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HIPPS

Ing A.F.M. Prins

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- What is a **HIPPS**?

  HIPPS stands for **High Integrity Pressure Protection System**

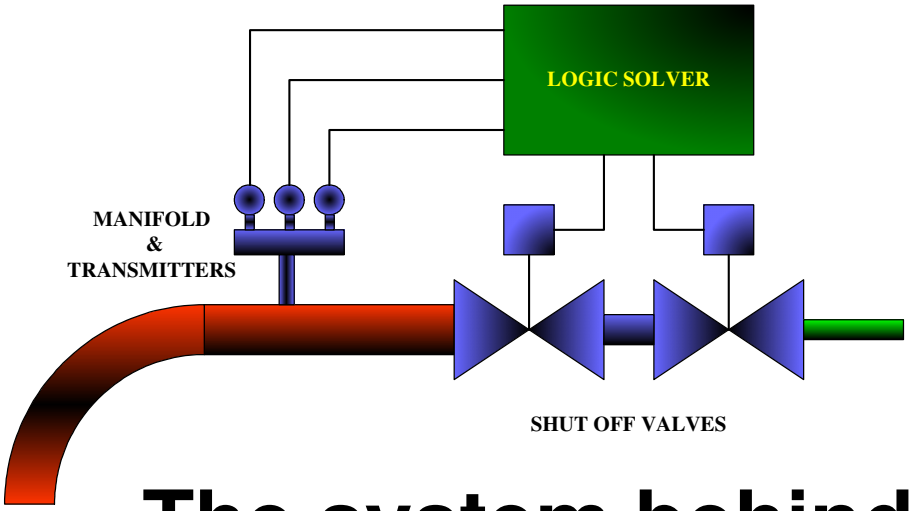
A **HIPPS** is a protection device.

It acts like a fuse;

if the current is too high, the fuse blows.

If the pressure is too high,

the valves close.



The system behind is safe!

HIPPS are used for more than 30 years.

The regulations used are:
German DIN V19250
German DIN 3381

And HIPPS are still used, in high quantities.

Why a HIPPS?

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A HIPPS is or can be a protection against…

- Human casualties
- Environmental damage
- Damage to your Investments
- Penalties due to emissions (no flaring policy)
- Too high investments….?

A HIPPS can be cost saving?

A few Examples:

- De-rating and cost saving of field equipment and piping.
- Lower insurance costs.
- No long shutdown time due to damage.
- Lower personal risks, less casualties and related costs.
- No penalties due to less emissions. (no flaring policy)




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WHAT IS **SAFETY**?

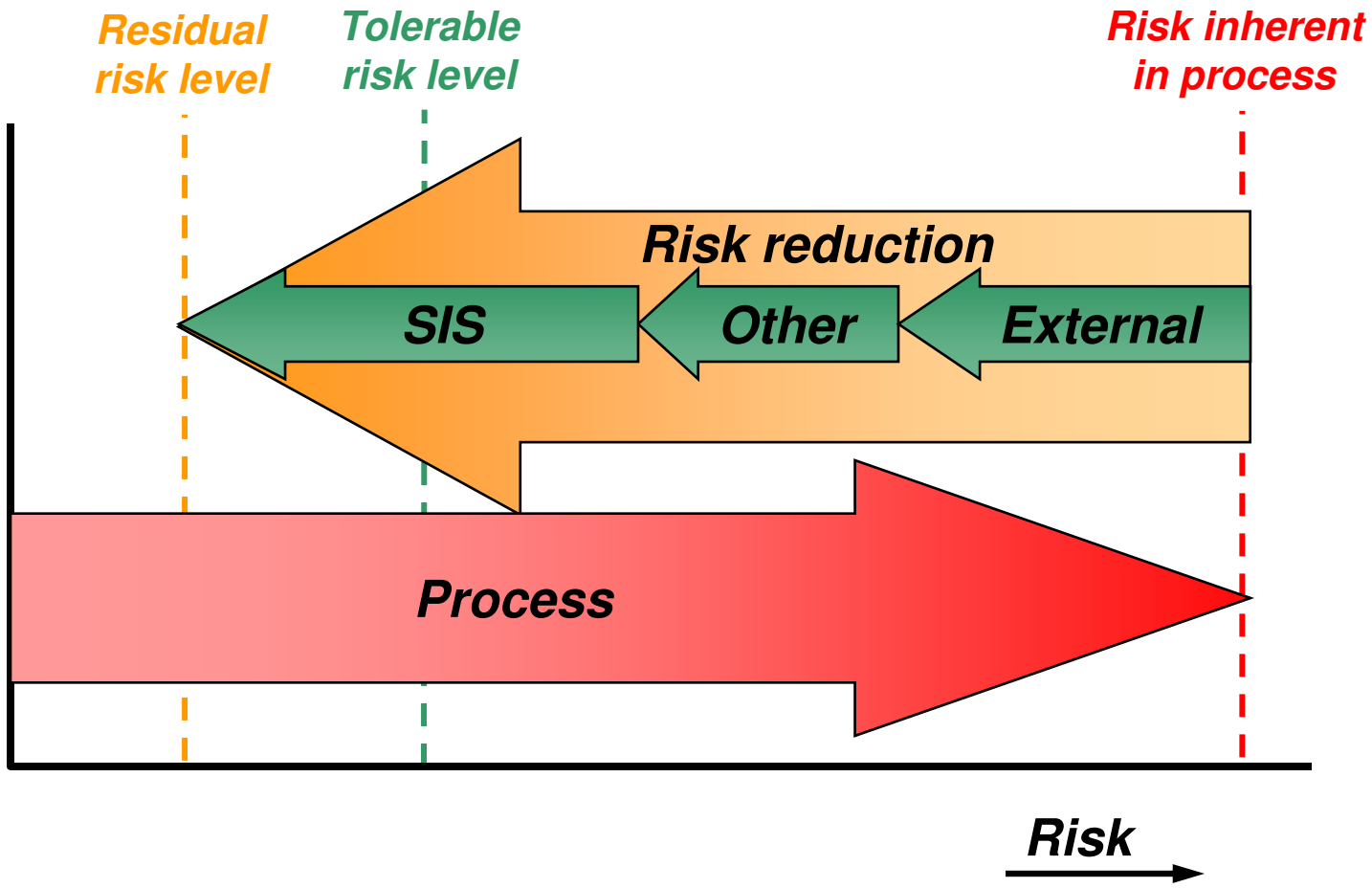
Safety is the Absence or minimization of **risk.**

What is **Risk?** (in relation to Hazard)

Hazard is the potential to cause HARM.

