Process Safety Congress 14th May 2025

Preventing disaster - How captive key locks could have averted two industrial accidents

G-G-BD-E-PUB-25-05-001-01-EN

sofis
Netherlocks interlocks
Smith interlocks

Originator: Stephan Sadowski

A Halma company

Preventing disaster - How captive key locks could have averted two industrial accidents

sofis
Netherlocks interlocks
Smith interlocks

Content

1. Introduction
2. US Chemical Safety and Hazard Investigation Board
3. Incident Valero Meraux Refinery, Louisiana
4. Incident MGPI Processing, Kansas
5. Discussion Round

Our purpose

sofis
Netherlocks interlocks
Smith interlocks

“We protect people, property & planet with our expertise & solutions that guarantee safe & efficient manual valve operations ”

No injuries. No accidents. No spills. No loss. No downtime.

sofis
Netherlocks interlocks
Smith interlocks

Stephan Sadowski

sofis	Head of Business Development
sofis	Regional Sales Manager Europe
NETHERLOCKS safety systems	Branch Manager Germany
GSI SYSTEME	Branch Manager Germany
GSI SYSTEME	Project Manager

A Halma company

Process Safety Congress 14th May 2025

Introduction

sofis
Netherlocks interlocks
Smith interlocks

Halma: global group of life-saving technology companies.

Founded:	1894
Nr of employees:	7,000
Nr of companies:	45 companies
Net income:	244.2 million GBP (2022)
Listed:	London Stock Exchange (FTSE 100).

Sofis, a Halma company

With our expertise, global service team & partner network, we provide full support & site services.

sofis

2016 MERGED IN	30 YEARS OF EXPERIENCE	7 WORLDWIDE OFFICES
350000 TOTAL NUMBER OF INTERLOCKS INSTALLED	1985 MARKET LEADERS SINCE	100 NUMBER OF EMPLOYEES

Europe	Alphen a/d Rijn, The Netherlands
	Maldon, Essex, United Kingdom
	Stockstadt, Germany
Middle East & Asia	Vadodara, India
	Mumbai, India
Americas	Houston, Texas, USA

A Halma company

Process Safety Congress 14th May 2025

US Chemical Safety and Hazard Investigation Board

The CSB is an independent federal agency charged with investigating industrial chemical accidents. Headquartered in Washington, DC, the agency's board members are appointed by the President and confirmed by the Senate.

Process Safety Congress 14th May 2025

Valero Meraux Refinery

sofis
Netherlocks interlocks
Smith interlocks

Incident Summary

Date: 10th April 2020 at 12:46 AM

Location: Meraux, Louisiana USA

Description:
A mixture of hydrogen and hydrocarbon gas was accidentally released within the Hydrocracker unit.
The flammable gas formed a vapor cloud that ignited, resulting in an explosion and fire that seriously injured one Valero operator and caused approximately $5.15 million in property damage.

Picture by Valero Meraux Refinery

Process Safety Congress 14th May 2025

Valero Meraux Refinery

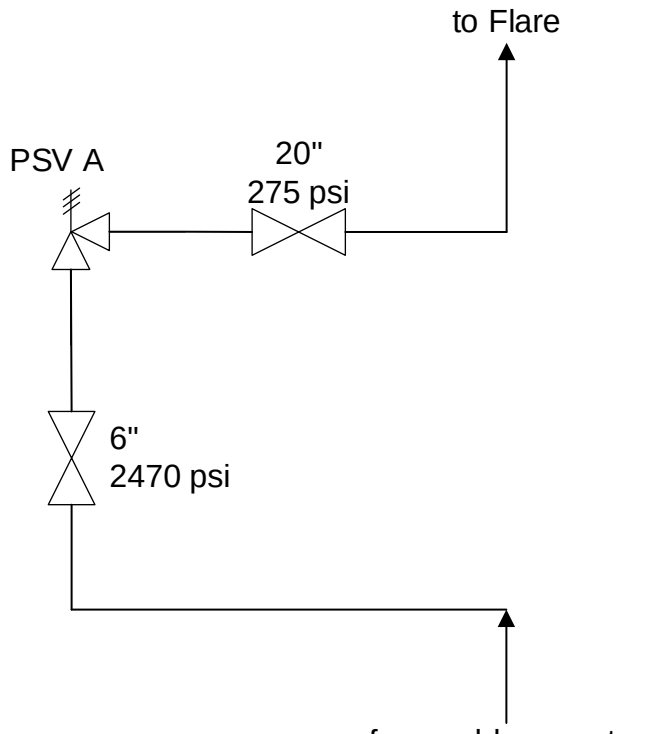
Route Cause

- After a heavy rainstorm, the flow of the Hydrocracker unit´s flare began increasing
- An emergency pressure-relief had a malfunction and remained open
- A "reseating" was ordered and approved
- Safety concerns to access the 6" inlet valve
- Decision was made to close the 20" outlet valve

