

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

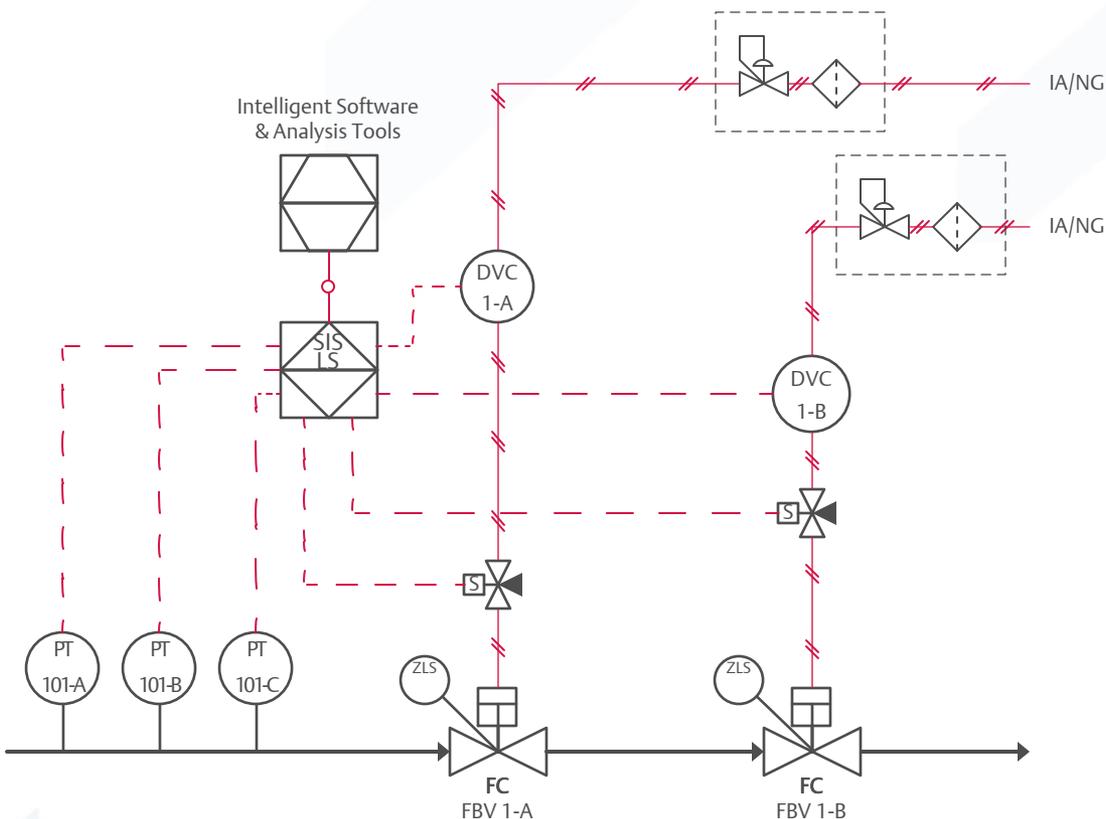
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



HIPPS System Description

Use this interactive document to:

1. Understand processes and technical concepts
2. Become aware of Emerson's full capabilities
3. Illustrate Emerson's featured products and value

Customers Pain

When pressure relief valves (PVR) are not appropriate, many industry codes require SIL rated protection of downstream equipment through isolation of the pressure source

Reasons for Pain

High pressure release is impossible or impractical

Environmental protection is mandated

Facility / Asset updates require flare capacity expansion

Full Service Vendor

HIPPS Systems Experience

Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

Interactive Solutions Tool

High-Integrity Pressure Protection Systems (HIPPS)

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

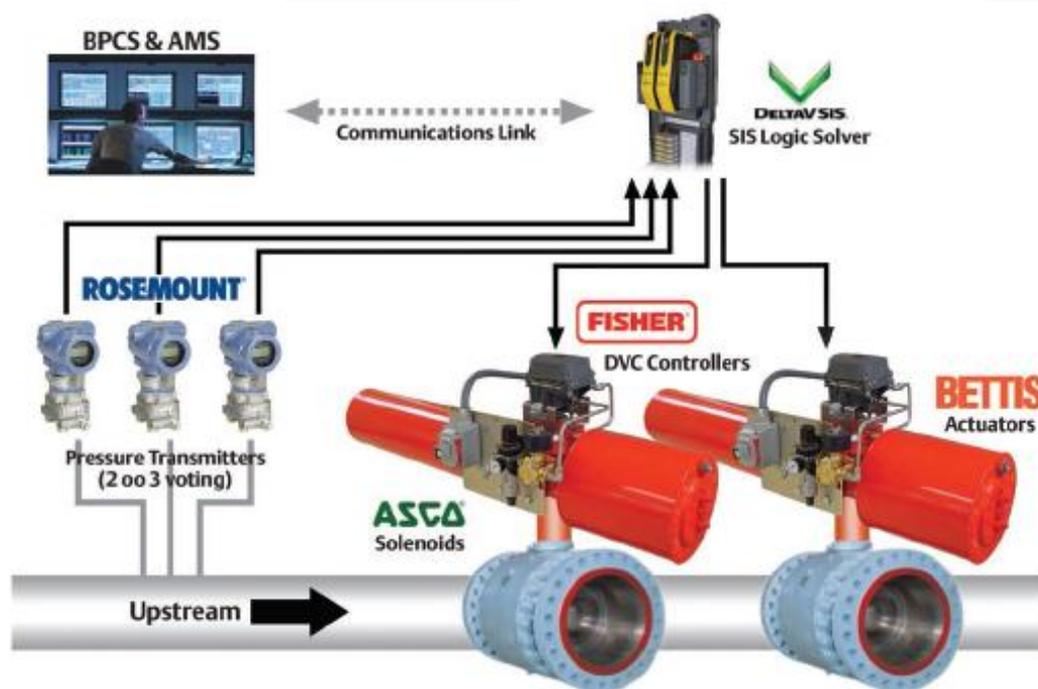
HIPPS System Description

Full Service Vendor

There are many challenges engineering, building, installing and operating a HIPPS, to ensure that the system will provide the required safety throughout the lifetime of the installation.

Emerson has a one-stop-shop solution for HIPPS, which is not limited to providing best in class products, but also includes the resources necessary to support all phases of a HIPPS lifecycle. Emerson products and services will ensure compliance with functional standards and jurisdictional requirements and are configured to minimize systematic failures.

Emerson has developed a global process for compliant HIPPS design including the development of SRS, verification, test and calibration records to ensure all requirements of IEC 61511 / ISA 84 have been met.



Full Service Vendor

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Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description



Experience in Valve & Actuation Systems

Emerson's experience with hundreds of HIPPS applications means that we recognize that operating the large mechanical forces in a controlled manner is imperative. We understand that shut down of the final element depends heavily on the design and selection of the correct valve and actuator and the speed of the shutdown are critical.

Proven experience with fast closing, critical valves and actuators include:

- Local, Regional and Global Integration
- All type of Valves and Actuators
- SIL Rated Designs Available
- Full Lifecycle Support Capabilities

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Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description



Simple to Highly Engineered Solutions

Emerson's product designs are the result of decades of experience. Our engineers are equipped with the latest software tools to provide products that range from simple on-off valves to fully integrated HIPPS solutions encompassed by product, documentation, verification and validation services.

We are committed to delivering proven products that are thoroughly tested to ensure they comply with industry standards and maintain the highest safety ratings. Many of our products are certified to global performance standards by respected 3rd party organizations.

- Complete range of products
- Engineered and fully tested HIPPS systems
- On-off valves and actuators
- Proven services

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Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

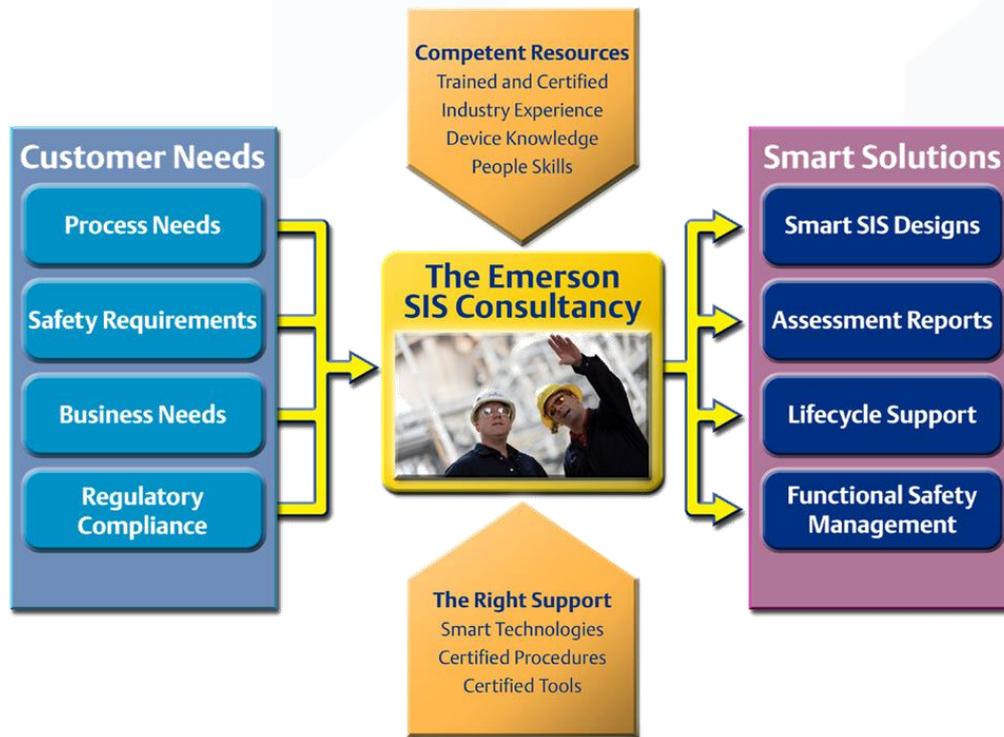
Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description



Consulting Capability

Once the over pressure hazards have been identified and a risk mitigation factor established, developing the Safety Requirements Specification (SRS) becomes the heart of every successful HIPPS Project.

Emerson's consultants and engineers are experienced in the methods for pre-feed engineering, data gathering, SIL analysis, and are expert at the process of developing the important SRS documents.

Being in the unique position to have all products in our portfolio plus many years of experience integrating HIPPS systems, our staff of engineers and safety consultants can complement your development team.

- Pre-FEED Engineering
- SIL Verification Analysis
- Development of the SRS
- Experienced Safety Consultants

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Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description

Regional Project Execution Capability

Emerson has developed a global network of automation service facilities including system engineering and design, integration to provide a full suite of lifecycle services.

Executing projects in different world areas can be challenging and introduces an increased risk of project failure if not handled correctly. This is why Emerson's integration centers utilize a common SIS processes that has been developed in full compliance with IEC 61511 / ISA 84.

- Globally consistent process
- Consistent HIPPS designs
- Elimination of systematic failures
- Full suite of lifecycle services



Full Service Vendor

HIPPS Systems Experience

Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

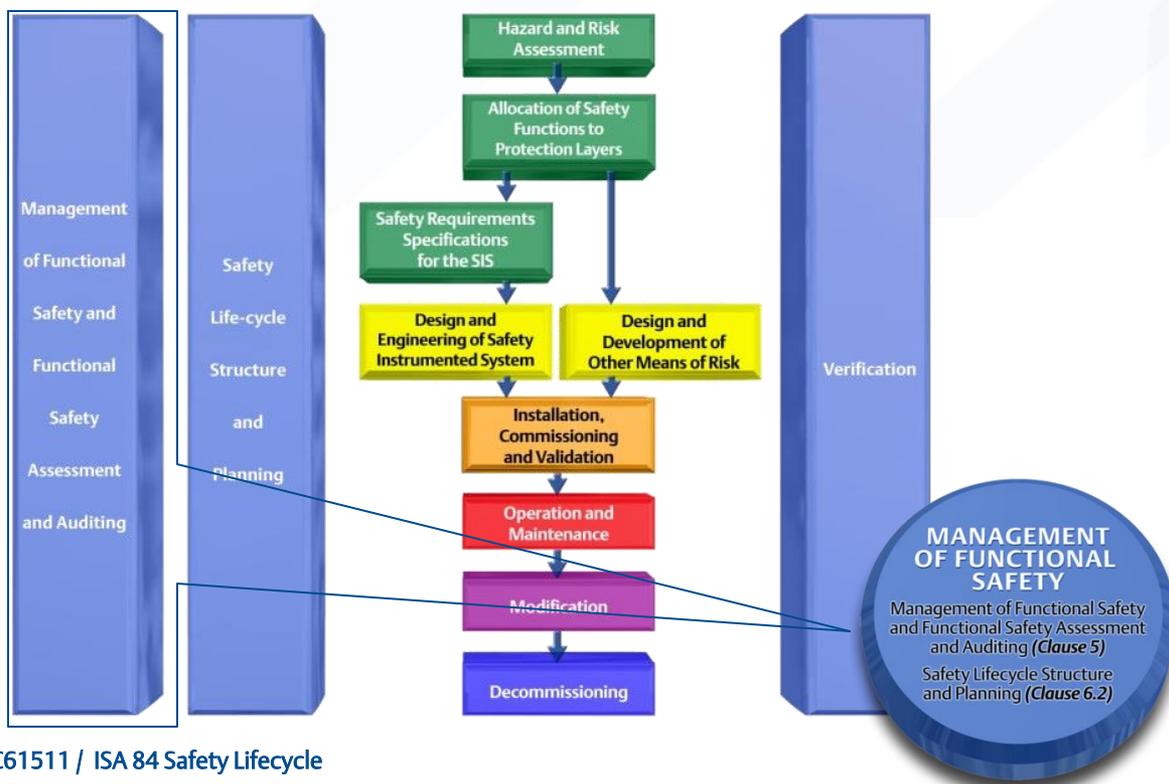
Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description



IEC61511 / ISA 84 Safety Lifecycle

Certification and Testing

Certification of the final element to the required Safety Integrity Level (SIL) is often difficult because it is only part of the Safety Instrumented Function (SIF).

Emerson's engineers are experienced in the validation and verification of SIL rated systems and the procedures that ensure the HIPPS system fully meets the requirements defined in the SRS.

In addition, Emerson has the capability to performance test the Final Element of the Automated Valve Assembly and can certify the valve to any specified application criteria.

- Expertise to design and integrate complex systems
- Certification to the overall SIL rating
- Performance Testing of Final Elements
- Global process for HIPPS design

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Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

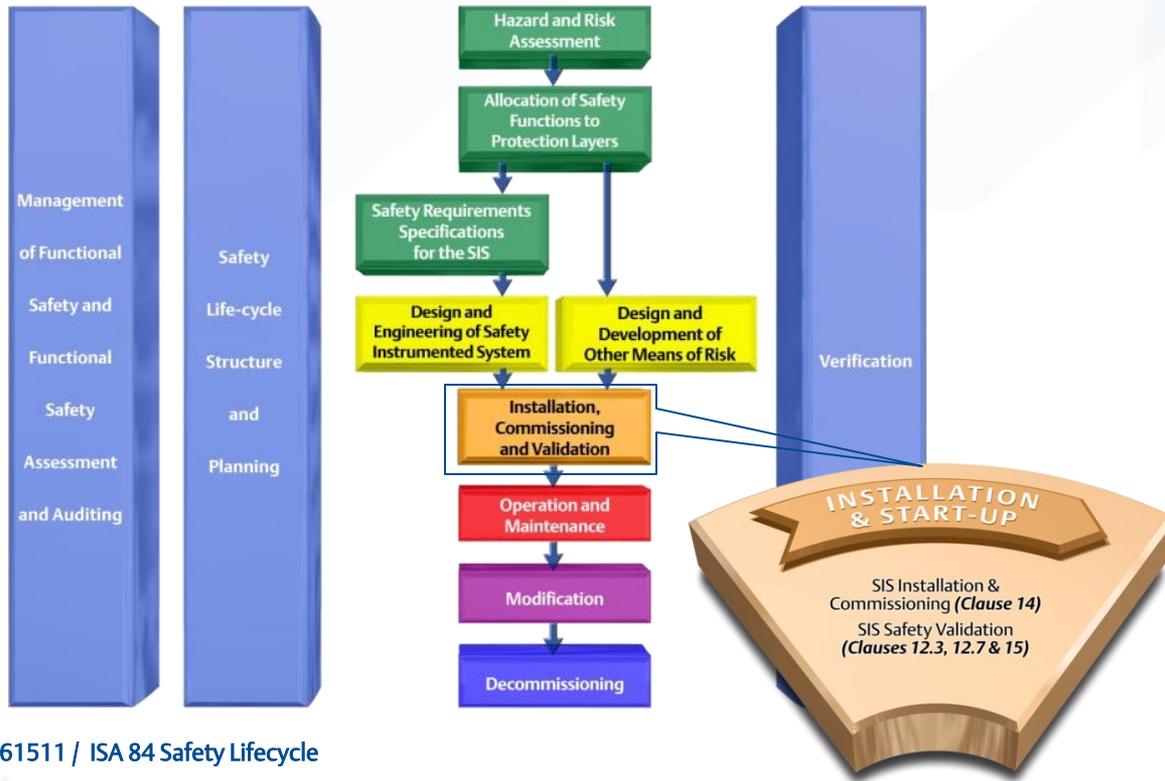
HIPPS System Description

Installation & Commissioning

Correct installation and commissioning of the HIPPS is critical for the safety function. Selecting a supplier with experienced resources and proven capability to handle the full scope of the project including an integrated site acceptance test is important.

Emerson engineers also have the experience and resource to provide validation services anywhere in the world, ensuring that your HIPPS system will function as designed for the life of the facility.

- Comprehensive Lifecycle Services
- Globally Resourced
- Experienced Resources



IEC61511 / ISA 84 Safety Lifecycle

Full Service Vendor

HIPPS Systems Experience

Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description

Lifecycle Services

Implementation of a HIPPS requires that the integrity of the automation system be maintained for the lifespan of the facility. The system functionality must be reliable to ensure its operation under all operating conditions to protect your assets and the people who work in the facility.

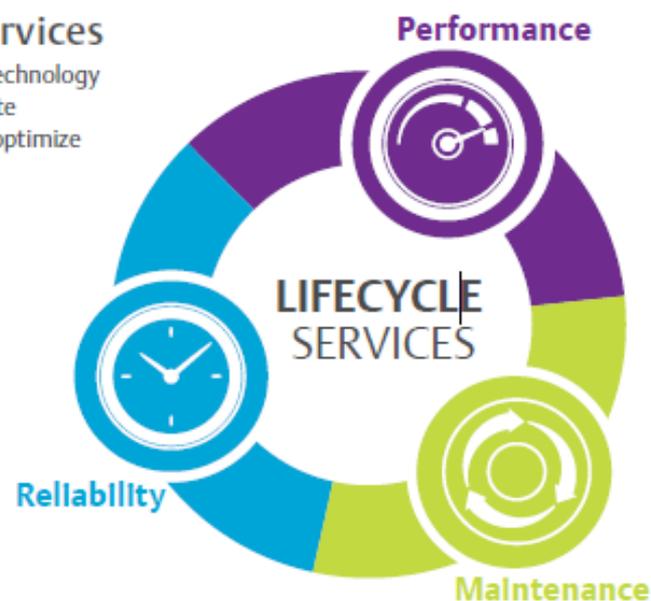
Key to this is accessing the right resources necessary to keep your plant performing optimally and achieve your business goals.

Emerson's Lifecycle Services will assist you in managing the total cost of ownership by providing the proactive maintenance resources that help to plan and implement a long-term lifecycle strategy for reliability and risk management.

- Local, Factory Trained Resource
- Experience with all Automated Valve Assemblies
- Ensures Highest System Reliability
- Manage the total cost of ownership

Emerson Lifecycle Services

provide customers with expertise, technology and processes that help them operate safely, improve asset reliability and optimize process capability.



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Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

Interactive Solutions Tool

High-Integrity Pressure Protection Systems (HIPPS)

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

HIPPS System Description

Educational Services

Educational Services focuses on training our customers on Emerson products and the HIPPS solutions we provide to ensure they have a working knowledge of product capabilities, as well as safe use and proper maintenance and repair procedures.

Emerson's world class training program enables customers to maximize their product investment and extend the reliability of Emerson products under all operating conditions throughout the lifetime of the asset.