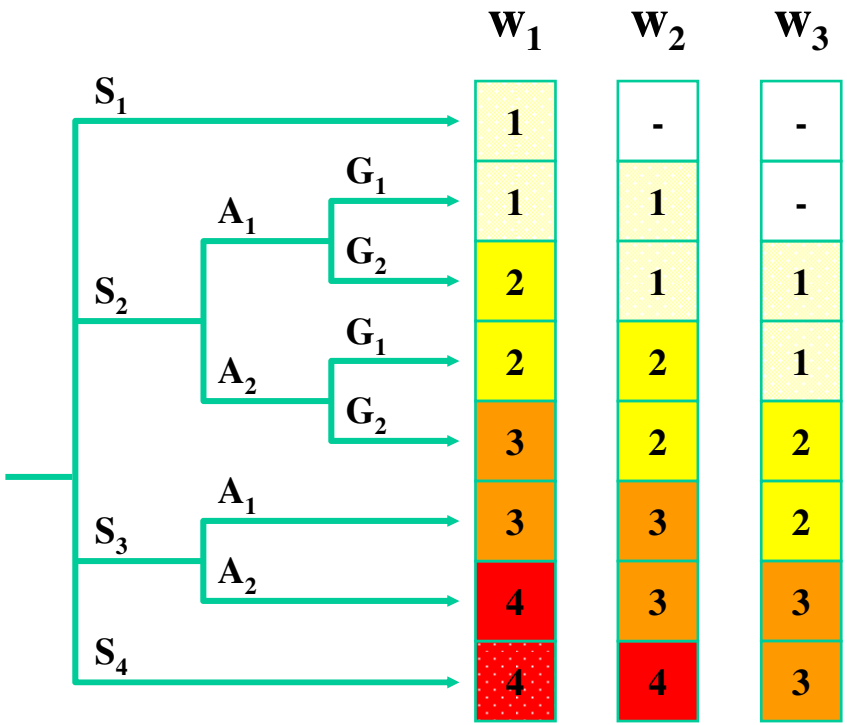
Risk is the like hood of HARM being realized.

process risk



risk graph

- Extent of damage (S)
  - S_1: Minor injury/damage
  - S_2: Serious injury, death of one person
  - S_3: Death to several persons
  - S_4: Catastrophic consequences
- Frequency of exposure (A)
  - A1: Seldom
  - A2: Quite often to permanent
- Avoiding of hazard (G)
  - G1: Possible
  - G2: Almost impossible
- Probability of event (W)
  - W1: High
  - W2: Low
  - W3: Very low



requirements safety instrumented system

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- From the risk graph a *Target SIL* for the SIS will result
- The target SIL indicates the maximum average Probability of failure on demand (PFD) the safety system may have

Safety Integrity Level	Average Probability of failure on demand	Safety Availability	Risk Reduction Factor
4	$\geq 10^{-5}$ to $< 10^{-4}$	> 99.99%	> 10 000
3	$\geq 10^{-4}$ to $< 10^{-3}$	99.9 - 99.99%	1 000 - 10 000
2	$\geq 10^{-3}$ to $< 10^{-2}$	99 - 99.9%	100 - 1 000
1	$\geq 10^{-2}$ to $< 10^{-1}$	90 - 99%	10 - 100
0	(Control NA)		

Industrial standards for safety

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- IEC 61508
  - Functional safety of electrical/electronic/programmable electronic safety-related systems (E/E/PE)
    - Can be applied to all electro-mechanical systems across a wide range of industries.
- IEC 61511
  - Functional safety / Safety Instrumented Systems for the process industry
    - Targeted at end users implementing SIS for the process industry, it has with more emphases towards

