High Integrity Pressure Protection Systems (HIPPS)

Technical brochure

ISS INTEGRATED SMART SOLUTIONS BY AMPO POYAM VALVES

Commitment made of steel

1. COMPANY PROFILE

AMPO is an **international leader** in highly engineered valves and Integrated Smart Solutions for the most severe applications and industries as well as in stainless steel and high alloy castings. Through our AMPO SERVICE team **we guarantee a prompt response** to customer needs wherever they are throughout the world: technical support in start-up stages, equipment selection, predictive and preventive maintenance, training, etc.

Fully inhouse manufacturing process

Worldwide references

Project based on people

Innovative spirit

700+ people

In more than 60 countries

Most important partners in the industry

Cutting edge technologies

Our commitment: the best service

Customer focus

Since 1964

2. APPLICATION

SAFETY INSTRUMENTED SYSTEMS (SIS)

Safety Instrumented Systems (SIS) have been used for many years to perform Safety Instrumented Functions (SIFs) in the process industries. If instrumentation is to be effectively used for SIFs, it is essential that these instrumentations achieves certain minimum standards.

IEC 61508
Functional Safety of Electrical/ Electronics/Programable Electronic Safety-Related System

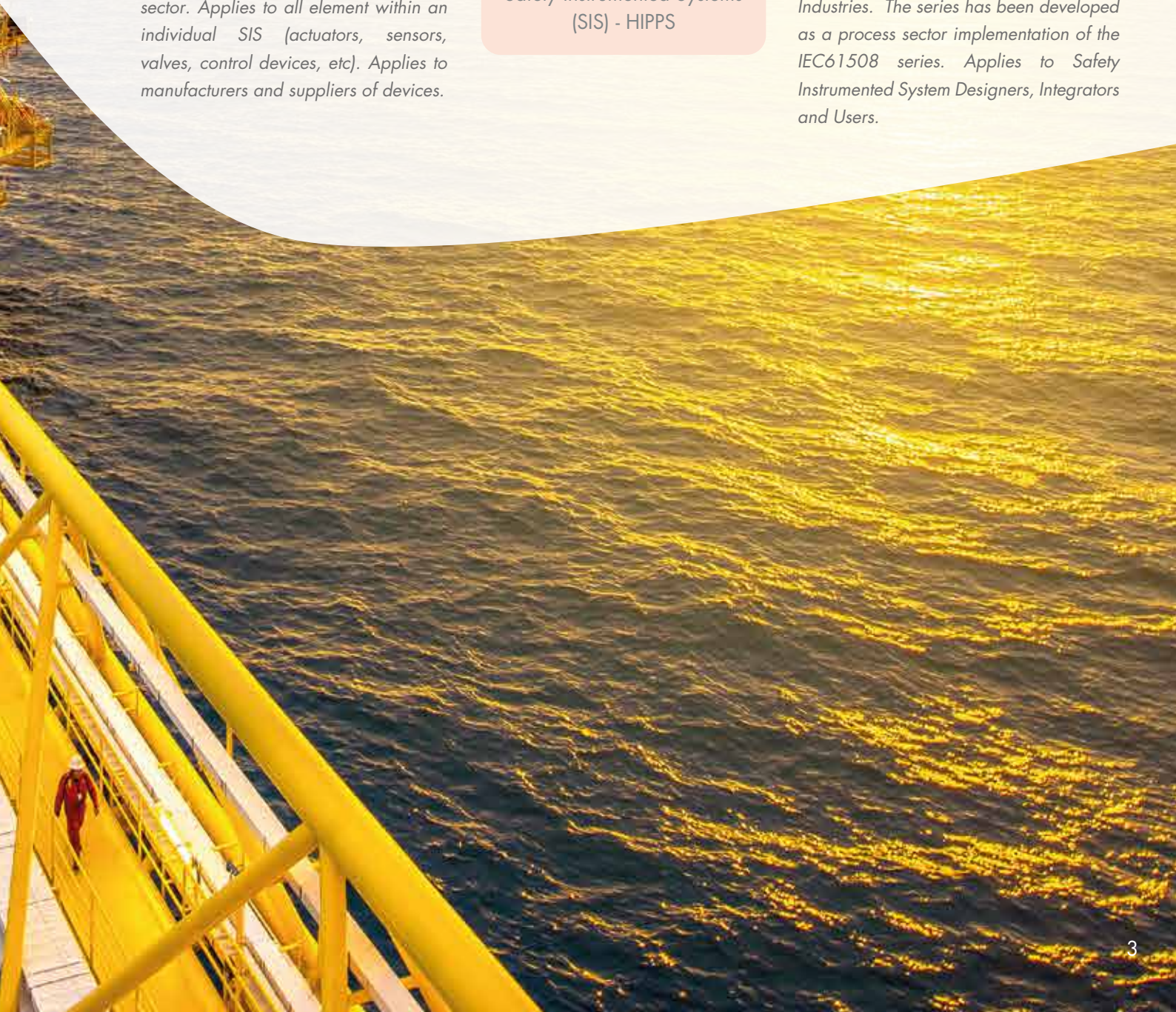
IEC 61511
Safety Instrumented Systems for The Process Sectors

