

EPSC Webinar 7th March 2024

How can the Captive Key Concept contribute to Process Safety?

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Originator: Stephan Sadowski



How can the Captive Key Concept contribute to Process Safety?

Content

1. Introduction
2. Safety Principles versus Investment Costs
3. Captive Key System
4. Captive Key Applications
5. Pipeline Pigging
6. Key Handling
7. Applications across the Industries
8. Discussion Round



Our purpose



“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.



Stephan Sadowski



Head of Business Development



Regional Sales Manager Europe



Branch Manager Germany



Branch Manager Germany



Project Manager



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Introduction



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.



A Halma company

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

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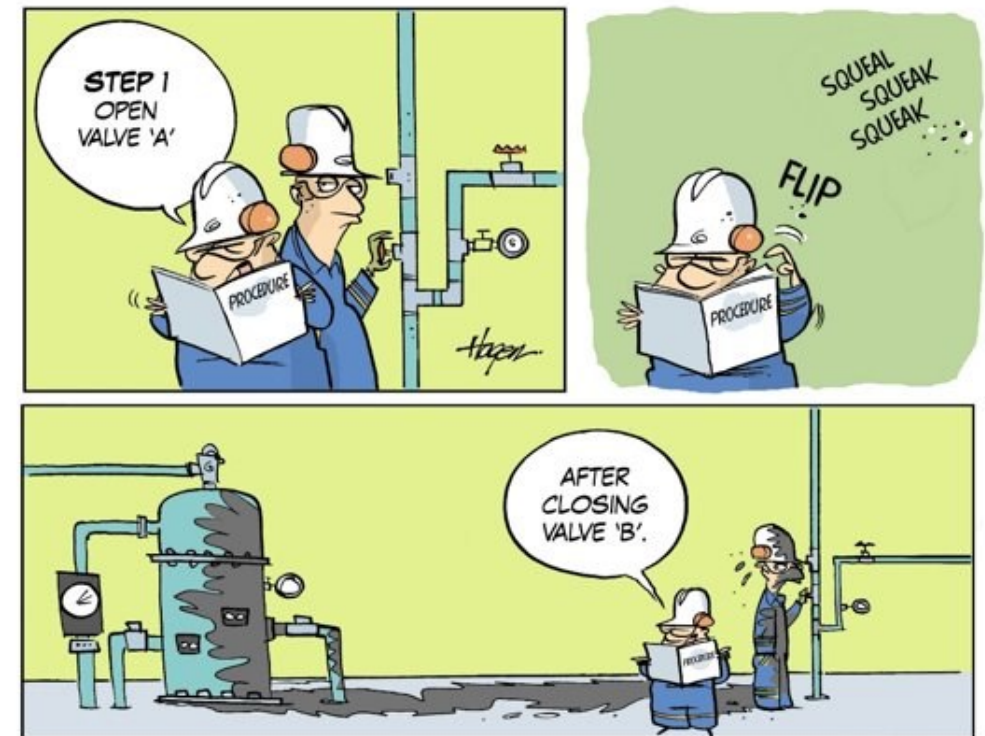
Safety Principles versus Investment Costs



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Written Procedure

- Common way to guide operators through tasks
- Ensure that tasks are performed correctly.
- 49 of 100 incidents in oil and gas industries over the past two decades include some sort of procedural errors
- Tend to be ambiguous and complex
- Require judgment or decisions from operators



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LOTO

LOTO is a procedure, used to isolate hazardous energy sources to prevent accident during servicing or maintenance

In Process Industry “LOTO” is the used to prevent valve operation.

Main Challenges:

- Clear definition between both way of use
- Lack of Procedures
- Training all Employees
- Audit of procedures and review of findings



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Individual Solution

- Massive Steelwork in front of the valves
- Steelwork hamper the operation of the valves
- Sliding bar difficult to operate and position
- All valve stems at one level
- Space consuming design
- Welding at the valve stem required



- Additional infrastructure required
- Save human resources on operation
- Implementation into the control system
- High investment costs
- Difficult to retrofit
- Potential risk for override by local operation



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Captive Key

- Fully mechanical
- Operator guiding by unique coded keys
- No misinterpretation of steps
- Safe handling of complex processes
- Easy retrofitting
- Involvement of all kind of equipment
- No additional infrastructure
- Training all Employees



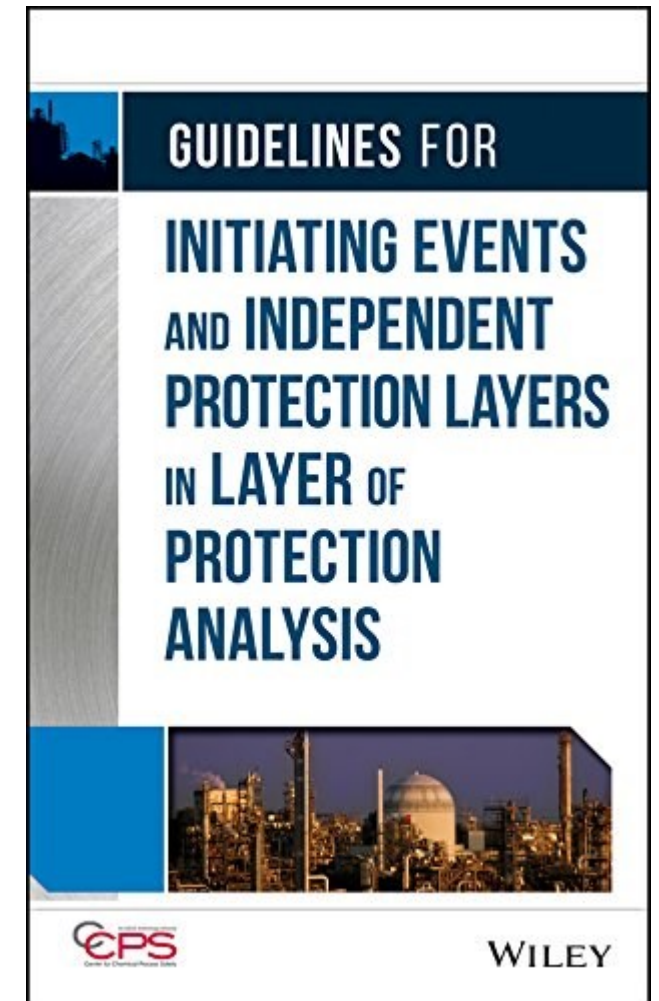
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Captive Key System

The Captive Key System is described as follows:

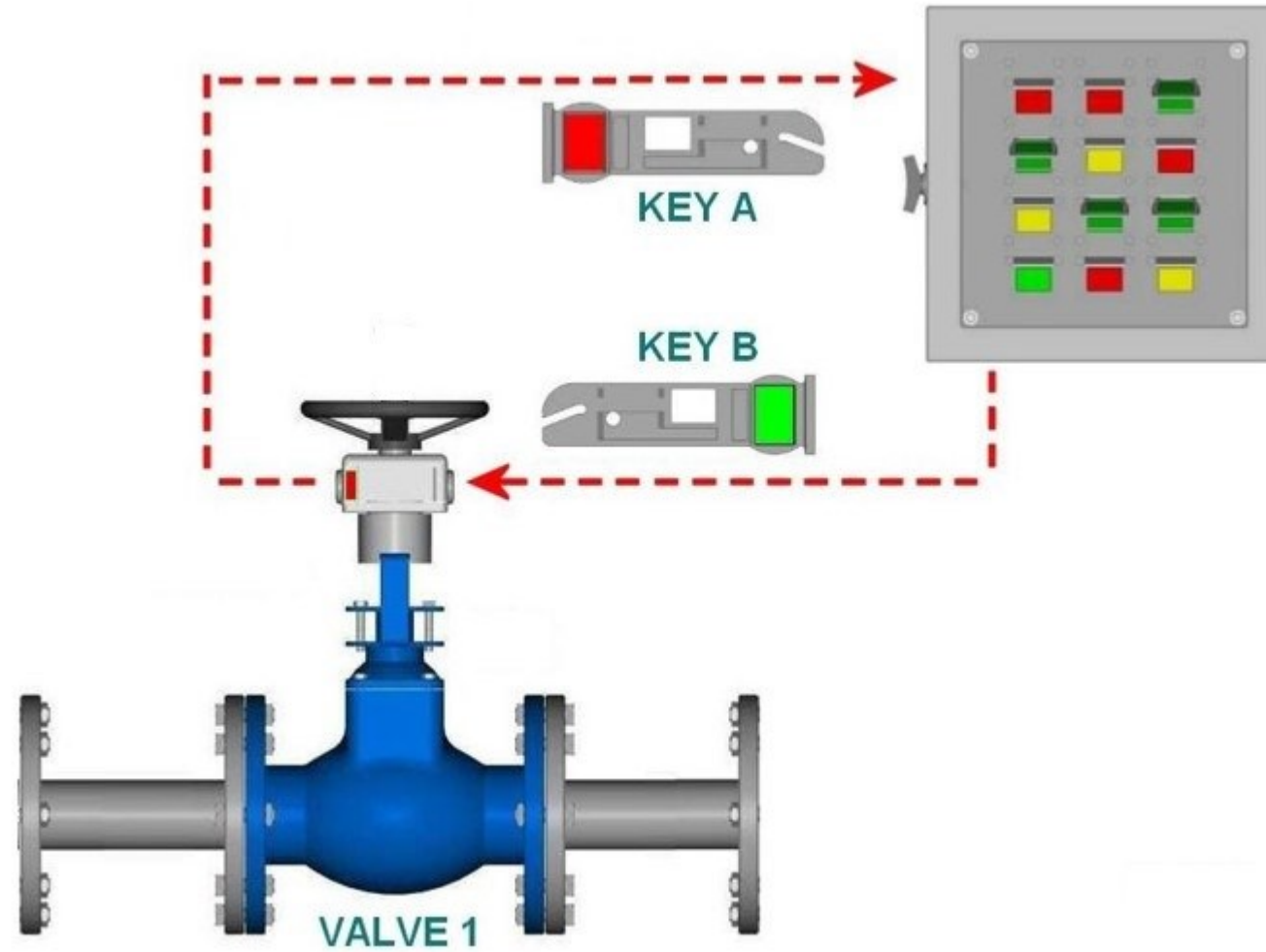
A captive key/lock system employs mechanical linkages that are released by unique keys to prevent movement of a device (such as door handle or valve). This prevent humans from operating the valves in the wrong sequence. The captive key lock capability is an integral part of the hardware design and is not able to be removed or defeated by tools readily available to the worker.