      PROVEN IN USE

three most significant aspects of IEC 61508

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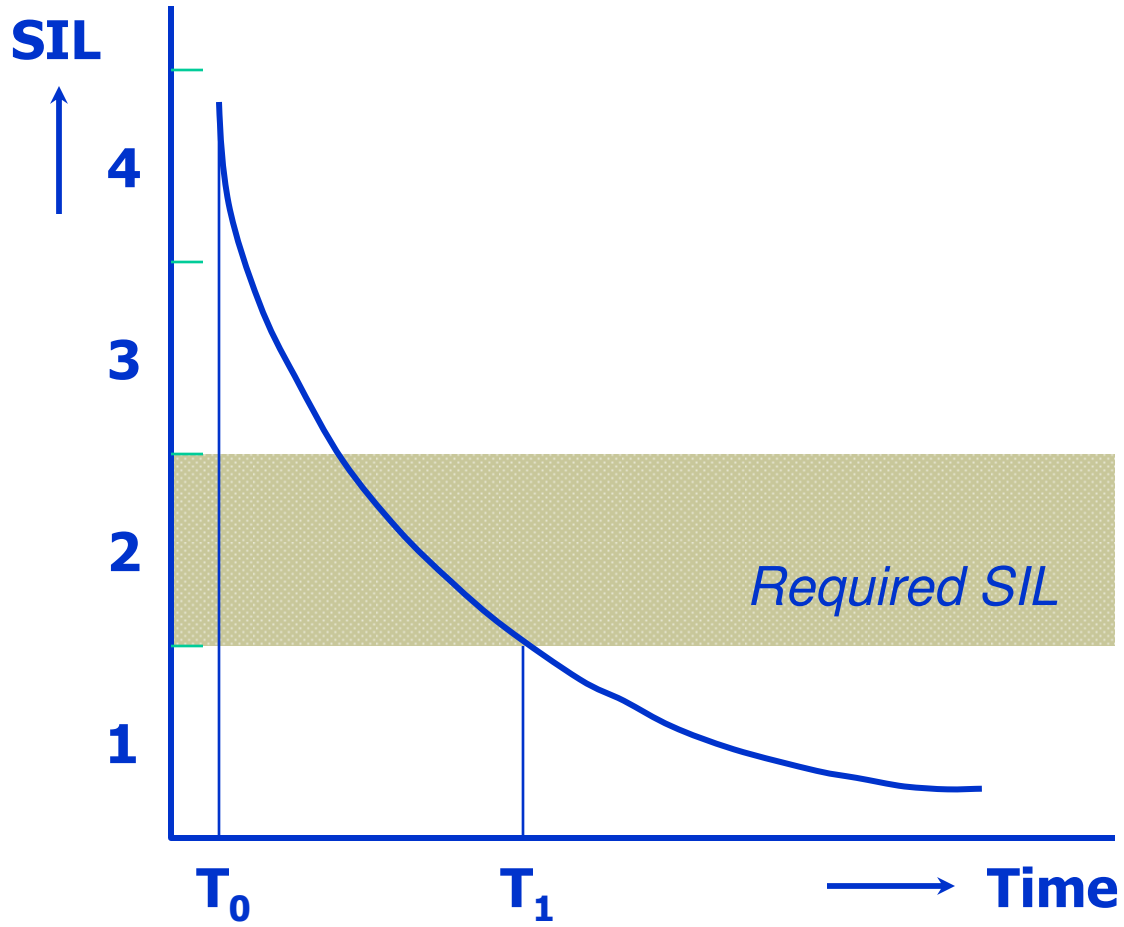
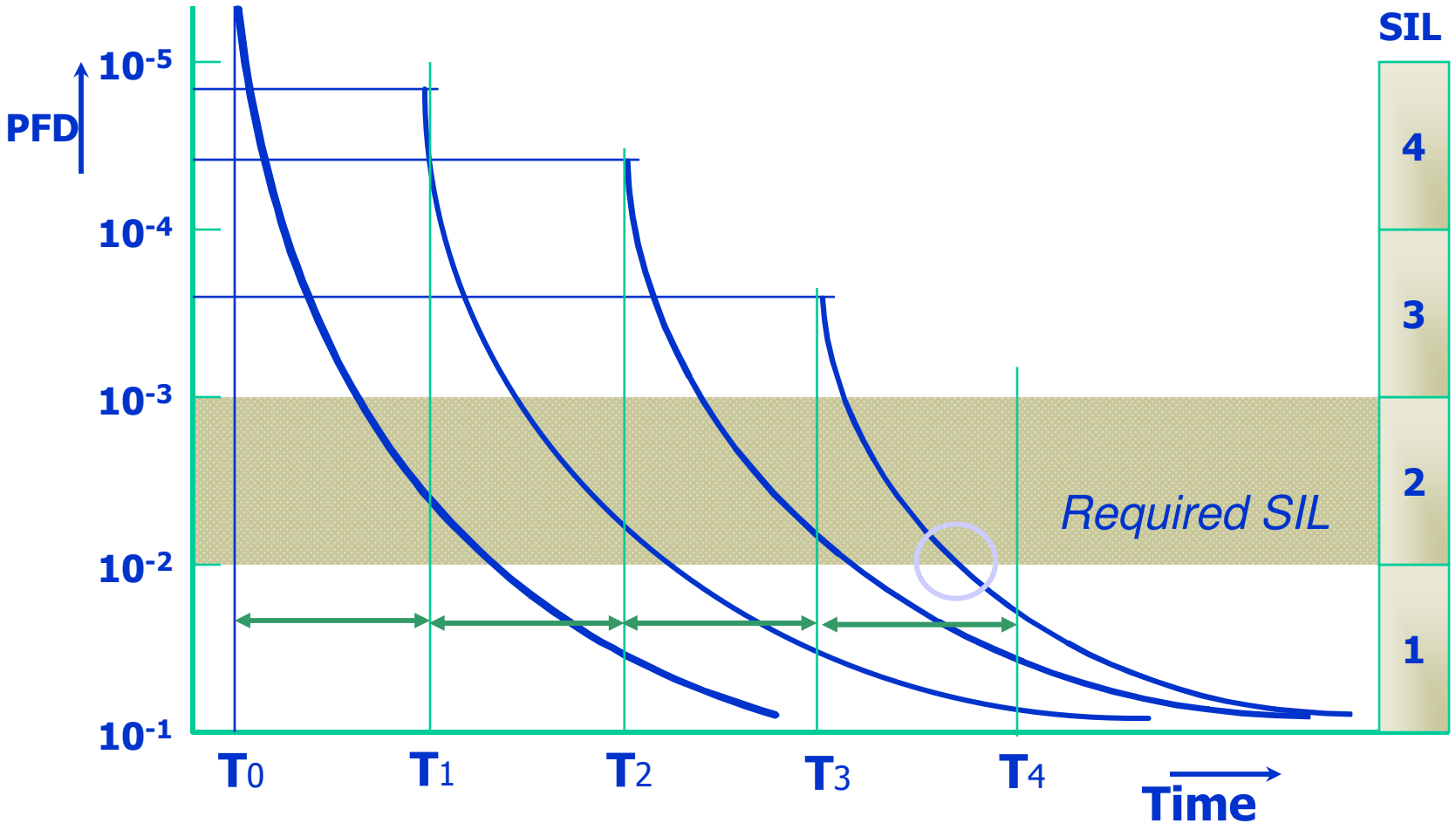
- The Safety Lifecycle
- The "Pipe-to-Pipe" approach
- The quantitative safety assessment