- Training for all Emerson products
- Operational testing programs
- Maintenance procedures training
- Local & web-based training available



Full Service Vendor

HIPPS Systems Experience

Simple to Complex Solutions

Consulting Capability

Project Execution

Certification and Testing

Installation and Commissioning

Lifecycle Support

Educational Services

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

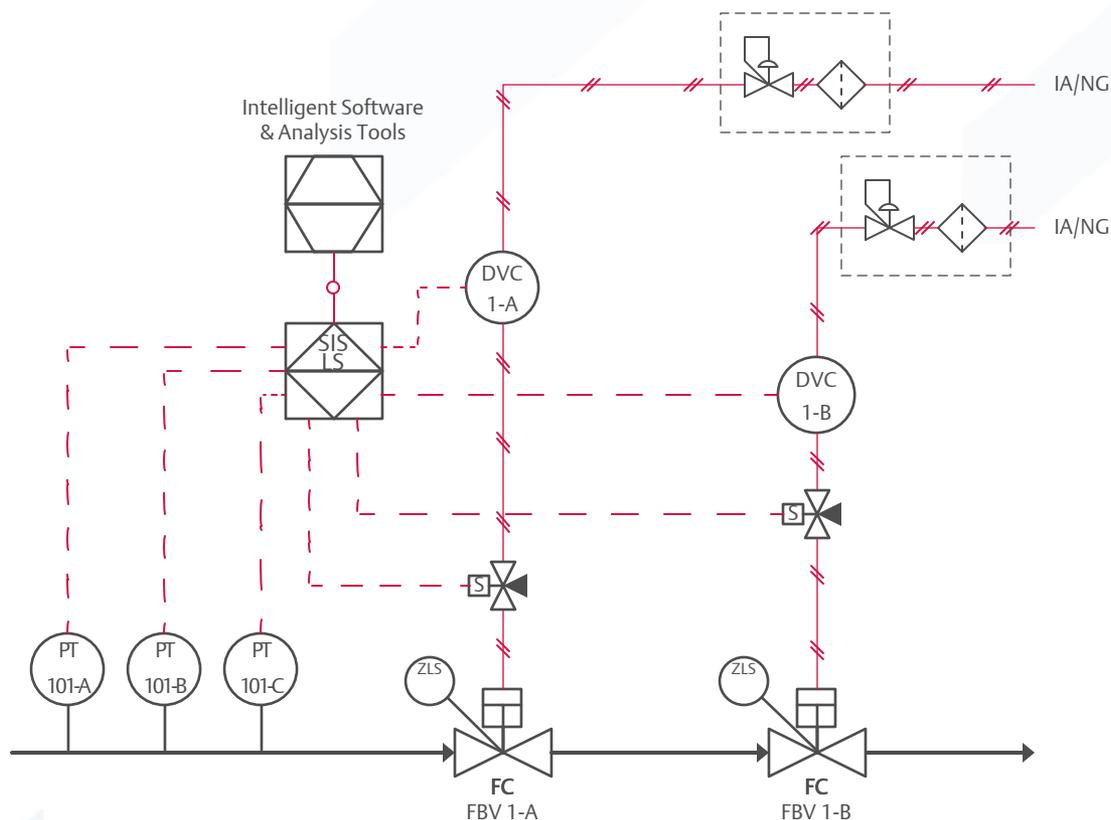
On-Line System Testing

Featured Products

Overpressure Protection System Types

Since each over pressure protection system is focused on a unique application, the requirements and architecture must be thoroughly analyzed and defined based upon applicable codes and standards. The main categories of over pressure protection systems include:

- High Integrity Pressure Protection System - HIPPS
- Shut Down Valve - SDV / ESDV
- Blow Down Valve - BDV
- On-Off Isolation Valve - XV
- Self-Contained Hydraulic ESD



HIPPS

Shut Down Valve

Blow Down Valve

Isolation Valve

Hydraulic ESD

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

Overpressure Protection System Types

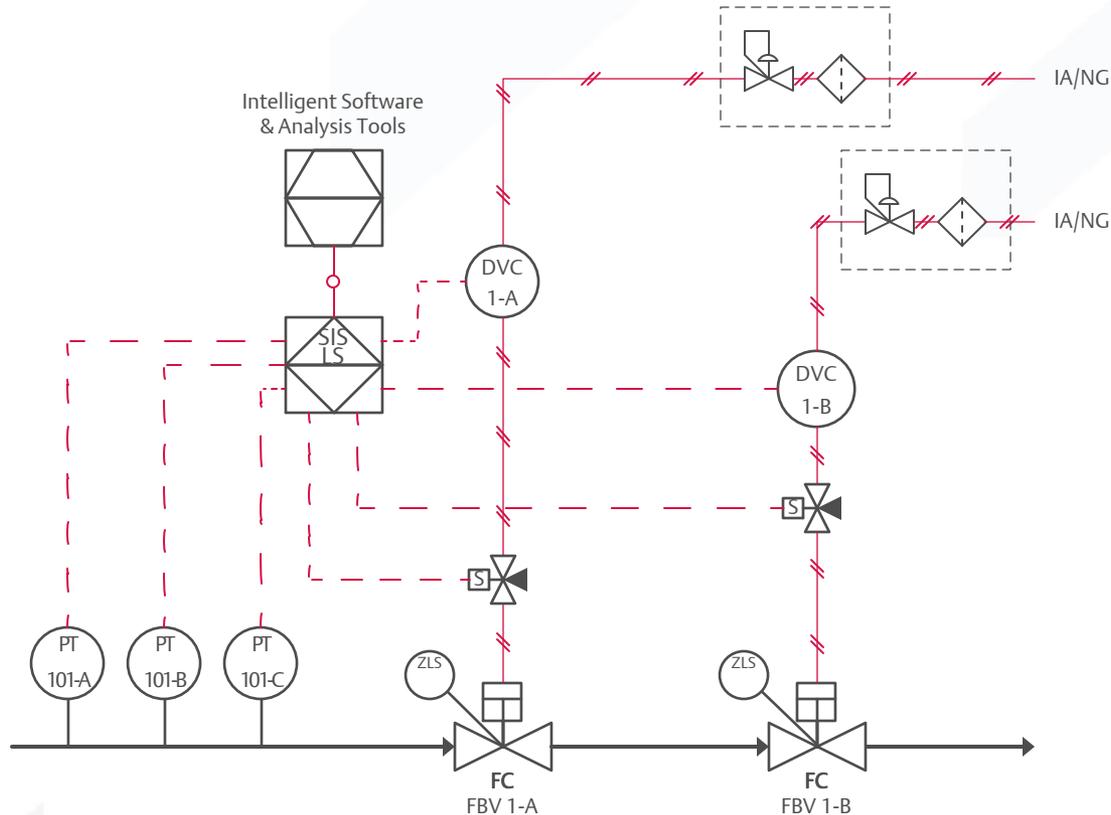
High Integrity Pressure Protection System - HIPPS

When it is impractical to apply a mechanical pressure relief device, the HIPPS can be used to provide the “last line of defense,” to prevent vessel or pipeline rupture. These systems are designed to isolate high operating pressure so using a performance-based life-cycle approach in their design is essential.

A SIL rated HIPPS design is typically used to mitigate risk if the pressure within a vessel or pipeline that has the potential to exceed 116% of the rated design pressure.

The main components of a HIPPS are designed for fault tolerance and include:

- Pressure sensors
- Logic solver
- Fail-safe actuators
- Emergency shutdown valves
- Online diagnostics and partial-stroke test components



HIPPS

Shut Down Valve

Blow Down Valve

Isolation Valve

Hydraulic ESD

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

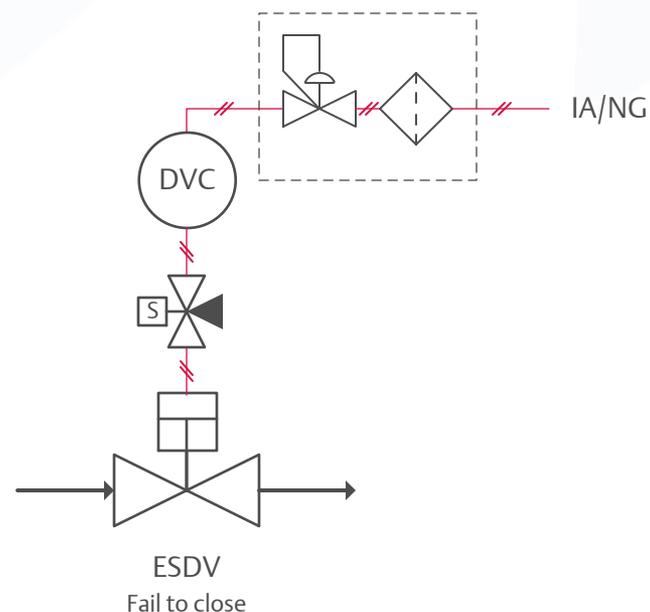
Overpressure Protection System Types

Shut Down Valve (SDV / ESDV)

A shut down valve is an actuated valve designed to isolate the flow of a hazardous fluid or hydrocarbon gas upon detection of a dangerous event and provides protection against possible harm to people, equipment or the environment.

As shutdown valves often form part of a safety instrumented system, they are primarily associated with the Oil & Gas industry and required by law on any equipment placed on an offshore drilling rig to prevent catastrophic events.

- Suitable for remote and critical service applications
- Can utilize pneumatic, hydraulic or electro-hydraulic actuators
- Valve and actuators typically require SIL compliance



HIPPS

Shut Down Valve

Blow Down Valve

Isolation Valve

Hydraulic ESD

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

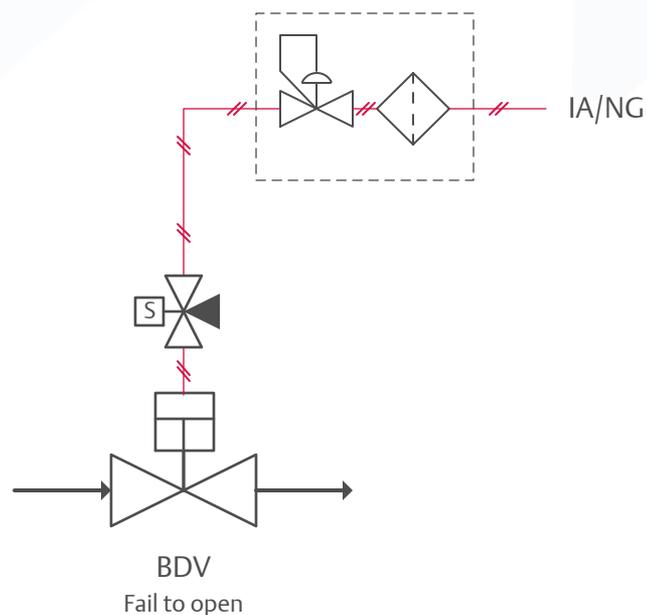
Overpressure Protection System Types

Blow Down Valve (BDV)

As the term blowdown implies, the purpose of the valve is to immediately depressurize the equipment in the event of specific process upsets by sending the unwanted gases to flare. A BDV is typically specified as a tight shut-off valve configured to “fail-safe” by specifying that the actuator’s spring will open the valve if the electrical signal or upon the loss of instrument air.

Blowdown valves are emergency on-off valves activated by a signal from the Emergency Shutdown (ESD) system rather than direct initiation by over pressure sensors in the protected equipment.

- Designed for tight shut-off
- Configured fail-safe
- Initiated by SIS



HIPPS

Shut Down Valve

Blow Down Valve

Isolation Valve

Hydraulic ESD

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

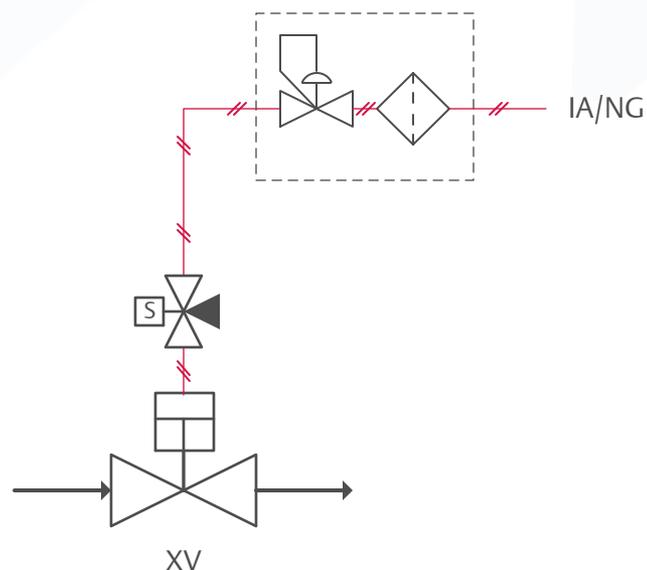
Overpressure Protection System Types

On-Off Isolation Valve and Actuator (XV)

The On-Off Isolation Valve ensures reliable on/off service by maintaining process and production safety at all times.

Pneumatic, hydraulic and electric actuators can be used to automate a variety of ball, triple offset butterfly, butterfly, and other quarter-turn devices. Typical actuator applications include safety-related areas in nuclear service, gas turbines, and auxiliary emergency shut off valves.

- Provides reliable on/off service
- Pneumatic, hydraulic and electric actuators
- Used to automate quarter-turn valves
- Used as auxiliary emergency shut off valves



HIPPS

Shut Down Valve

Blow Down Valve

Isolation Valve

Hydraulic ESD

HIPPS System
Description

Overpressure
Protection
System Types

System
Justification

Solution
Engineering

Pressure
Sensing Loops

Logic Solver

Final Elements

On-Line
System
Testing

Featured
Products

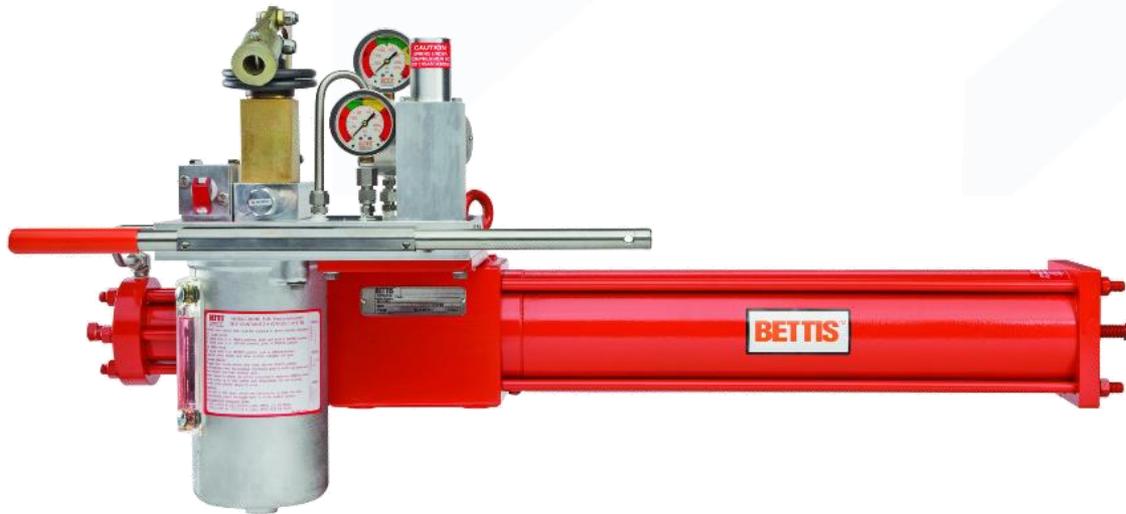
Overpressure Protection System Types

Self-Contained Hydraulic ESD

A self-contained hydraulic system is often deployed for ESD applications in remote locations where a power source is either not available or not reliable.

When armed, the system is designed to remain dormant until a violation of the user configurable pressure setpoint is detected. A reliable pressure switch will release the hydraulic pressure and a mechanical spring will move the linear or rotary valve to the fail-safe position.

- Suitable for remote and critical service applications
- Simplified fail-safe design, with few parts for increased reliability
- Eliminates the need for plant air, electricity or nitrogen backup
- Control can be mounted onto standard hydraulic actuators



HIPPS

Shut Down
Valve

Blow Down
Valve

Isolation Valve

Hydraulic ESD

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

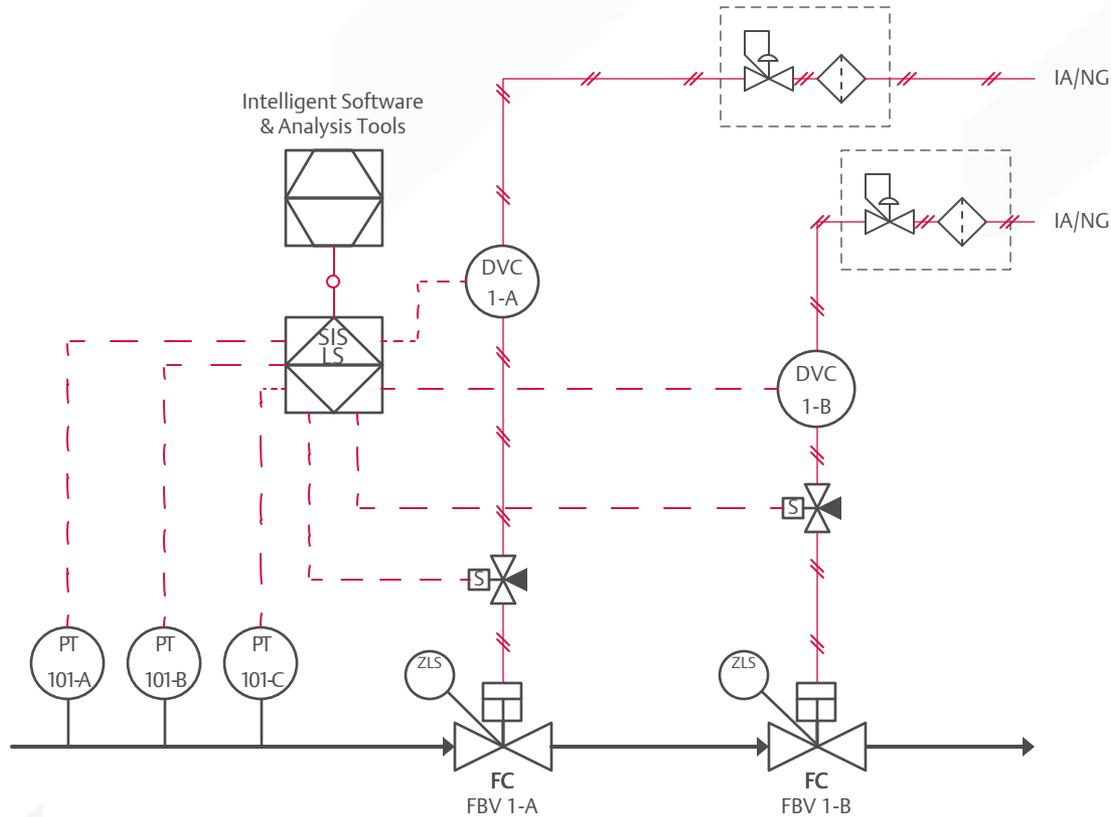
Logic Solver

Final Elements

On-Line System Testing

Featured Products

System Justification



Many codes and standards which define the use of a HIPPS require that the system be “as safe as, or safer than”, a conventional relief valve design.

These standards also imply that the implementation of a SIS should be based on the safety lifecycle defined by IEC 61511 / ISA 84 standards which apply the concept of Safety Integrity Level, or SIL, to measure the amount of risk reduction that a HIPPS system is capable of providing.

In comparison, a pressure relief valve will have a probability that it will fail to open when a demand occurs; so the justification for the use of HIPPS must include an analysis of its Probability of Failure on Demand (PFD) which is directly proportional to the system SIL rating.

Regulatory Compliance

Reduce CAPEX

Reduce OPEX

Reducing Risk

Equipment Protection

MOC Analysis

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

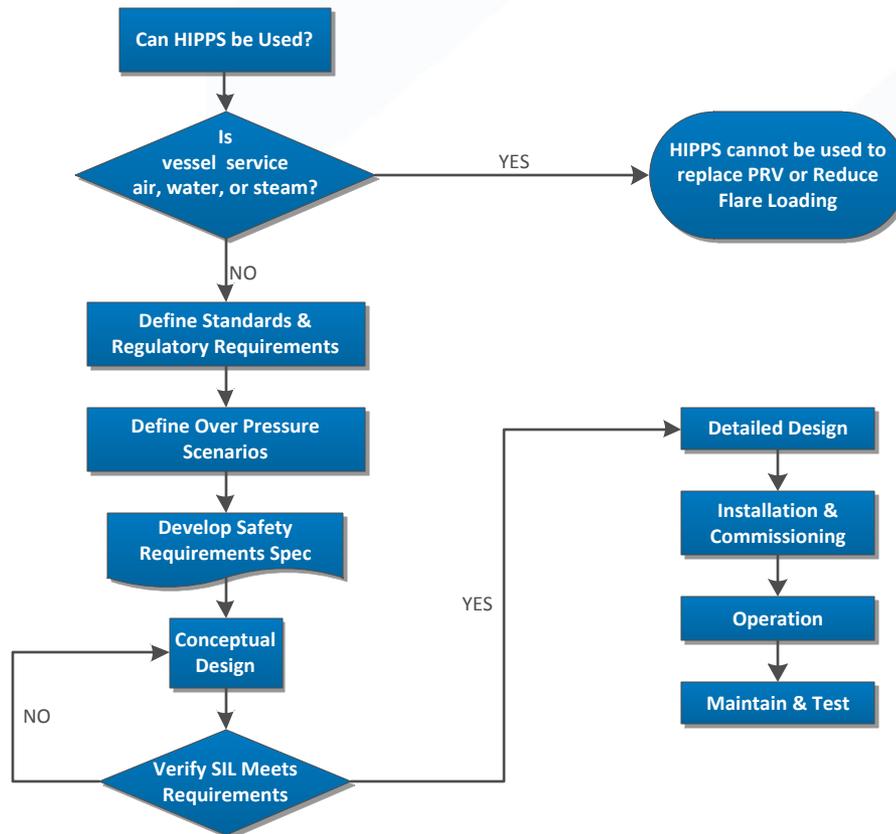
Logic Solver

Final Elements

On-Line System Testing

Featured Products

System Justification



Environmental & Regulatory Compliance

The justification must thoroughly document the hazards and identify all potential over pressure scenarios. It also requires that the design, operation, maintenance, and testing to ensure standard's compliance is documented.

In addition, a rigorous testing and maintenance program must be achieved and must be understood by all management, operations, and maintenance personnel.

All of this activity related to the design must be documented in the SRS including:

- Reasons for using HIPPS
- Applicable standards
- All over pressure scenarios
- SRS requirements defined
- Risk mitigation level

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Equipment Protection

MOC Analysis

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

System Justification



Reducing CAPEX

The primary reduction in project cost from the use of a HIPPS is the reduction of flare and pressure relief manifold size when adding new equipment to existing facilities.

Significant cost savings can also be realized by minimizing the process downtime related to equipment that will release pressurized product into the header.

A HIPPS system can often be installed with minimal process downtime when compared to a flare system expansion project and provides the following cost benefit:

- Eliminates need for resizing of the flare and / or relief manifold
- Reduced process downtime
- Reduces the volume and number of flaring events
- Cost of manual testing decreased

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Reduce CAPEX

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MOC Analysis

HIPPS System
Description

Overpressure
Protection
System Types

System
Justification

Solution
Engineering

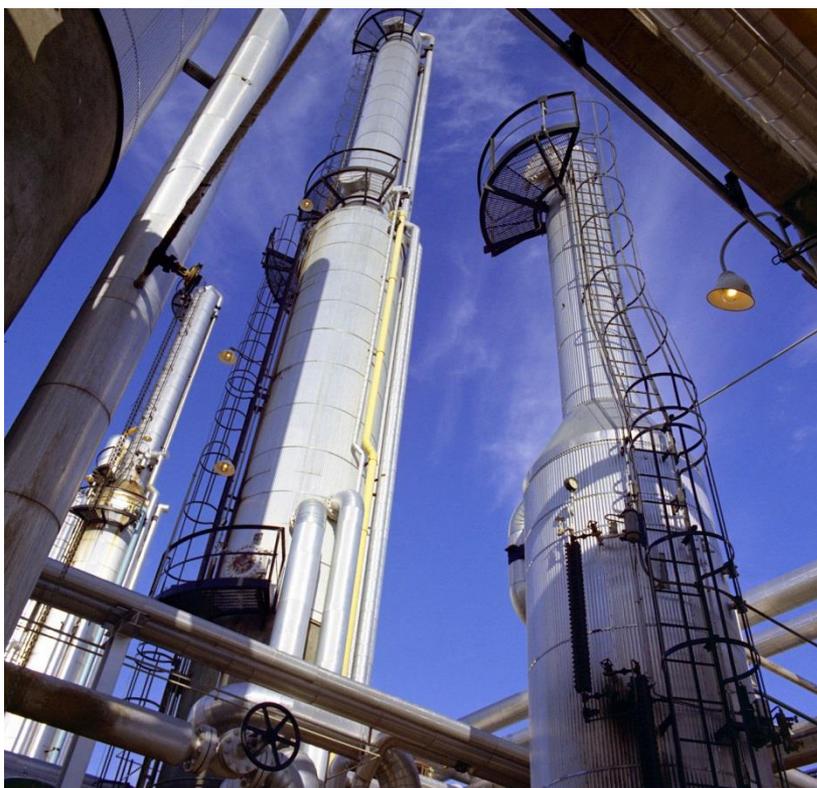
Pressure
Sensing Loops

Logic Solver

Final Elements

On-Line
System
Testing

Featured
Products



System Justification

Lowering Operational Cost

Installation of an Emerson HIPPS solution reduces the labor to comply with the testing and inspection requirements for mechanical over pressure relief systems.

Other benefits include the reduction in the volume and number of flaring events which has become increasingly important as regulatory agencies impose greater restrictions and penalties on emissions and flaring events.

