The Value of Safety-Certified Products White Paper

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The Value of Safety-Certified Products

Safety-related parts of control systems (SRP/CS) can be implemented using standard components, though safety components offer significant advantages.

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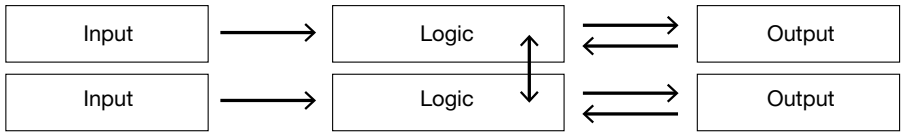
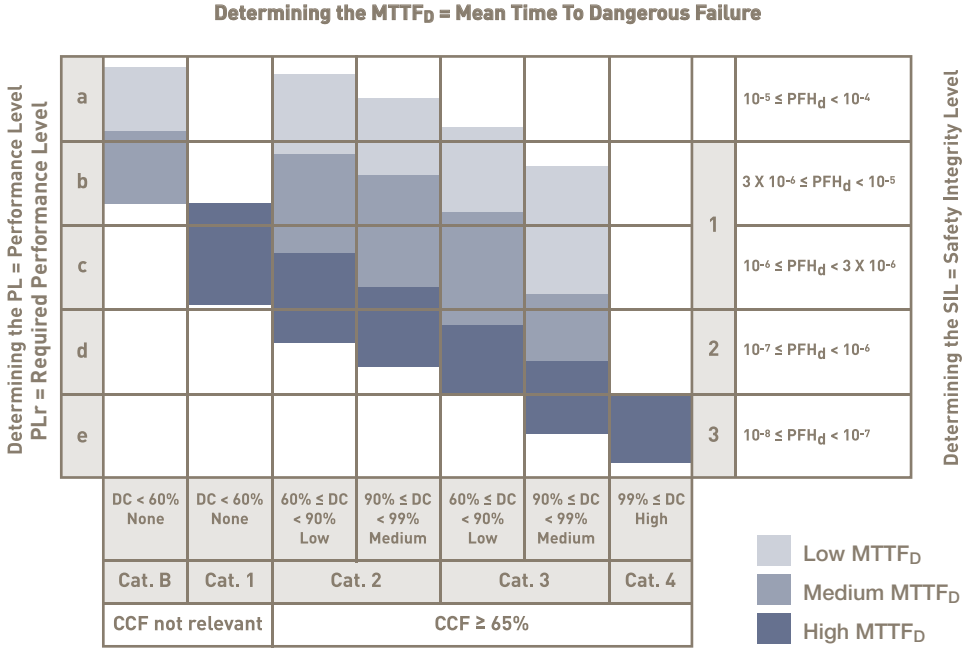
The use of standard components in safety applications is fundamentally possible according to EN ISO 13849 and Annex V of the Machinery Directive 2006/42/EC. There is no legislation prescribing the specific use of safety-rated products. There is only legislation requiring safe function and the use of redundancy, high diagnostic values, and high mean time to dangerous failure values (MTTFD) when designing safety and controls; depending of course on the level of safety your application requires. USA Standards such as EN ISO 12100 and ANSI B11 have followed suit and are harmonized to this effect.

The components used to achieve safety typically include an input device, a logic controller and an output device commonly referred to as ILO. Common input devices are light curtains, e-stop buttons, and laser scanners. The logic controllers can vary from simple relays up to safety PLCs based again on the safety level required. Output devices are devices that perform a safe function (stopping, blocking, holding, reversing, or exhausting).

Input Logic Output Flow Diagram





The standard EN ISO 13849-1 offers simplified charts for achieving the required category and performance levels needed.

These variables work together to ensure that safety is not just focused on component reliability but instead introduces common sense safety principles such as redundancy, diversity, and fail-safe behavior of the safety-related control parts.

When determining the performance level, the greater the risk, the higher the requirements of the control system.

Product Selection

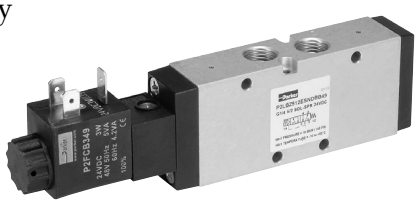
In effect, there are three levels of products a machine builder can choose from:

Standard Fluid Power Components

The first type can be any component the machine designer chooses (standard fluid power components). All relevant testing, documentation, and validation to ensure integrity become the liability of the machine designer to prove the components they selected are suitable for safe function in the system design. In addition to the familiar basic framework of the Categories, the current standards EN ISO 13849 Parts 1 and 2 (Safety of machinery – Safety- related parts of control systems – Part 1: General design principles [1], Part 2: Validation [2]) also describe a probabilistic assessment of the functional safety achieved. Whereby there have been misinterpretations during the application of the standards about the use of standard components. The complexity and work required to prove safe function are significant. For this reason, most machine designers seek products that are suitable for use as SRP/CS.