Generic PFD suggested for use in LOPA: 0,01



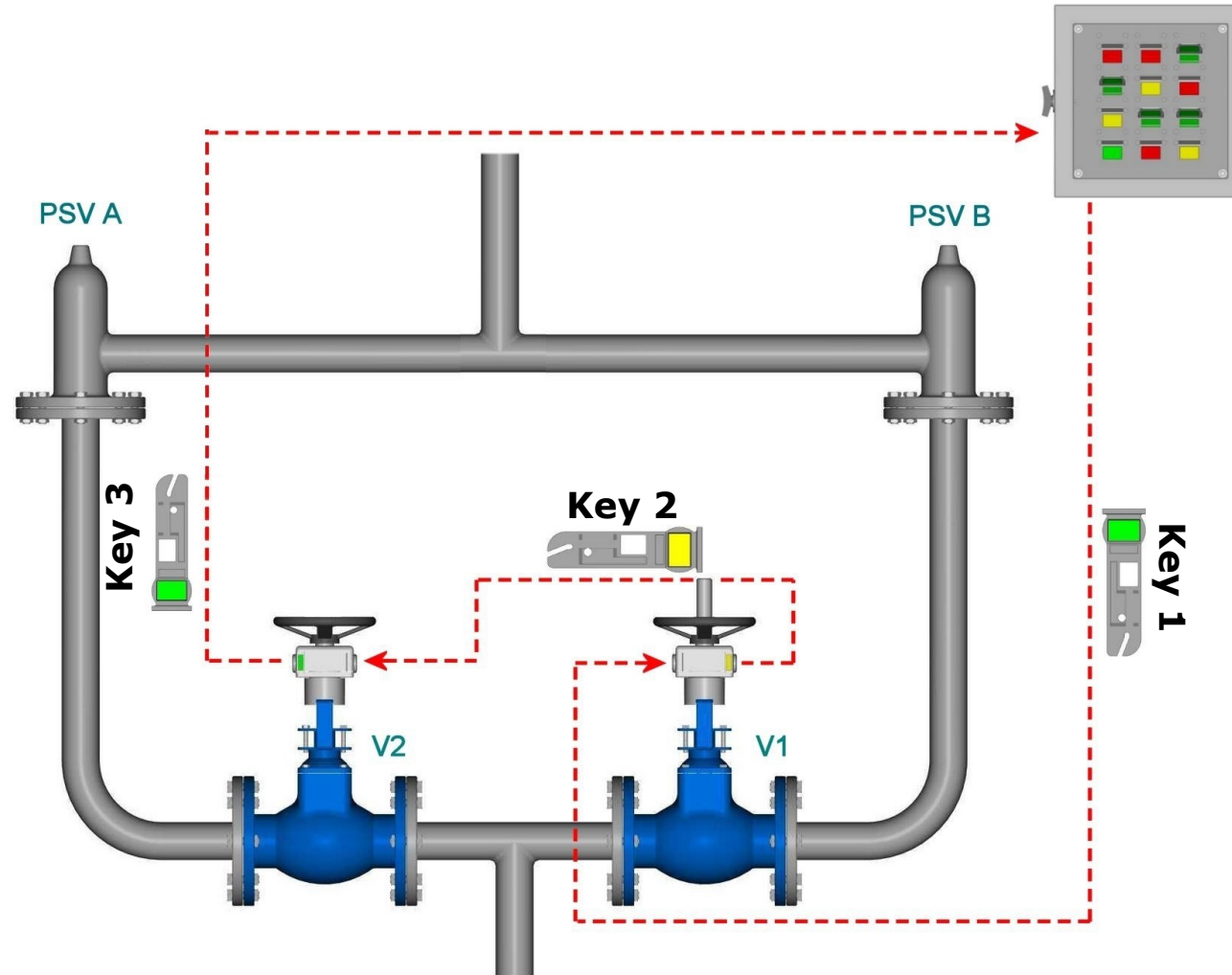
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Simple captive Key Application



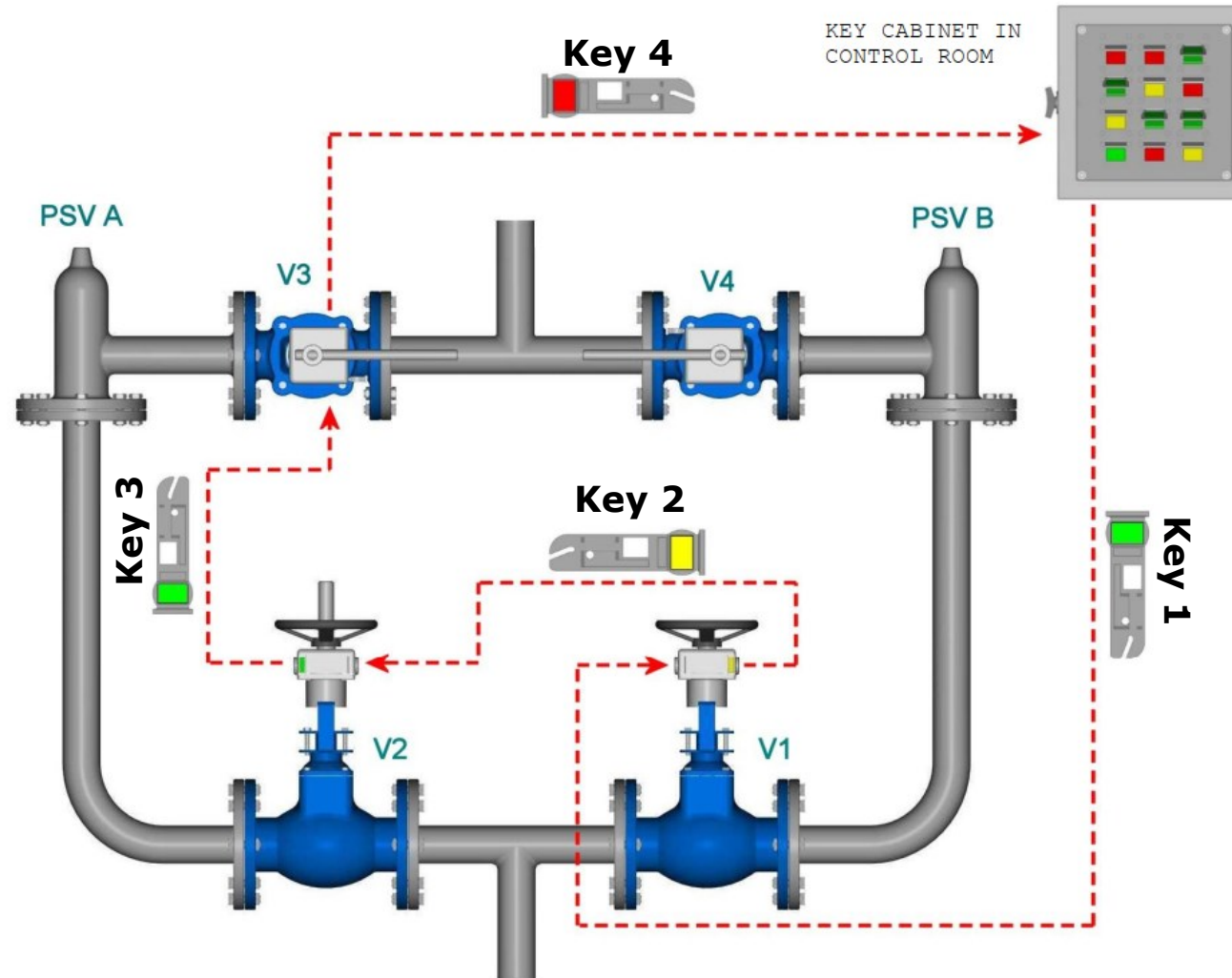
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Captive Key goes PSV Systems



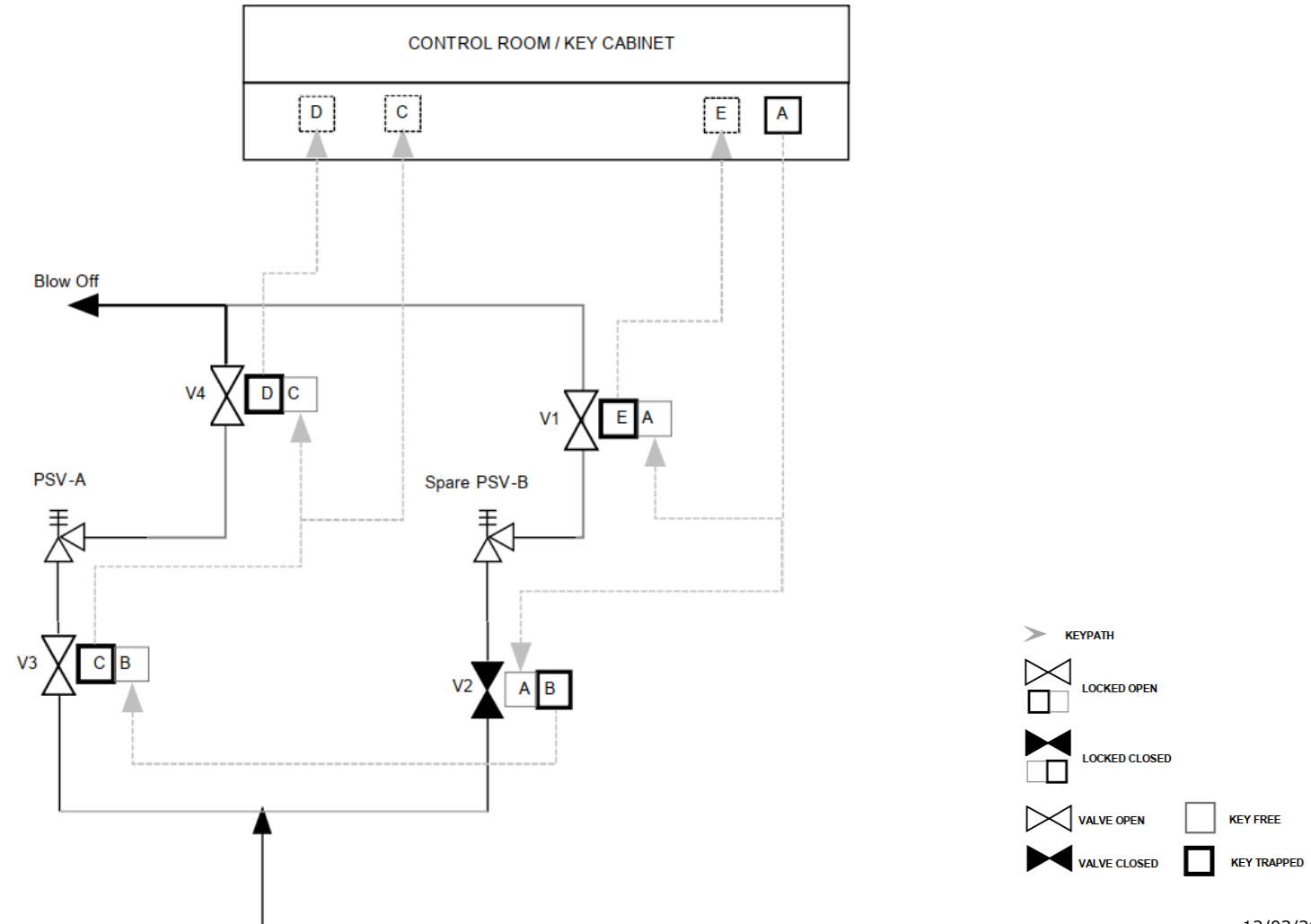
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Captive Key goes PSV Systems