- Eliminates manual testing of PRV's
- Reduces manual testing errors
- Automated recording of PST & trip events
- Extends time between proof tests

Regulatory
Compliance

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CAPEX

Reduce OPEX

Reducing Risk

Equipment
Protection

MOC Analysis

HIPPS System
Description

Overpressure
Protection
System Types

System
Justification

Solution
Engineering

Pressure
Sensing Loops

Logic Solver

Final Elements

On-Line
System
Testing

Featured
Products

System Justification



Reducing a Plant's Risk Profile

Installation of the HIPPS system lowers the potential of an over pressure event and can help to eliminate releases to the environment thereby reducing the plants risk profile.

Mitigation of risk is extended to the protection equipment and includes:

- Safely combust the gases relieved during an over pressure event
- Enhances PRV Functions
- Augments Flare System Protection
- Flare Load Mitigation

Regulatory
Compliance

Reduce
CAPEX

Reduce OPEX

Reducing Risk

Equipment
Protection

MOC Analysis

HIPPS System
Description

Overpressure
Protection
System Types

System
Justification

Solution
Engineering

Pressure
Sensing Loops

Logic Solver

Final Elements

On-Line
System
Testing

Featured
Products

System Justification



Protect Downstream Assets

While these mechanical relief systems are still widely available, regulatory restrictions are becoming more restrictive especially when the process fluid is flammable or toxic.

To overcome the challenge of protecting downstream equipment and the environment, facility operators are selecting Emerson's HIPPS technologies which allow them to:

- Protect Personnel
- Protect the environment
- Reduce the facility risk level
- Protects low pressure rated assets
- Operate under high pressures or flow rates

Regulatory
Compliance

Reduce
CAPEX

Reduce OPEX

Reducing Risk

Equipment
Protection

MOC Analysis

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

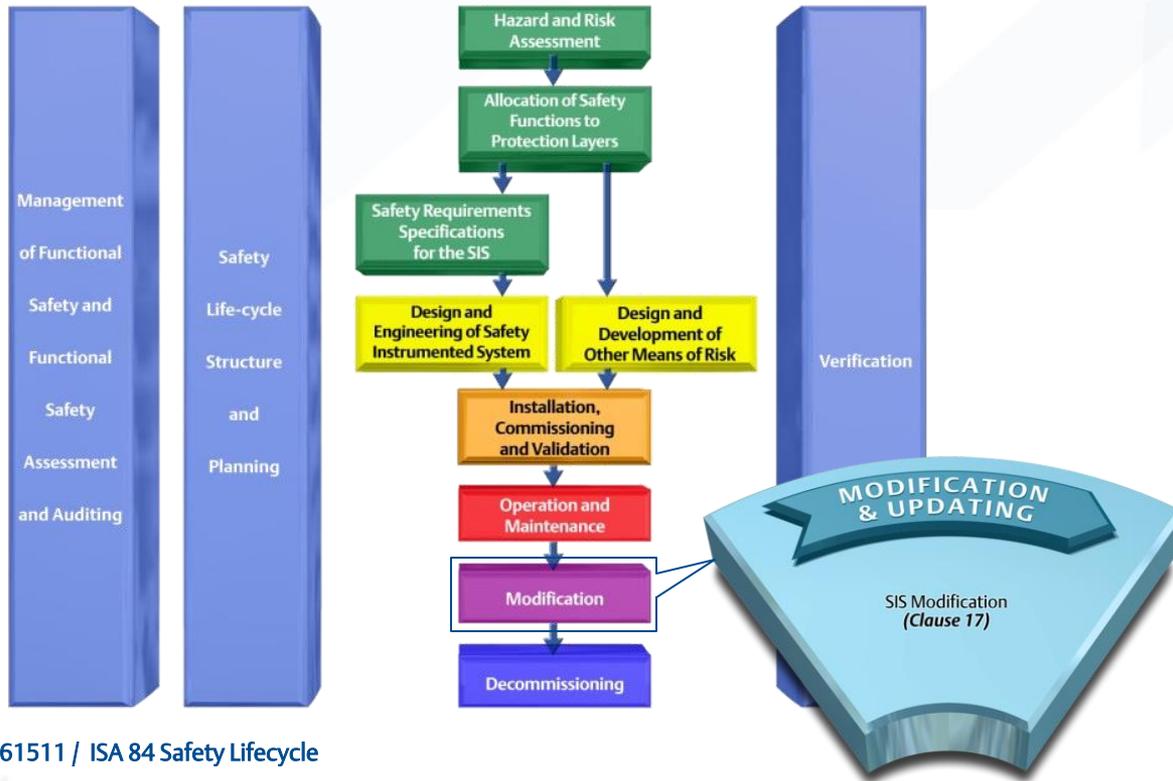
System Justification

Management of Change Analysis

As pressure relief is one of the primary applications necessitating PSM, any change to an asset and / or procedure within a facility represents the potential requirement to reevaluate the integrity requirements of the existing HIPPS.

This analysis can be prompted by:

- Operating Issues
- Regulatory Changes
- Near-Miss Investigations
- Changes in Mechanical Integrity
- Physical Asset Modifications



IEC61511 / ISA 84 Safety Lifecycle

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Reducing Risk

Equipment Protection

MOC Analysis

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

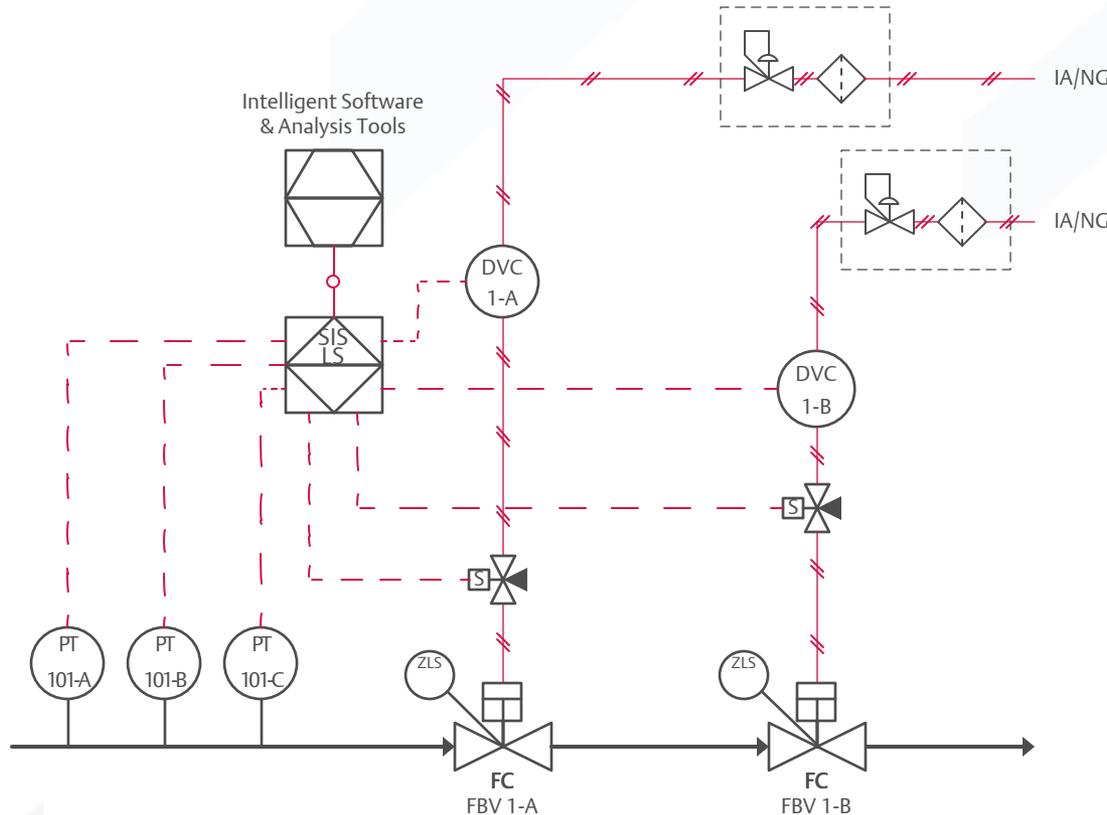
Featured Products

Solution Engineering

There are many challenges that come with designing, analyzing, building and testing a HIPPS system.

Not only can Emerson supply all the necessary equipment with certified failure data for all components, but also contribute to the HIPPS design, verification of the SIL, development of procedures and inspection plans that include proof test processes to ensure the safety integrity is maintained throughout the safety life cycle.

- Emerson - one stop solution supplier
- Solutions Engineering to reduce HIPPS complexities
- Integrated systems help ensure safety integrity levels
- Products compliant to IEC 61508
- System designed in accordance with IEC 61511 / ISA S84 standards



Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

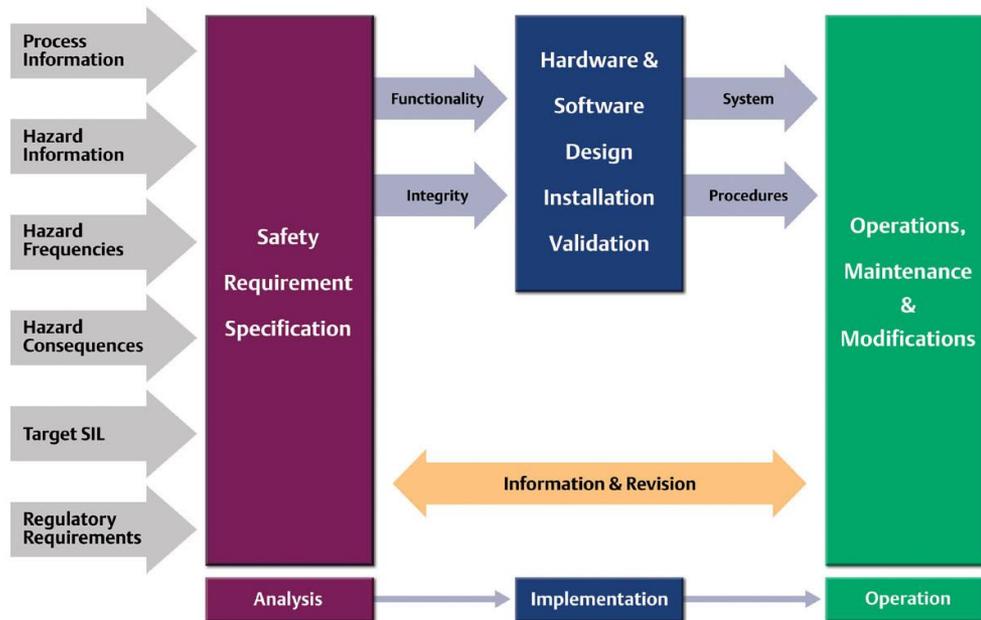
Solution Engineering

Engineering & System Integration

To achieve the desired level of protection, it is essential that the design ensures all elements of the HIPPS system will operate as designed when a demand occurs.

Utilizing Emerson as the HIPPS integrator will ensure the combination of sensing elements, logic solver and final control elements meet the integrity, operability and maintainability that is desired in a HIPPS system and defined in the Safety Requirements Specification (SRS):

- Functionality, availability, survivability
- Assessment of system integrity
- Well defined reliability data
- Reaction and response times of sensor, logic solver and final elements
- Identifies and describes all credible process and service conditions



Engineering / System Integration

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- HIPPS System Description
- Overpressure Protection System Types
- System Justification
- Solution Engineering**
- Pressure Sensing Loops
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- Final Elements
- On-Line System Testing
- Featured Products

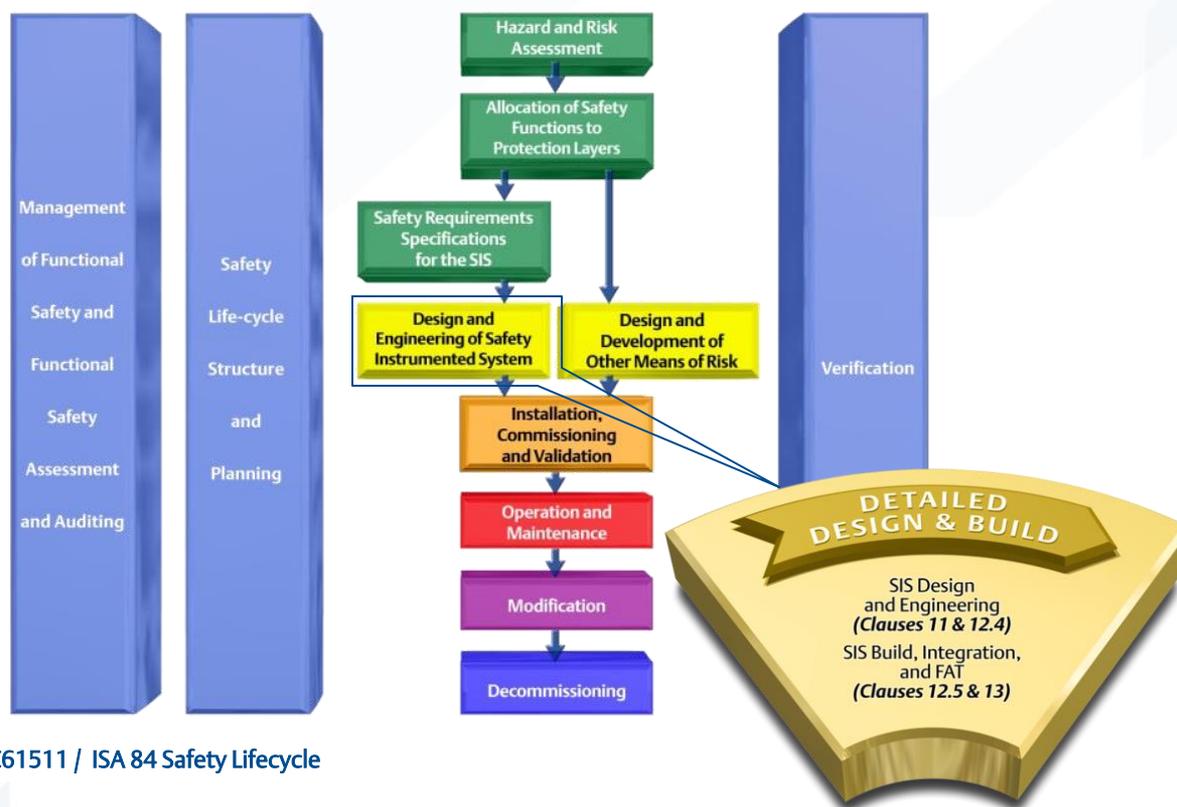
Solution Engineering

Smart HIPPS Product Selection

Component selection is a very important part of designing a HIPPS system. Each product must be SIL certified and selected so that no single device can compromise the overall integrity target of the HIPPS.

To become SIL certified under IEC 61508, the supplier must demonstrate that the failure rate and mode for each component in the product is identified and minimizes the Probability of Failure on Demand (PFD).

- The considerations for the PFD relate directly to the SIL rating of the HIPPS and include:
- Determining hardware failure rate
- Common mode failure percentage
- Proof test coverage
- Proof testing interval



IEC61511 / ISA 84 Safety Lifecycle

- Engineering / System Integration
- Smart HIPPS Product Selection
- Assembly and Testing
- Installation and Commissioning
- Field Testing Procedures Manual
- Safety Requirement Specification
- SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

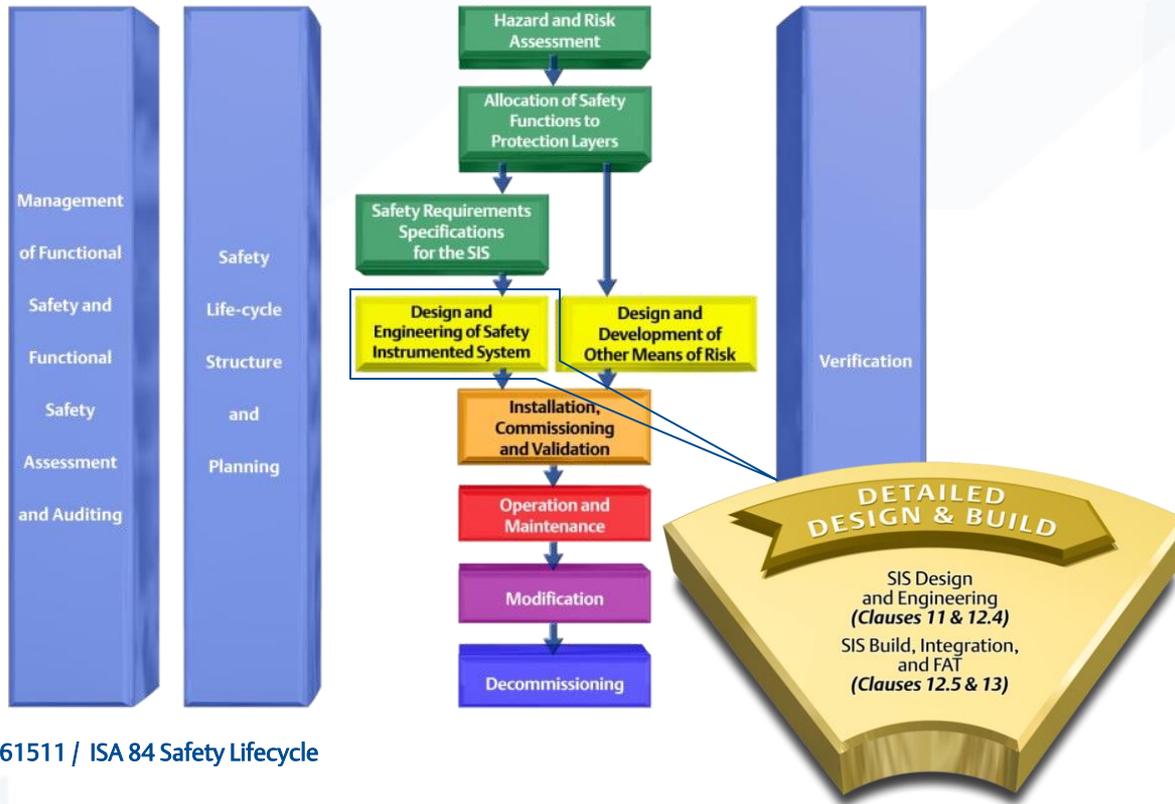
Solution Engineering

Assembly & Testing

Testing should demonstrate the system meets the well-defined requirements of the Safety Requirements Specification. Testing of a HIPPS system not only consists of operational tests, but also includes testing throughout the manufacturing, commissioning and start-up processes.

Testing often includes:

- Design validation test
- Factory acceptance tests
- Integrated factory acceptance test
- On-Site pre-commissioning tests
- Operational proof testing
- Site acceptance test
- HIPPS performance tests



IEC61511 / ISA 84 Safety Lifecycle

Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

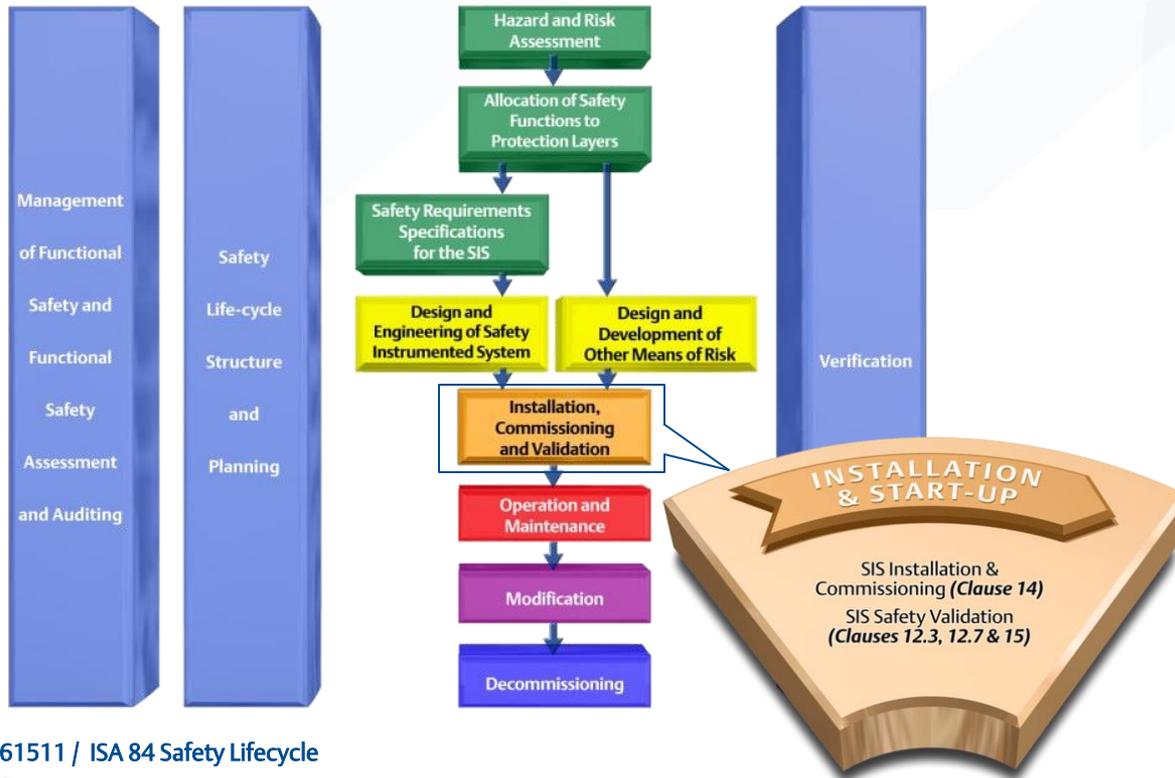
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Solution Engineering

Installation & Commissioning

This is final step in the process and one of the most important as the testing should ensure that the system was not damaged in shipment and that all parts of the system were installed correctly and the system performs as defined in the SRS.

- Proof testing and site acceptance test verifies operation of sensor, logic controller and final element
- Validates installation and commissioning procedures were complete
- Verifies all conditions of the SRS are met



IEC61511 / ISA 84 Safety Lifecycle

Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

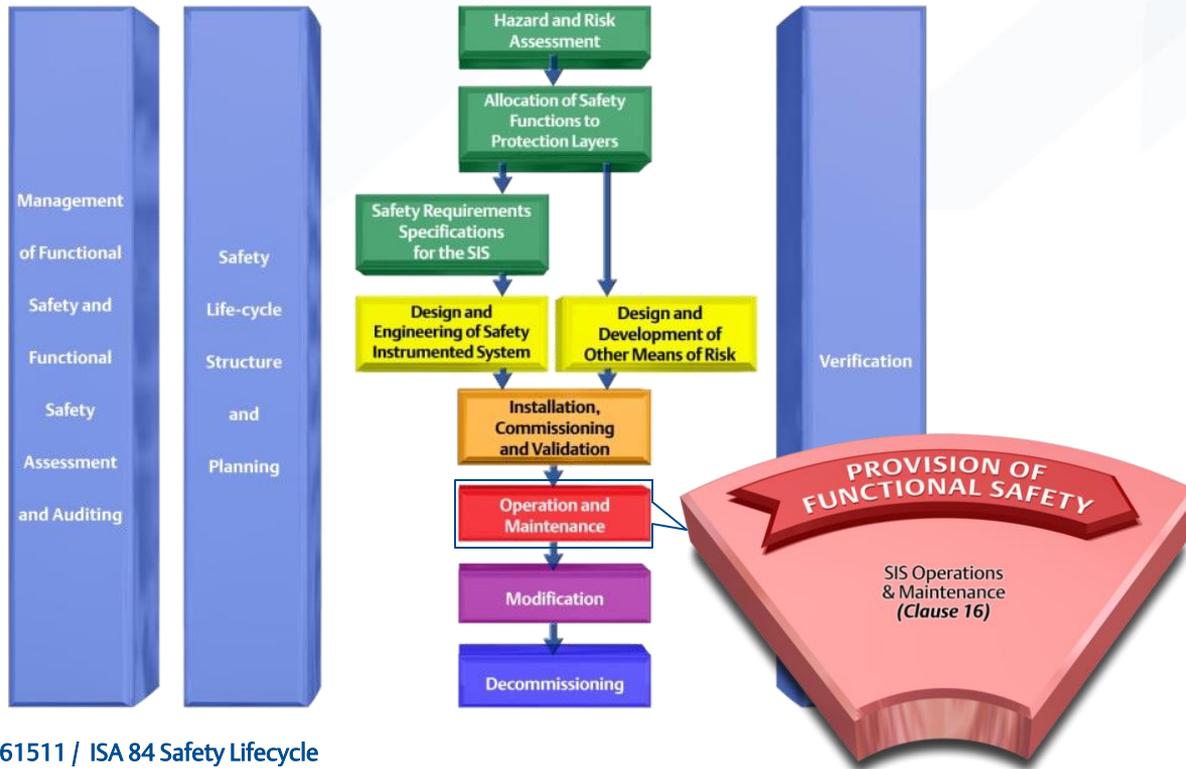
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Solution Engineering



IEC61511 / ISA 84 Safety Lifecycle

Field Testing Procedures Manual

The objective of periodic testing is to maintain the SIL rating of the system while minimizing any disruption to the process.

