolation

Types of isolation are given on page 14 of HS(G) 253

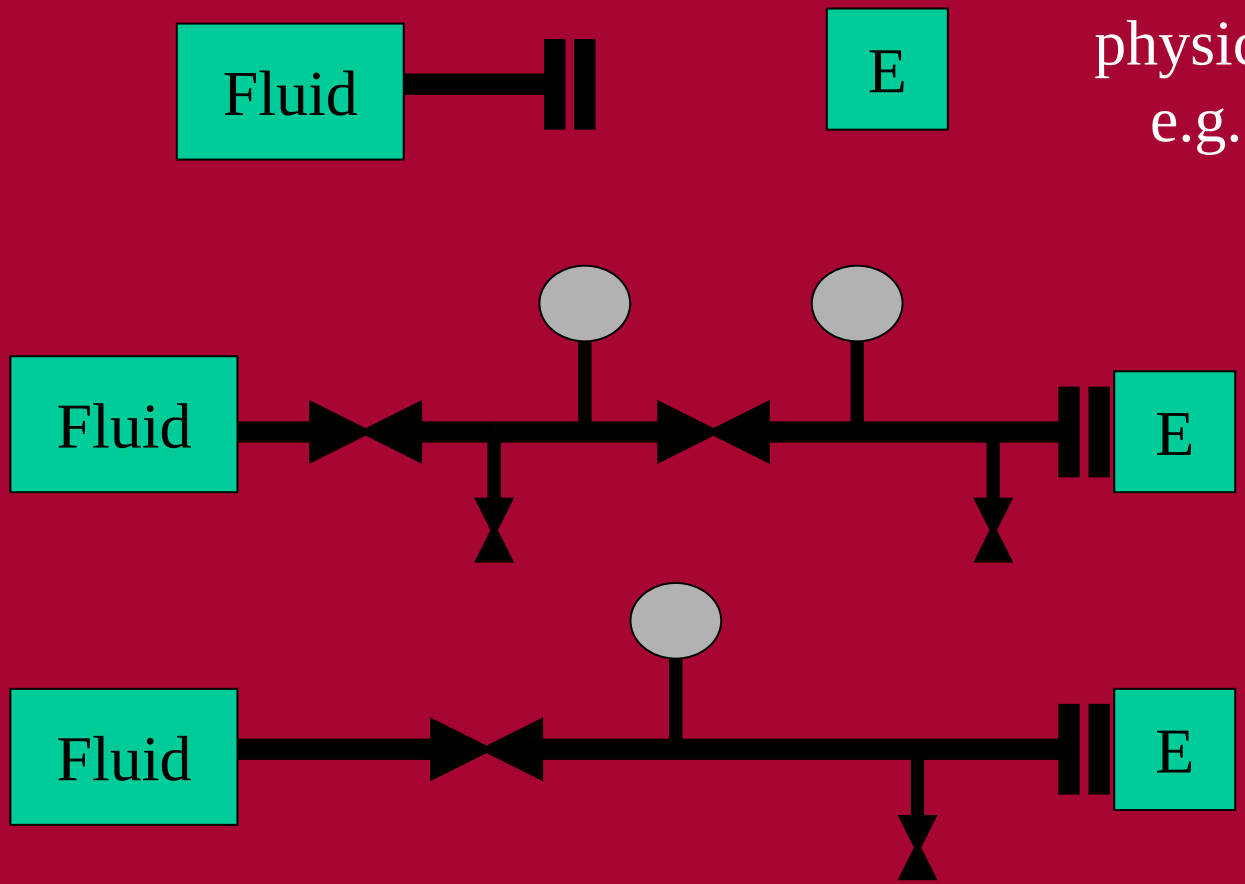
- NOTE – for confined space entry and extended term isolations – DO MORE – Physical disconnection or insertion of spades

TABLE G - Isolation Baseline Standard

		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

Types of isolation - 1 Positive isolation:

Complete separation of plant from other parts of the system

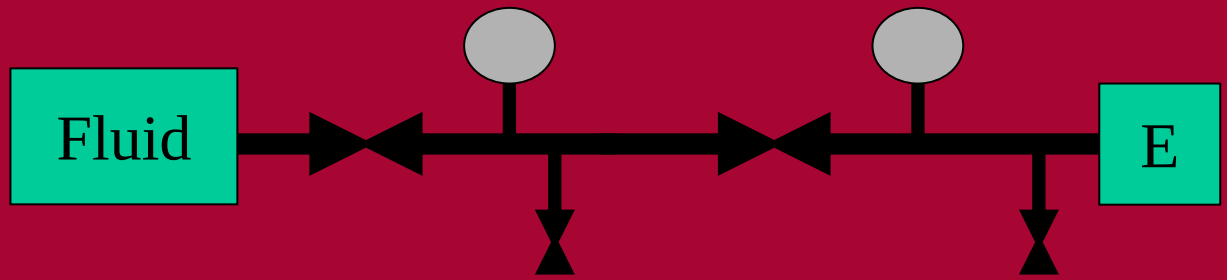


physical disconnection
e.g. spool removal

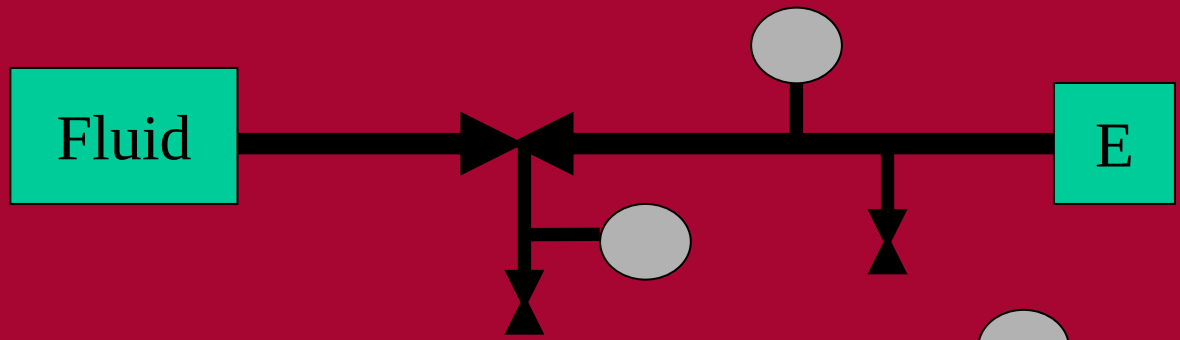
double block &
bleed with spade

single block &
bleed with spade

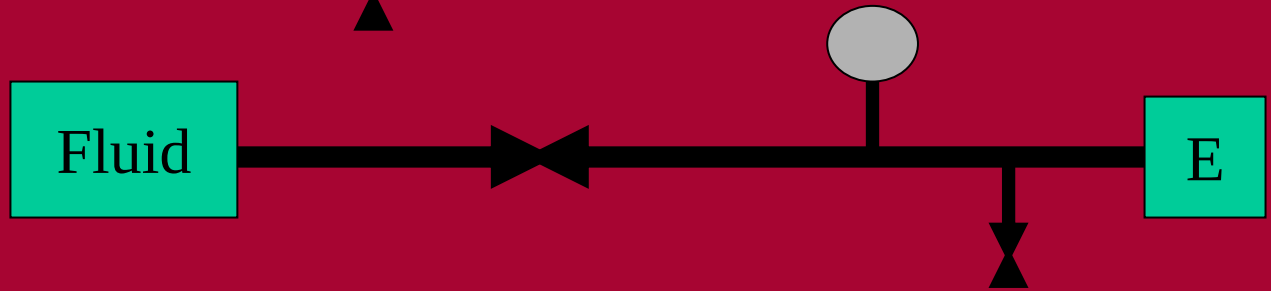
2 Proved isolation – Valved isolation with bleed to prove isolation effectiveness



double block and bleed



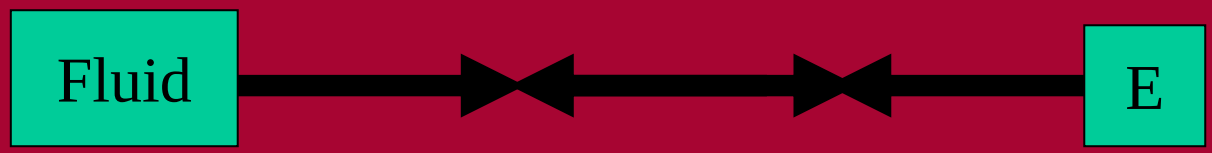
double seals in a single valve body with a bleed in between



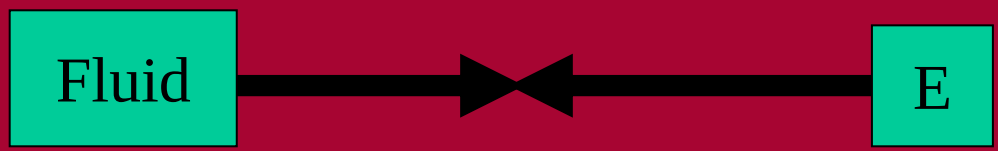
single block and bleed

Note for COMAH substances a minimum of double block and bleed is expected

3 Non-proved isolation – Valved isolation with no provision to prove effectiveness



double valve



single valve

Worked Examples

Example 1 - 4” steam main at 12 bar.g protection required for two fitters.