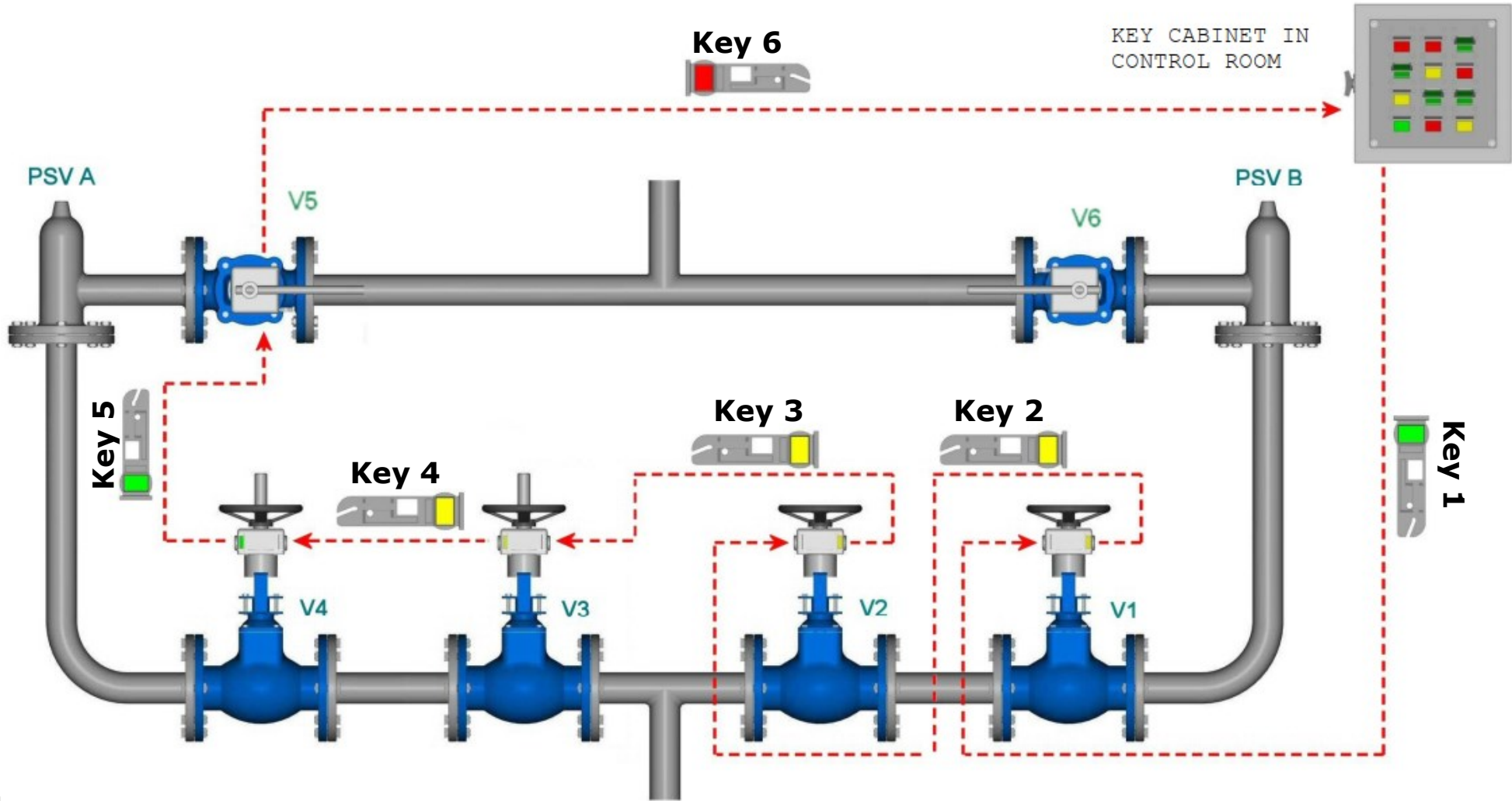
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Captive Key goes PSV Systems



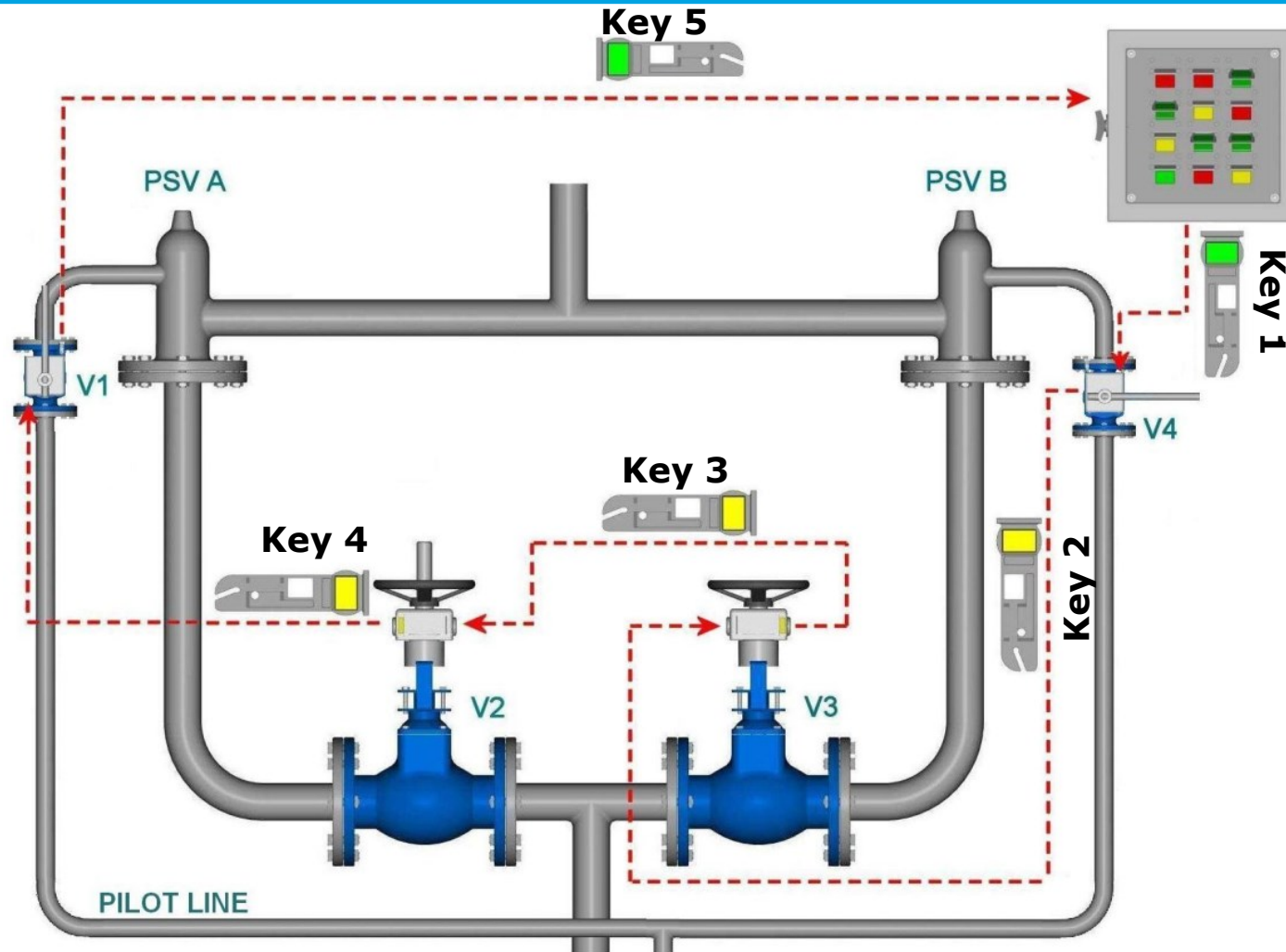
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Captive Key goes PSV Systems



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Captive Key goes PSV Systems



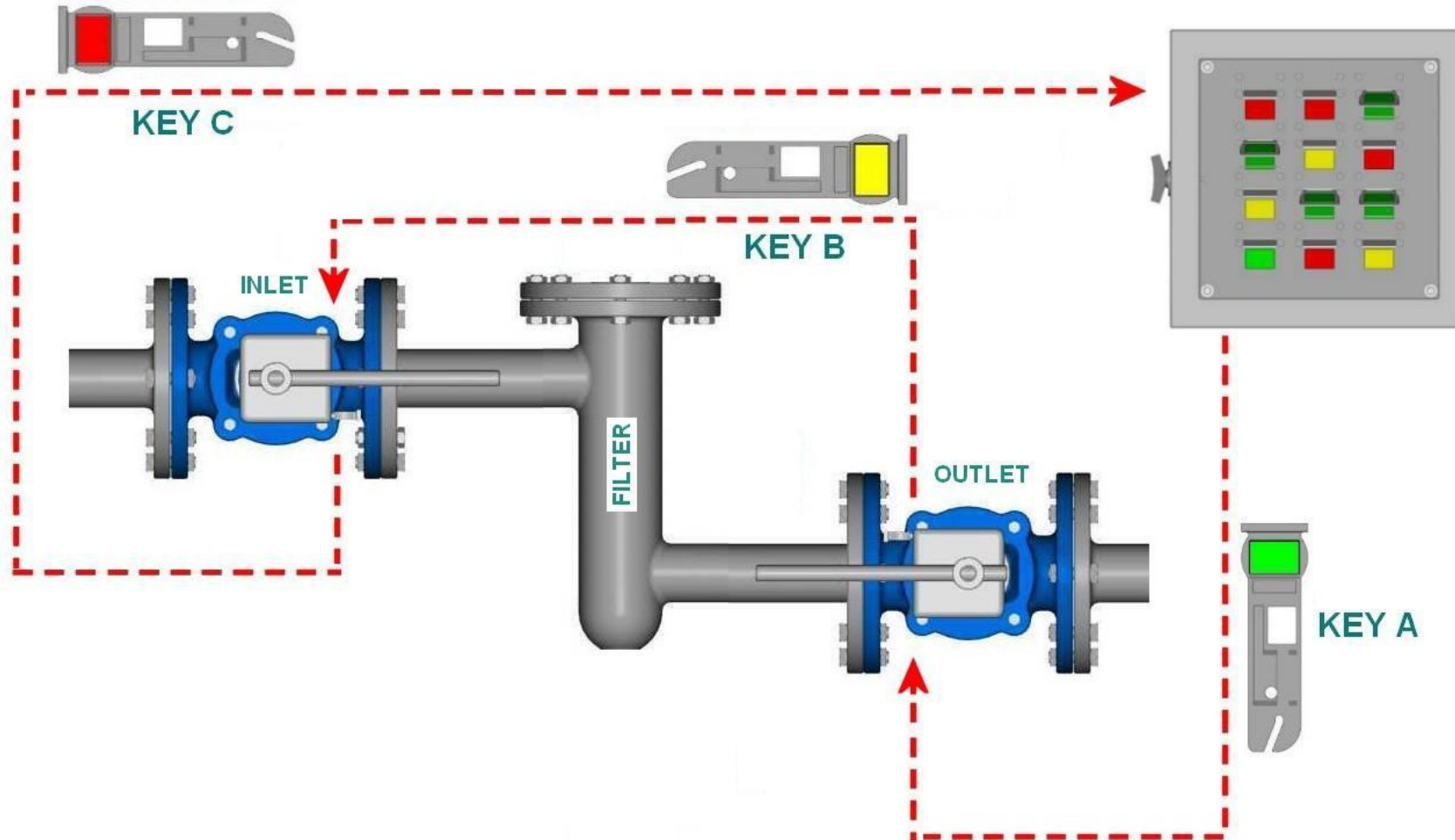
PSV, an Application with challenges

- Redundancy
- Pilot operated (including the pilot line)
- PSV with pneumatic Air assistance (including the monitoring line)
- Status of the outlet valves (open or close)
- Captive key system with or without start key
- PSV Chattering



