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## **High Integrity Pressure Protection Systems (HIPPS)**

HIPPS are designed to enhance or replace over pressure protection traditionally addressed with mechanical relief and flare systems.

# Safety and the Environment

Regulations are becoming more restrictive especially when the process fluid is flammable or toxic. Current overpressure protection methods work by releasing excess pressure either into the atmosphere or to a flare system. Jurisdictional authorities in many areas of the world now consider atmospheric releases of any kind a violation of the facility's environmental responsibility and community trust. To address this process designers must move to higher levels of protection while tightening environmental release restrictions without increasing the capital cost of their projects.



## The Solution to Overpressure

Designers have historically dealt with overpressure protection by installing a mechanical overpressure relief system which served as the last line of defense against catastrophic damage to mechanical equipment.

Unlike a mechanical relief or flare system, a HIPPS system is designed to close the valves and isolate the process at its source before an over-pressurization event occurs. This eliminates the loss of product and fugitive emissions associated with relief systems.

## Safety Comes First

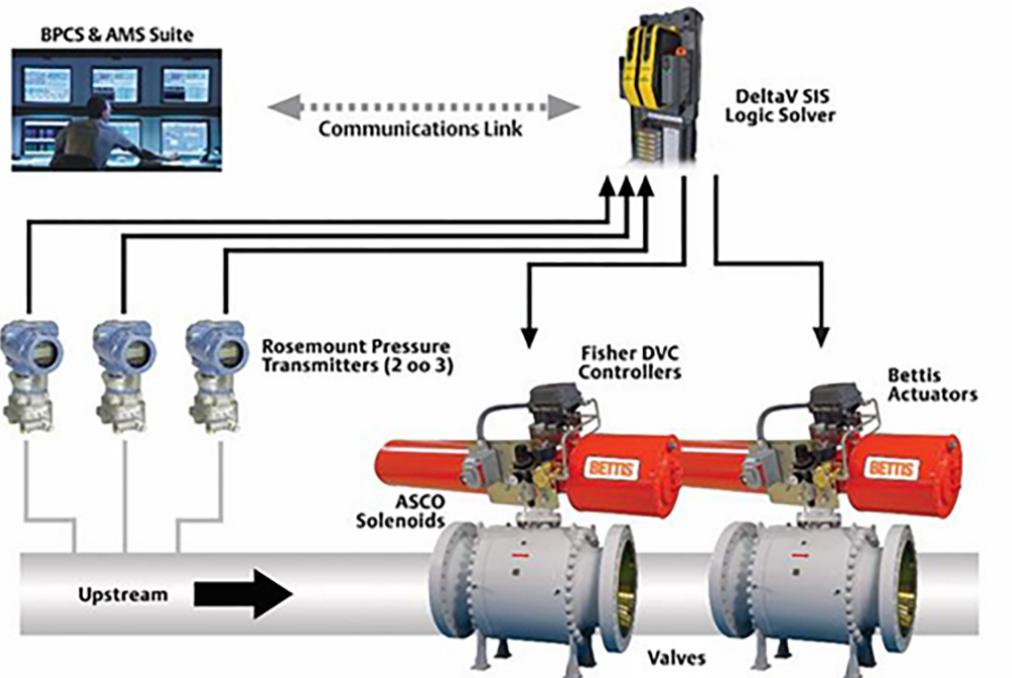
High Integrity Pressure Protection Systems are a Safety Instrumented System that is designed to enhance or replace the over pressure protection traditionally addressed with mechanical relief and flare systems.

A properly designed HIPPS can lower the overall risk profile of a facility by preventing an overpressure event from occurring in the first place.

One of the most significant attractions to employing a properly designed and maintained HIPPS system is that it can substantially reduce CO<sub>2</sub> emissions as well as the size and cost of the installed flare system.