Picture by Valero Meraux Refinery

Result

- The 6” inlet valves are designed for 2470 psi
- After the outlet valve 20” 275 psi was closed by about 90% the valve failed
- Releasing a high-pressure mixture of hydrogen and hydrocarbon vapor into the surrounding air
- The flammable gas formed a vapor cloud, ignited and resulted in the explosion and fire.



Picture from CSB Incident report Volume 1 Page 5

Valero Meraux Refinery

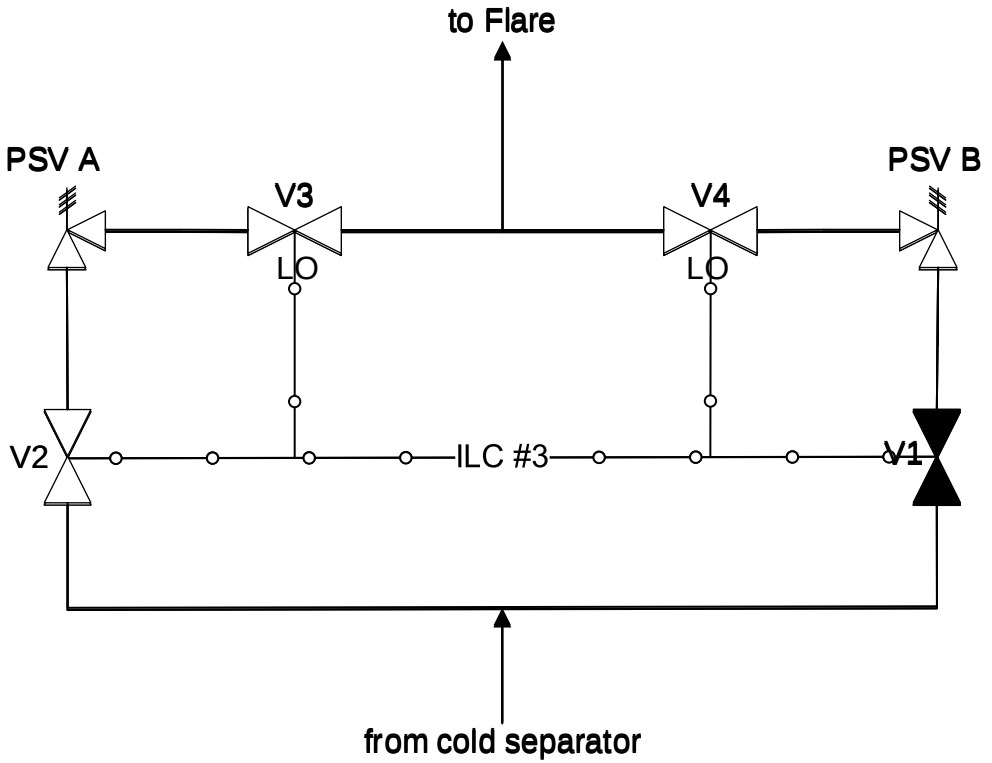
sofis
Netherlocks interlocks
Smith interlocks