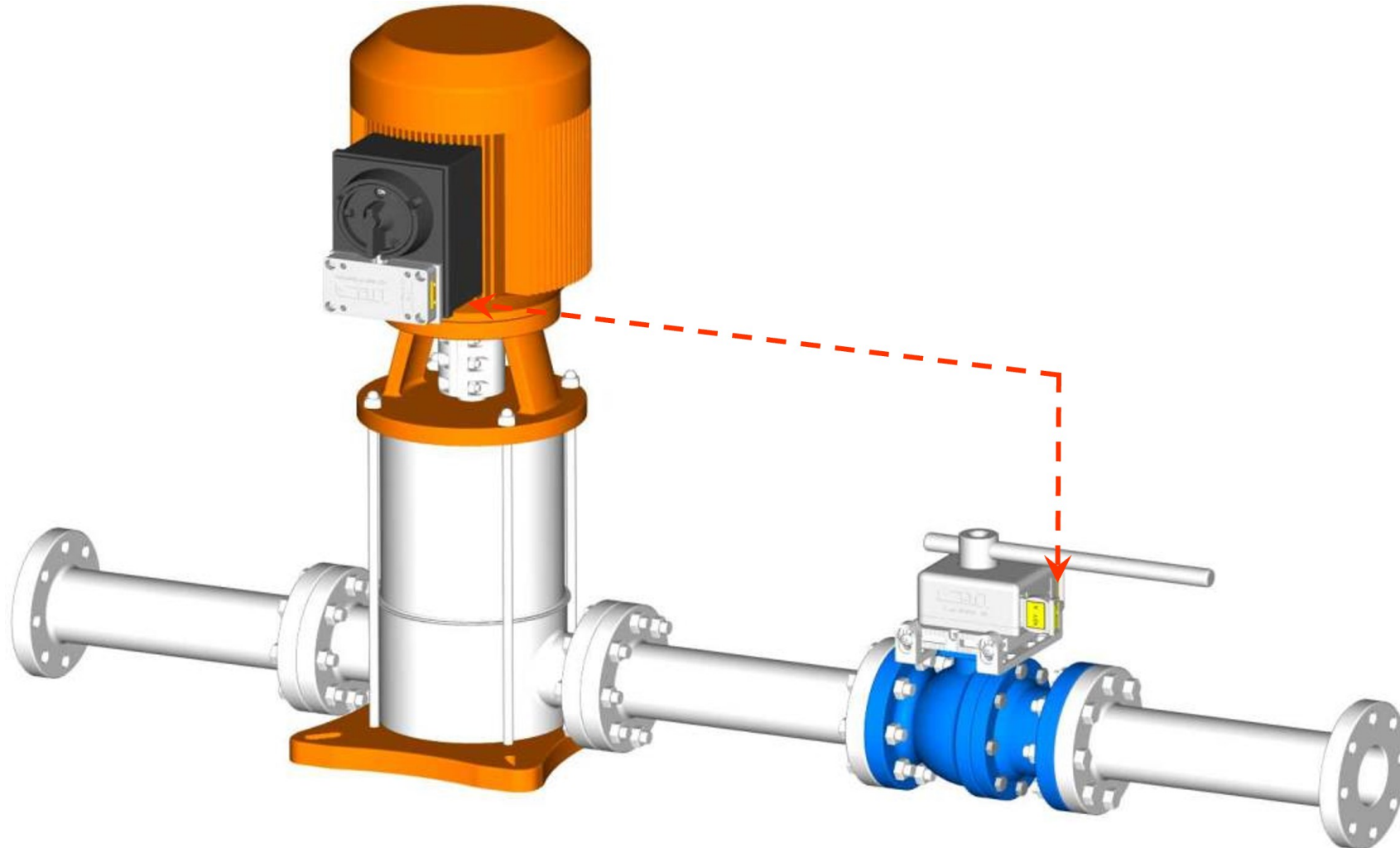
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Captive Key for Filters



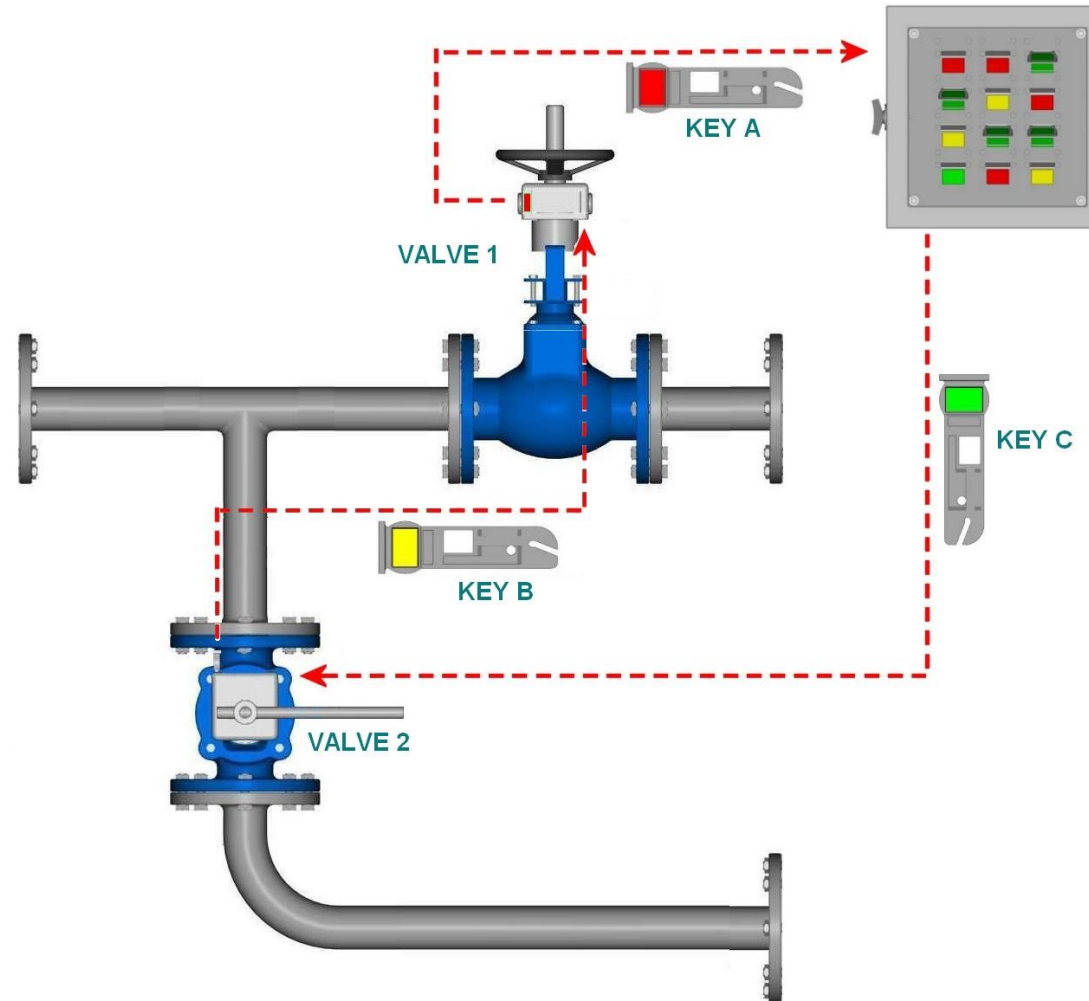
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Captive Key for pumps



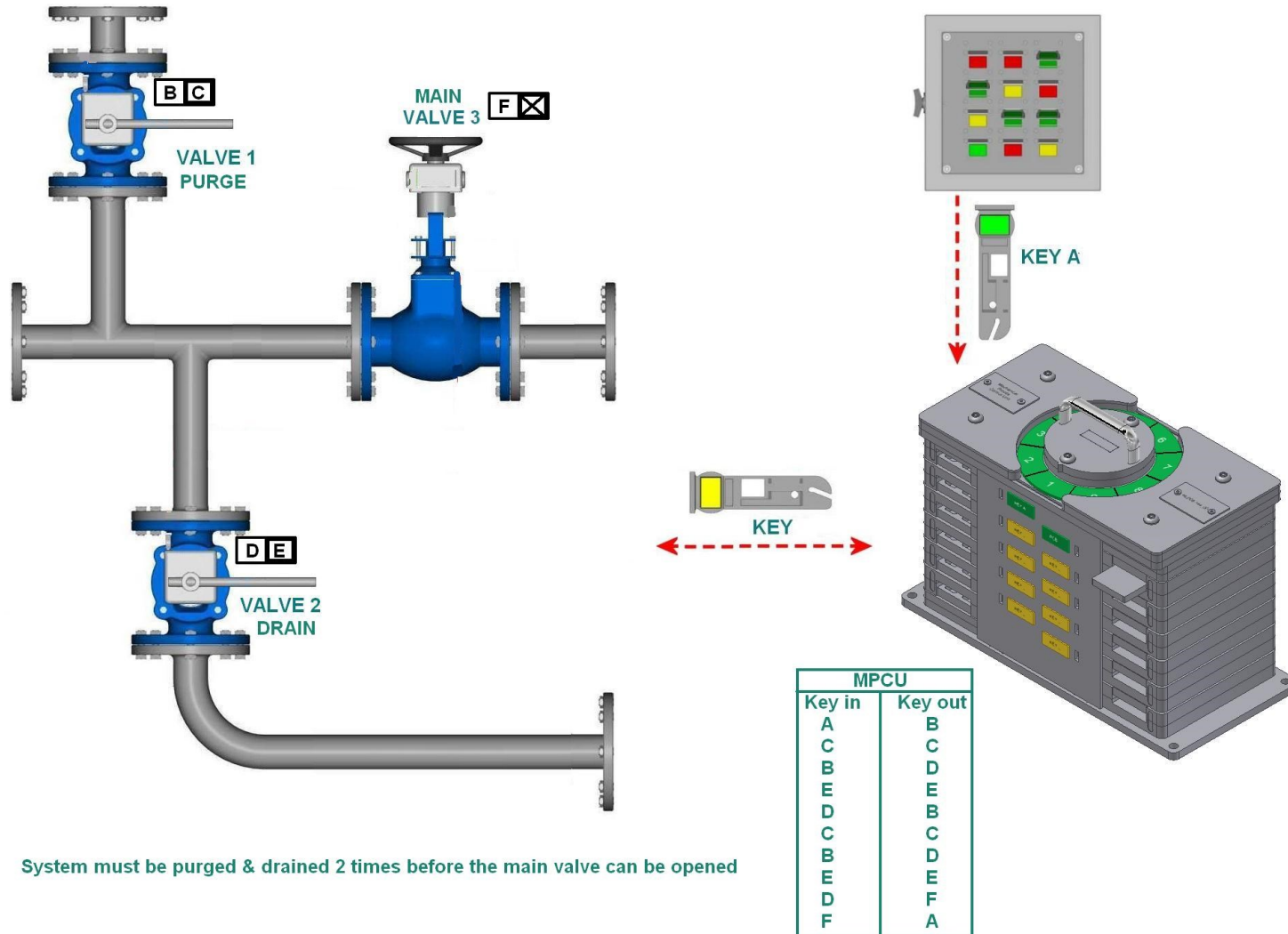
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Captive Key guarantee Product Flow