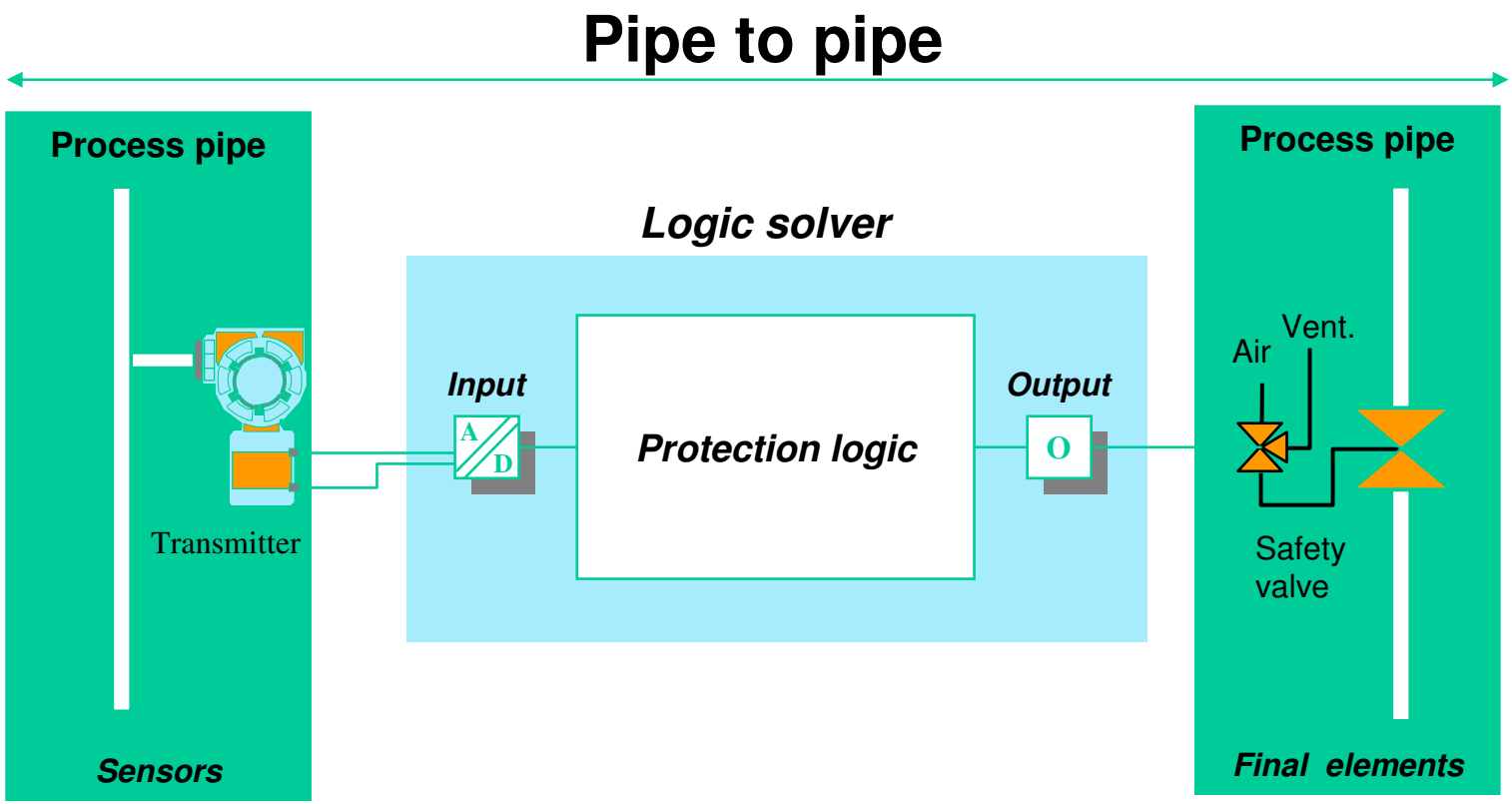
System integrity



Periodic proof test interval



Safety Instrumented System



Quantitative Assessment

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- Total Loop

  The safety requirements concern *(as a minimum)* a complete safety loop and are expressed in Safety Integrity Levels (SIL).

- PFD

  The SIL levels correspond to the average Probability of failure on demand (PFD target) of a complete safety loop.

- Quantification

  Calculations need to be performed to show that a specific safety loop meets its required SIL level.

Probabilities / Safety Integrity Level

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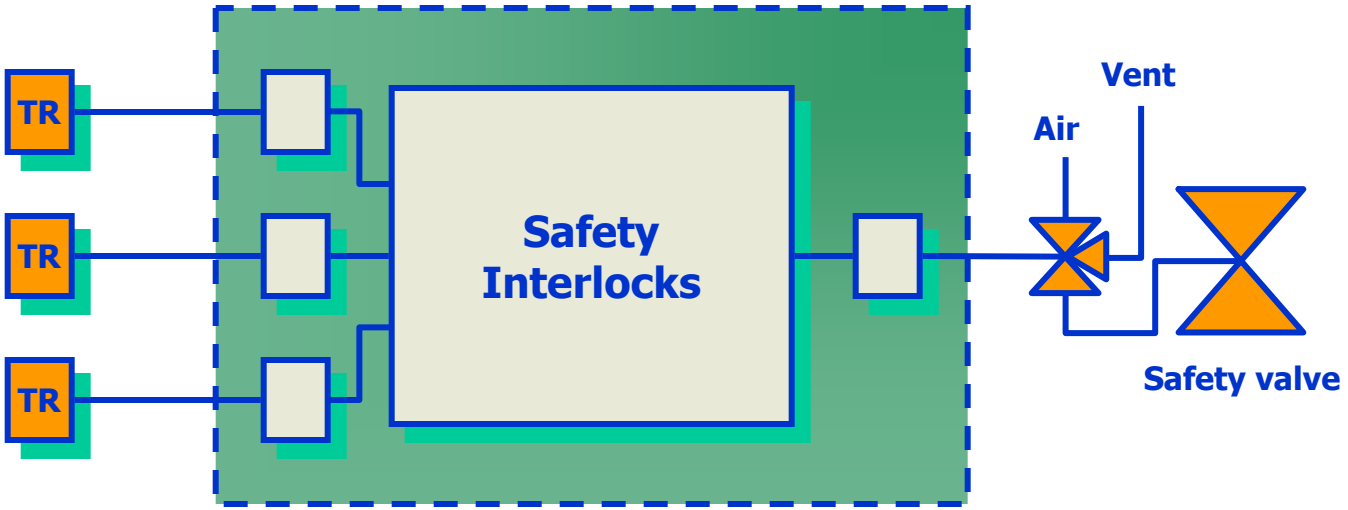
SIL = Pfd_{target}