Emerson can document a recommended field testing procedure that complements the automated partial stroke and SOV component testing and ensures the integrity of the safety function throughout its lifetime.

Also, by utilizing proper valve design, the pipeline can be pig inspected to avoid the disruption and cost of removing the valve during the maintenance process.

A comprehensive field test procedure can be supplied with system to:

- Minimize process disruptions
- Confirm system integrity
- Maximize system uptime
- Ensure safety integrity levels

Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

Solution Engineering

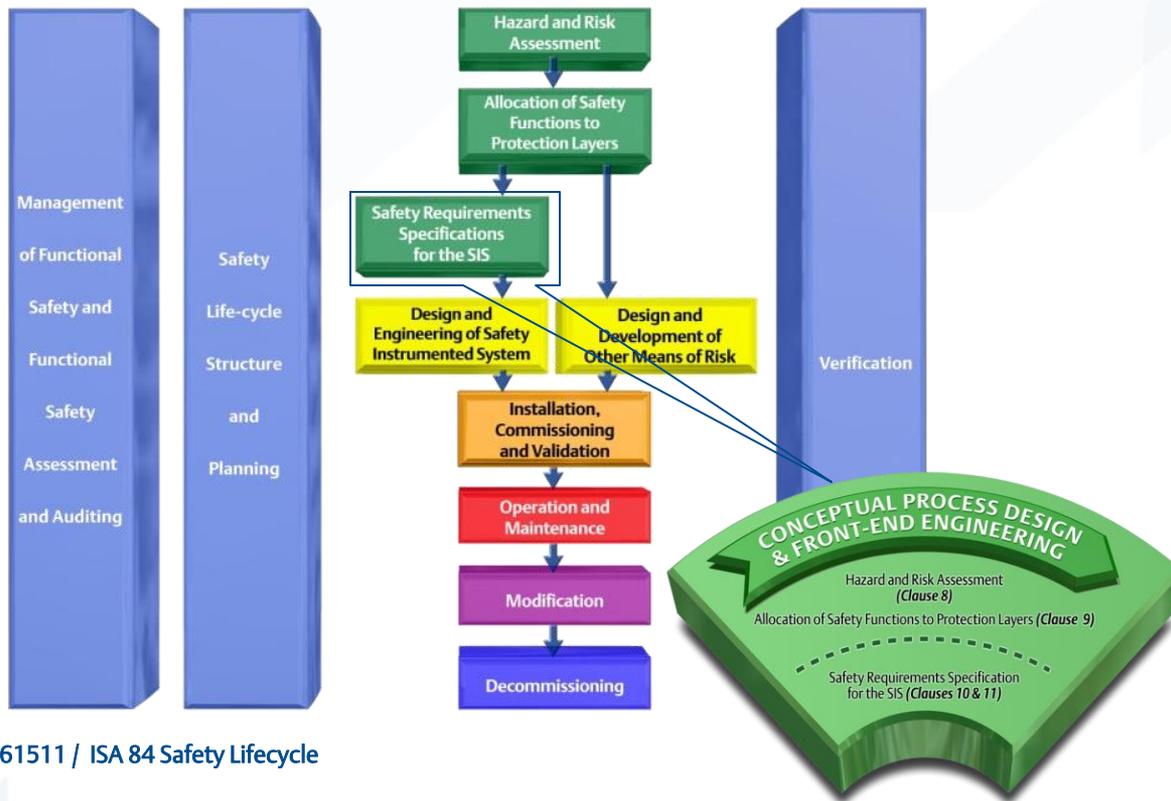
Safety Requirement Specification Development

Once the over pressure hazards have been identified and a risk mitigation factor established, the SRS becomes the heart of every successful HIPPS Project.

Emerson's engineers can complement your development team and are experienced in the methods for pre-feed engineering, data gathering, and SIL analysis.

Our engineers and safety consultants are expert at the process of developing the important SRS documents which include.

- Project Description
- Functional SIS Requirements
- HIPPS System Requirements
- Basis of Design
- SRS Data



IEC61511 / ISA 84 Safety Lifecycle

Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

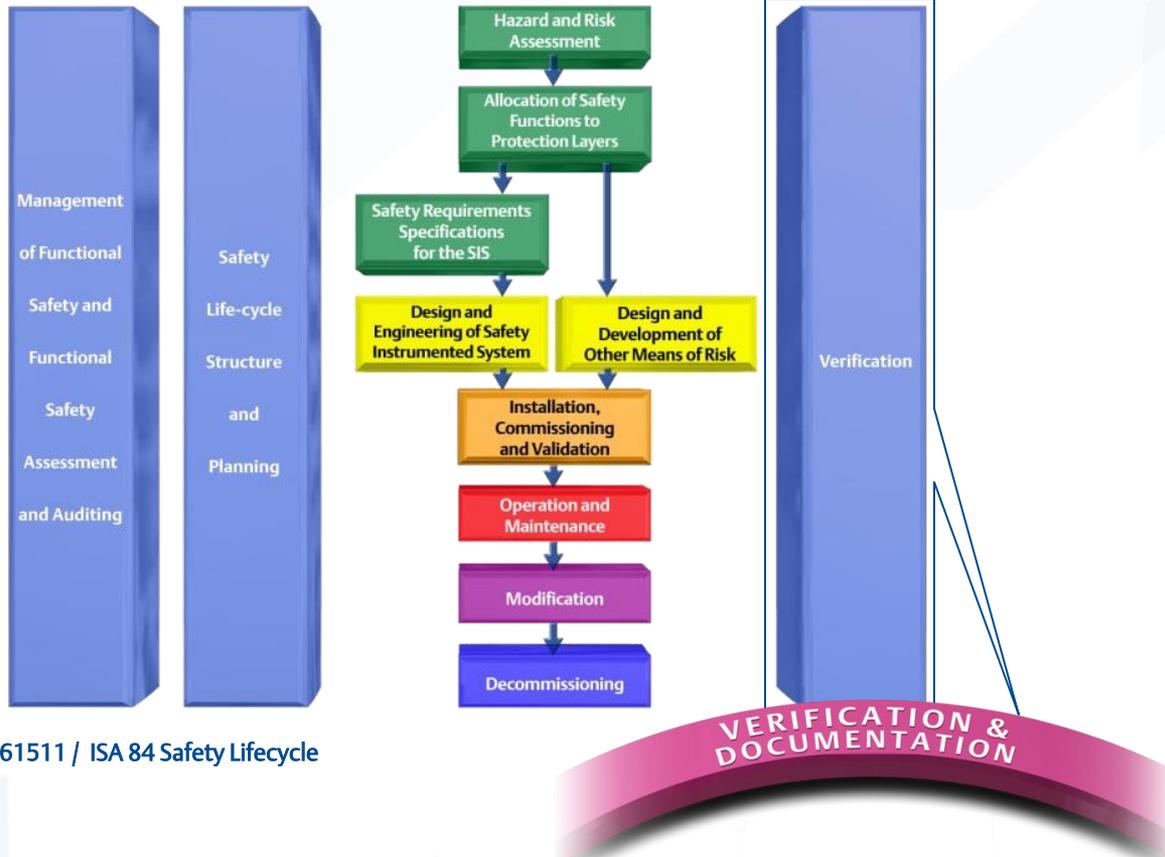
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SIL Verification

SIL Verification is the process of verifying that the design of the Safety Instrumented Function (SIF) meets the targeted SIL Requirement. The object is to certify 4 basic criteria:

- Operational & Functionality
- Independent of the Control System
- Document Design Requirements
- Meets Target SIL



IEC61511 / ISA 84 Safety Lifecycle

Engineering / System Integration

Smart HIPPS Product Selection

Assembly and Testing

Installation and Commissioning

Field Testing Procedures Manual

Safety Requirement Specification

SIL Verification Compliance Report

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

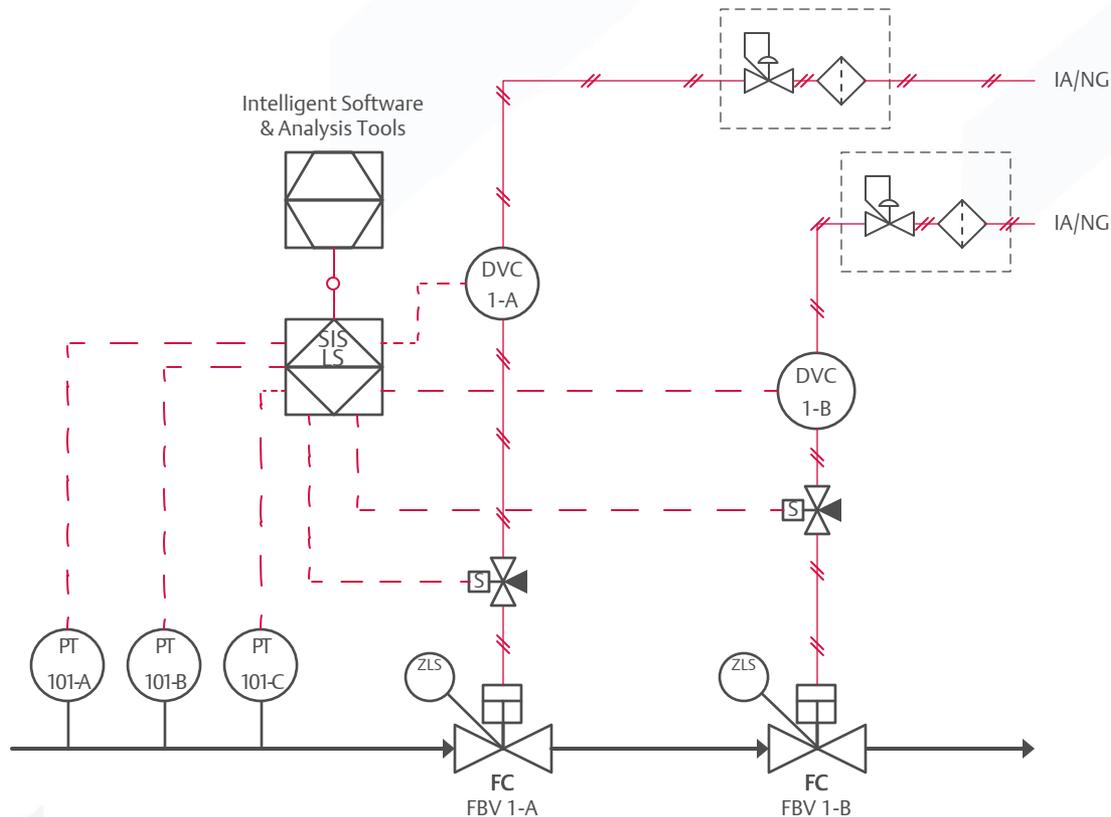
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Pressure Sensing Loops

Replacing switches with transmitters is your first step toward reducing undetected failures.

Emerson's smart sensors, including Rosemount™ pressure devices, go beyond detecting component failures. They evaluate the performance of the complete measurement system, extending diagnostics outside of the transmitter to provide process diagnostics and:

- Detect over pressure scenarios
- Meet Functional Safety Requirements
- Improved System Reaction Time
- SIL & Redundancy Requirement



Rosemount 3051S

Pressure Manifold

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

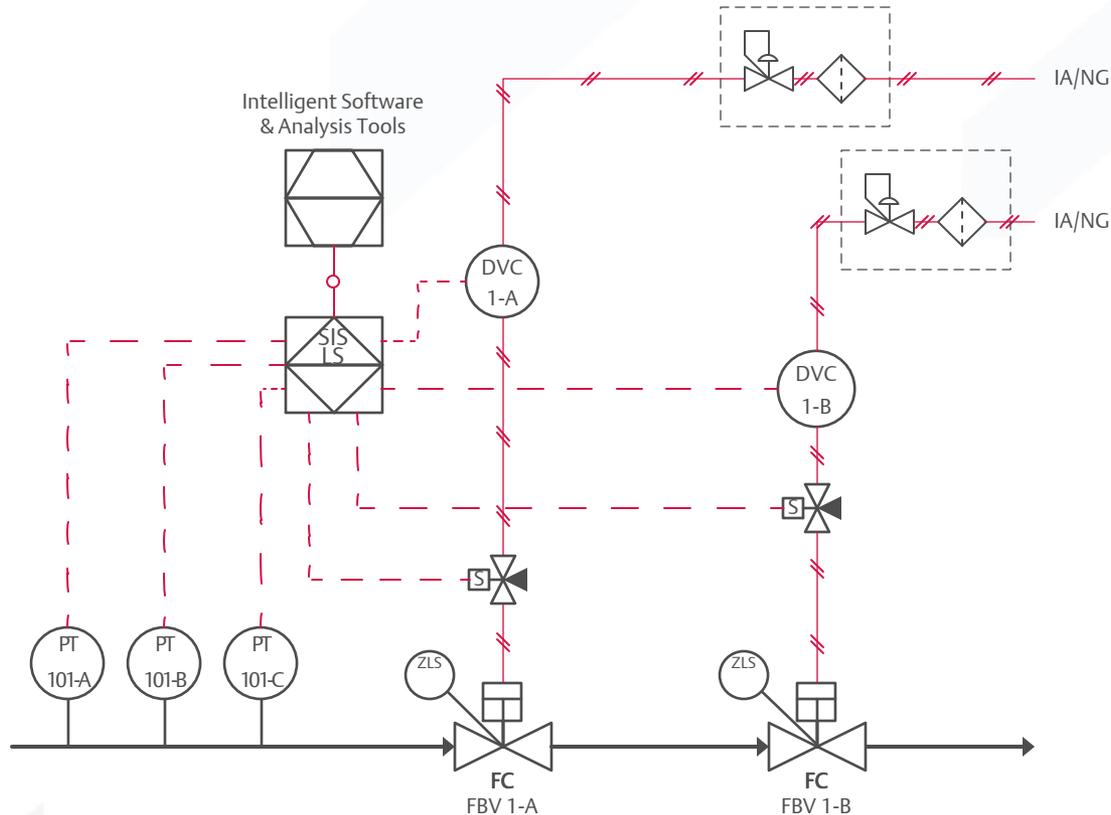
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Pressure Sensing Loops



Rosemount 3051S

Pressure Manifold

Emerson Pressure Manifold

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 test. To provide this safety, the manifold must have an interlock system that ensures only one transmitter can be isolated at a time. It should also include a Double Block & Bleed function that allows the operator to safely shut off pipeline pressure and isolate for testing.

- Provides personnel protection
- 1 central or 3 individual tap configuration
- Reduce common cause failures
- Suitable for use in SIL3
- Ensures PT isolation



HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

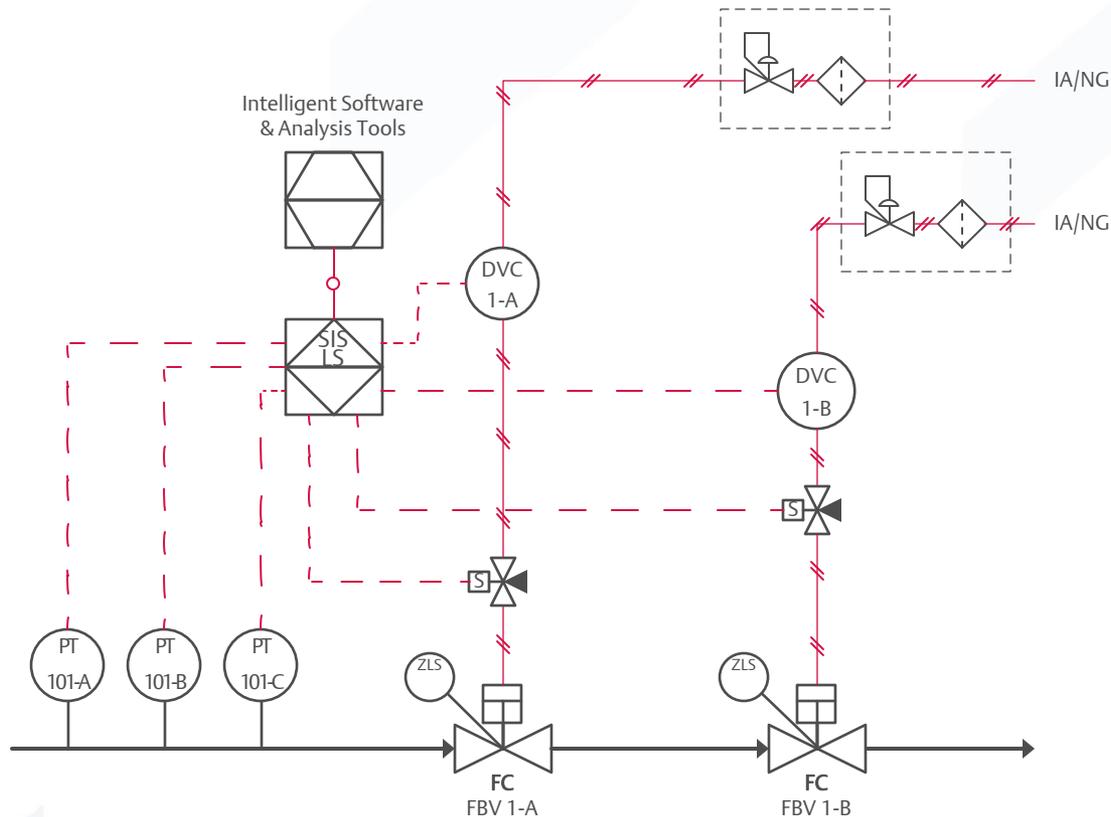
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Logic Solver

In a HIPPS, the logic solver is responsible for activation of the appropriate signal outputs based on preconfigured logic conditions and /or inputs from pressure sensing devices.

Purpose designed safety systems which are SIL 3 certified are typically used as a logic solver and consists of a Central Processing Unit (CPU) and a redundant / fault tolerant I/O interface designed for safety-related applications.

Shutdown logic should be embedded in the CPU and automatically initiated based upon well-defined criteria. HIPPS activation should require no external intervention or acknowledgement.



DeltaV SIS

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

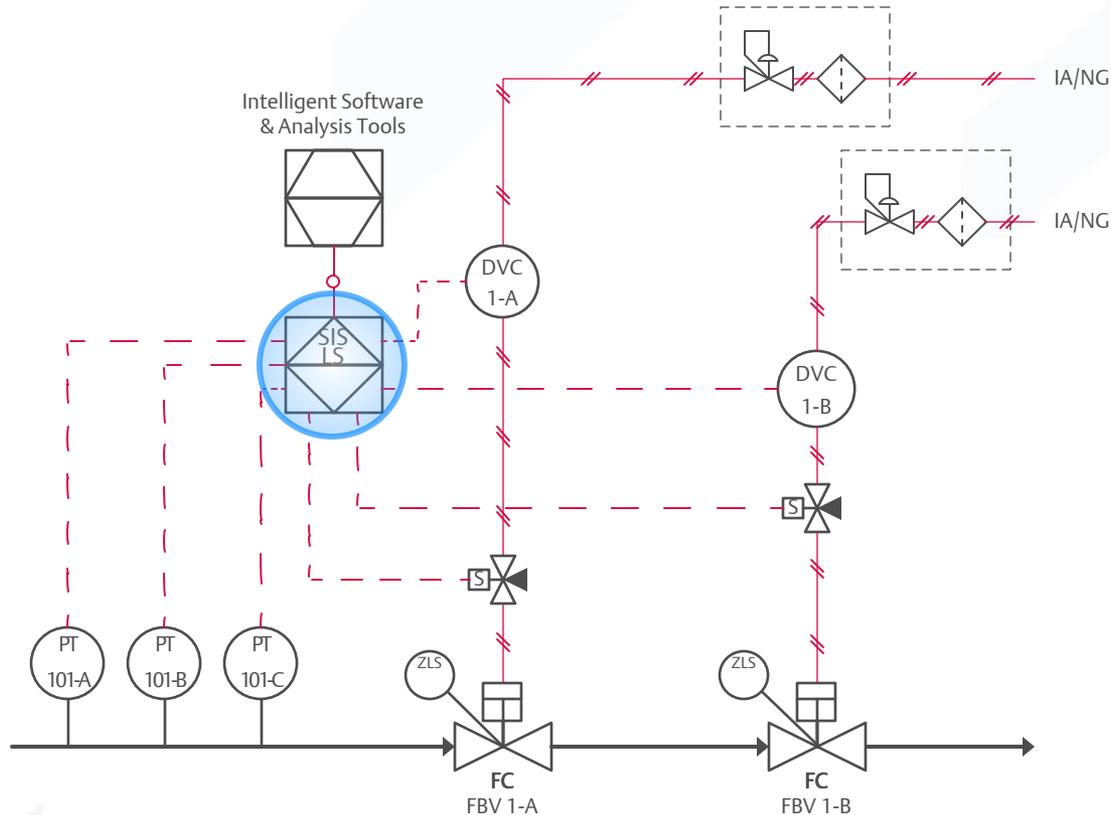
Logic Solver

DeltaV SIS™ CHARMS Safety Logic Solver

In a Logic Solver is not only there to process the logic based shutdown configuration programmed to memory but must be able to monitor the considerable number of diagnostic tests that are continuously occurring throughout the life of the system.

In addition, the DeltaV SIS Safety Logic Solver eliminates single point of failures and includes the ability for periodic final element and solenoid testing which can extend time between proof tests.