Standard Fluid Power Components Suitable for Use as an SRP/CS

The second type is a standard component that is "well-tried and trusted" and may have an associated endurance B10 or MTTF value. It is deemed suitable for use as a safety-related part of a control system (SRP/CS) by the manufacturer of the component. This component is typically endurance tested and the manufacturer will provide the life expectancy value as either a B10 value, a B10D value, or a MTTF value. (Hydraulic products typically offer an MTTFD value whereby pneumatics will publish a B10D value given that MTTFD in pneumatics is highly dependent on the number of operations (Nop) of the system.) It is then up to the system designer to use this data to calculate his probability of failure based on the components he has chosen within the safety circuit. In essence, it saves time and money in testing and provides some level of assurance of the component's reliability although, it has not been third-party validated.



B10D = 40 million switching cycles

Safety Rated Products

Products designed and placed on the market specifically for safety applications bear significant upfront testing and costs by the manufacturer. These products must be tested extensively and evaluated for fault performance to ensure they are fail-safe and pass all applicable electrical certifications. They are then passed to an authorized notified body for full third-party evaluation and certification. These products are provided with the assurance of testing, a documented performance level or MTTFD, documented diagnostic coverage capability and CCF (evaluations of common cause failure), and third-party verification of the same. These tests mitigate a significant amount of work and liability for the machine builder.

Validation

An essential step in system design is the validation of the safety circuit and components. Validation must be done on the safety circuit to ensure the circuit will function properly and fail safely. Testing must consider faults to ensure the machine responds accordingly and that the interconnect means provide the proper level of performance as noted in the risk assessment. Regardless of which type of products are selected for the safety circuit, it is the responsibility of the machine designer to ensure compliance with the standards. Safety-rated products offer significant advantages in that they are certified to conform to specific safety Categories thereby saving time and reducing liability.

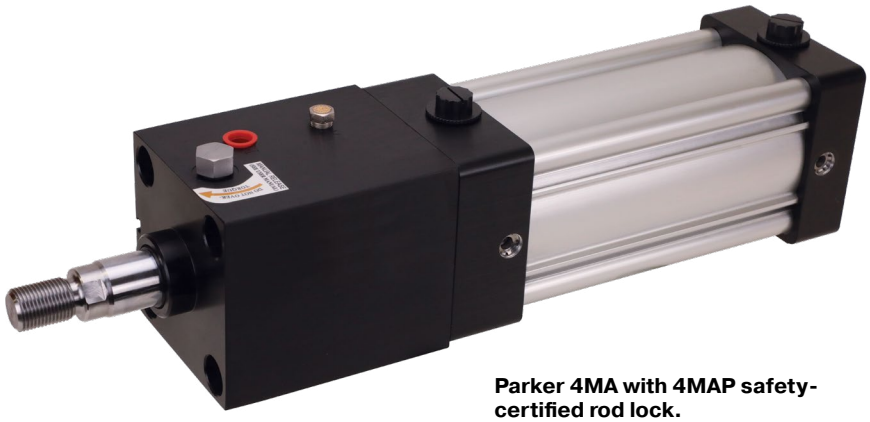
The Value of Safety-Certified Rod Locks

Mary Zimmerman

Product Sales Manager

Zimmerman is a Product Sales Manager at Parker Hannifin, Pneumatic Division. She is responsible for all rodded cylinder products and has over 15 years of experience in automation.

Machinery directives mandate the removal of energy in a system to prevent unexpected movement of equipment. When the removal of energy creates an unsafe condition, the energy can be maintained so long as a secondary means of ensuring safety is used. One such device is the rod lock.



Parker 4MA with 4MAP safety-certified rod lock.

Rod locks are an essential safety component to ensure unexpected movement of a machine does not occur. They are a backup means of holding an actuator when energy is removed and can be a required secondary means of holding a load when energy is stored in a system per all relevant machinery directives. This is an essential and critical tool in machinery safety.

During our journey of rod lock development, we have learned that different forces are present for static and dynamic braking and that the finish on the rod and sensors used are an essential part of how the rod lock will perform. For this reason, Parker offers the 4MAP rod lock on the 4MA cylinder in different configurations from Category B up to Category 4, PLe. This configuration includes the required sensors for monitoring and feedback on the locking mechanism.

Given the dangers involved in applications with stored energy, the liability required to ensure compliance, and the amount of testing and work involved in ensuring hazards are removed, the rod lock is one component where the significant advantage of safety certification certainly outweighs the risk of using standard, uncertified components.

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