Pfd_{loop} =

$Pfd_{sensors}$ + $Pfd_{logic\ solver}$ + $Pfd_{final\ elements}$



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HIPPS Functionality

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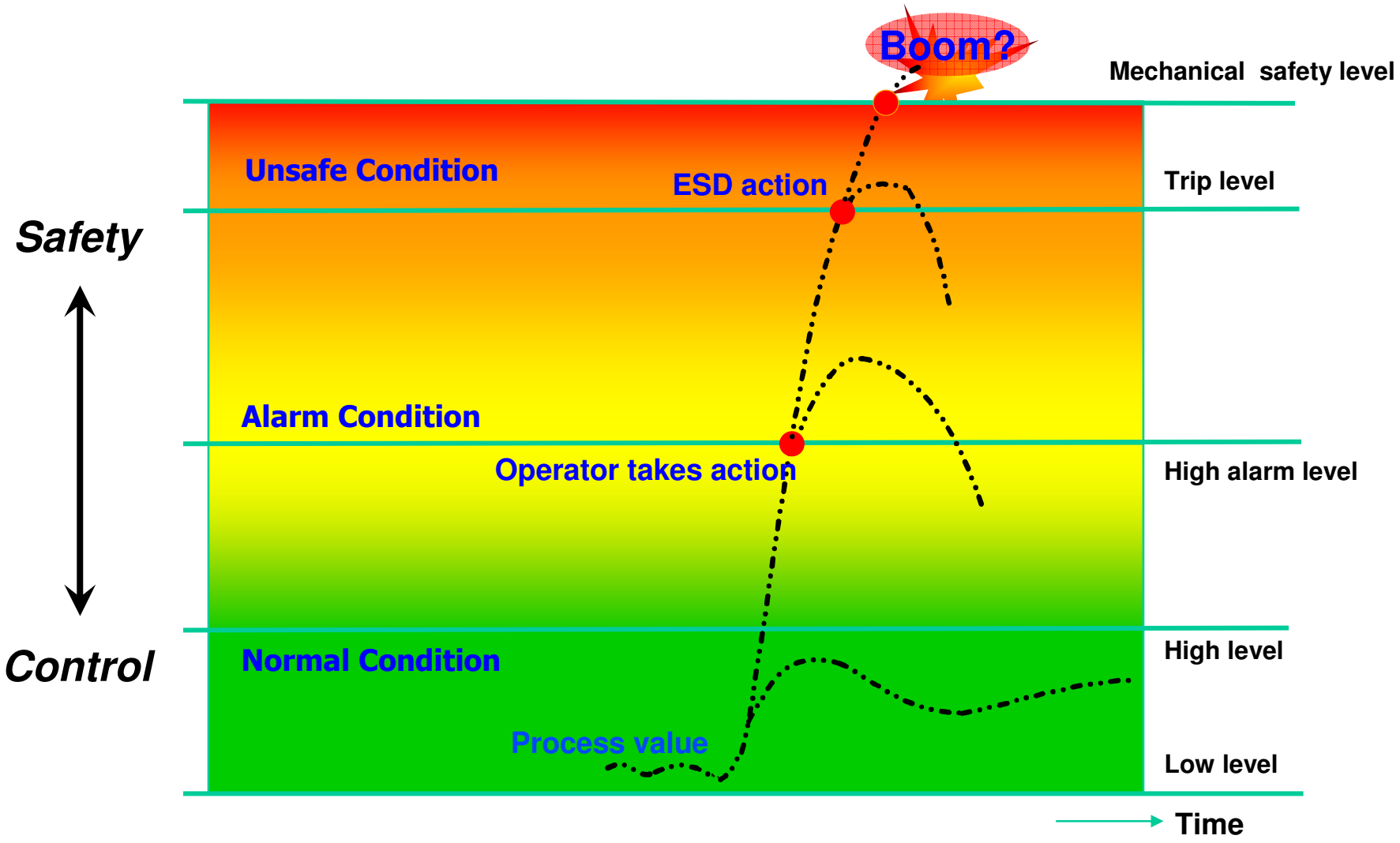
Process parameter range



What is a HIPPS

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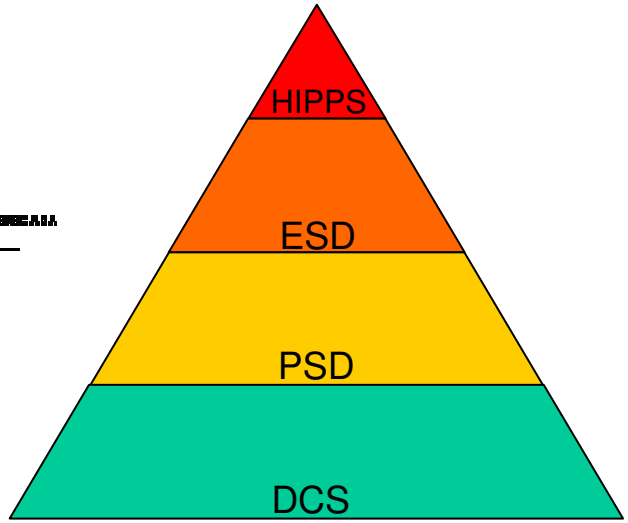
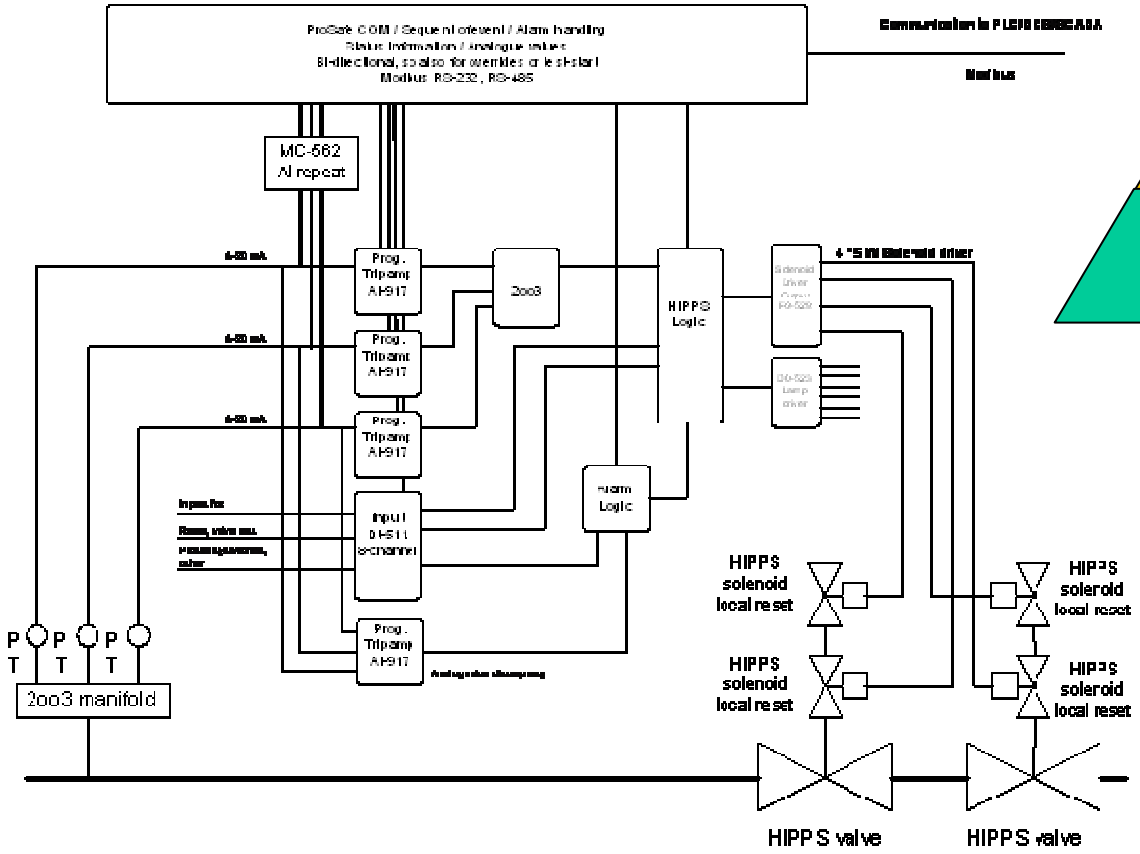
- HIPPS, the last line of defense