Safety Instrumented Function (SIF)

Safety Instrumented Systems (SIS) - HIPPS

**The IEC61508 series is to facilitate the development of product and application sector. Applies to all element within an individual SIS (actuators, sensors, valves, control devices, etc). Applies to manufacturers and suppliers of devices.*

**The IEC61511 series addresses the application of SISs for the process Industries. The series has been developed as a process sector implementation of the IEC61508 series. Applies to Safety Instrumented System Designers, Integrators and Users.*



SAFETY INTEGRITY LEVEL (SIL) AND FAULT TREE ANALYSIS (FTA) FOR HIPPS:

Safety integrity level (SIL) is defined as a relative level of risk-reduction associated with a specific hazard provided by a safety function or to specify a target level of risk reduction. In simple terms, SIL is a measurement of performance required for a SIF. In the IEC 61508 standard, four SILs are defined, with SIL 4 the most dependable and SIL 1 the least.

Safety Integrity Level (SIL)	Probability of Failure on Demand	Risk Reduction Factor	Safety Availability in %
4	$>=10^{-5}$ to $<10^{-4}$	100,000 to 10,000	99.99 to 99.999
3	$>=10^{-4}$ to $<10^{-3}$	10,000 to 1,000	99.9 to 99.99
2	$>=10^{-3}$ to $<10^{-2}$	1,000 to 100	99 to 99.9
1	$>=10^{-2}$ to $<10^{-1}$	100 to 10	90 to 99