## Key Features

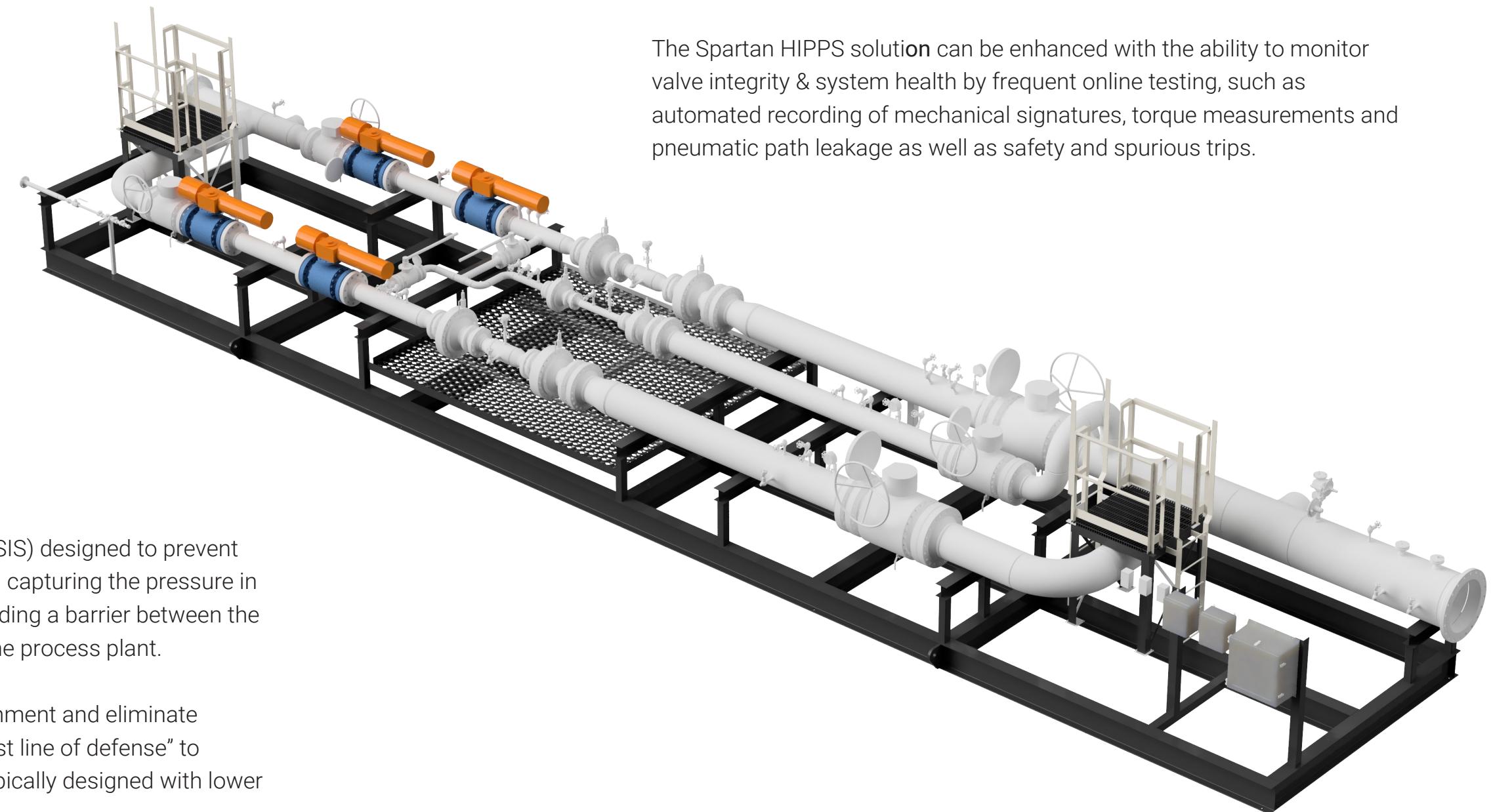
- Prevent an overpressure event in the plant
- Reduced costs and eliminates the manual testing requirements of mechanical relief devices
- HIPPS has a relatively low cost compared to the total installed and commissioned cost of a flare system and the associated header piping
- In addition to reducing the size and cost of the flare system, in new plants a HIPPS system can reduce the size, pressure ratings and cost of relief valves, relief piping, and flaring equipment, saving Capex dollars in the process
- Provides protection for a wide variety of process units and mechanical equipment



# System Architecture

A HIPPS is a Safety Instrumented System (SIS) designed to prevent overpressure by shutting off the source and capturing the pressure in the upstream side of the system, thus providing a barrier between the High Pressure and Low Pressure sides of the process plant.