Prevention

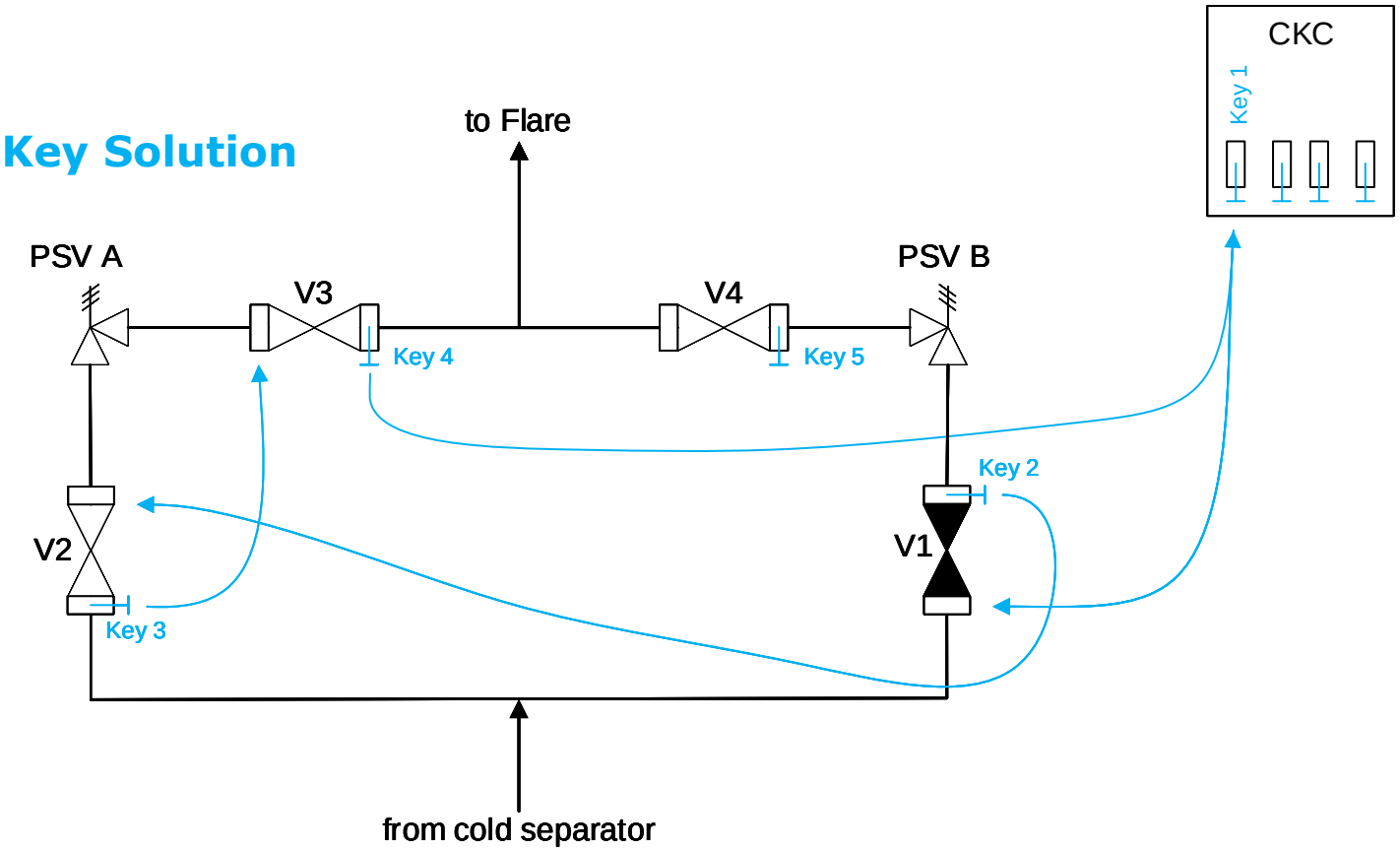
- Implementing a captive key lock solution
- Including the inlet **AND** outlet valves into the solution
- Guarantee a continues over pressure protection of the equipment
- Guarantee overpressure protection of the outlet line and valve

Picture from CSB Incident report Volume 1 Page 5

Typical Specifications



Possible Captive Key Solution



Process Safety Congress 14th May 2025

Valero Meraux Refinery

sofis
Netherlocks interlocks
Smith interlocks

Key Features

- Safe operation of a redundant PSV system (guaranteed protection of the equipment)
- Protection of the outlet valves against overpressure
- Clear indication of the isolated PSV by the end key
- Easy implementation of pilot valves in case of pilot operated PSV
- Optional the cascading of redundant PSV´s can be realized to prevent chattering

A Halma company

Process Safety Congress 14th May 2025

MGPI Processing

sofis
Netherlocks interlocks
Smith interlocks

Incident Summary

Date: 21st October 2016 at around 7:35 AM

Location: Atchison, Kansas USA

Description:
The accidental mixing of incompatible chemicals, sulfuric acid and sodium hypochlorite, produced a cloud containing chlorine and other compounds.