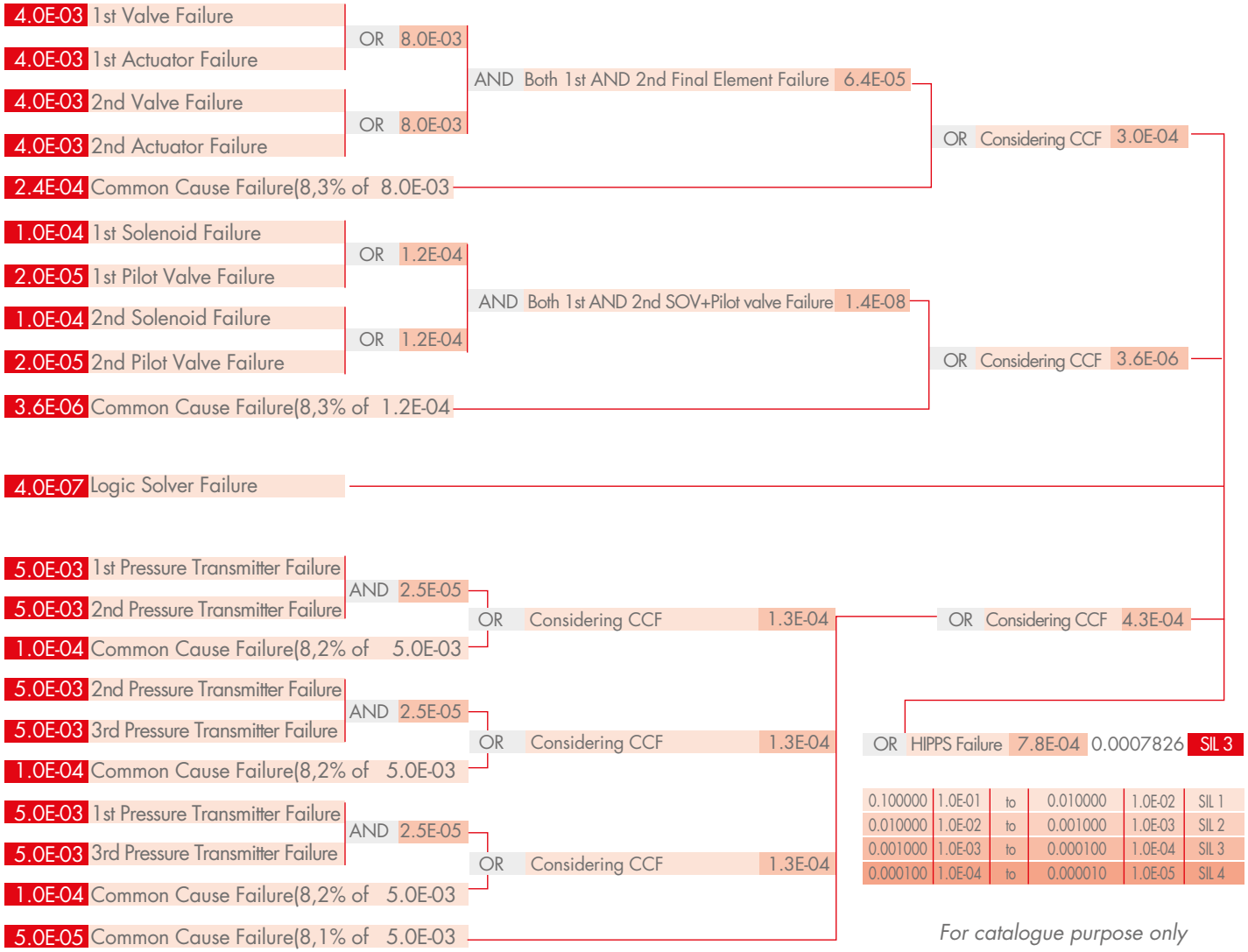
For the end-user, there are several methods used to assign a SIL. Risk Matrix, Risk graphs and Layers of Protection Analysis (LOPA) are techniques that are considered by the standard to determine the level of risk for protection by the SIS.

Hazards of a process system must be identified then analyzed through risk analysis. Mitigation of these risks continues until their overall contribution to the hazard are considered acceptable. The tolerable level of these risks is specified as a safety requirement in the form of a target 'probability of a dangerous failure' in a given period of time, stated as a discrete SIL.

The supplier in turn, typically use Fault tree analysis (FTA) to justify the offered system to the required SIL. Any sufficiently complex system is subject to failure as a result of one or more subsystems failing. The likelihood of failure, however, can often be reduced through improved system design.

Fault tree is a top-down, deductive failure analysis which maps the relationship between faults, subsystems, and redundant safety design elements by creating a logic diagram of the overall system. A single fault tree is used to analyze one and only one undesired event, which may be subsequently fed into another fault tree as a basic event. The most severe conditions require the most extensive fault tree analysis.