- Continuous loop diagnostics
- Integral partial stroke testing
- Fast Pulse SOV Testing
- Flexible integration
- SIL3 capable



DeltaV SIS



HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

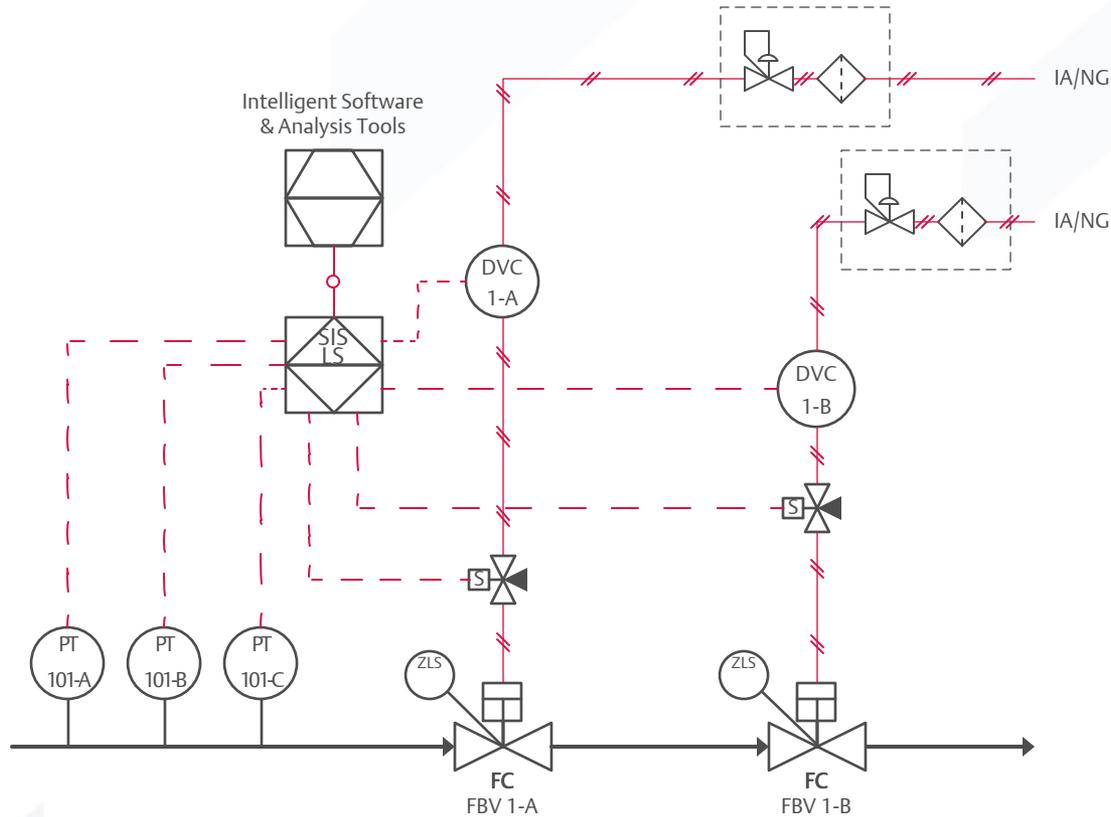
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



Valve Operating System

Actuators

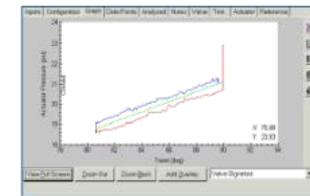
Controls

Valves

Final Elements

Due to the complexity of HIPPS, compared with conventional pressure relief systems, operators fear losing control during scheduled test. This often results in tests being incomplete or not carried out at all, impacting the required safety level of the system. A solution with proof test procedures and automated partial stroke testing (PST) will ensure this is handled correctly and extend the integrity of the system between proof tests.

- Ensure system operation and integrity.
- Reduce manual test cost and errors,
- Minimizes costly process disruptions
- Collects & records diagnostic data



HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

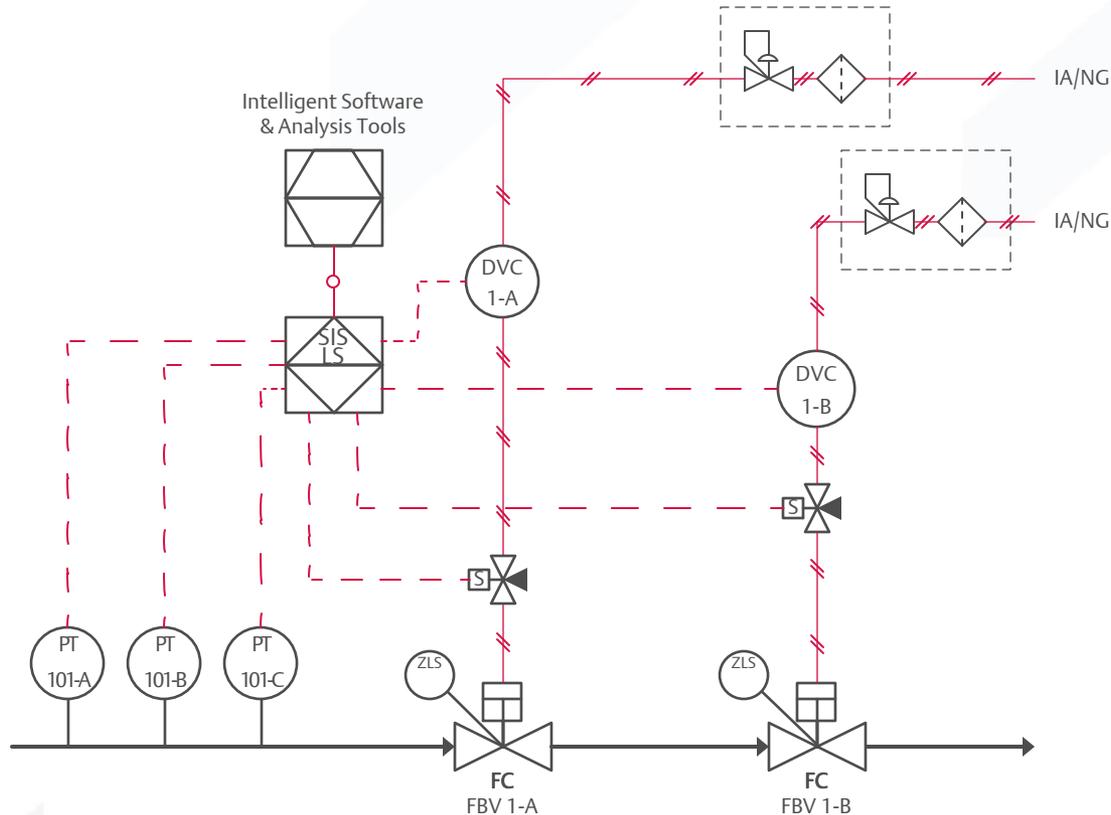
Final Elements

Valve Operating System

Final Elements are split between the Valve and the Operating System. The valve is designed to maintain the pressure integrity of the pipeline, whereas the operating system is often energized by a separate, external power source.

The VOS consist of an actuator and the control components, with options for electric, pneumatic or hydraulic operation. The controls will be connected to the DCS or SIS, depending on the function and SIL requirement of the VOS.

- VOS can be pneumatic, hydraulic or electrically driven
- Control the valve from DCS or SIS
- Position feedback, PST and diagnostics should be included
- Wired or wireless interface to DCS can be supplied



Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

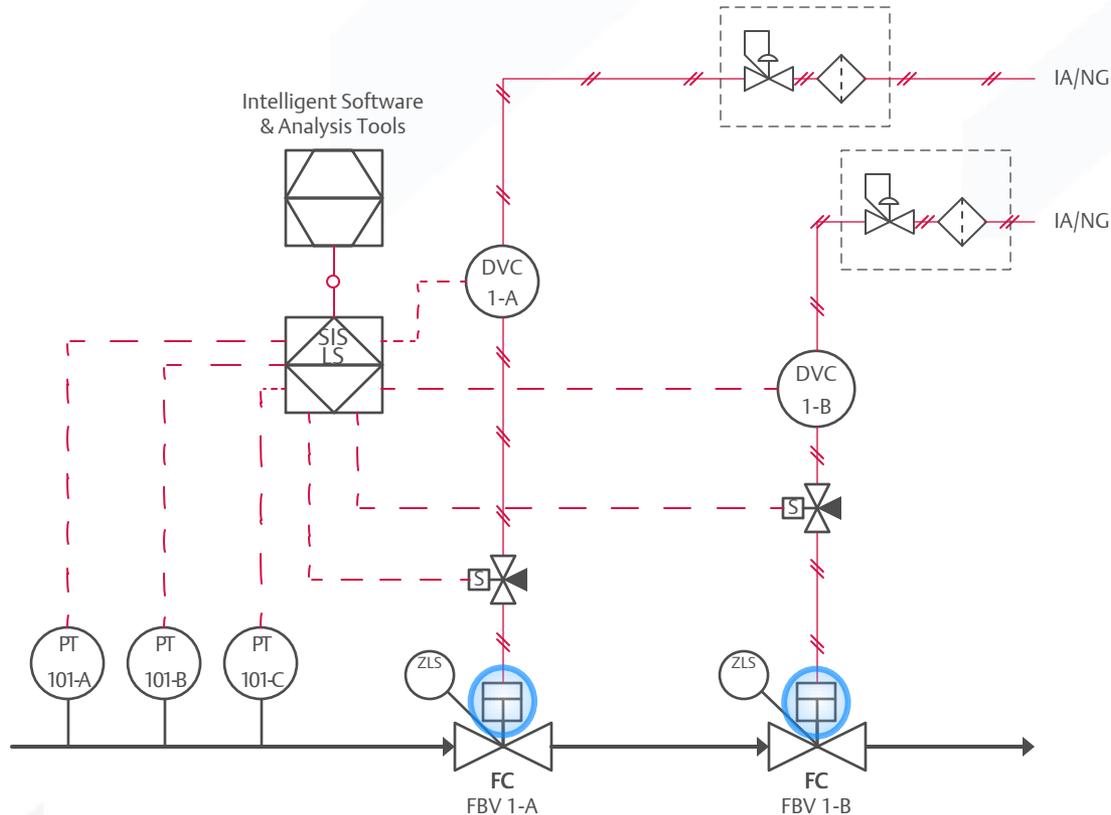
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements



Valve Actuators

Actuators are designed to drive valves, either for rotary or linear movement. They can be energized by Pneumatic, Hydraulic or Electrical drives, each depending on the specifics of the application and the requirements of the control valve.

- Air Driven Pneumatic actuators are the most common type of valve control and the actuator mechanism and control component must have seamless integration to provide reliable actuation

[+ Click to learn more about Pneumatic Actuators](#)

- Hydraulic actuators are often used when fail-safe valve control is critical, as the non-compressible control fluids allow precise control during shutdown

[+ Click to learn more about Hydraulic Actuators](#)

- Electric is only used for on/off, but can be augmented by an Electro Hydraulic Operator to provide a fail-safe operation

[+ Click to learn more about Electro Hydraulic Actuators](#)

Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

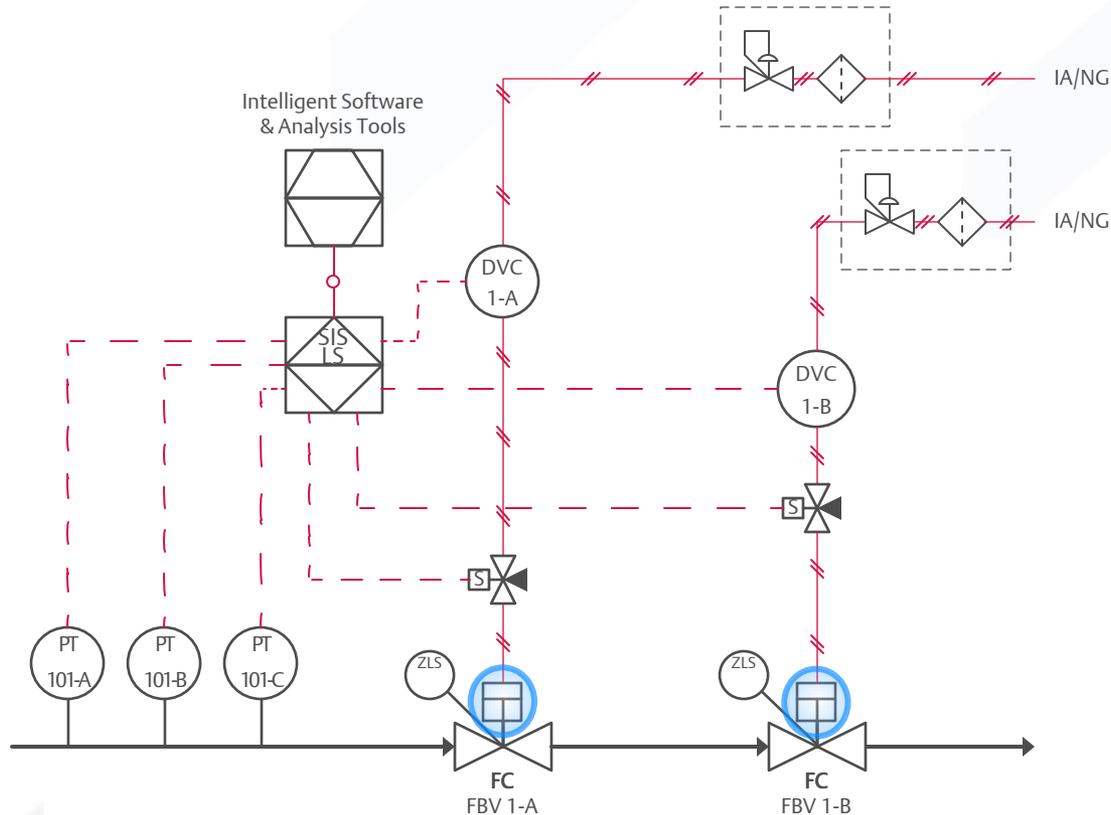
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements



Pneumatic Actuators

Pneumatic actuators utilize compressed air to operate a valve and are the most commonly used actuator. The big advantage of pneumatic actuators is that compressed air is easily available in most sites and they are quick to respond with shutdown times as low as 1-2 seconds. This makes them a perfect fit in many HIPPS applications. Emerson has a variety of pneumatic actuators to fit most process applications and they can be supplied with various certifications including SIL 3.

- Ideal for applications requiring fast closure speed
- Can be either spring return or double acting
- Piston type scotch-yoke actuators are most common
- Modular design increases the safety, reliability and product life

[⊕ Click to learn also about Hydraulic Actuators](#)

[⊕ Click to learn also about Electro Hydraulic Actuators](#)

Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements

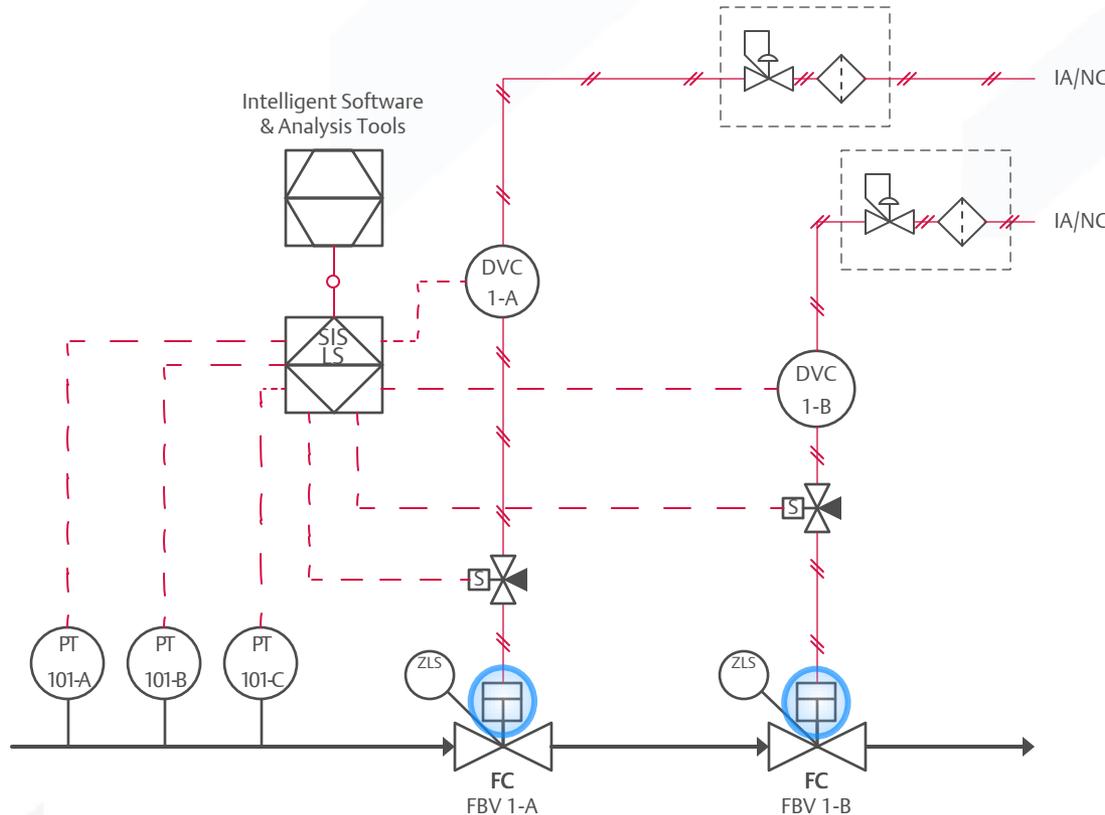
Hydraulic Actuators

Hydraulic actuators convert fluid pressure into motion and most commonly provided with a scotch-yoke piston style actuator. Hydraulic operated actuators work well in high pressure situations because they can exert force necessary to overcome the pressure of the process liquids. Emerson offers actuators suitable for use in the demanding applications of a SIL environment such as HIPPS.

- Excellent for applications where high torque is required
- Ideal for applications requiring accurate control and speed
- Fail-safe features close or open under ESD conditions
- Commonly use scotch-yoke or piston style actuator

[+ Click to learn also about Pneumatic Actuators](#)

[+ Click to learn also about Electro Hydraulic Actuators](#)



Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

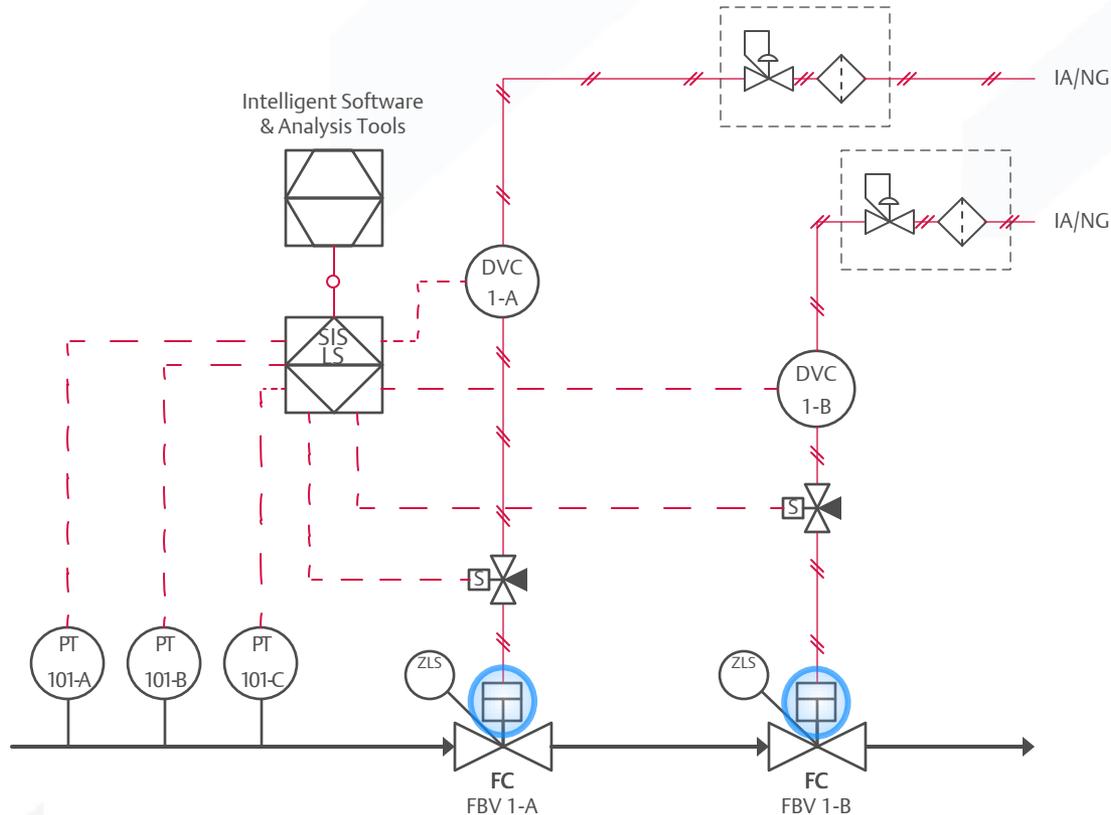
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements



Electro Hydraulic Actuators

The Electro-Hydraulic Operator (EHO) is a self-contained, quarter-turn, valve actuator designed for critical shutdown applications where reliability is paramount. The EHO utilizes a dependable spring-return actuator for the fail-safe stroke combined with an integral hydraulic power pack and electronic control module. Emerson's EHO is complete and designed for the toughest conditions where remote ESD with built in preventative and reactive measures are required.

- Self-contained, no hydraulic supply required
- Reliable in high pressure applications
- High accuracy and speed
- Compliments electric actuation as fail-safe option
- Solar powered and ideal for remote locations

[⊕ Click to learn also about Pneumatic Actuators](#)

[⊕ Click to learn also about Hydraulic Actuators](#)

Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

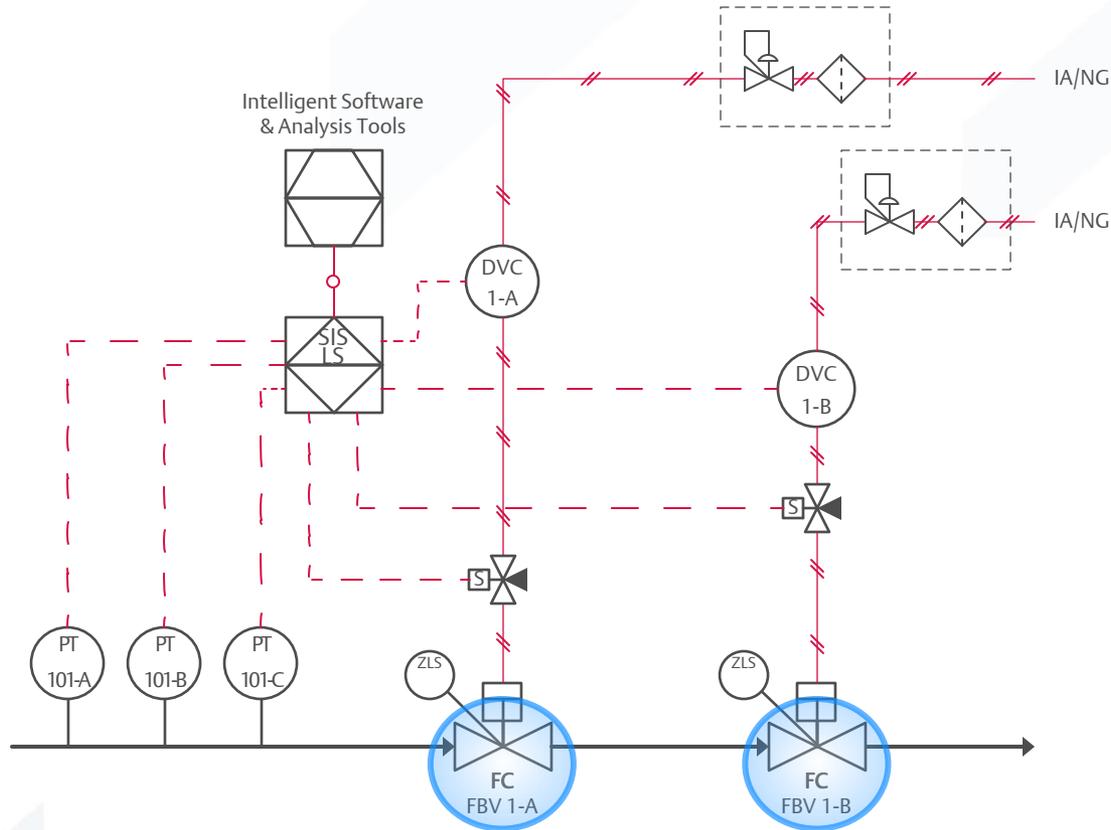
Final Elements

Controls

Control of the Final Element is crucial for the correct fail-safe function in case of an emergency. The design of the controls can be pneumatic, hydraulic or electric and should be designed to incorporate the required redundancy.