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Pressure Transmitter

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TÜV SIL 2 Approved

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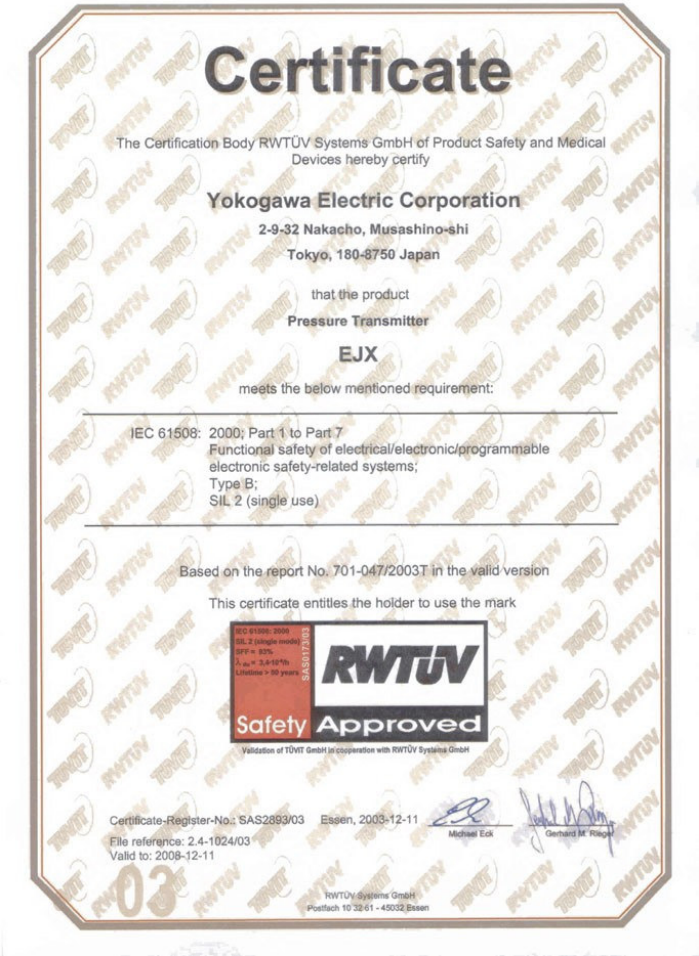

Certificate

The Certification Body RWTÜV Systems GmbH of Product Safety and Medical Devices hereby certify

Yokogawa Electric Corporation

2-9-32 Nakacho, Musashino-shi

Tokyo, 180-8750 Japan

that the product

Pressure Transmitter

EJX

meets the below mentioned requirement:

IEC 61508: 2000; Part 1 to Part 7
Functional safety of electrical/electronic/programmable electronic safety-related systems;
Type B;
SIL 2 (single use)

Based on the report No. 701-047/2003T in the valid version

This certificate entitles the holder to use the mark

RWTÜV Safety Approved

Validation of TÜVIT GmbH in cooperation with RWTÜV Systems GmbH

Certificate-Register-No.: SAS2893/03 Essen, 2003-12-11

File reference: 2.4-1024/03
Valid to: 2008-12-11

Michael Eck

Gerhard M. Riegler

RWTÜV Systems GmbH
Postfach 10 32 61 - 45032 Essen

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- Transmitters; certified for use in a SIL 2 loop…
  - 3 transmitters meeting SIL 3 … SIL 4
    voting 2oo3 or 1oo2.
  - What is the influence of a common fault...




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MANIFOLD

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manifold

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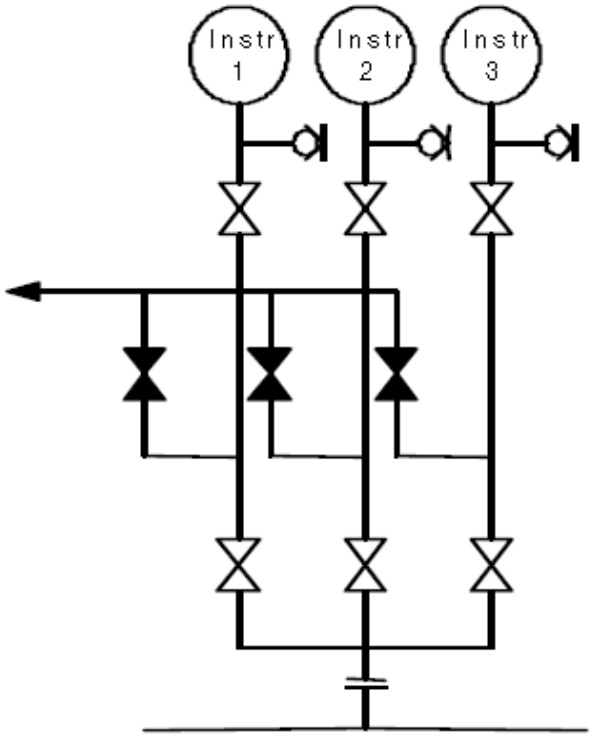
- Double block and bleed
- Mechanical interlock
- Detection
- SIL approval



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Manifold




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LOGIC SOLVER

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Requirements building a HIPPS

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- Logic Solver
  - Input signals, discrepancy, stuck.
  - Logical functions, like voting.
  - Fail Safe Outputs.
  - Figures of a hard wired system. (every fault will lead to a safe operation)
  - Data communication. (Sequence Of Events, Alarms)
  - A HIPPS should be treated as an Autonomic System.

A Solid state Logic Solver

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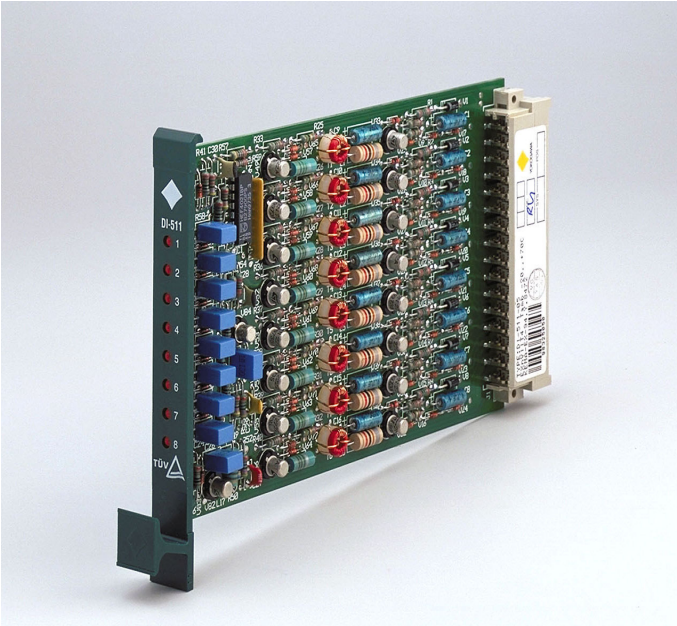