High Integrity Pressure Protection System Fault Tree Anaysis



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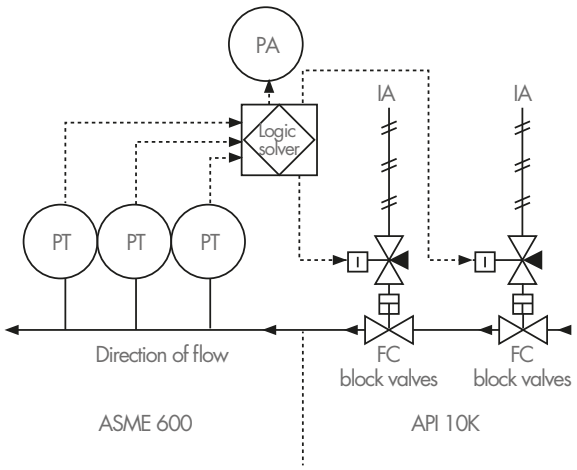
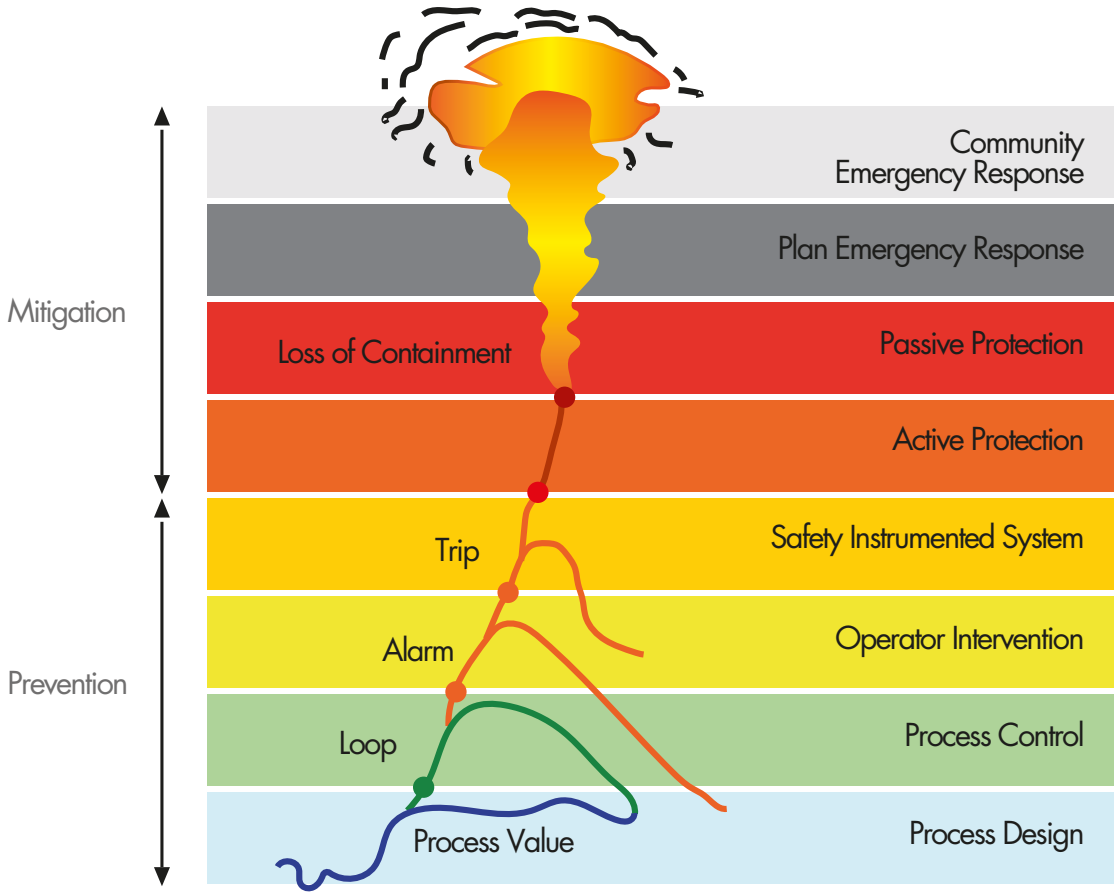
Some use both fault trees and event trees (Probabilistic Risk Assessment). An event tree starts from an undesired initiator (loss of critical supply, component failure etc.) and follows possible further system events through to a series of final consequences. As each new event is considered, a new node on the tree is added with a split of probabilities of taking either branch. The probabilities of a range of 'top events' arising from the initial event can then be seen.