The valves operational controls can also be designed to increase the diagnostic coverage of the entire Final element:

- Digital Valve Controllers (DVC) for shutdown and partial stroke testing (PST), to uncover the dangerous failures in the Final Element and controls
- Single or Redundant Solenoids will provide reliable shutdown, but can also be tested for functionality while in service
- High flow shutdown components can be integrated in PST to verify functionality
- Asset Management Software (AMS) is used to monitor device alerts in the system and predict failures before they occur



Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

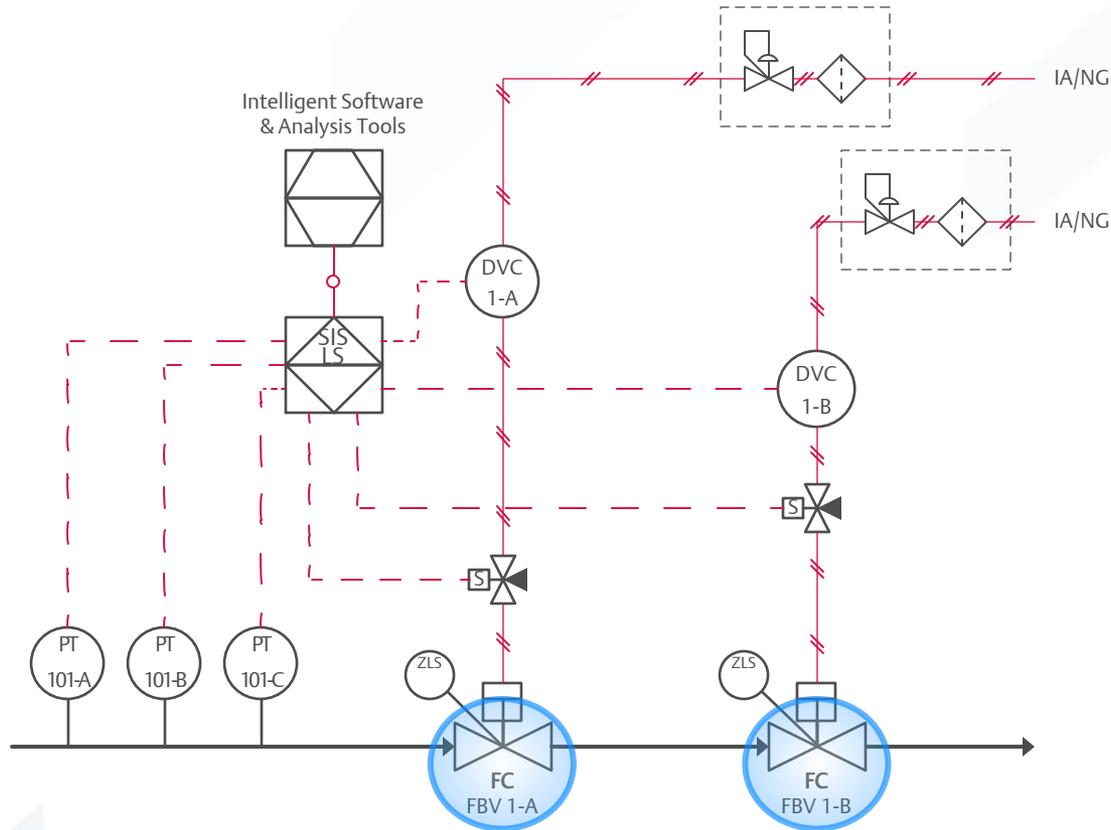
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements



Specialized Valves for HIPPS

One of the most critical parts of a HIPPS system is the valve. The valve must be reliable and ready to perform when needed and under all operating conditions.

In order to make the certification process for a safety shutdown system, especially a HIPPS system, easier it is important you select a valve supplier that has third party safety evaluations for SIL 3. Achieving such a certification validates that the supplier can demonstrate a history of producing reliable products that perform when needed.

Emerson has a full line of valves to solve the most demanding safety shutdown applications.

- SIL 3 certificated products
- Demonstrated history of producing safety shutdown systems
- Valves for most any process application
- Zero leakage capabilities
- Easily automated or supplied as complete system

[⊕ Click to learn about Ball Valves](#)

[⊕ Click to learn about Triple Offset Valves](#)

Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

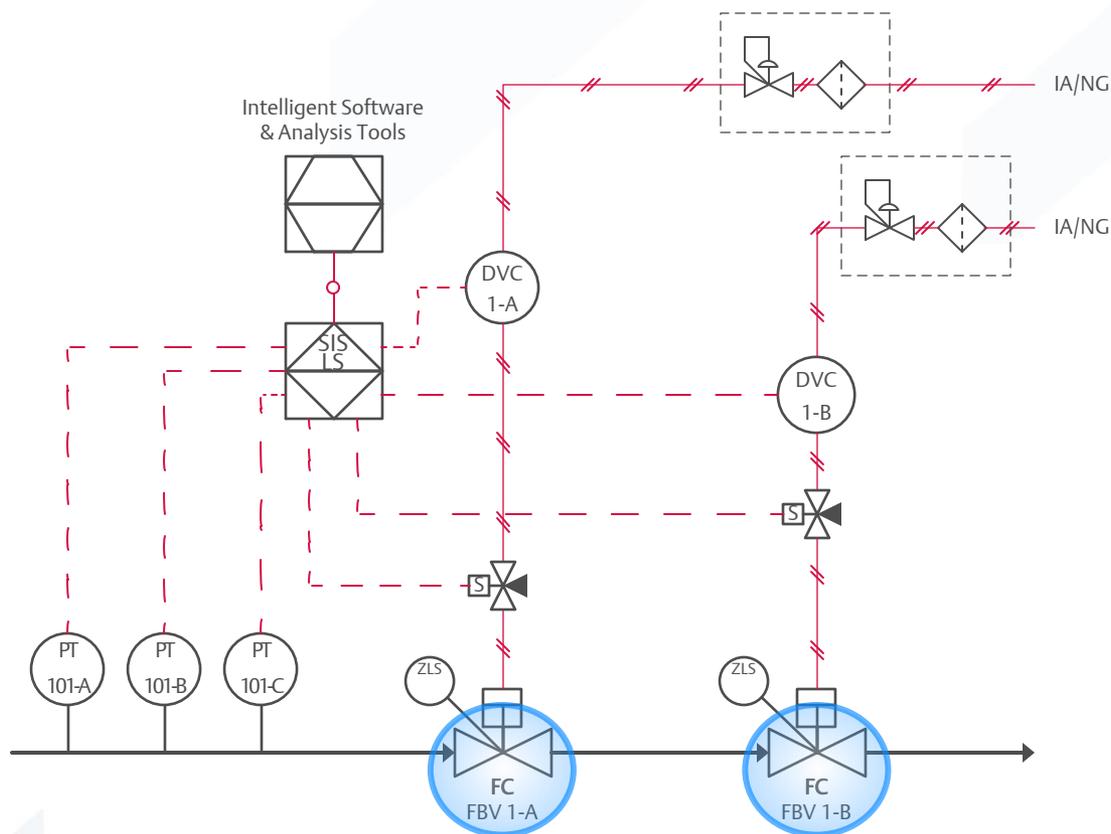
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



Final Elements

Ball Valves

A ball valve is an excellent choice for an over pressure shutdown system. A ball valve is high reliable, quick to close, piggable, and pressure drops are minimized. Ball valves are available from 1/2" to over 60" and in pressure classes up to 4500#. Quality ball valves offer bi directional sealing with zero leakage. Ball valves can be easily automated to meet HIPPS requirements.

- High reliability – can achieve SIL 3
- Zero leakage capable
- Wide range of sizes
- Piggable
- Easily automated

[⊕ Click to learn also about Triple Offset Valves](#)

Valve Operating System

Actuators

Controls

Valves

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

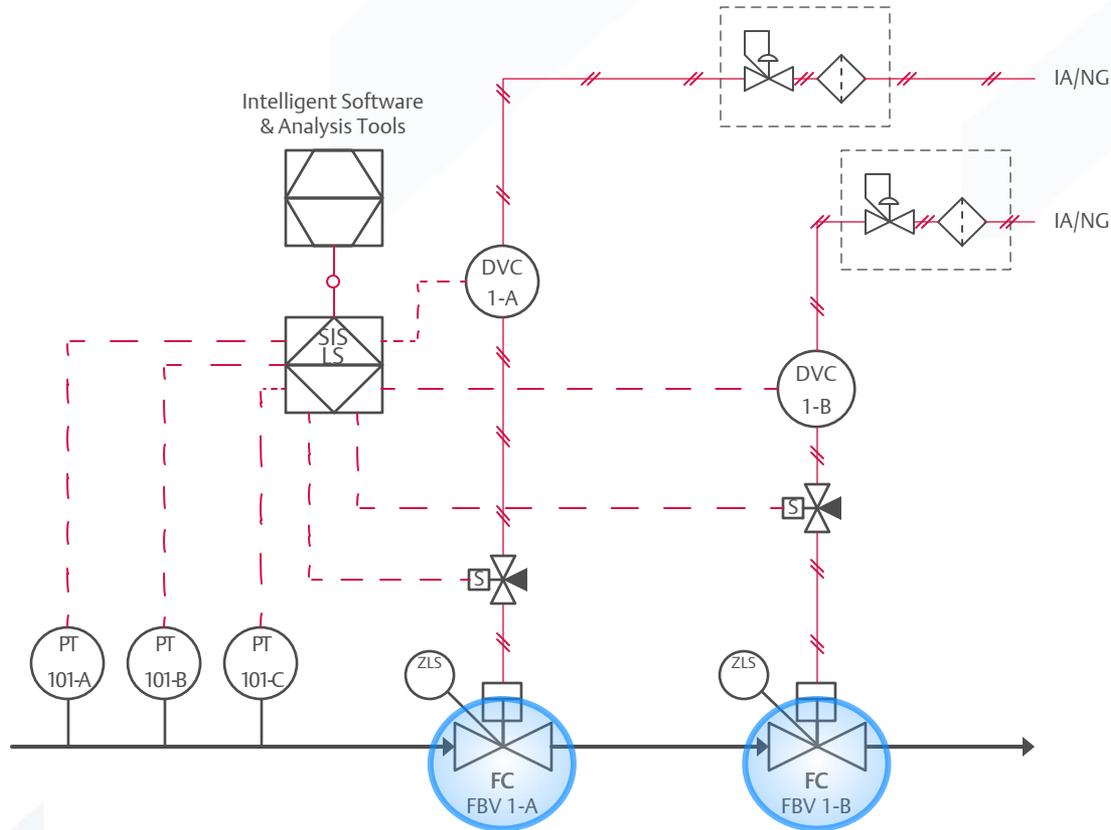
Logic Solver

Final Elements

On-Line System Testing

Featured Products

Final Elements



Triple Offset Valves

A highly reliable valve is crucial in a safety shutdown system. A triple offset valve (TOV) proves to be an excellent choice due to the virtually maintenance-free design and long service life.

Unlike butterfly and gate valves whose seats are chafed with every stroke, the design of the TOV provides a non-rubbing, open/close operation.

Additionally, its torque-assisted seal assures tight shut-off and uniform contact without wear which translates to better performance over a longer life.

- Low maintenance
- Triple offset minimizes wear
- Zero leakage sealing
- Cost effective automation
- High reliability – can achieve SIL 3

Valve Operating System

Actuators

Controls

Valves

[Click to learn also about Ball Valves](#)

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

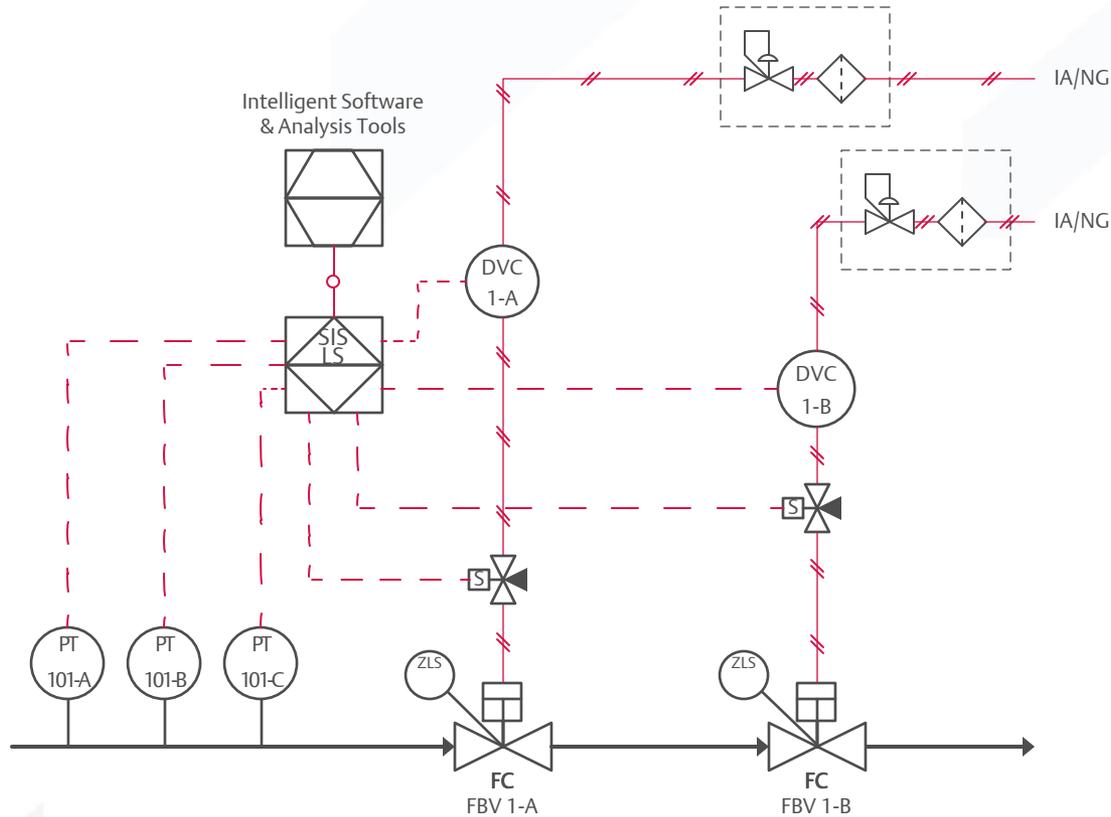
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



On-Line System Testing

Due to the complexity of HIPPS compared with conventional pressure relief systems, operators fear losing control during scheduled test. This can result in tests being postponed or not carried out at all, potentially impacting system safety integrity.

A solution with detailed proof test procedures and automated SOV / PST testing will ensure this is handled correctly and confidently.

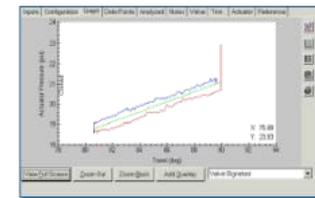
- Ensure system operation and integrity
- Reduce manual test cost and errors
- Minimize costly process disruptions
- Collects and records diagnostic data

Pressure Sensor Test

Logic Solver Test

SOV Pulse Test

Partial Stroke Test



HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

On-Line System Testing

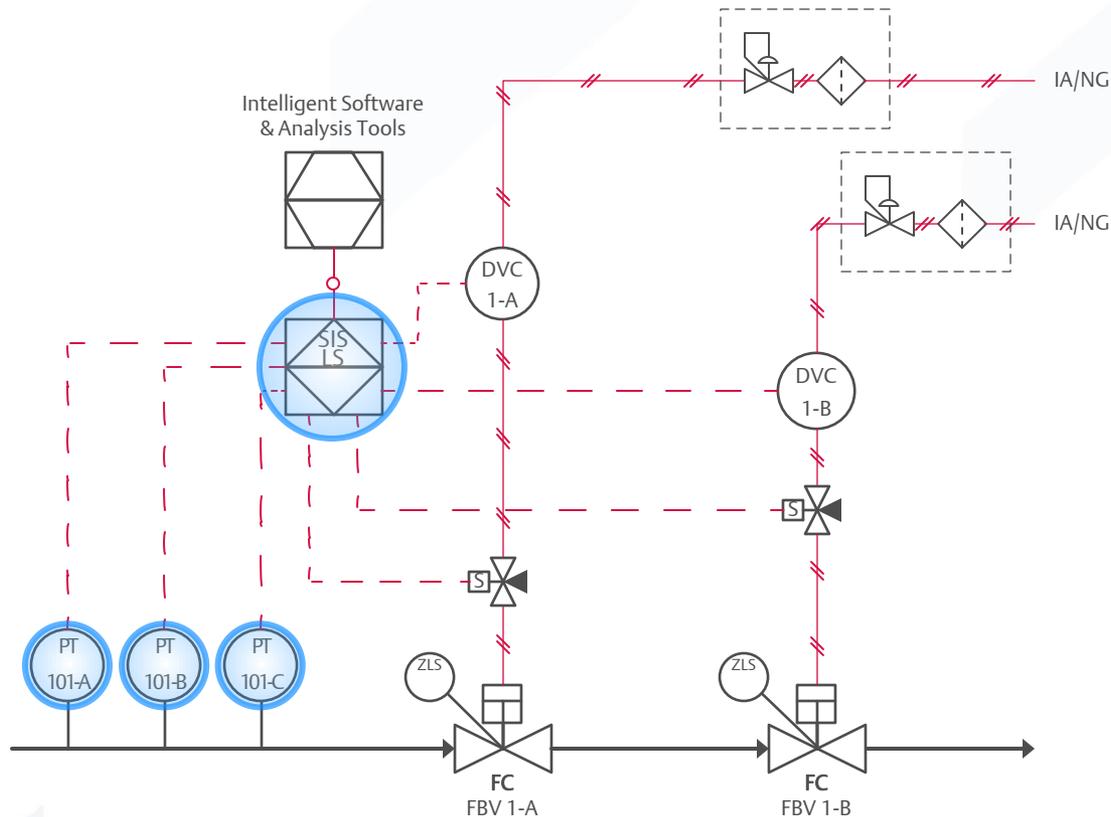
Redundant Pressure Transmitters

The HIPPS System integrity depends on the accuracy and reliability of the pressure transmitters to initiate the shutdown sequence.

The 3051S Pressure Transmitter runs continuous diagnostic checks to ensure that the certified SIL 3 capable integrity is maintained.

In addition, the DeltaV SIS complements the HART enabled pressure transmitter and provides deviation monitoring and safety loop testing; from sensor, to logic solver.

- Continuous HART diagnostics
- Built in transmitter test
- Integral loop test verifies loop wiring and transmitter output
- Can detect plugged impulse line



Pressure Sensor Test

Logic Solver Test

SOV Pulse Test

Partial Stroke Test

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

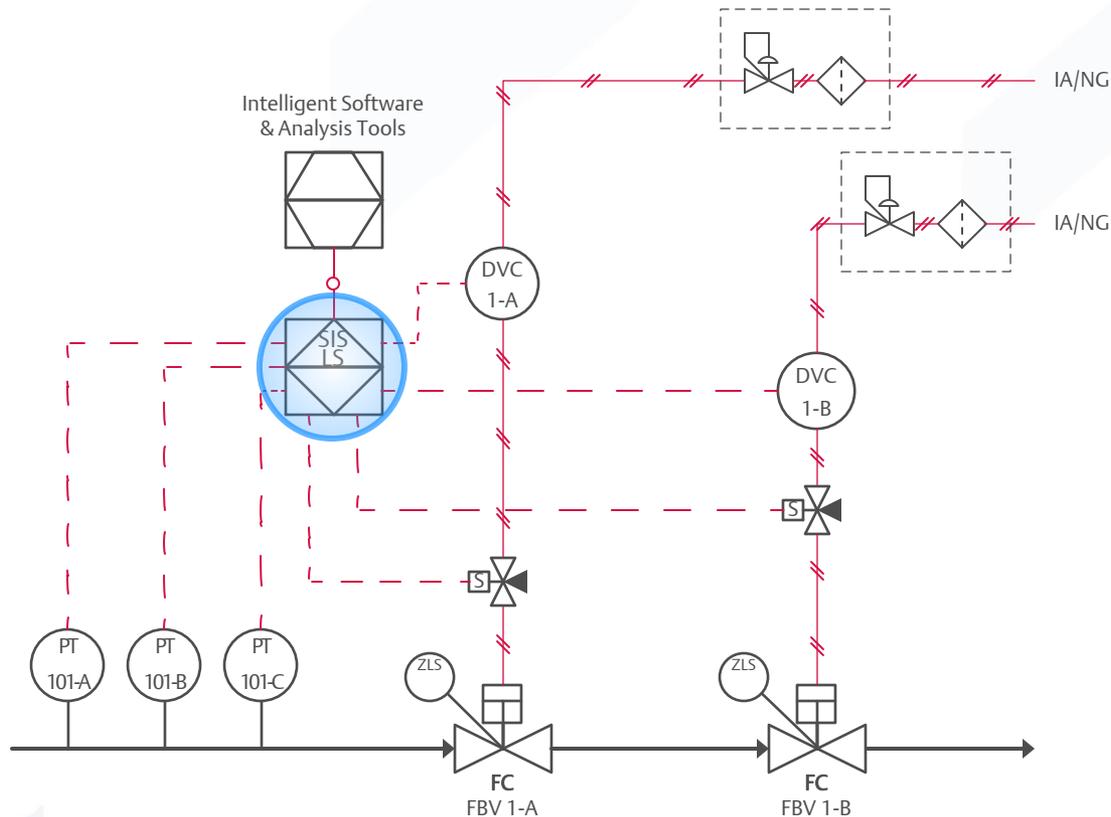
On-Line System Testing

Safety Logic Solver Test

The DeltaV SIS CHARMS Safety Logic Solvers eliminate the single point of failure and continuously monitors system diagnostics and tests the health of each SIS loop.

The DeltaV SIS provides integrated monitoring for the complete safety loop; from sensor, to logic solver, to final control element and provides test notifications so your SIS integrity remains stable for a longer period of time.