Table C – Substance Category

Category	Description
1	Very Toxic, Toxic Carcinogenic, Sensitising, etc.
2	Flammables Petroleum Explosive Steam etc.
3	Corrosives, Harmful, Irritant
4	Flammable liquids stored below flashpoint and following release
5	Non-classified & not stored in a potentially harmful state

Release factor

Table D – Release Factor for **4" steam main at 12 barg**

		Pressure		
Line size		> 50 barg	≤ 50 barg >10 barg	< 10 barg
	≥ 20cm	H	H	M
	Line **>5cm** <20 cm	H	**M**	L
	≤ 5cm	M	L	L

Location factor

Table E – Location Factor

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

Remember to consider the environment

Outcome factor

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

So Isolation Baseline is II

		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

Requires proved isolation – SBB as minimum for each supply line into the isolation – DBB a must for COMAH

Example 2
6’ water main protecting 2 fitters

- Substance Category 5
- Release factor M
- Location factor L
- Outcome factor C
- Baseline III
- Non-proved isolation – so could use a single valve but where possible double valve required

Example 3 - Process gas toxic at 0.3 bar.g 260C in a 450mm diameter pipe.

Substance Category for toxics is 1 from Table C

Category	Description
1	Very Toxic, Toxic Carcinogenic, Sensitising, etc.
2	Flammables Petroleum Explosive Steam etc.
3	Corrosives, Harmful, Irritant
4	Flammable liquids stored below flashpoint and following release
5	Non-classified & not stored in a potentially harmful state

Release factor M

Table D – Release Factor for 450mm dia pipe at 0.3 barg

		Pressure		
Line size		> 50 barg	≤ 50 barg >10 barg	< 10 barg
	≥ 20cm	H	H	**M**
	Line >5cm <20 cm	H	M	L
	≤ 5cm	M	L	L

Location factor H (off site risk)

Table E – Location Factor

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

Outcome factor B

Location Factor		Release Factor		
		H	M	L
	H	A	**B**	B
	M	B	B	C
	L	B	C	C

Isolation Baseline I

		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

- Positive isolation – spade or spool removal etc

Example 4
LPG pipe 75mm diameter.

- Substance Category 2
- Release factor M (hot day)
- Location factor H (offsite risk)
- Outcome factor B
- Baseline I
- Again positive isolation

Example 5
LPG 25mm diameter pipe

- Substance Category 2
- Release factor L
- Location factor L
- Outcome factor C
- Baseline II
- Proved isolation and as a minimum double block and bleed

Instrument isolation

- The most common need for isolation
- Should be treated the same as other isolations – see HS(G) 253 Appendix 9
- Instrument connections beyond the primary isolation may not be as robust as the plant-side isolation
- *Note also UKOOA guidance on vibration fatigue of small bore piping*

Recommended way forward

- List all fluids on your site
- Use appendix 6 to set isolation standard for each fluid and each diameter of pipe
- Write out the standard of isolation required for each pipe
- Survey all isolations on site and mark up P&IDs with isolation positions
- Create a time bound action plan to improve all isolations to the standard set

The way forward (2)

- Write down procedures to make and control each isolation – involve the work force
- Train all workers so that they understand the need and the application of the isolation standard
- Monitor and audit the use of the isolation standard and procedures
- Improve the standard and procedures based on the audit results

Ask Yourselves ?

- Have you appropriate isolation procedures that fully address planning, draining venting purging & flushing activities and testing & reinstatement of plant
- Are your procedures reviewed and updated periodically?
- Have you adequate supporting documentation? P&ID’s, GA’s or piping isometric drawings, valve line ups, isolation certificates, etc?

Ask Yourselves ?

- Have you trained and competent persons that perform and supervise isolations?
- Are roles and responsibilities defined and recorded?
- Do you audit and review isolations to ensure standards are achieved and maintained?
- Have you isolation KPI’s?
- Do you have effective communication at all levels and particularly at shift handovers?

Ask Yourselves ?

- Have you got all equipment necessary to perform isolations?
- Are your plant items identified and labelled appropriately?
- Have you got control of contractors and do they comply with your procedures and expectations?

Do you need to do more to improve your current practice?

If not – Address complacency

Thank You

Any Questions?