HIPPS System Layout - Standard configuration



3. HIGH INTEGRITY PRESSURE PROTECTION SYSTEMS (HIPPS)

HIPPS is a SIF applied to prevent over-pressurisation of a plant or pipeline by isolating and containing the source of the high pressure and protect the low-pressure line. It is the last line of defence in preventing loss of containment.

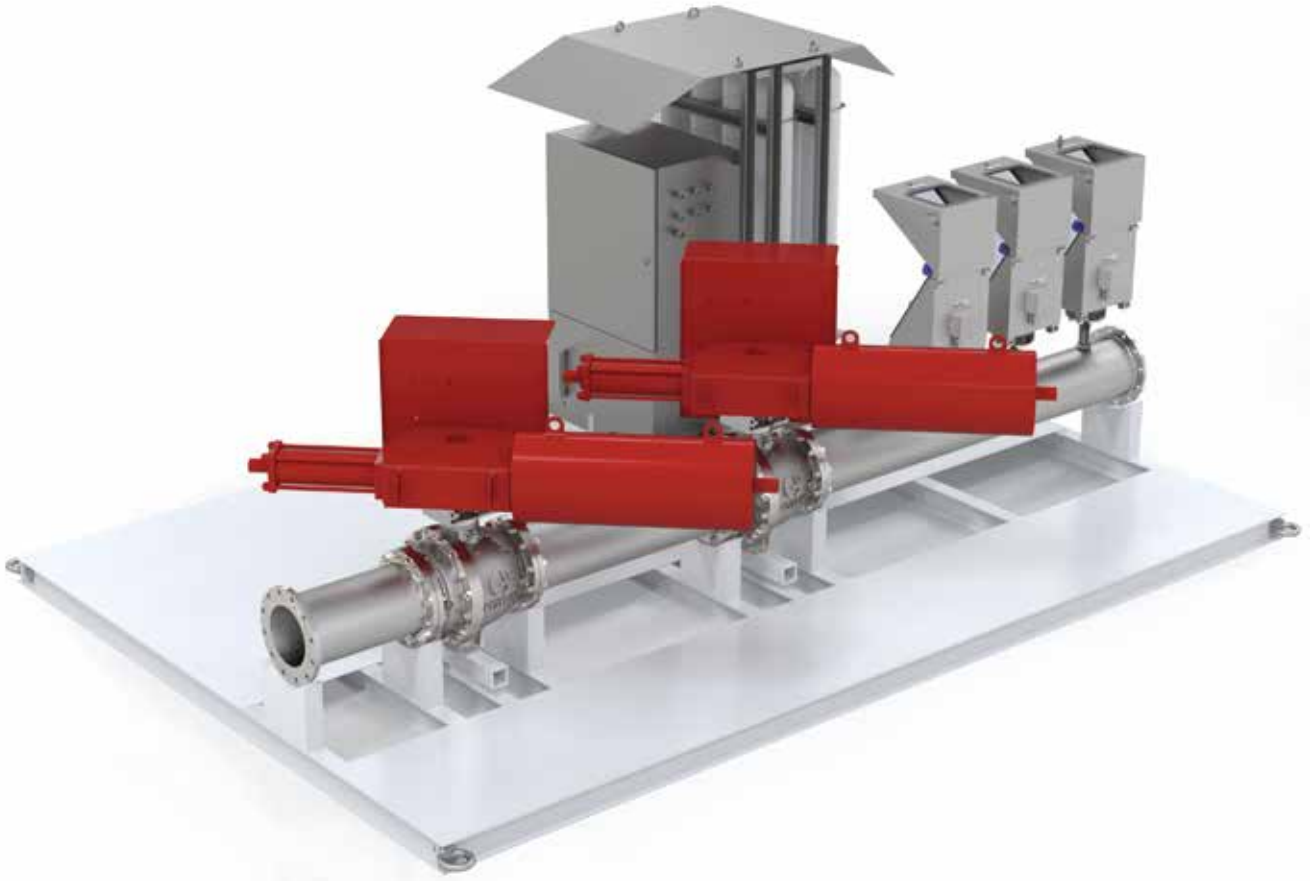


HIPPS is also known as;

HIPS = High Integrity Protection System
IPS = Instrumented Protection System
SSD = Safety Shutdown System
SIS = Safety Instrumented System
OPPS = Overpressure Protection System

It is a complete functional loop comprising three main elements: a final element (valve, actuator and the control panel) to isolate the pipeline, pressure sensors (initiators) to detect a pressure build-up and a controller to check the pressure signal is real rather than spurious, thus avoiding 'no cause' HIPPS activation and to activate isolation when there is a real demand.

Typically for a SIL3 HIPPS, the system consists of two redundant final elements.

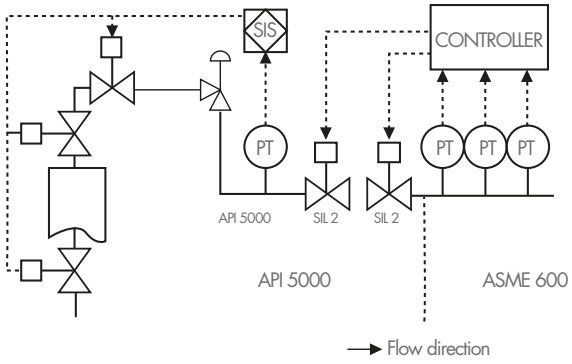


AMPO HIPPS can be found:

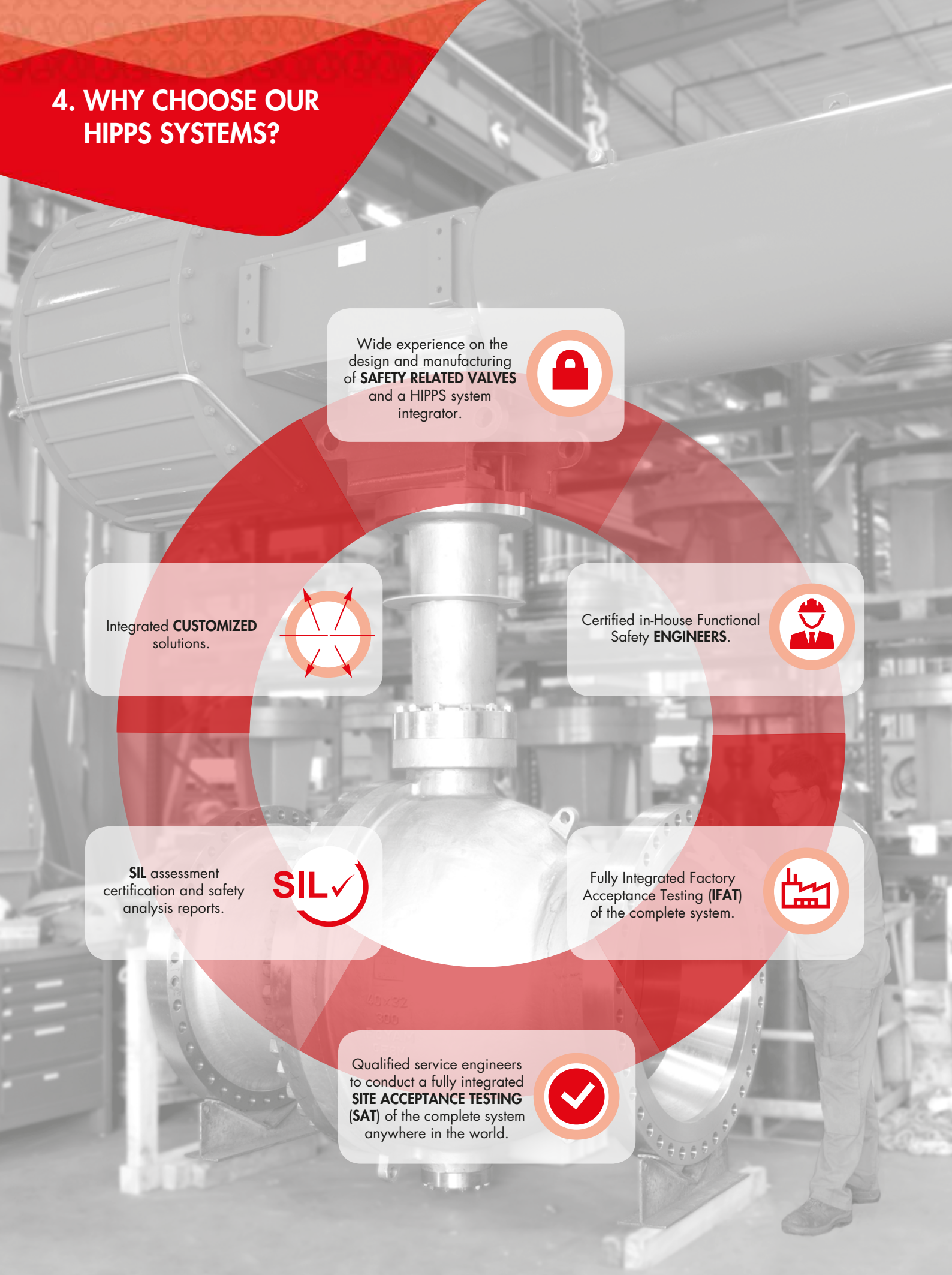
1. On offshore WHP, just after the tree before the spec. break.
2. At the on-shore receiving facilities.
3. On transmission pipelines at take up stations.

Licenses and Certifications:

- API 6A and API 6D
- SIL Certifications for Safety Shutdown Valves
- ISO 9001 : 2008
- CE ATEX
- PED (Pressure Equipment Directive)
- IEC 61511 Stage 4: Life Cycle Design and Engineering of Safety Instrumented Systems - Functional Safety Management



4. WHY CHOOSE OUR HIPPS SYSTEMS?



Wide experience on the design and manufacturing of **SAFETY RELATED VALVES** and a HIPPS system integrator.

Integrated **CUSTOMIZED** solutions.

Certified in-House Functional Safety **ENGINEERS**.

SIL assessment certification and safety analysis reports.

Fully Integrated Factory Acceptance Testing (**IFAT**) of the complete system.

Qualified service engineers to conduct a fully integrated **SITE ACCEPTANCE TESTING** (**SAT**) of the complete system anywhere in the world.

5. TECHNICAL FEATURES

HIPPS SUB-SYSTEMS

1. INITIATOR

PRESSURE TRANSMITTERS

Pressure transmitters monitor the pipeline pressure against a pre-defined limit. The number and types of transmitters and their voting systems is a function of the overall SIL requirement. In a HIPPS, pressure transmitter are configured for 2oo3 voting for SIL 3 capable.