- Automatic proof test notifications
- 61508 and 61511 compliant
- Constant loop health diagnostics
- Maintains SIS integrity



Pressure Sensor Test

Logic Solver Test

SOV Pulse Test

Partial Stroke Test

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

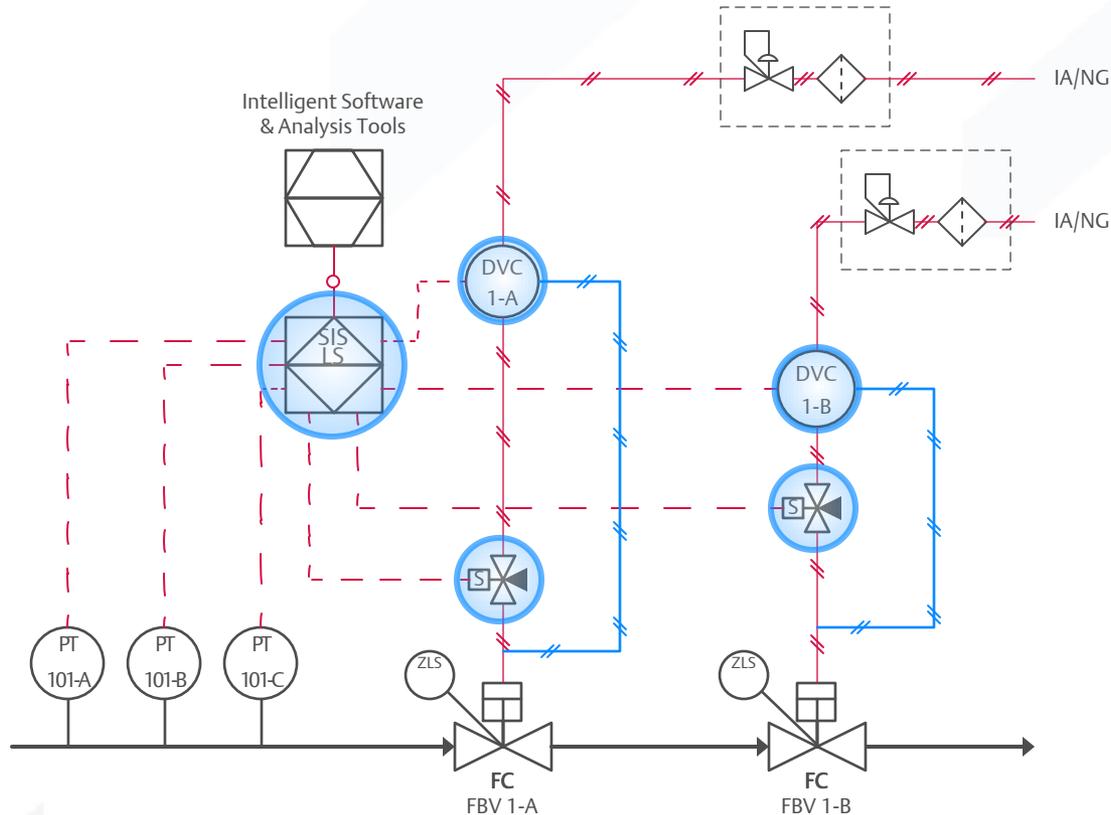
On-Line System Testing

Solenoid Operated Valve Testing

It is critical to ensure the entire final element is available during a safety demand, even when proof test intervals are extended with the help of online partial stroke tests. Including the solenoid operated valve (SOV) in online testing can help diagnose dangerous failure modes between proof tests.

The Fisher FIELDVUE DVC6200 SIS digital valve controller can be used to monitor the health of an external SOV:

- Logic Solver briefly pulses the SOV
- DVC monitors SOV to detect pressure drop across SOV
- Pulse speed ensures the final control element does not move
- Utilizes on-board pressure sensors to record the pressure drop across the SOV
- Applies time/date stamp to support recordkeeping requirements



Pressure Sensor Test

Logic Solver Test

SOV Pulse Test

Partial Stroke Test

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products

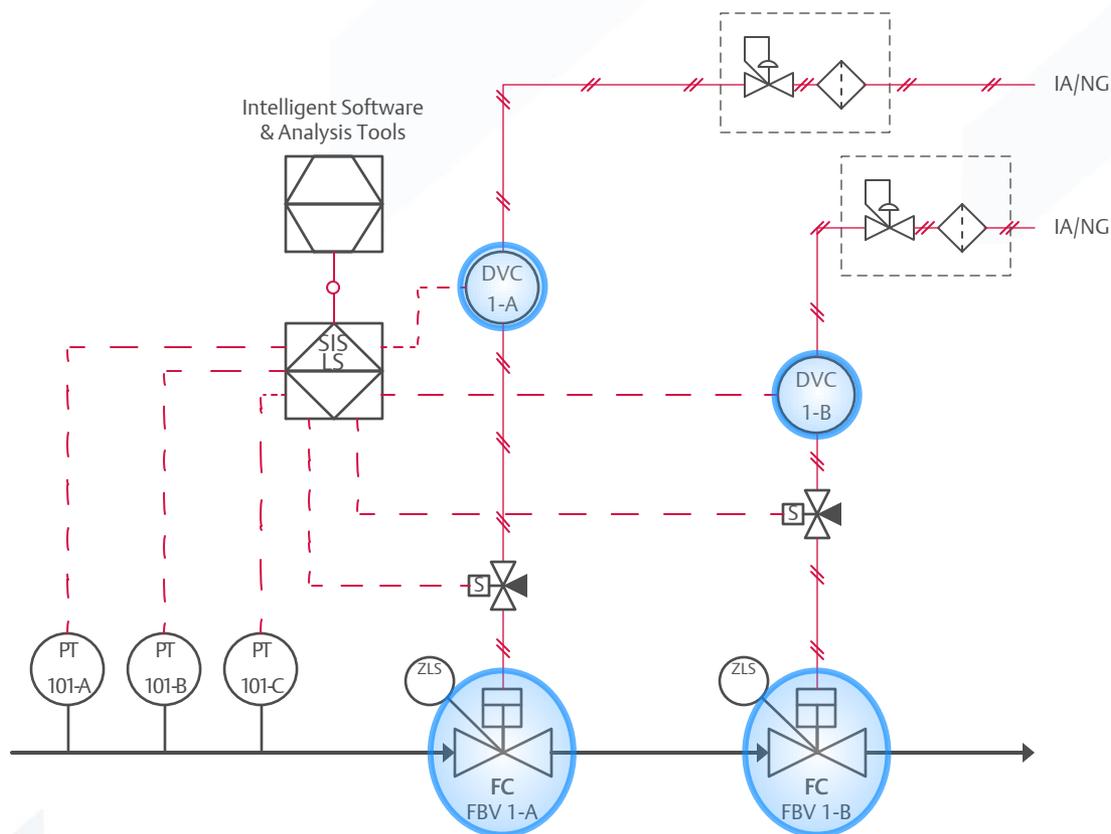
On-Line System Testing

Partial Stroke Testing

HIPPS requires partial stroke testing to safely extend the time between proof test intervals.

The results are improved system performance and valve diagnostic capability. Many customers also appreciate the reduction in testing time and initial investment cost while minimizing spurious trips.

- SIL 3 capable safety shutdown
- Automated Valve PST
- Spurious trip avoidance
- Integral position transmitter



Pressure Sensor Test

Logic Solver Test

SOV Pulse Test

Partial Stroke Test

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

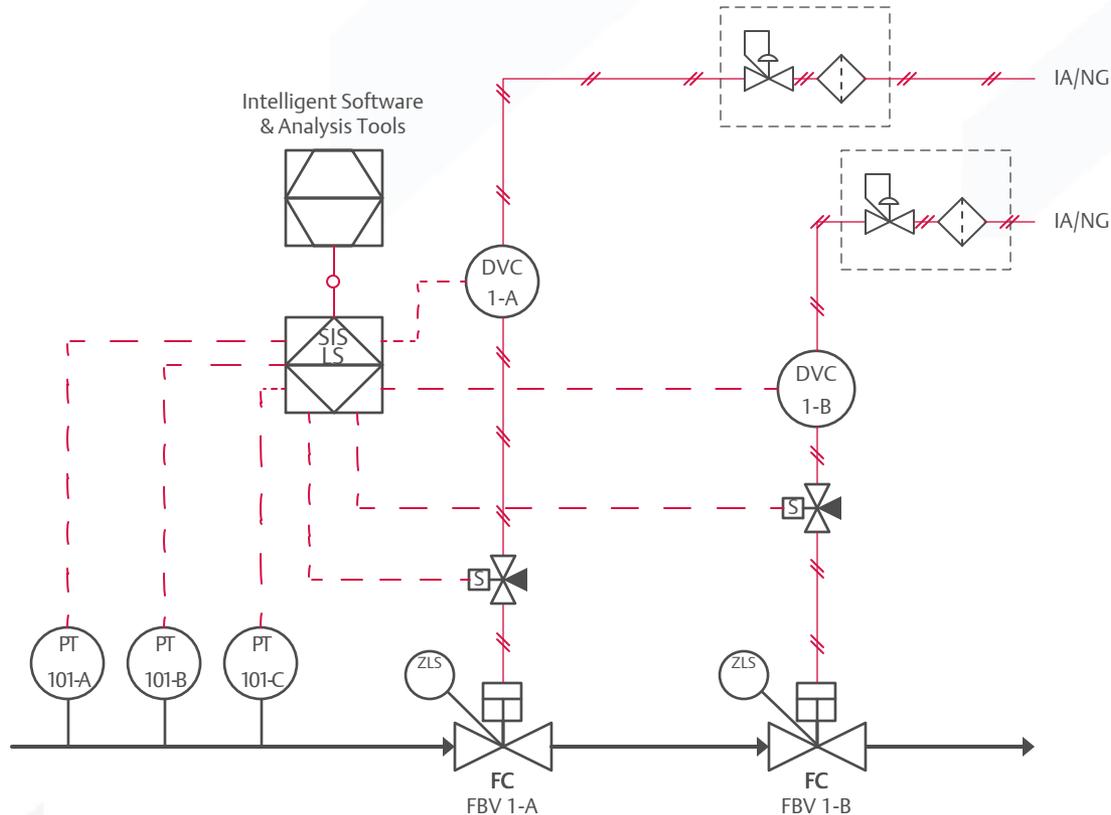
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



Featured Products

Emerson has a complete portfolio of high integrity components that can be used in the design of a HIPPS system.

All of our products are rated best in class and include embedded diagnostics that help to minimize systematic failures and ensure compliance with functional standards throughout the system lifecycle.

- ⊕ *Rosemount™ Pressure Transmitters*
- ⊕ *Bettis™ Actuators*
- ⊕ *Fisher™ / Virgo™ Valves*
- ⊕ *Fisher FIELDVUE® Digital Valve Controllers*
- ⊕ *ASCO® Solenoid Valves*
- ⊕ *Topworks™ D-ESD Switchbox*
- ⊕ *DeltaV SIS™ CHARMs Safety Logic Solver*
- ⊕ *AMS Suite: Intelligent Device Manager*
- ⊕ *AMS ValveLink™ Snap-on™ Software*
- ⊕ *Fisher Regulator Technologies*

Rosemount Pressure Transmitters

Bettis Actuators

Fisher / Virgo Valves

Fisher DVC

ASCO Solenoids

Topworx

DeltaV SIS

AMS Suite

AMS ValveLink

Fisher Regulators

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

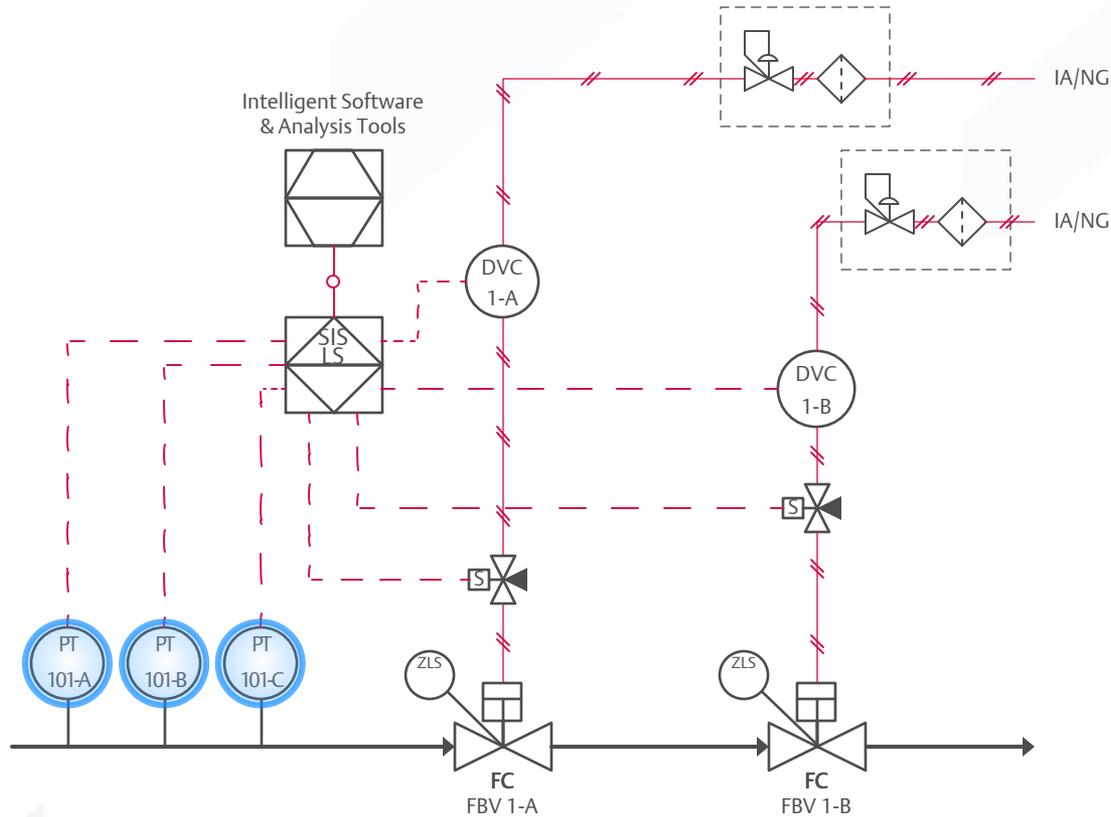
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



Featured Products

Rosemount™ 3051S Pressure Transmitters

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. The 3051S can detect plugged impulse line via SMART diagnostic (using HART), allowing DeltaV SIS to take appropriate action and increasing the Diagnostic Coverage of the HIPPS.

Pressure, level and flow applications are all covered by Rosemount Pressure Transmitters.

- Plugged Impulse Line Detection
- Proven Accuracy, 0.025% of span
- Process Intelligence
- Advanced Diagnostics
- SIL 3 Capable



Rosemount Pressure Transmitters

Bettis Actuators

Fisher/Virgo Valves

Fisher DVC

ASCO Solenoids

Topworx

DeltaV SIS

AMS Suite

AMS ValveLink

Fisher Regulators

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

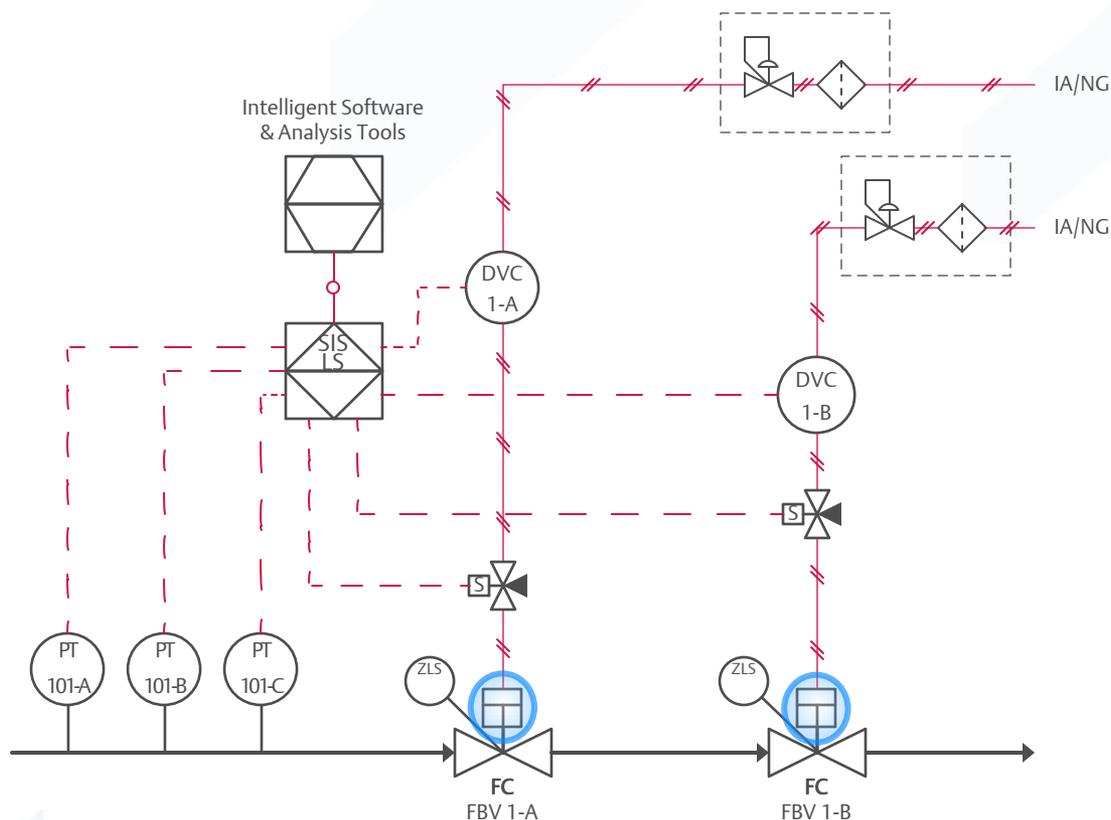
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

Featured Products



Featured Products

Bettis Actuators

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 conditions for many years, with maximum reliability.

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



Rosemount Pressure Transmitters

Bettis Actuators

Fisher/Virgo Valves

Fisher DVC

ASCO Solenoids

Topworx

DeltaV SIS

AMS Suite

AMS ValveLink

Fisher Regulators

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

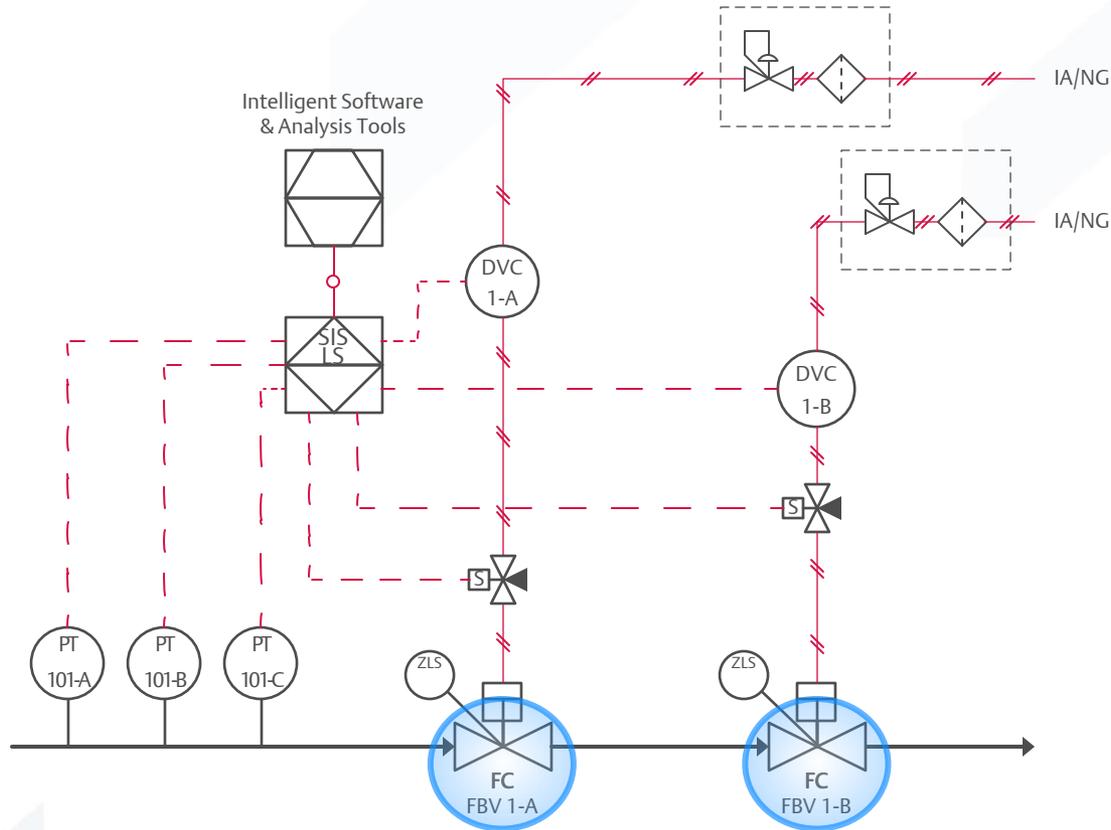
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

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Fisher / Virgo Valves

Virgo ball valves and triple offset valves are designed using the latest engineering tools including Pro-E, Computational Fluid Dynamics (CFD), and Finite Element Analysis (FEA) to ensure our products are safe, reliable and perform as specified.

Our design and manufacturing is validated with an industry leading in-house test facility. Not only do we ensure Virgo products are made according to exceptional quality standards, our facility can certify that our products are compliant to the latest standards and regulations.



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HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

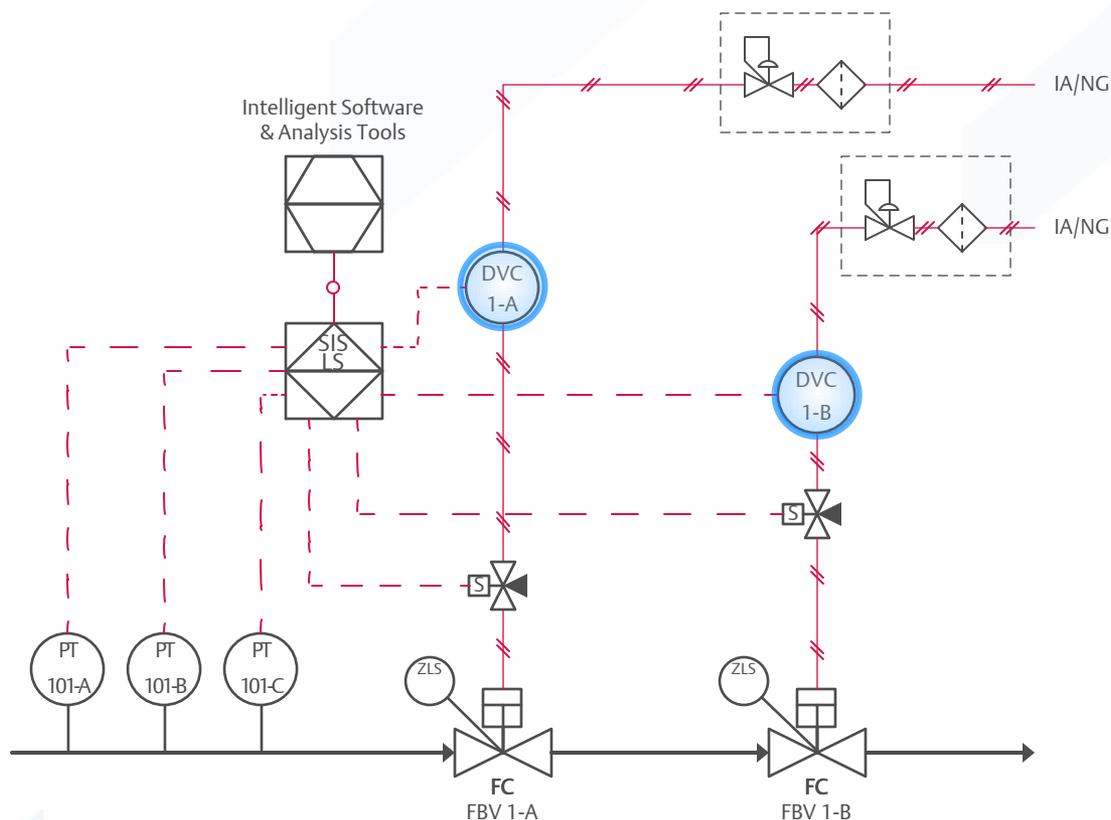
Pressure Sensing Loops

Logic Solver

Final Elements

On-Line System Testing

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Featured Products

Fisher FIELDVUE Digital Valve Controllers

Using Fisher FIELDVUE DVC6200 SIS 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 and your process offline. With vital diagnostics, facilities can be confident that the final control element will perform when needed.