The cloud impacted workers onsite and members of the public in the surrounding community.

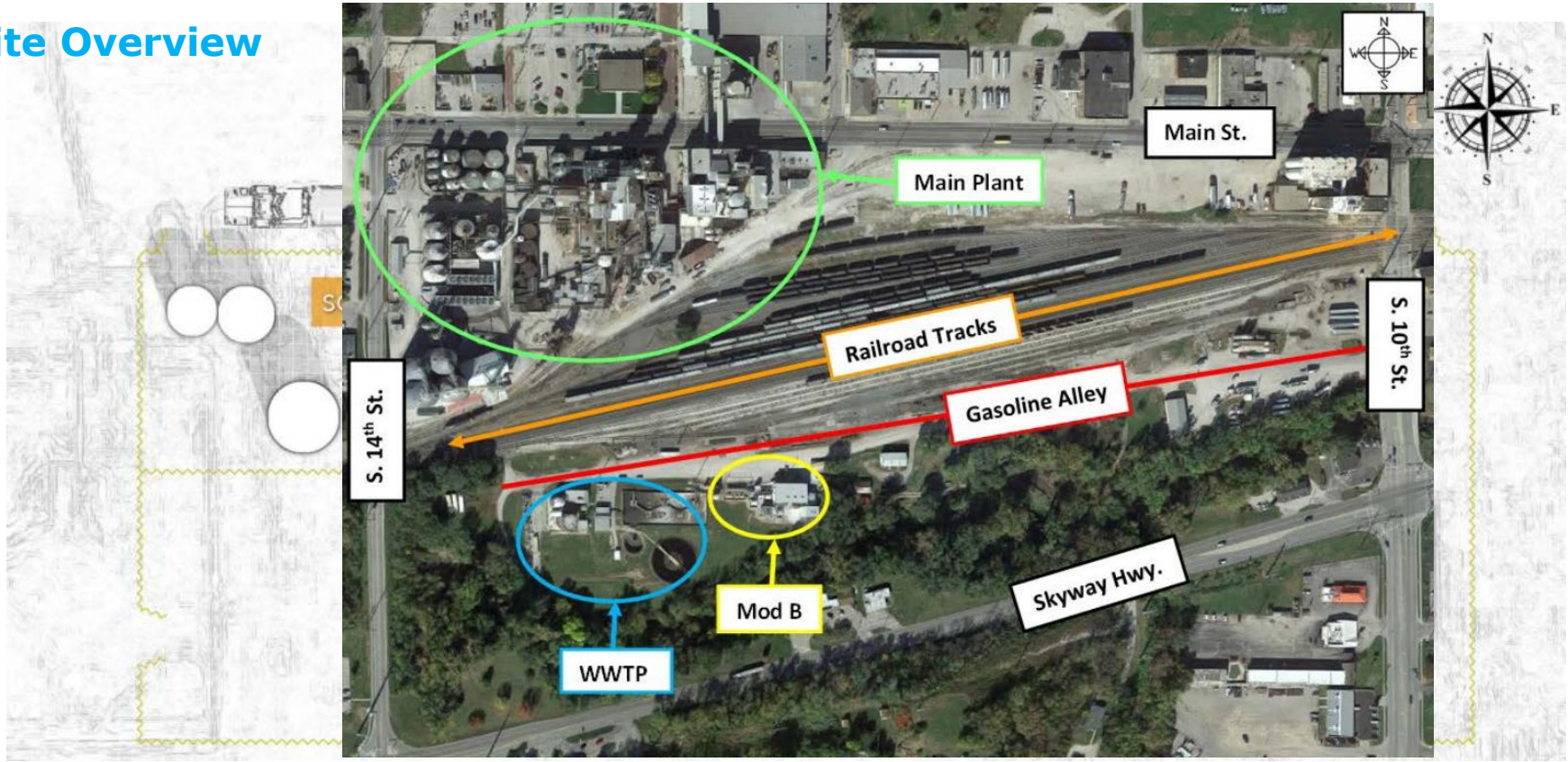
Picture by chuckcowdery.blogspot.com

Process Safety Congress 14th May 2025

MGPI Processing

sofis
Netherlocks interlocks
Smith interlocks

Site Overview



MGPI and surrounding area (Source: CSB)

Mod B Chemical unloading area (Source: CSB)