- Highest safety class available SIL 4
- Inherently Fail-Safe configuration
- Zone 2 applications
- Very high mechanical and electrical robustness
- High temperature range (-20 - +70 °C)
- Extreme low power consumption
- Physical/Galvanic separations
- Very high EMC immunity
- Very long technical life span (> 30 years)
- Test intervals many years
- Low Cost of Ownership
- Event Recorder (1 ms resolution)




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HIPPS Valves

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HIPPS Valves

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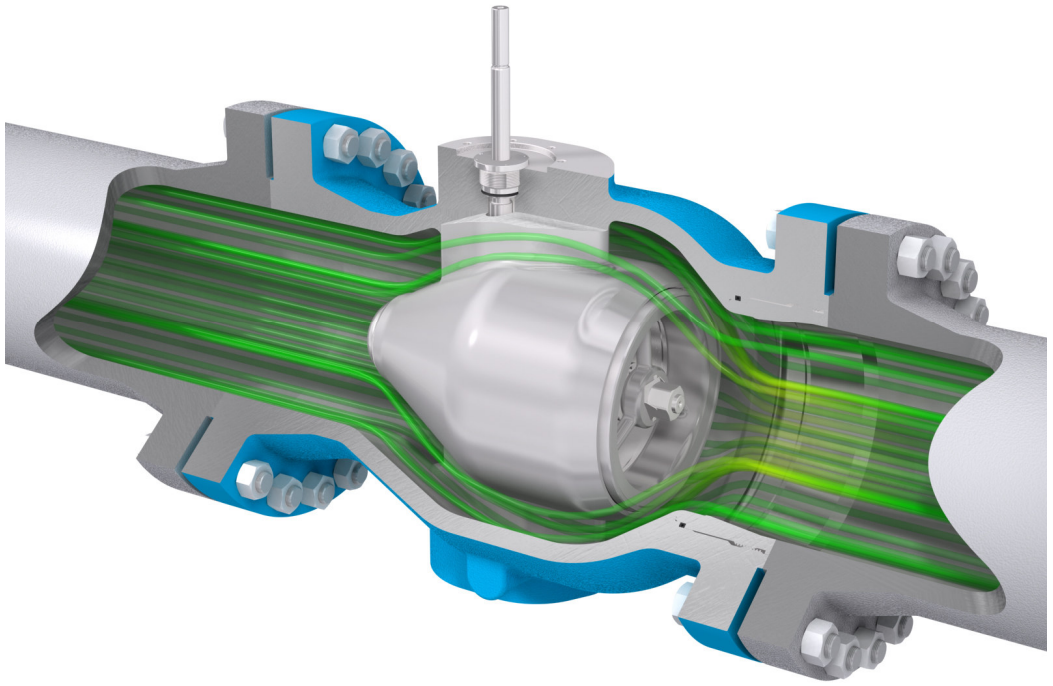
- HIPPS VALVES can replace:
  - Pressure safety valves
  - Blow down systems
  - Flare Systems



Control of the Valves

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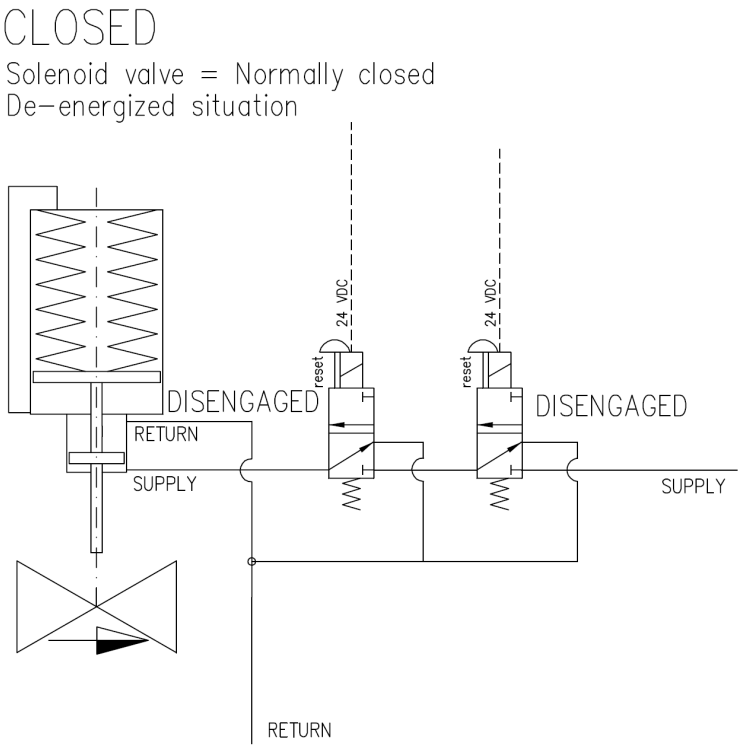
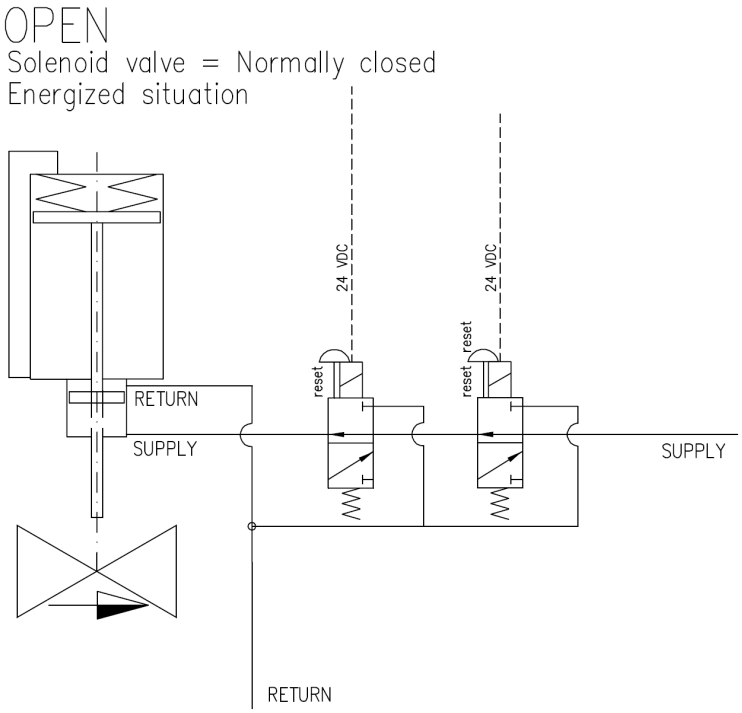
- Solenoids
- Actuator
- Valve





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HIPPS philosophy:

Isolate the source of the problem rather than releasing to the atmosphere.