- Safety function priority
- SIL 3 capable shutdown
- Spurious trip avoidance
- Robust linkage-less design
- Easily verify and record final element performance
- Integral SIL 2 capable position transmitter reduces valve hardware needs

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Overpressure Protection System Types

System Justification

Solution Engineering

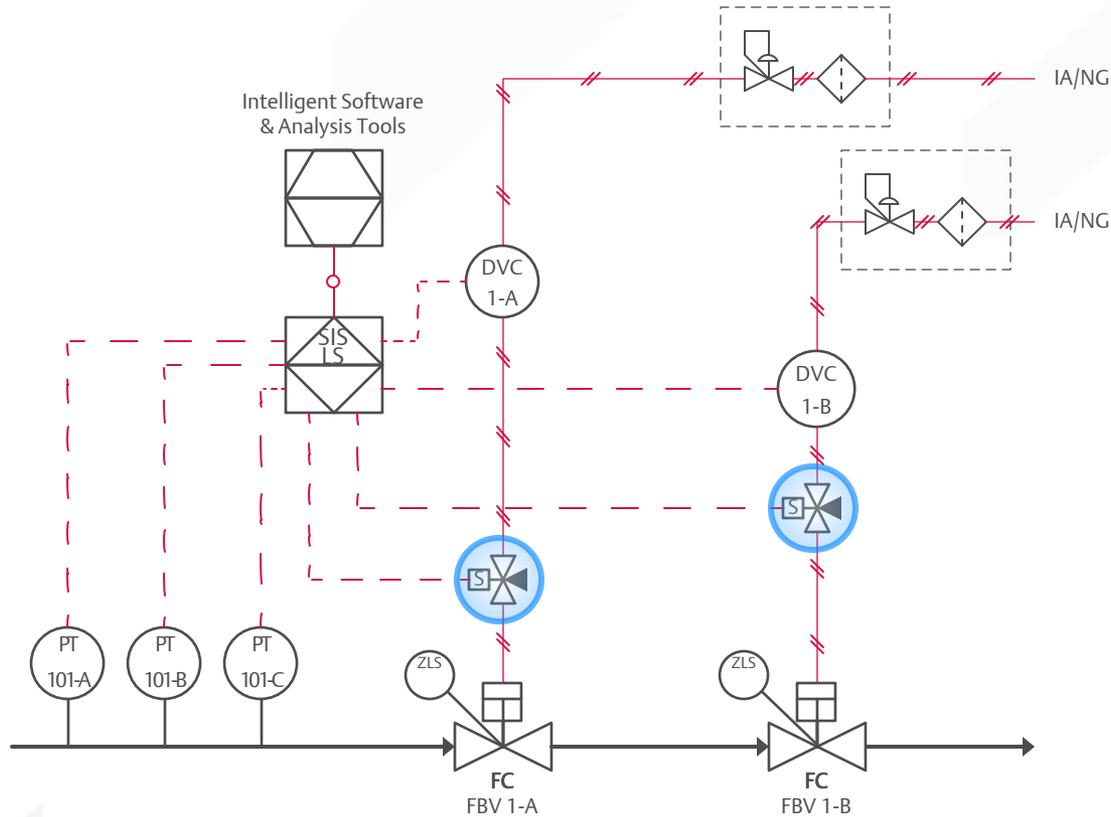
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Logic Solver

Final Elements

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ASCO Solenoid Valves

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

ASCO solenoid valves can deliver higher performance ratings for less power. This means less maintenance and power consumption for remote applications and increased reliability all-around.

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



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Fisher Regulators

HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

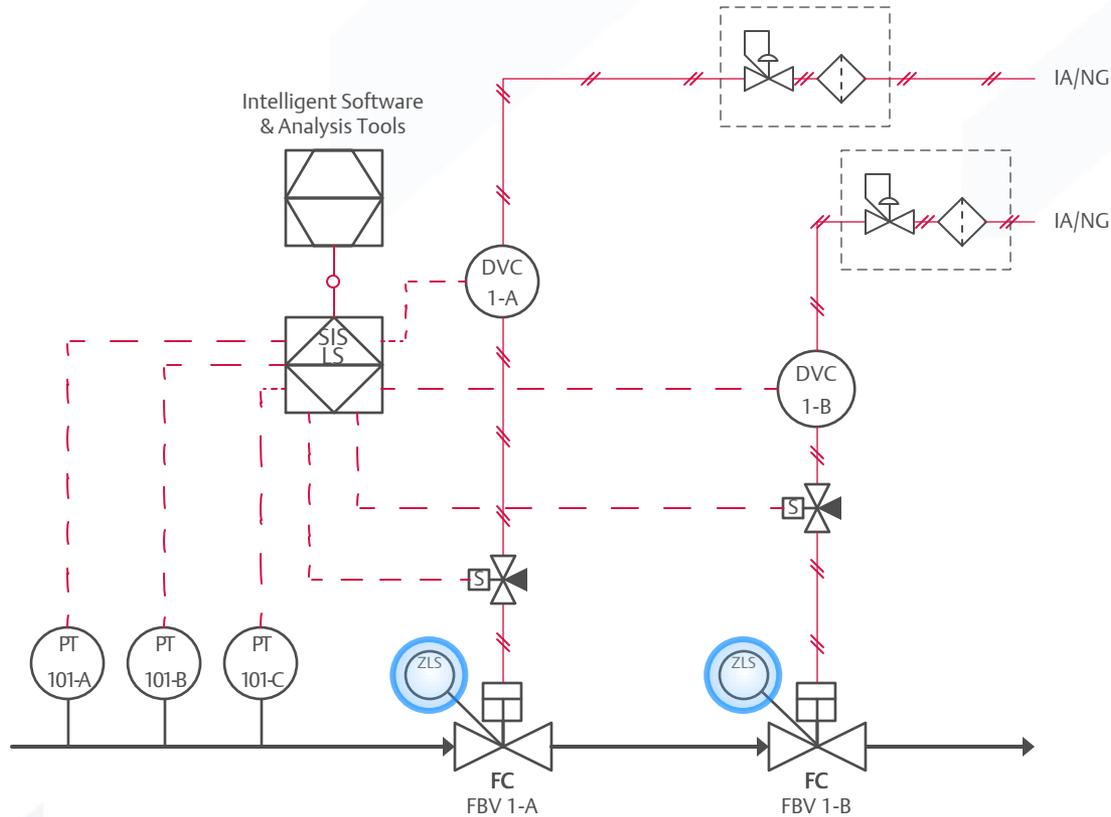
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Logic Solver

Final Elements

On-Line System Testing

Featured Products



Featured Products

TopWorx D-ESD Switchbox

SIL-3 Capable Emergency Shutdown (ESD) Valve Controller that provides a complete partial stroke test (PST) solution with unique features and functionality that enables local partial stroke testing of final control element without disrupting or shutting down the process, a fully integrated solution with all controls in a single housing.

- Local PST capability
- Pass/Fail indication
- Feedback to logic solver
- Diagnostics



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HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

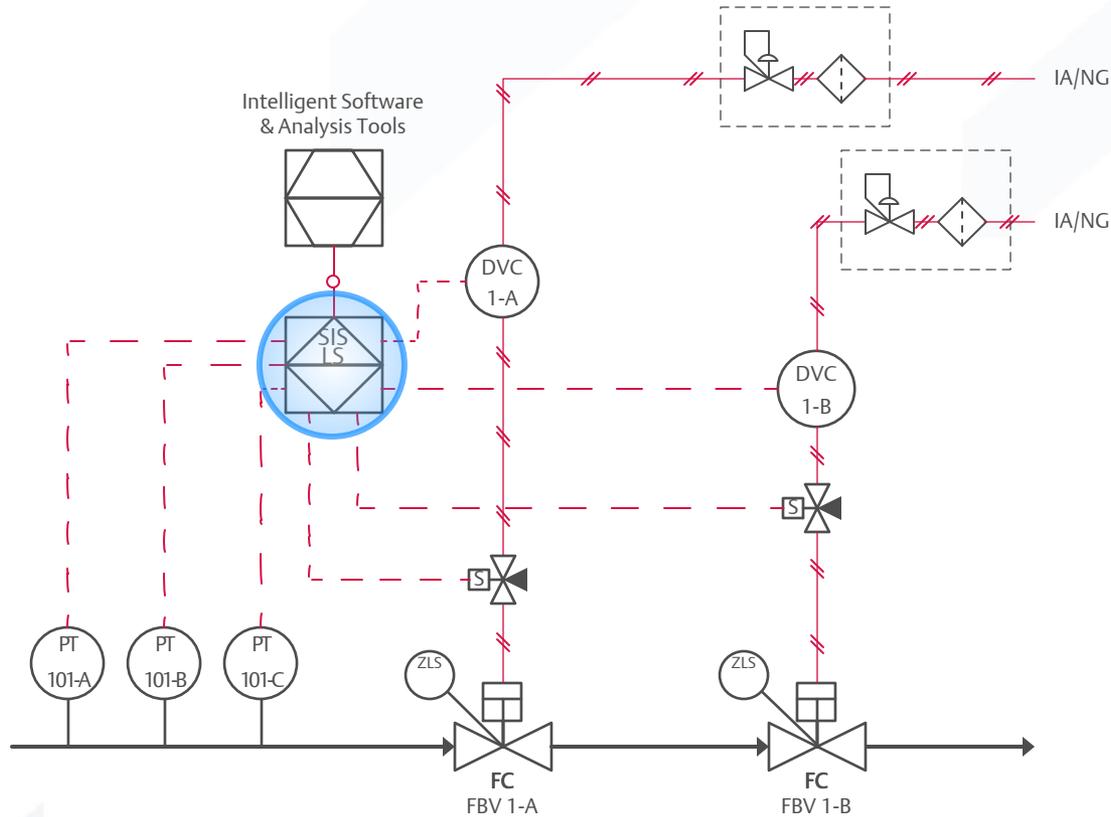
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Logic Solver

Final Elements

On-Line System Testing

Featured Products



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DeltaV SIS CHARMS Safety Logic Solver

Traditional process safety systems for HIPPS functions were designed for large central systems with large I/O counts. If the central unit failed, all the safety loops fail, and caused a huge focus on the logic solver.

The DeltaV SIS CHARMS Safety Logic Solvers eliminate the single point of failure and continuously monitors and tests health of all SIS loops. In addition, DeltaV SIS is an integral part of final element testing which can extend time between proof tests.

- Comprehensive diagnostics
- Reduced engineering
- Streamlined proof tests
- Simplified compliance
- Flexible integration
- SIL3 capable

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Overpressure Protection System Types

System Justification

Solution Engineering

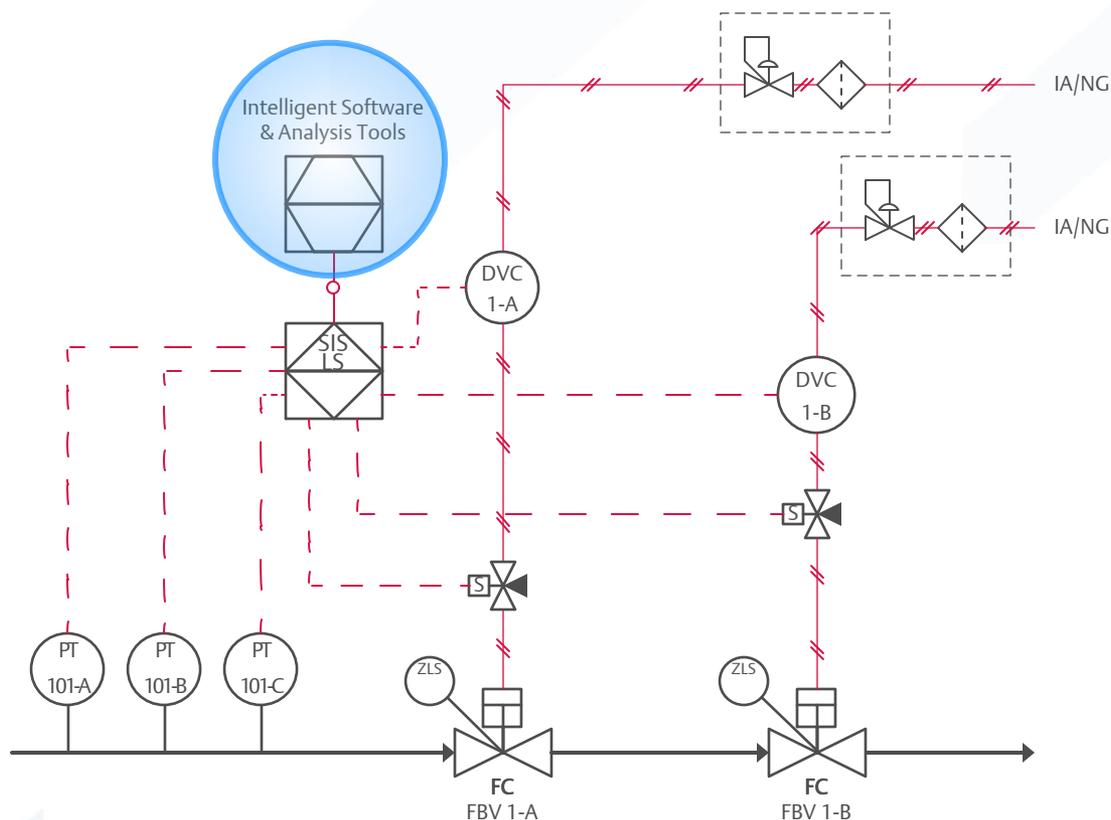
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Logic Solver

Final Elements

On-Line System Testing

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Featured Products

AMS Suite: Intelligent Device Manager

AMS Device Manager delivers the HIPPS system with the ability to perform on line tests that helps to avoid unplanned shutdowns and avoids a reduction of system integrity over time.

It gives your maintenance and operations personnel the ability to work smarter. Based on real-time condition data from your intelligent field devices, AMS can give your plant staff the diagnostic alerts they need to respond quickly and make informed decisions on whether to maintain or replace field devices.

- Real-time analytics and reporting
- Safety asset performance protection
- Supports online testing
- Identifies bad actors before shutdown
- Predictive intelligence improves reliability

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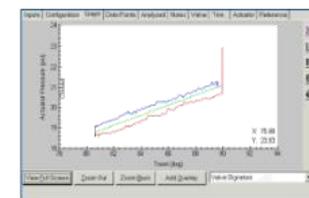
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HIPPS System Description

Overpressure Protection System Types

System Justification

Solution Engineering

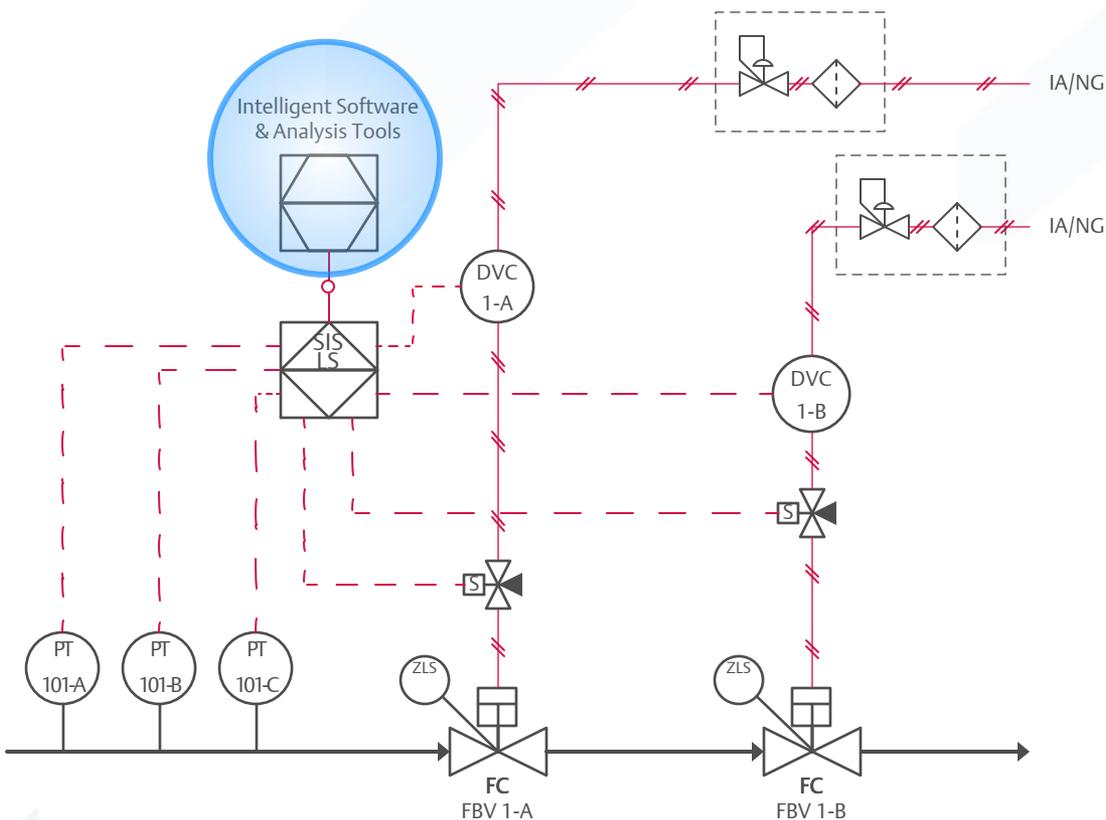
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AMS ValveLink Snap-on Software

ValveLink Software is used for easy setup, calibration, configuration, and diagnostics with Fisher FIELDVUE DVC digital valve controllers and provides real-time notifications of current and potential instrument problems when used with the Performance Diagnostics.

Advanced diagnostics allow for insight of valve performance, or degradation that would otherwise go unseen. It can be used as an excellent preventative maintenance tool and provides insight into your valves.

- Complete valve diagnostics
- Initial valve and rebuild baselines
- Actionable alerts
- Partial / full stroke SIS testing
- Valve health monitoring

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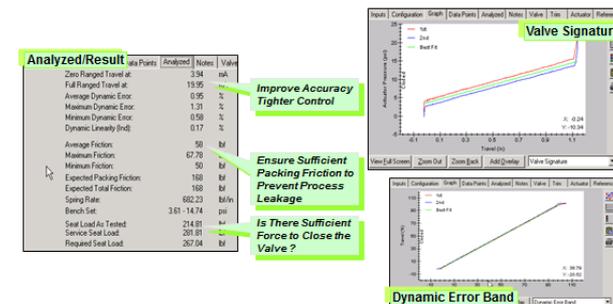
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HIPPS System Description

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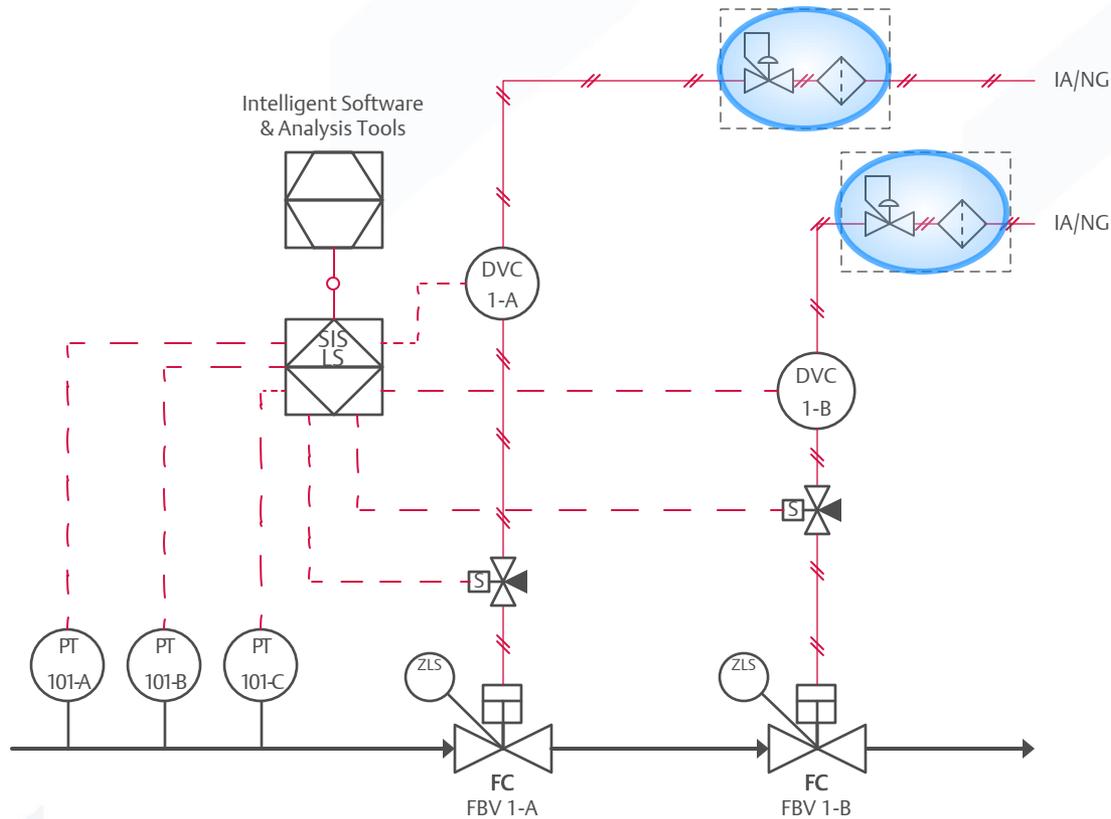
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Logic Solver

Final Elements

On-Line System Testing

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Fisher Regulator Technologies

Pneumatic actuators in HIPPS applications require a high quality, precision supply of air or gas for consistent, reliable operation.

Fisher filter regulators are engineered to remove debris and to eliminate supply gas leakage. The integrated filtration system optimizes the quality of supply gas to increase HIPPS system reliability.

- Sour Gas Service Capability
- Easy Maintenance
- Rugged Compact Design
- No Air Loss
- Smart Bleed



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