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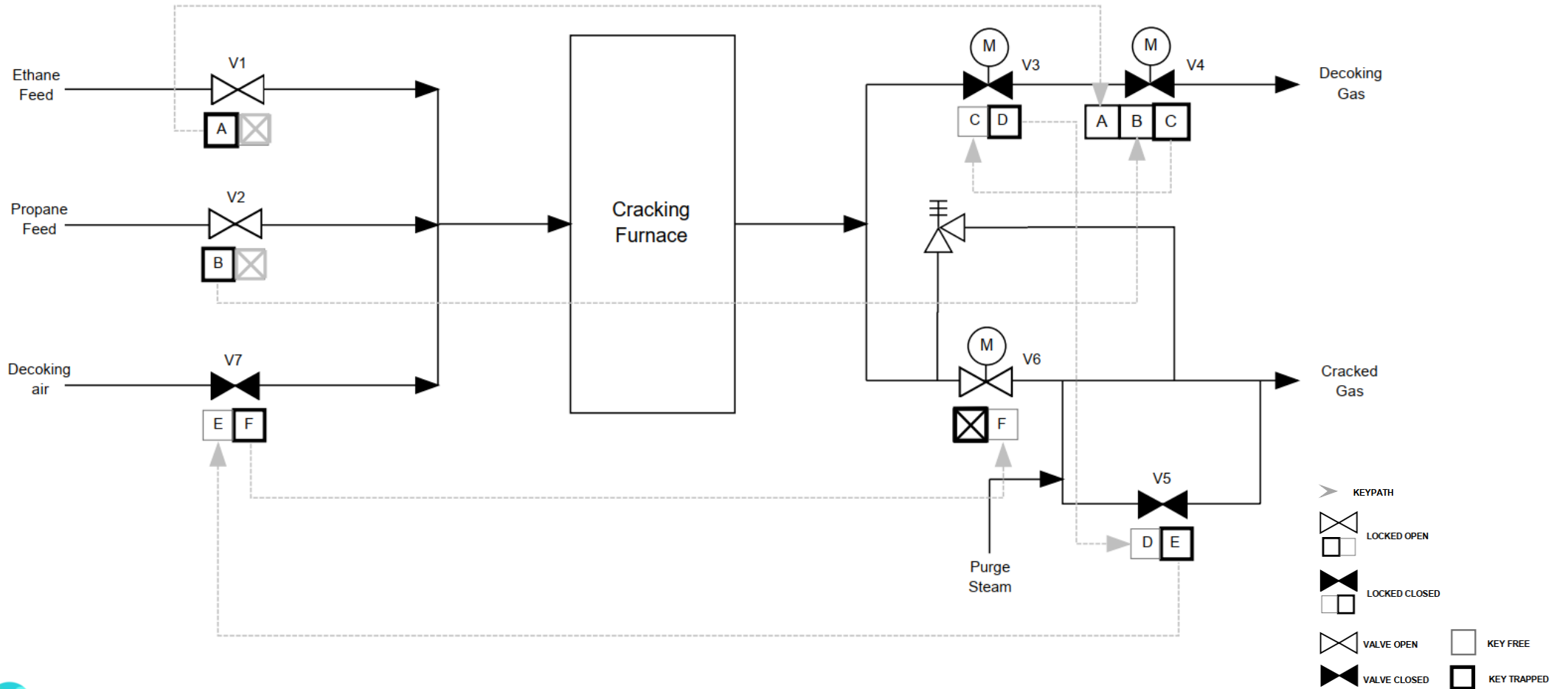
Captive Key for nonlinear Sequences



System must be purged & drained 2 times before the main valve can be opened

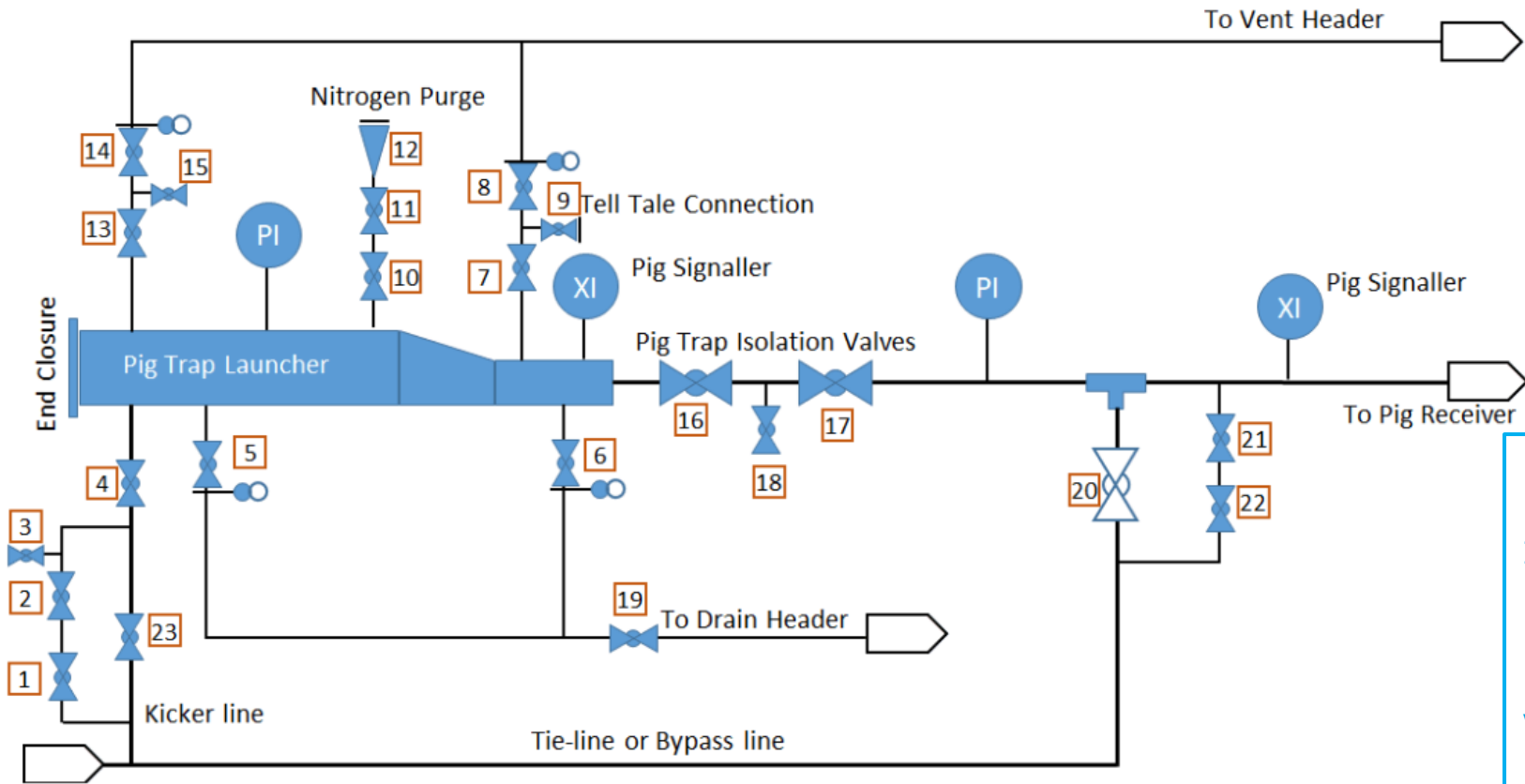
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Captive Key for Cracking Furnaces



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Captive Key for Pipeline Pigging

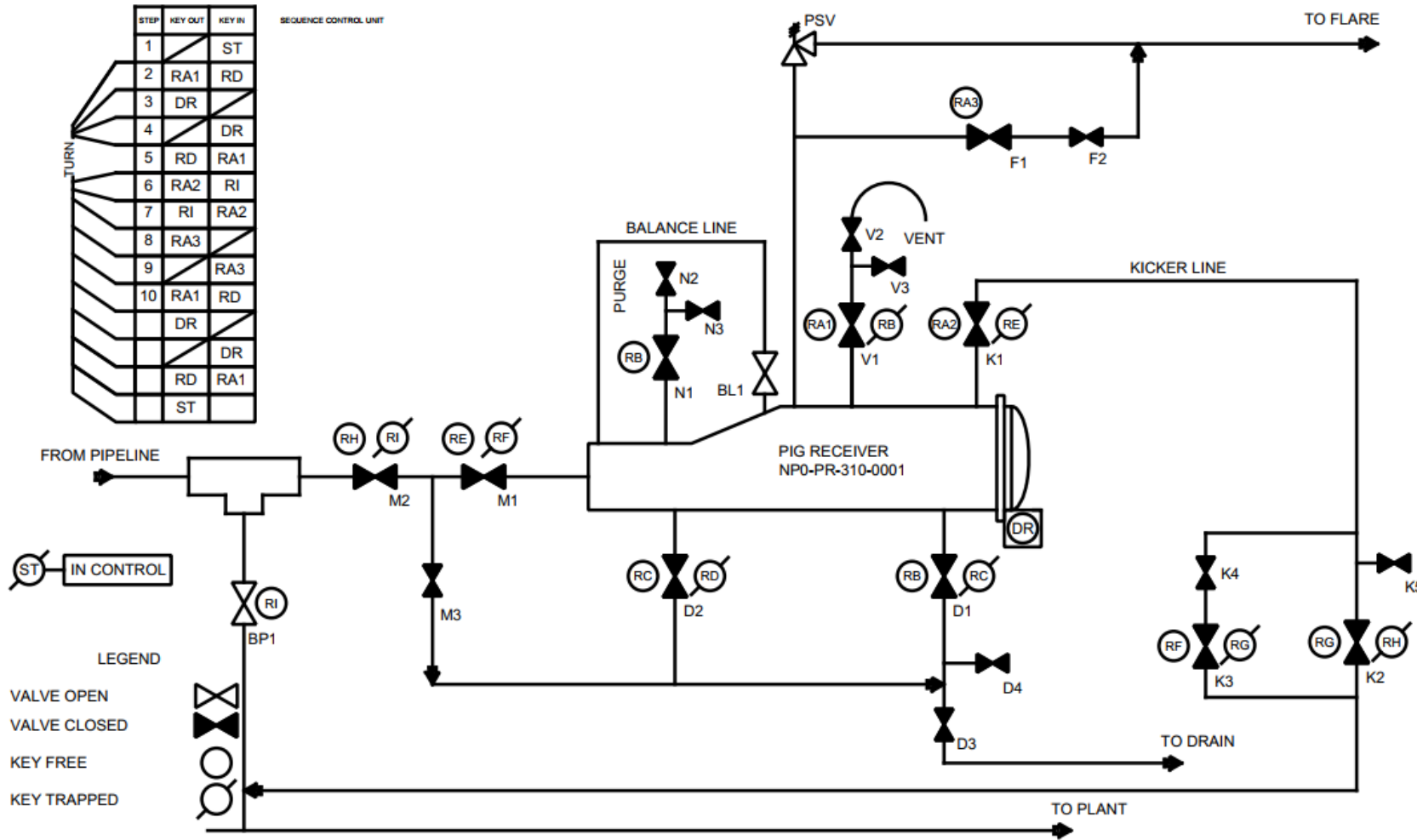


- Kicker Line Valve 4, 23
- Isolation Valve 16, 17
- Main Line / Bypass Line Valve 20
- Balance Valve 1, 2, 21, 22
- Vent Valve 7, 8, 13, 14
- Drain Valve 3, 5, 6, 9, 15, 18, 19
- Nitrogen Purge Valve 10, 11