To do so;
High reliable equipment is required.

A matter of making the correct decisions.

A failure in case of an installed HIPPS will result in damage of equipment or endanger the safety of personnel.




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CONFIGURATION

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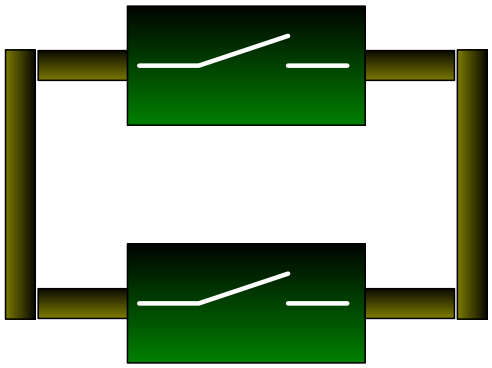
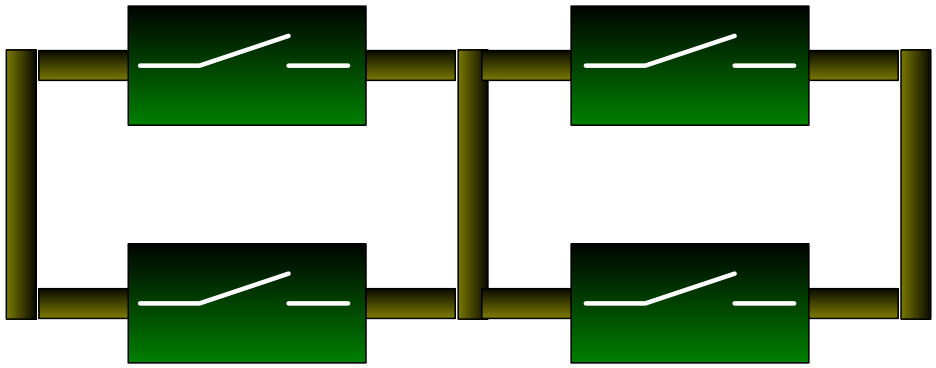
- **Redundancy…**

Keep it simple,
the best Safety System
is a Elementary System.

Safety

Availability





Risk Reduction Factor

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- RRF = 1/PFD
  - The RRF of SIL 3 is 1000
  - SIL 3 Safety Availability = 99.9%

- Safety Availability = 1- PFD
- Hazard Rate = PFD * Frequency of Demand

- Hazard Rate < Tolerable Risk

Feeling comfortable…

An idea of safety…
… and feeling comfortable.

SIL 3 complies with a availability of 99.9%

This corresponds to 35.000 missed heartbeats a year!

(1 every 15 minutes …)




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CERTIFICATION

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SIL capability demonstrated by PFD only …

The calculation is not enough:

- Comply with fault tolerance tables IEC 61508-2
- Although outside scope, consider also architecture of field equipment
- Report omissions/deviations to client (external safety consultancy)

Functional Safety Management

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- Procedures, tools, templates
- Configuration management (life time docs.)
- Safety Assessments
- Safety Validation (after FAT and after SAT)
- Safety Audits

These are ongoing living documents, changing and being updated during the various projects phases.

Safety Competence

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You will be proving your skills, experience and know how in a ongoing base during this and any safety project.

- Relevant knowledge of project management for safety projects
- Relevant safety knowledge
- Relevant safety engineering knowledge
- Relevant safety application knowledge

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By giving support to the realisation of safety projects

- Perform safety assessments (review of deliverables like SIL calculations)
- Safety validation and (company) certification
- Executing periodical safety audits

To put it briefly:

Wherever you need safety expertise,

whether in bid phase,

early project involvement,

or in project execution …

contact a

Safety Assurance & Consultancy

TÜV Rheinland / Berlin-Brandenburg

TÜV

TÜV Anlagentechnik GmbH
Automation, Software und Informationstechnology
Certification Body for Functional Safety Management Systems

ZERTIFIKAT
CERTIFICATE

FUNCTIONAL SAFETY MANAGEMENT
- IEC 61508 -

No. 968/FSM 104.00/03

Audit Scope: E/E/PE-System Integration

The Company

Yokogawa System Center Europe B.V.

Lange Amerikaweg 55
7332 BP Apeldoorn

The Netherlands

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has successfully given proof within the scope of an audit that it has introduced and applies a Functional Safety Management System.

The Functional Safety Management System embraces the integration of E/E/PE-Systems, Sensors and Actuators and comprises their Configuration, Programming, Assembly and Test for specific industrial safety applications.

The standard forming the basis of audit is the IEC 61508, part 1-7, issues 1998 to 2000.

The subjects of the audit procedure in the framework of certification are the requirements defined in the standard mentioned above relating to **Management of Functional Safety**, the **Documentation**, the **Functional Safety Assessment** as well as the **Company Specific Overall Safety Lifecycle Phases**.

The Company Specific Overall Safety Lifecycle Phases are:

- **Phase 9 - E/E/PES Realisation**
- **Phase 12 - Overall Installation and Commissioning**
- **Phase 14 - Overall Operation, Maintenance and Repair**
- **Phase 15 - Overall Modification and Retrofit.**

The phases 12, 14, 15 relate only to the support provided by the audited company to his clients without overall responsibility for different processes.

Relevant information at points of intersection from and to the adjacent Safety Lifecycle Phases were taken into consideration.

The Audit Report 968/FSM 104.00/03, dated 2003-05-23, and the Certification Contract 968/FSM 104/03, dated 2003-05-16, are the essential parts of this Certificate.

The Certificate does not replace approval or certification for specific E/E/PE-systems integrations. The audit results refer exclusively to those departments which are involved in the FSM-organisation on the location of the audited company.

The Certificate is valid until April 2006.

TÜV Anlagentechnik GmbH
Geschäftsfeld ASI
Automation, Software und Informationstechnologie
Am Grauen Stein, 51105 Köln
Postfach 91 09 51, 51101 Köln

Cologne, 2003-05-28

Certification Body for Functional Safety Management Systems

The Business Sector Automation, Software and Informationtechnology operates an accredited test laboratory according to DIN EN ISO/IEC 17025 and DIN EN ISO 9001. Therewith has given proof to possess the competence and the ability to carry out functional safety tests.




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CONCLUSION

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So where do we base a HIPPS on?

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- A HIPPS is based on:
  - An identification of the possible risks to be reduced.
  - A calculation of the related costs & cost savings.

Conclusion

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In general you can say:

"A well designed HIPPS,

not only saves money but

makes the world

a little safer after all".

Thank you for your attention.

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Commitment means building the future to last.