A Halma company

MGPI Processing

Route Cause

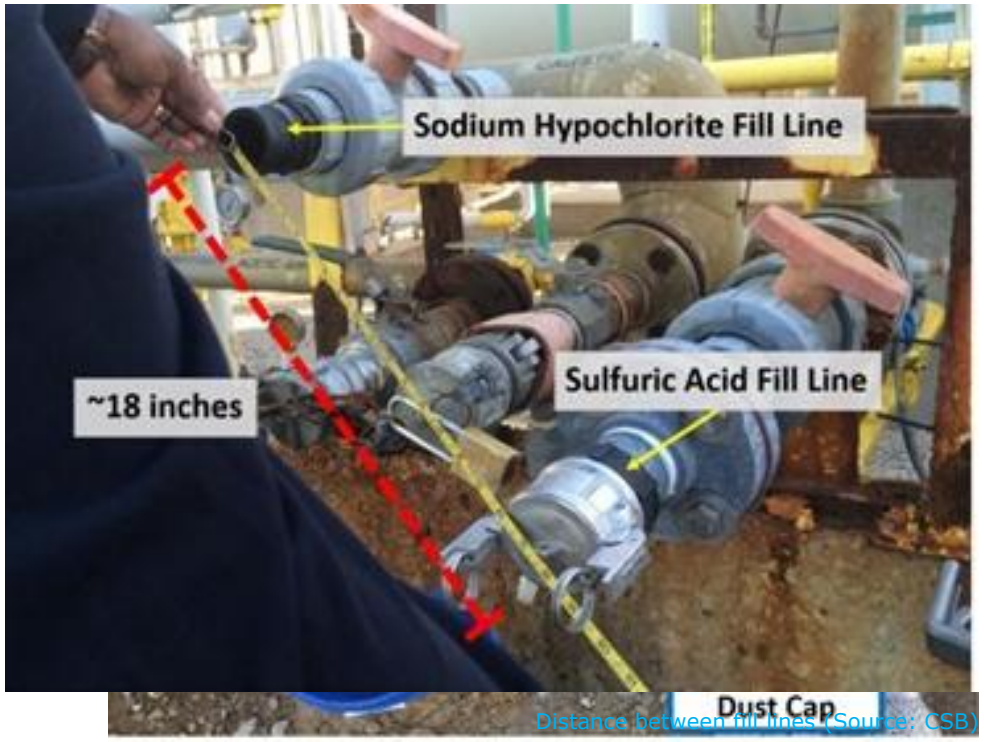
- Operator from the night shift accepted the delivery of 30% Sulfuric Acid
- Operator escorted the driver to the chemical unloading area.
- Operator unlocked the gate in front of the transfer equipment and removed the lock on the cam lever dust cap for the sulfuric acid fill line.
- Operator reports that he pointed out the location of the sulfuric acid fill line.
- Driver reports that the operator did not point out the fill line.

Chemical unloading operations at the time of the incident (Source: CSB / MGPI)

MGPI Processing

Route Cause

- Operator returned to the Mod B building before the driver connected the discharge hose.
- Driver removed the dust cap from the first unlocked fill line.
- Driver connected the hose to the fill line and to the truck.
- Driver checked for leaks and started the discharging process.



Distance between fill lines (Source: CSB)

Chemical unloading operations at the time of the incident (Source: CSB / MGPI)

Process Safety Congress 14th May 2025

MGPI Processing

Result

- The Sodium Hypochlorite fill line was unsecured and therefore accessible for the driver.
- 4.000 gallons (15 m³) of Sulfuric Acid got mixed with 5.850 gallons (22 m³) of sodium.
- The chemical reaction produced maximum theoretical 3.490 pounds (1,6 tons) of chlorine gas and other gases.
- The gas were released through a 3” atmospheric vent and an 18” lid on the roof of the bulk tank.

Released Chlorine Cloud (Source: CSB)

Process Safety Congress 14th May 2025

MGPI Processing

Prevention

- Implementation of incompatible line sizes.
- Usage of incompatible connection shapes
- Propper fill line marking.
- Separation of unloading connections with secure cages around connection points.
- Sofis SiLoC solution.