The tight shutoff will prevent loss of containment and eliminate fugitive emissions. HIPPS is seen as the “last line of defense” to protect downstream equipment which is typically designed with lower pressure ratings.



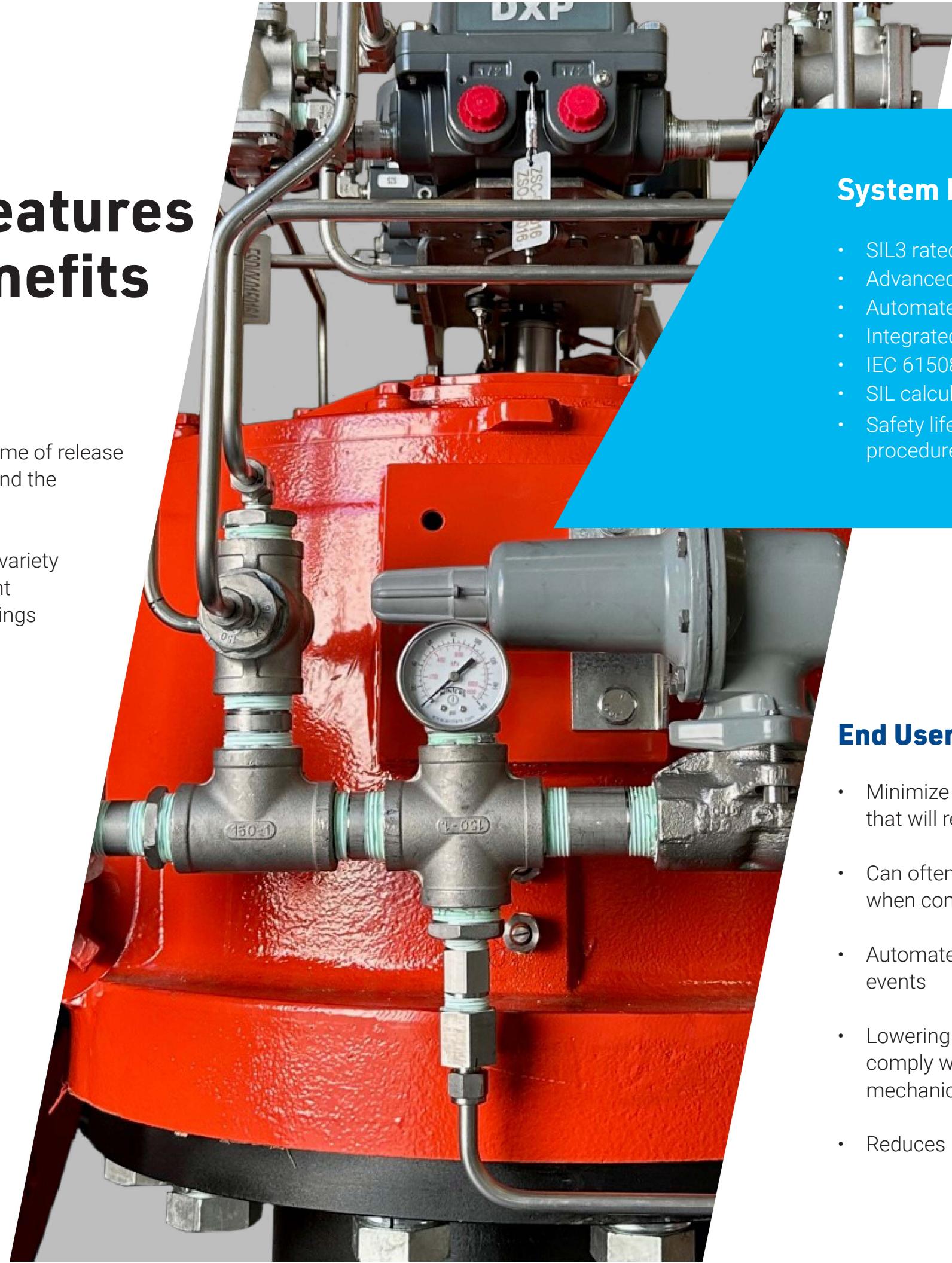
A typical HIPPS will include 2 or 3 final elements in series and is generally required to fully activate within 2-4 seconds for gas and 6-8 seconds for liquids, depending on the pipeline pressure, flow rate and the diameter and class of the pipeline.