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Captive Key for Pipeline Pigging pure mechanical



STEP	KEY OUT	KEY IN
1		ST
2	RA1	RD
3	DR	
4	DR	
5	RD	RA1
6	RA2	RI
7	RI	RA2
8	RA3	
9		RA3
10	RA1	RD
	DR	
	DR	
	RD	RA1
		ST

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Digital Transition



Involved Equipment

- Pressure Transmitter (Kicker Line, Pig Trap)
- Pig Signalers 1 and 2
- Pig Trap Door
- MOV 's (Isolation Valve A+B, Kicker Line, Main Line)
- Hand operated valves (Vent Valve 's, Kicker Bypass Valve, Balance Line Valve 's, Sampling System)



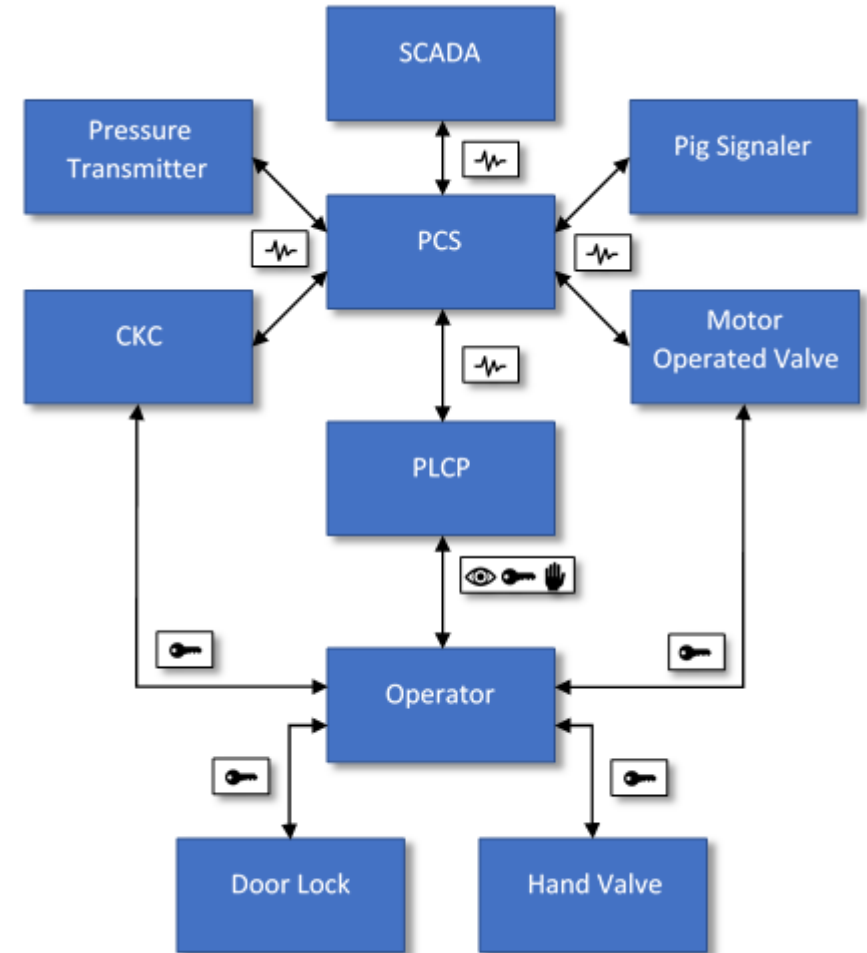
System Architecture

PLCP is the interface between:

- Operator
- PCS
- Hand operated valves
- Motor operated Valves
- Door lock
- Electrical Key Cabinet (CKC)
- Instrumentation devices

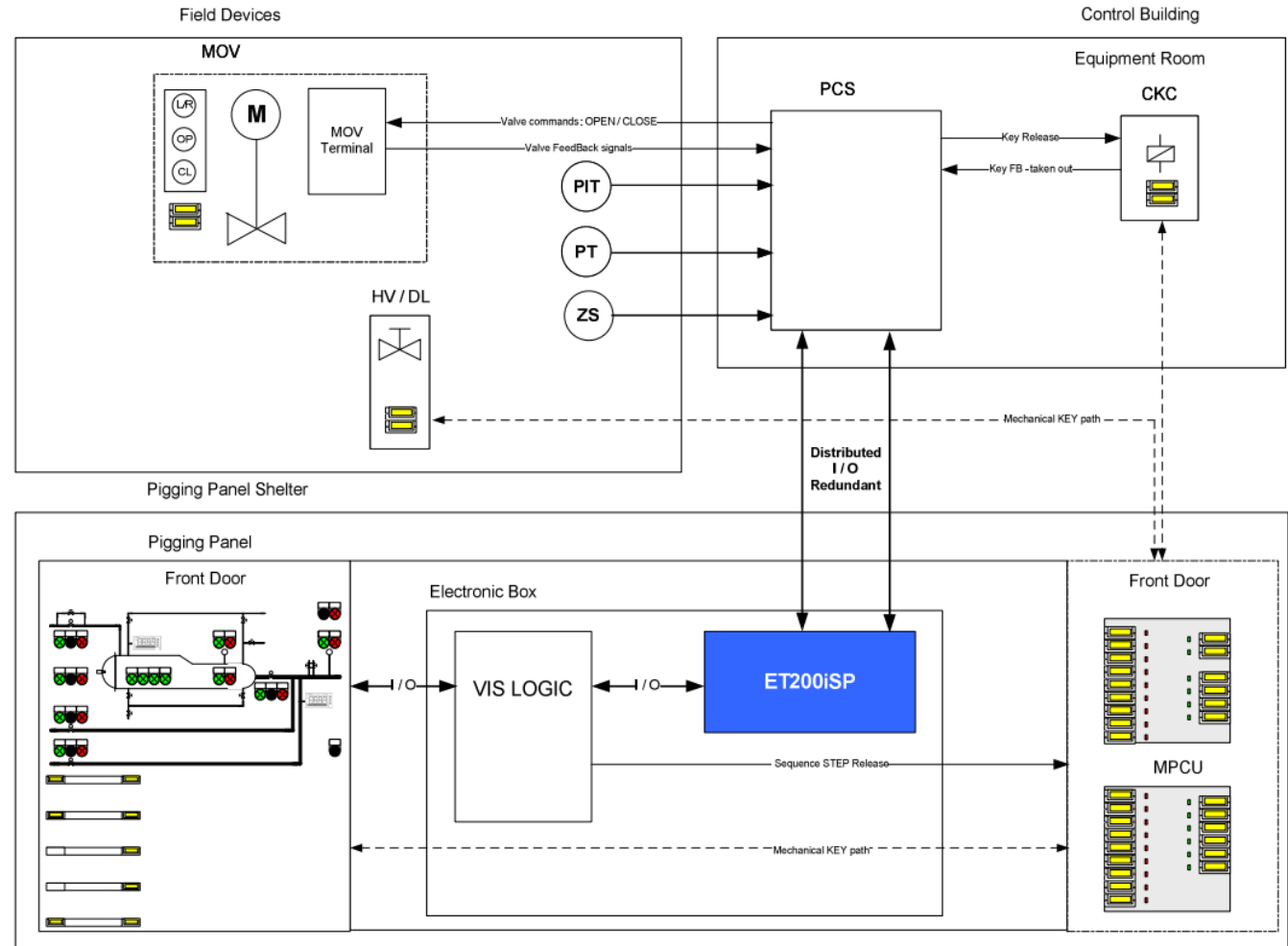
The PLCP guide the operator through the pigging operation procedure.

The PLCP (or EPCU) is the electrical comparison of a MPCU



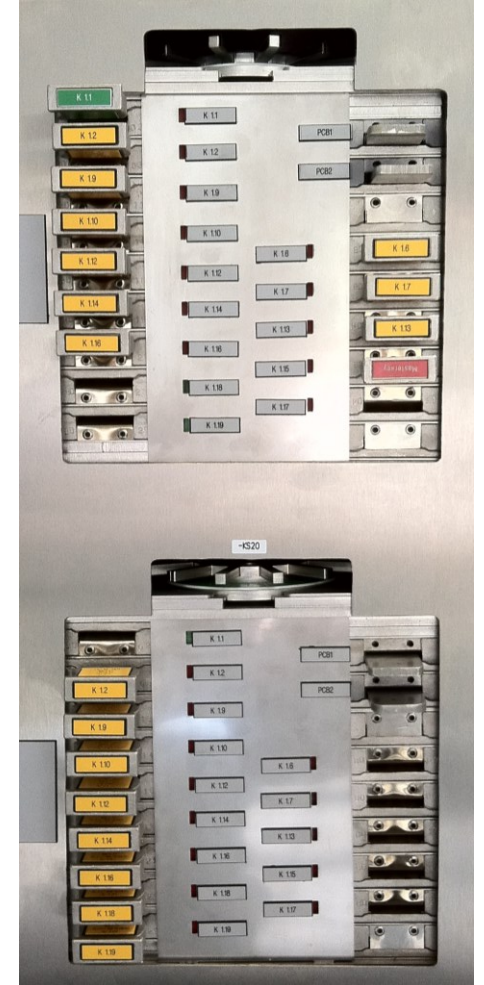
High Level Overview

The command for releasing the keys (start key, group key and master key) is initiated by the SCADA operator in MCC/BUCC



EPCU versa MPCU

- Easy change of the sequence of operation
- One EPCU can be used for launching and receiving
- Sequence variations based on additional information
- Dedicated Status information