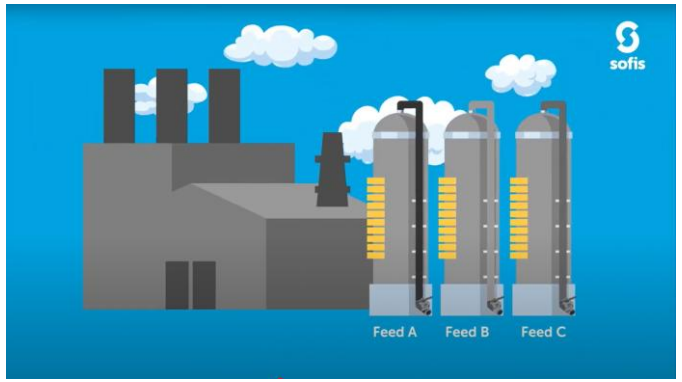
Separation of unloading connections (Source: CSB)

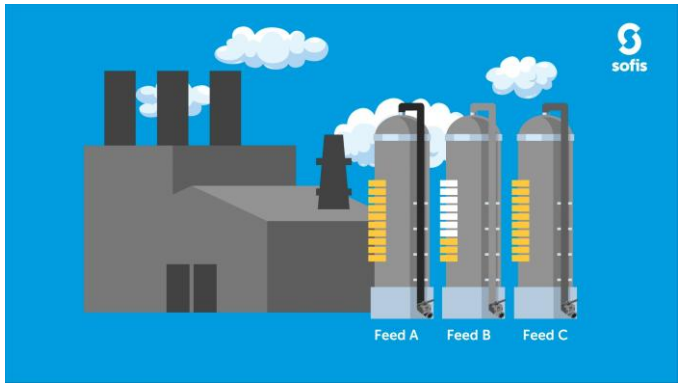
Combination of fill line shapes and sizes (Source: CSB)