The Spartan HIPPS solution can be enhanced with the ability to monitor valve integrity & system health by frequent online testing, such as automated recording of mechanical signatures, torque measurements and pneumatic path leakage as well as safety and spurious trips.

# Features and Benefits

## End User Benefits

- Eliminate or reduce the frequency and volume of release events thereby reducing CO<sub>2</sub>e emissions and the environmental impact of pressure venting
- Provide downstream protection for a wide variety of process units and mechanical equipment that were designed with lower pressure ratings
- Eliminate over pressure scenarios
- Protect the environment and plant personnel while improving the financials of a project
- Reduce the size of a plant's flare system
- Extends time between proof tests



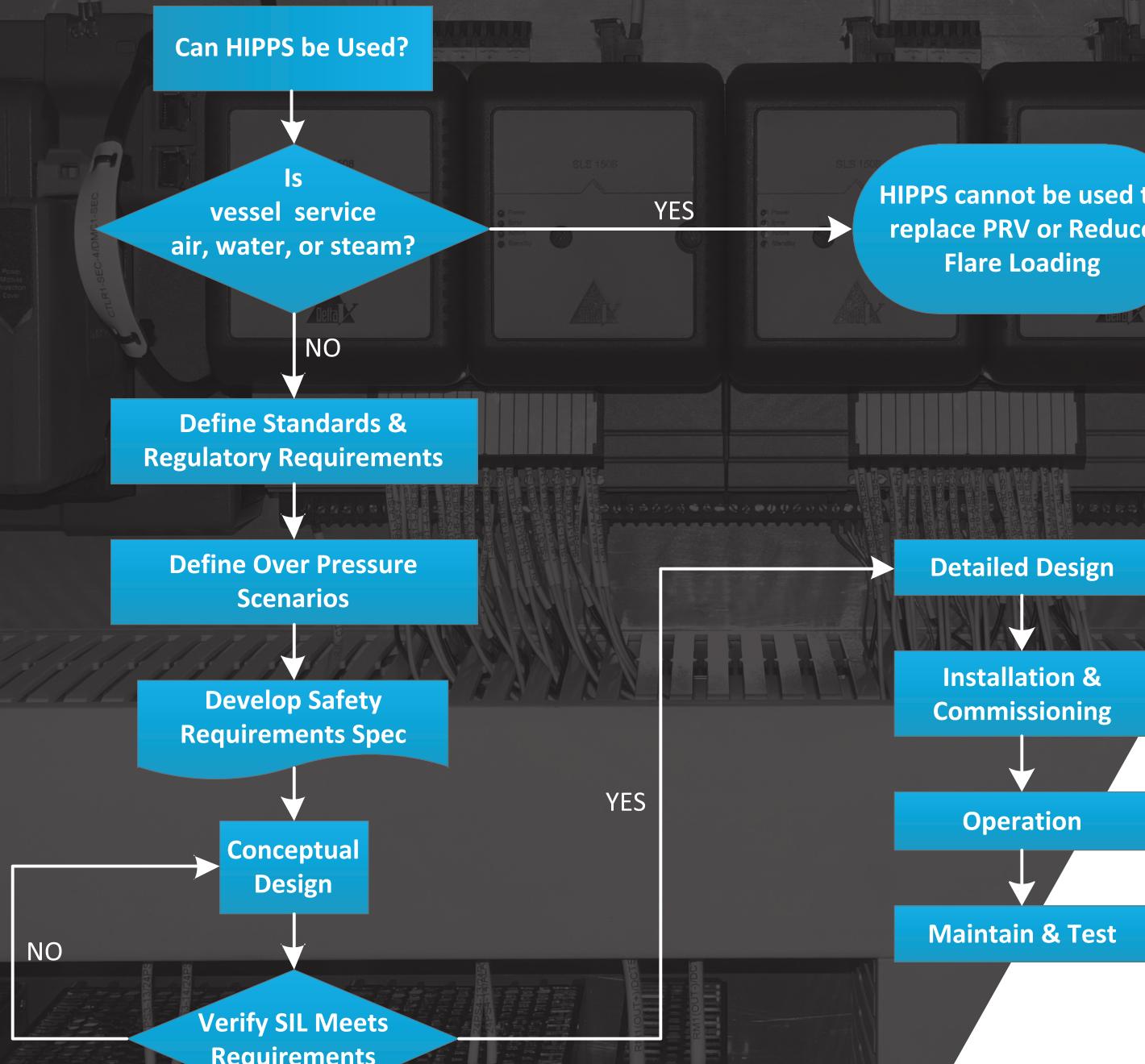
## System Features

- SIL3 rated system
- Advanced diagnostics
- Automated testing
- Integrated or standalone system
- IEC 61508 and 61511 compliant
- SIL calculations
- Safety lifecycle and SIS maintenance plans and procedures

## End User Benefits (continued)

- Minimize the process downtime related to equipment that will release pressurized product into the header
- Can often be installed with minimal process downtime when compared to a flare system expansion project
- Automated recording of partial stroke testing and trip events
- Lowering operational cost by reducing the labor to comply with the testing and inspection requirements for mechanical over pressure relief
- Reduces manual testing errors

# Is a HIPPS right for my plant?



## The Right Fit

While there are many standards relating to overpressure protection, systems are generally driven by national, state/province, and local requirements, as well as industry codes and standards. Spartan's experience with applicable regulations and standards, including jurisdictional authority (ABSA, TSASK, Technical Safety BC), streamline the design and execution of your HIPPS project.