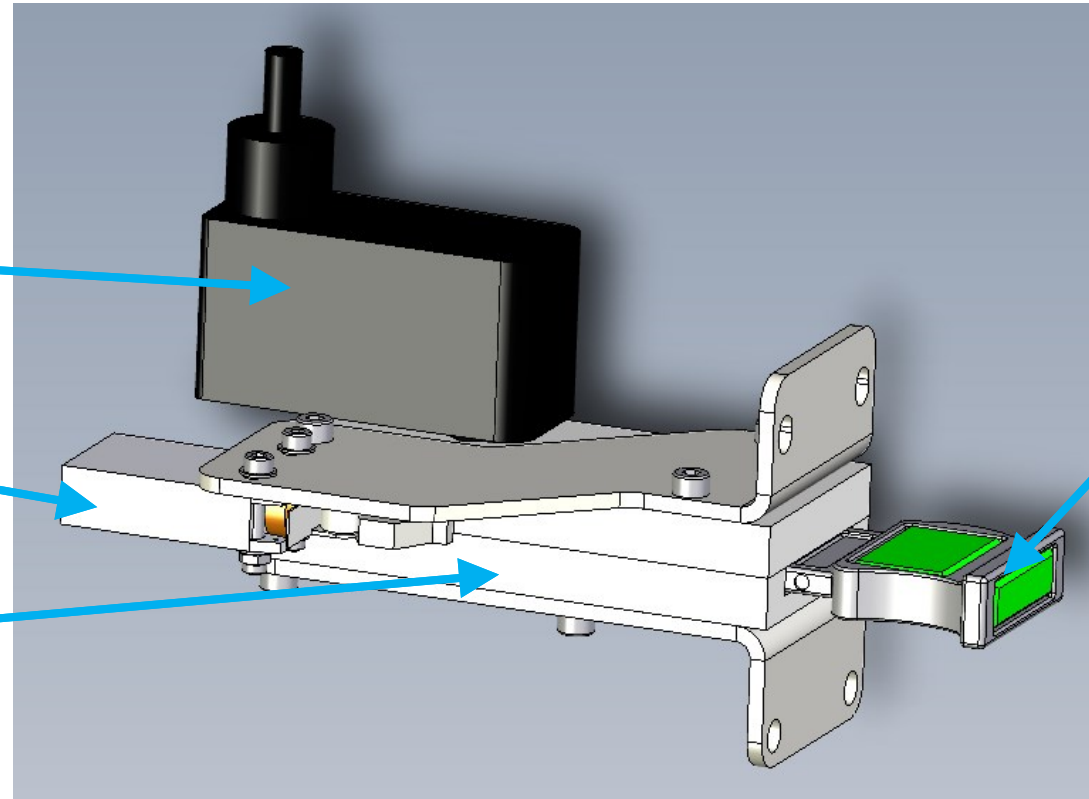


Key Position of an EPCU

Solenoid to trap and release the Key

Limit Switch to indicate the present or absent of the Key

Unique coded Key Position



System Key



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Digital Transition



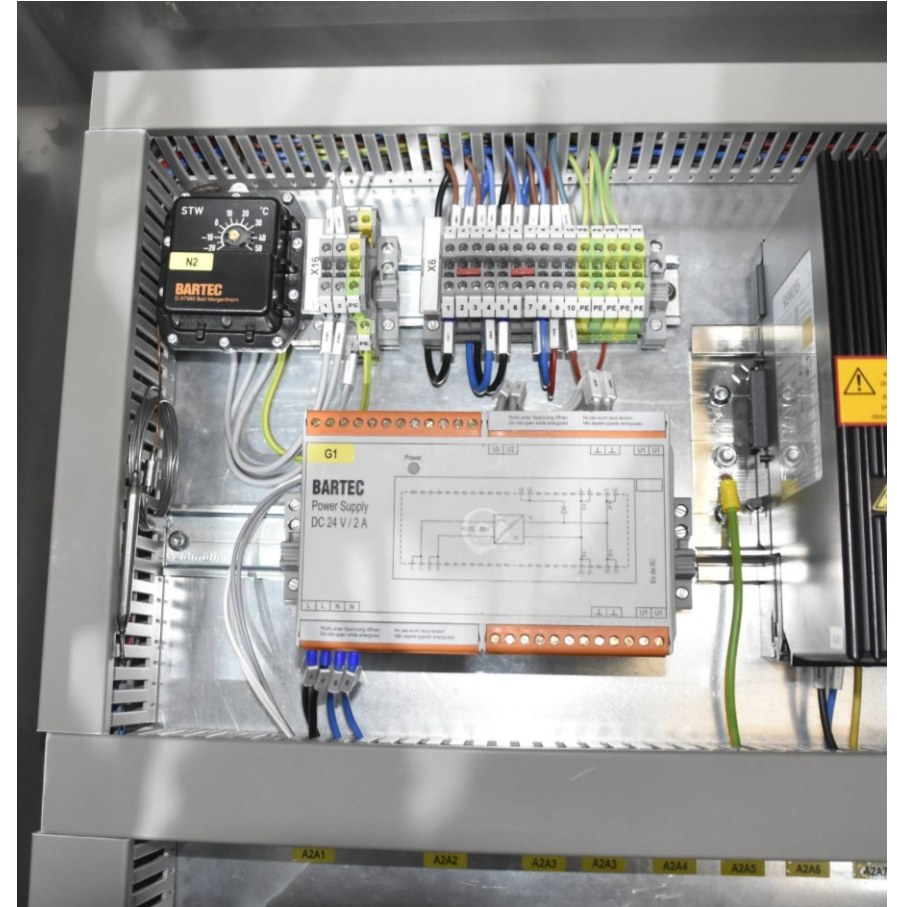
Plant & Process Safety Conference 2023

Digital Transition



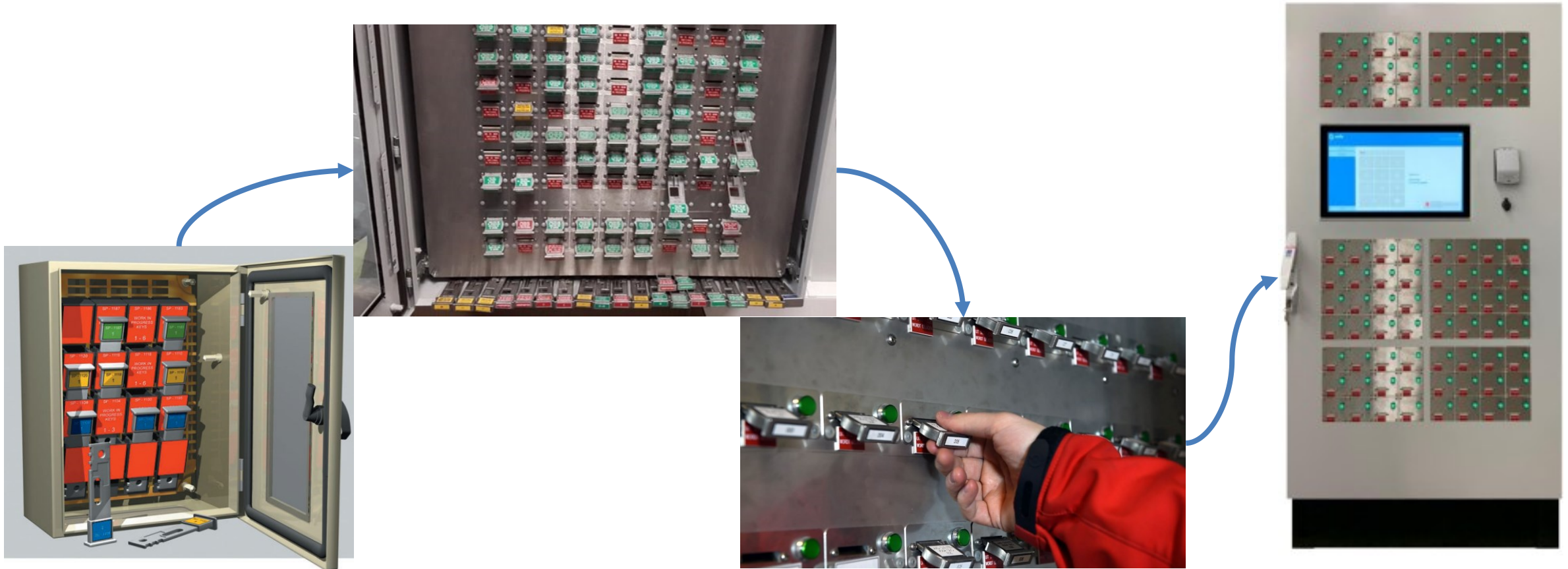
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Digital Transition



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Captive Key goes PSV Systems

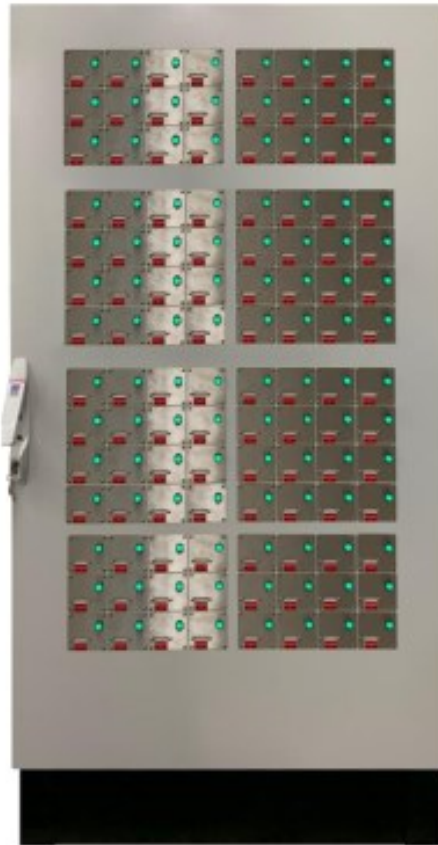


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Captive Key goes PSV Systems



Master Cabinet



Sub-Cabinet



Satellite Cabinet

KMS is a scalable combination of:

- ▶ Master Cabinet – 80 positions
- ▶ Sub-Cabinet(s) – 120 positions
- ▶ Satellite Cabinet(s) – custom



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Captive Key goes PSV Systems

Greenfield projects:

Each cabinet key is delivered equipped with an RFID chip

Brownfield projects:

- ▶ RFID tag / retrofittable attachment with tag for each key
- ▶ Sofis Product / Projects and Service teams will assist with planning and execution



Number of key positions per system defined by number of cabinet keys.

Uncoded key positions -> easily configurable

KMS 2.0 will identify the key automatically and guide the operator to insert the key in the correct key position



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Applications across the Industries

Pig Launching and Receiving

Guarantee save pig launching and receiving with full integration into the DCS system.