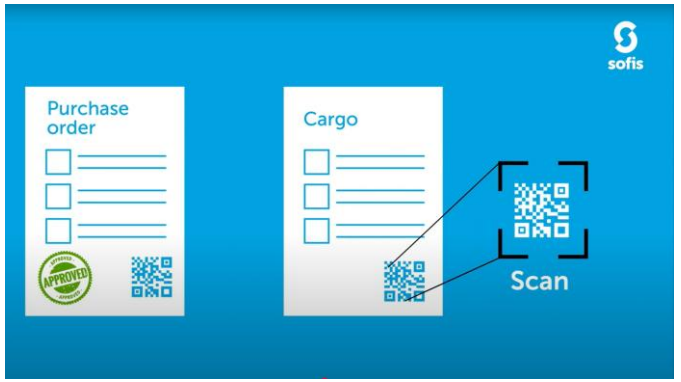
Process Safety Congress 14th May 2025

Sofis SiLoC

sofis
Netherlocks interlocks
Smith interlocks





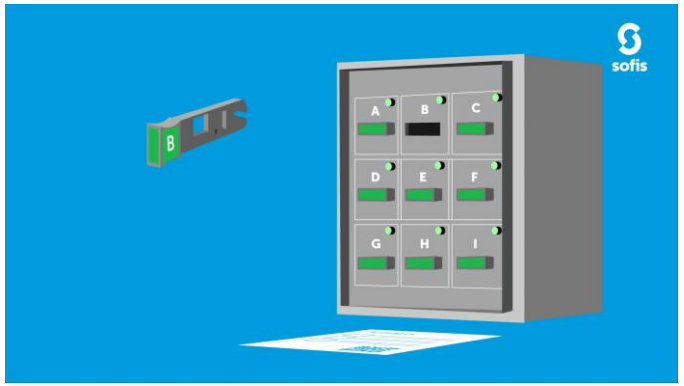


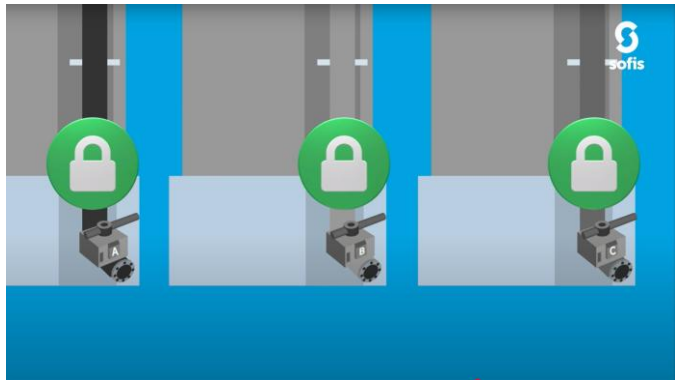
A Halma company

Process Safety Congress 14th May 2025

Sofis SiLoC

sofis
Netherlocks interlocks
Smith interlocks



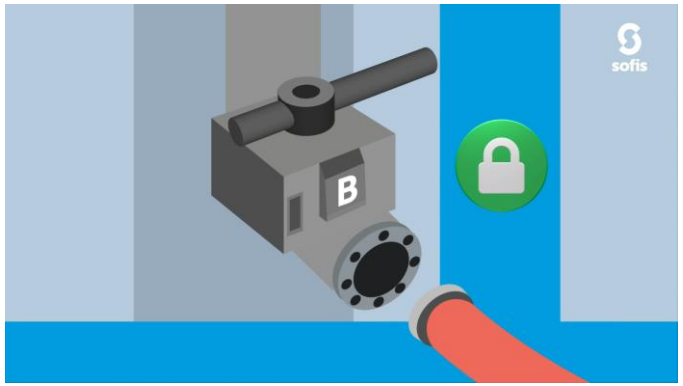


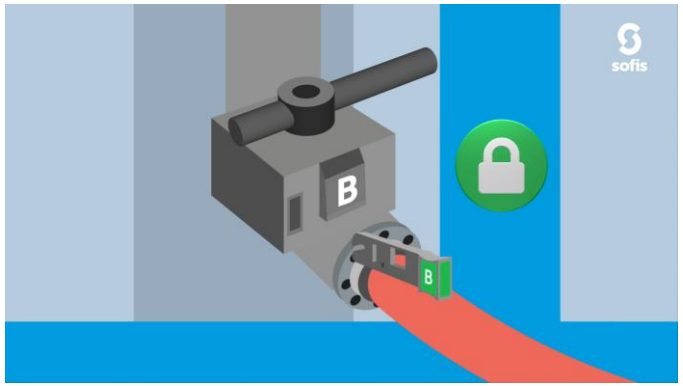
A Halma company

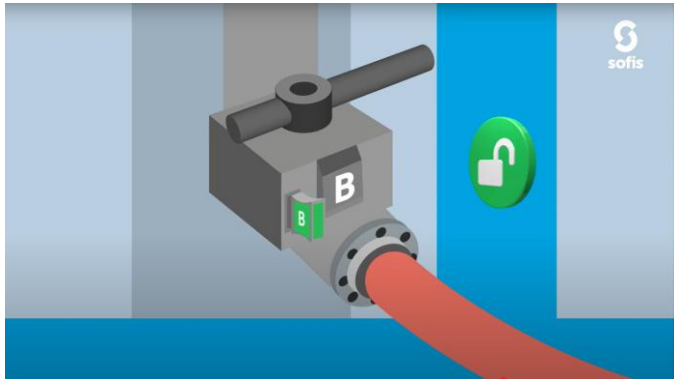
Process Safety Congress 14th May 2025

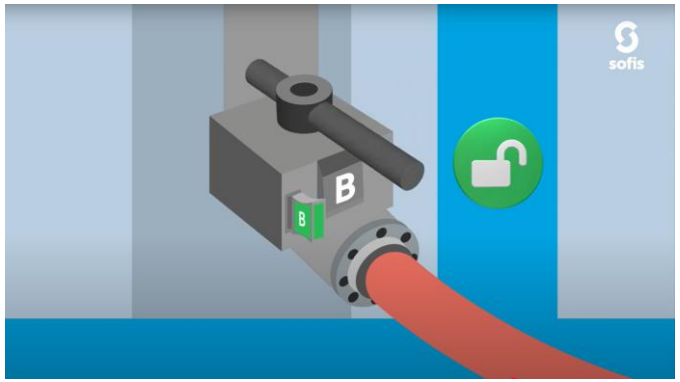
Sofis SiLoC

sofis
Netherlocks interlocks
Smith interlocks









A Halma company

Process Safety Congress 14th May 2025

Sofis SiLoC

sofis
Netherlocks interlocks
Smith interlocks

Benefits

- Elimination human errors during fill line selection process
- Unique key per silo
- Grouping of silos optional
- Interlocking of silos against each other during loading
- Connection to SCADA System possible
- Connection to DCS for interacting with other equipment

A Halma company

sofis
Netherlocks interlocks
Smith interlocks

Thank you for your attantion.

A Halma company