## Features

- Reduces a plant's risk profile by lowering the potential of an overpressure event and extends the risk mitigation
- Works independently of plant shutdown and control systems
- Enhances PRV functions
- Augments flare system protection
- Mitigates flare loading issues

## Applications

Any inlet to an industrial application requiring overpressure protection:

- Refineries
- Petrochemical facilities
- NGL fractionation facilities
- Power plants
- Compression and pumping systems
- Natural gas gathering systems
- Interstate pipeline systems
- Dew point processing plants
- Underground storage facilities and terminals as well as vessel, train, and truck loading facilities

# Spartan and Emerson Capabilities

## Key Components

Spartan and Emerson can provide full turnkey systems for HIPPS including:

- SIL certified automation components
- Controller cabinet design, fabrication and configuration
- Valve assembly and testing
- SIL verification calculations
- Partial stroke testing calibration and training
- Complete system FAT
- Safety lifecycle and maintenance documentation
- Project management
- Engineering to IEC 61511



The following are examples of the components that make up a HIPPS.

### Rosemount 3051S Pressure Transmitters



### Anderson Greenwood Keyblock Interlocking Manifold



### Bettis Actuator Valve Actuation



The ability to accurately measure pressure reliably is a key dynamic in HIPPS applications. When over pressure occurs, your system must respond immediately in order to initiate the pressure protection system response in time to protect your downstream equipment.