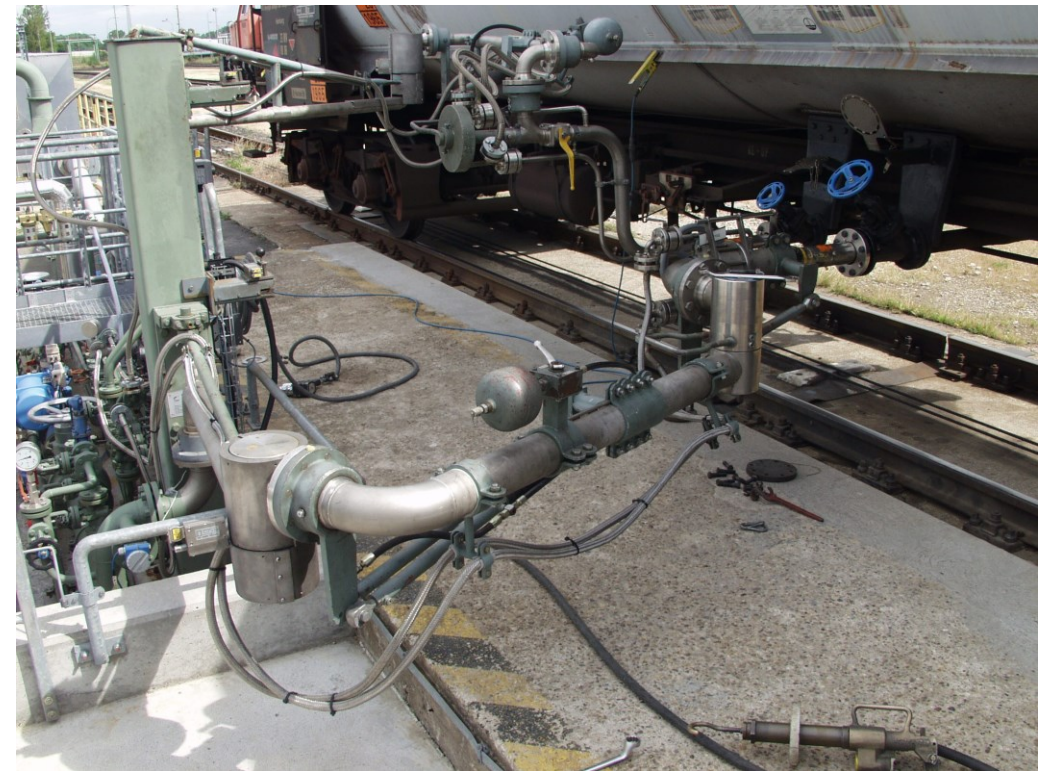


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Applications across the Industries

Railway loading and unloading

Prevent the tank wagon from moving during the loading process.

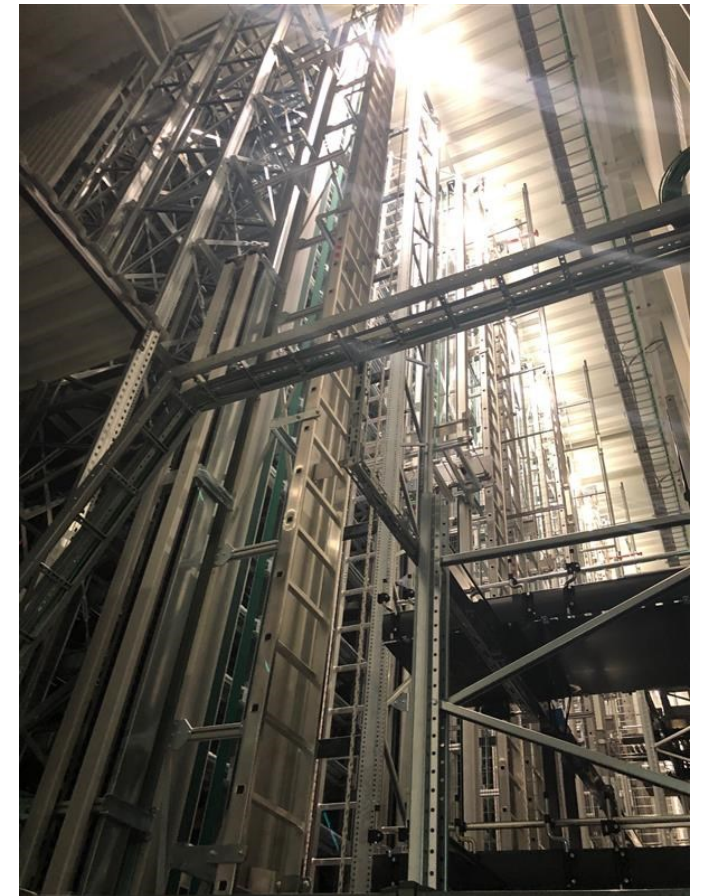


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Applications across the Industries

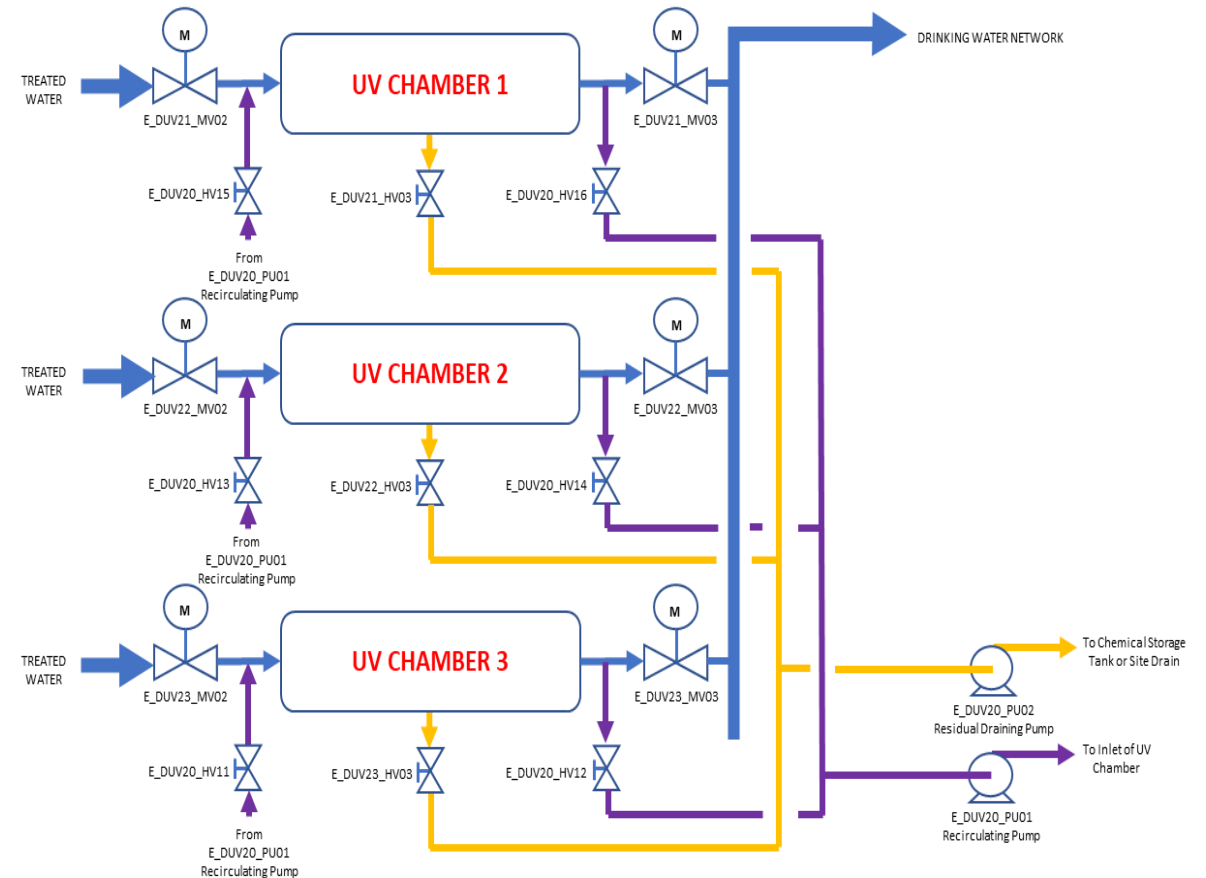
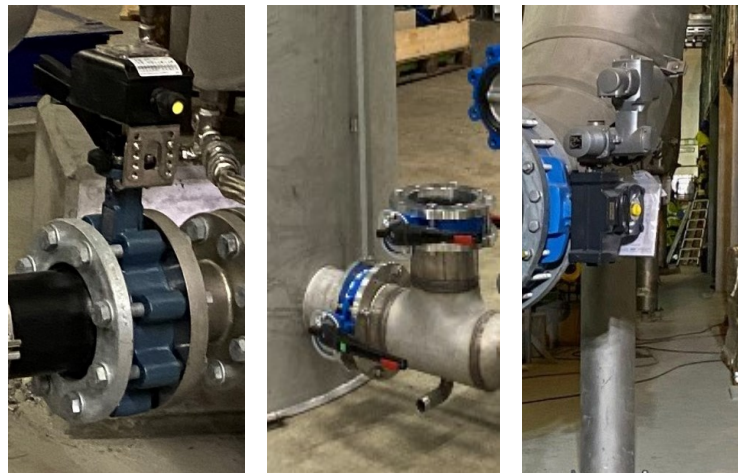
CO2 Fire Extinguishing System

Ensure that nobody is within the production area when the CO2 system get activated.



Drinking Water Supply

Prevent that Oxalic Acid, required for the cleaning process of the UV Chambers can be pumped into the drinking water network.

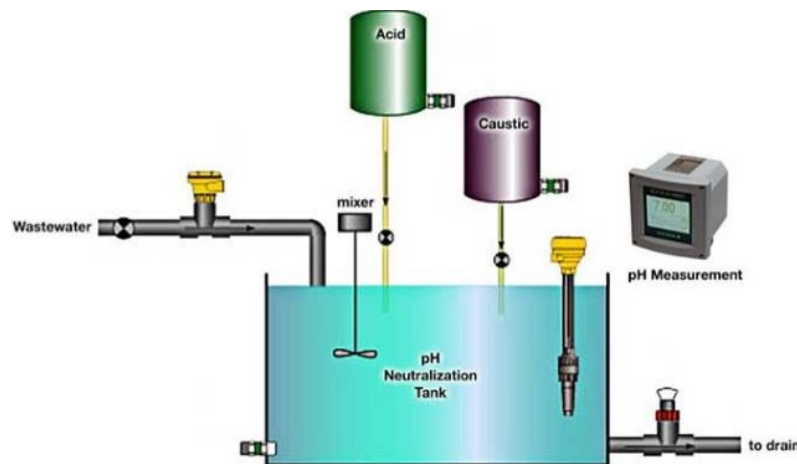


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Applications across the Industries

Wastewater Treatment

Prevent mixing of the chemicals as well as the contamination of the environment from offloading into the incorrect fill point.



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Resources



Typical industry challenges & applications:

- Whitepapers of a variety of applications:
- An overview of typical applications and solutions for the
- Solving industry specific challenges:

[Applications - Sofis valve operation](#)
[Chemical industry](#)
[Various Industries](#)

Improving safety in specific departments/customer events

- About safety regulation & risk management:
- Reduce risks & ease demanding operations:
- Avoid incidents & exceeding planned downtime:

[Process safety & accident prevention](#)
[Valve operations and maintenance](#)
[Turnarounds and shutdowns](#)

Solutions explained:

- Sofis YouTube channel with explanatory videos:
- An overview of Sofis solutions:

[Sofis valve operation - YouTube](#)
[Solutions - Sofis valve operation](#)

Sharing knowledge:

- Read about applications in our Sofis Knowledge Bulletin
- Read about reference projects / news on LinkedIn:

[Sofis \(list-manage.com\)](#)
[Sofis: Overview | LinkedIn](#)



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