MECHANICAL INTERLOCKING MANIFOLD

The Mechanical Interlocking Manifold, or high integrity manifold block (HIMB) is certified by TüV in accordance with IEC 61508 and IEC 61511. In order to prevent operational errors, an interlocking manifold with a fool proof "sliding key" design, is part of the system. This "sliding key" principle will only permit closing and opening of isolating valves and vent valves in a pre-determined safe sequence. This will allow on-line calibration of instruments while preventing any faulty operation and consequently eliminating undesired (nuisance) shut-downs. Concurrently, the interlocking feature ensures that the desired SIL rating of an instrumented system is maintained. The manifold guarantees instrument availability because it will not allow more than one instrument to be isolated at the same time.

2. CONTROLLER

LOGIC SOLVER

The HIPPS logic solver captures signals from the pressure transmitters, and performs a 2oo3 voting logic, before activating the solenoids and closing the pipeline. Two types of TÜV certified logic solvers are available: programmable and solid state, both provide scalable redundancy. Communication to Process Control System available in OPC, Profibus DP and MODBUS.

The controller cabinets can be supplied suitable for hazardous area installation in EEx-d enclosure IP-66 or for safe area installation in standard 19" rack cabinet IP-42.

3. FINAL ELEMENT

Final elements are accorded the highest priority in a HIPPS loop as studies suggest that they account for 50% of safety loop failures historically and calculations suggest that their contribution to PFD avg. is the highest when compared with the initiators and controllers. Thus selection and design of valves and actuator is of paramount importance in a safety loop.

Selection of the final elements depends on reliability of the valve to close on demand, to closes within the design time and to maintain TSO leakage across the valves after shut down.

As Final Element, we offer Systematic Capability (SC) 3 Safety Related Ball Valve both Top Entry and Side Entry (2 piece or 3 piece) with SC3 Hydraulic or pneumatic quarter-turn spring return actuators with related controls to suit the requirement.

Our final element used in a SIS are "proven in use" accordance with IEC61511 and the system is classified as TYPE A in accordance with IEC61508. We have considered our most recent installed base which conservatively gives an operational year of 50,642. Upon request, a detailed reference list can be provided.

6. AMPO SERVICE

Predictive and preventive maintenance

Technical support

Technical training

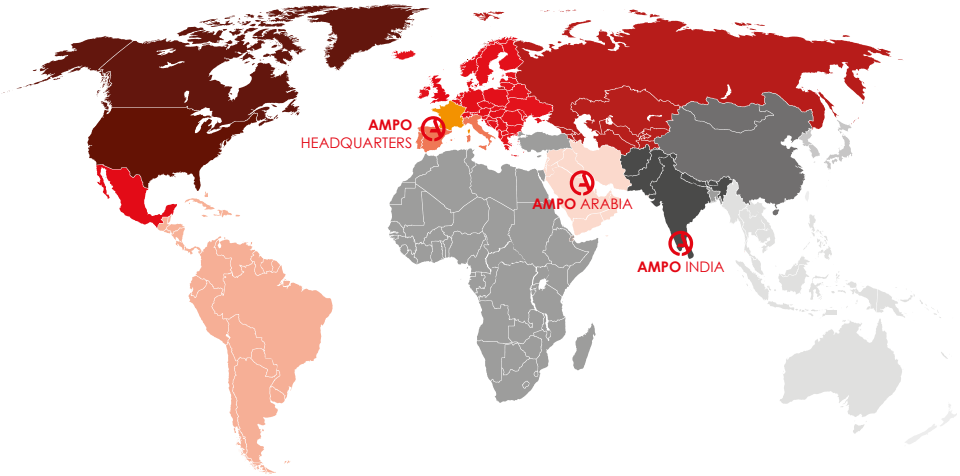
Valve condition monitoring

Spare parts and valve supply

On-site support within 72 hours.
Experience in executing global maintenance service for complete projects.

7. WORLDWIDE SALES AND MANUFACTURING NETWORK

AMPO
POYAM VALVES
Commitment made of steel



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AMPO is just 1 hour drive away from BILBAO (International Airport) and at the following distances from other important places:
65 km west of Pamplona/45 km south of San Sebastian/ 70 km south of the French border.