- Proven Accuracy
- Process Intelligence
- Advanced Diagnostics
- SIL 3

The pressure manifold is an important part of any high integrity solution, ensuring that the safety integrity level of the HIPPS is maintained, even when transmitters are isolated for testing.

- Interlocking System to ensure only one transmitter can be isolated at a time.
- Provides personnel protection
- Suitable for use in SIL 3
- Ensures PT isolation

Long term reliability and speed of operation are both important aspects of HIPPS. Bettis Actuators are fully capable of meeting the fast-closing speeds required in liquid and gas applications. In addition to its compatibility with a wide range of devices for any application, Bettis Actuators are proven to operate in the harshest of conditions for many years, with maximum reliability.

- Design reduces inventory costs
- PED 97/23/EC Compliant
- Water ingress and corrosion protection
- Field serviceable configuration

## Key Components (continued)

### GVS

Ball Valves



### Vanessa

Triple Offset  
Butterfly Valves



### AMS Suite and ValveLink

Asset Management



### ASCO™

Solenoid Valves



At the core of a HIPPS solution is the final control element – either a trunnion mounted ball valve or a triple offset valve. These valves must be carefully selected to ensure they can perform reliably in the most challenging SIL 3 HIPPS applications. GVS trunnion ball valves and Vanessa triple offset valves are all SIL 3 compliant and can meet a variety of size, pressure, and material specifications, as well as application specific performance metrics like fast acting critical closing times.

GVS trunnion ball valves and Vanessa triple offset valves are designed using the latest engineering tools to ensure our products are safe, reliable, and perform as specified.

AMS Device Manager configures, calibrates, and diagnoses safety instruments and valves to ensure they will perform effectively when needed. The AMS ValveLink SNAP-ON application performs valuable valve diagnostics and automatically records all Partial Stroke Test results.

Solenoid Valves operating in remote locations for HIPPS applications require reliable low-power operations and ability to endure voltage surges.

- Low power capabilities
- Optimized flow for greater throughput
- Redundant solenoid assembly solutions
- Less maintenance

### FIELDVUE DVC6200 SIS

Digital Valve Controllers



HIPPS requires Digital Valve Controllers that can withstand vibrations while providing alerts, trends, and diagnostics for more extensive parameterization and tuning. When overpressure conditions are met, the system needs to operate the valve actuators quickly and FIELDVUE DVC6200 SIS digital valve controller can accomplish this for any HIPPS application in a patented linkage-less, non-contacting, explosion-proof package. Perfect for almost all HIPPS applications as high vibration over time, will damage the linkages of most switches. Using the Fisher digital valve controller, you can safely extend the time between final element proof tests by using partial stroke testing (PST).

- By accessing built-in diagnostic capabilities operators can identify stuck valves, pressure droop, friction changes and other common valve issues without taking the valve offline
- Safety function priority
- Spurious trip avoidance
- SIL 3

### DeltaV SIS CHARMS

Safety Logic Solver  
(SLS)



A logic solver is not only included to process the logic based on shutdown configuration programmed to memory but must also be able to monitor the considerable number of diagnostic tests that are continuously occurring throughout the life of the system.

- Continuous loop diagnostics
- Integral partial stroke testing
- Fast Pulse SOV Testing
- Flexible integration



## Commissioning and Startup

Commissioning tests should ensure that the system was not damaged in shipment, that all parts of the system have been installed correctly, and the system performs as defined in the Safety Requirements Specification (SRS). Proof testing and site acceptance test not only verifies operation of sensor, logic controller and final element but also validates that the installation and commissioning procedures were complete and that all conditions of the SRS are met.

## About Spartan Service

Spartan's Services team is here to support you. Our trained technicians can provide:

- Commissioning and start-up (C&SU)
- Training at Spartan's Edmonton Automation Center or on-site telephone support/troubleshooting
- On-demand local field service available 24/7/365
- Maintenance agreements
- Remote service capability with SpartanPRO™ Connect
- **Common** spare parts available in-stock and available for next day delivery
- Site audits for existing installations



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