What you Need to Know About Safety Exhaust Valves White Paper

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What you Need to Know about Safety Exhaust Valves

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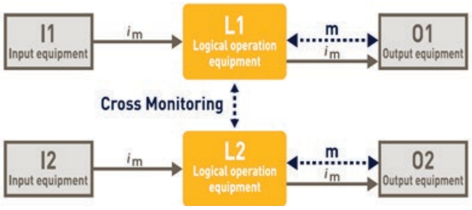
Hazards posed by pneumatic lines are not only in the air lines themselves, but are also caused by the moving components the pneumatic lines operate. Safety exhaust valves originated from the ISO safety standards (EN ISO 13849 and ISO 13118:2000) which mandate the dissipation of pneumatic energy to prevent unintended startup or movement in a machine. The exhaust of trapped air was traditionally done with pneumatic circuits utilizing two valves for redundant safety. This involved the purchasing of the valves and other peripherals, plumbing and space needed to ensure safe evacuation of the machinery because this traditional pneumatic circuit was slower to exhaust.

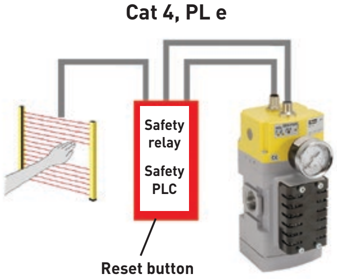
Today a handful of manufacturers have combined this pneumatic circuit into a compact product called a safety exhaust valve. Designed to ensure fail safe operation and ensure rapid exhaust of any pneumatic equipment on an e-stop, safety exhaust valves come in single channel or two channel (redundant) construction. High risk safety applications (based on a risk assessment ISO 13849-1) utilize safety exhaust valves that are integrated into a control circuit and monitored with a safety rated device. Here's what you need to know for a safe integration.

The intent in ***monitoring*** is to ensure that faults are not present in the control circuit (such as a wiring short) and that the safety exhaust valve is operating correctly. To monitor a safety product, you must have a safety rated device and a means of programming. This can be accomplished in several ways.

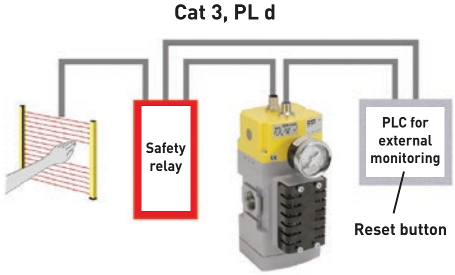


The safest and most costly way to do this is to use a safe PLC which is fully programmable and offers independent processors to manage the redundant two channels of monitoring.

Those looking for a less costly alternative can opt for a programmable safe relay while still achieving the highest safety level of Category 4, PL e.



Finally, you can build a redundant control circuit with the lowest cost using a standard PLC and safe relay. While this allows safe monitoring it will not meet the Category 4 criteria and the maximum achievable rating would be Category 3, PL d.



Valve Integration is an important discussion point because a safety valve rated for Category 4 and a safety device rated for category 4 will not always give you a category 4 safe solution. The secret to achieving your desired Category and Performance Level is in the design of the safety exhaust valve and its $MTTF_d$ (Mean time to dangerous failure), the diagnostic coverage of the control system and via the proper integration and wiring of your monitoring and control system as noted above.

Those experienced working with safety exhaust valves recognize two distinct styles of product. Internally monitored and externally monitored. So how are they different?

Internally monitored safety exhaust valves are costlier because the monitoring logic is programmed inside the valves either via electric or pneumatic logic. These internally monitored valves, while easier to integrate are slower to respond and typically have a reduced service life in switching cycles (B10 valves) and $MTTF_d$. The reduced service life comes from on board electronics which are contained, give off heat and have a tendency to fail earlier than mechanical components, reducing the service life of the valve. Further complexity is added with internal diagnostics which must be run each time the valve pressurizes resulting in a longer start time and therefore cycle time. EMI (electromagnetic interference) can also result if the internally monitored valves are not grounded on a machine. Much like a laptop internally monitored valves must be shut down and restarted properly or they will lock out the machine making resetting and repressurizing the machine a challenge.

Externally monitored safety exhaust valves simply cost less because the monitoring logic is programmed by the user into the programmable safety device or standard PLC via a function block. The complexity of the product is reduced internally making the valves easier to integrate, restart and will provide you with a higher B10 value for longer service life. The disadvantage is you do the programming and take control but they payoff is in functionality and life which far surpasses the work of programming.

What to Look for in a Safety Exhaust Valve

If you're in the market to build a safer machine or simply enhance the safety on an existing machine, there's several key things to consider. All safety valves are meant to exhaust out air but consider this:

How fast will the safety valve exhaust in a faulted condition? This is the worst case scenario which controls engineers should always work with in sizing. When a safety valve is in faulted condition standard exhaust flow rates (assuming normal stop) do not apply. There is a failure in the valve and the exhaust flow may have a restriction. A faster exhaust means a smaller machine footprint saving you space and money.

Consider the Valves Cycle Time – You want to pressurize the machine quickly and exhaust it even faster. Look at both the rated time in (ms) for on and off. The exception to this rule is the addition of a soft start which is always recommended for ease on. Consider at what point the soft start will open to full flow based on your input pressure and work that into your cycle time calculations.

Consider the B10 Value – The B10 value is the life expectancy in switching cycles and is based on B10 testing (the point at which 10% of a sample lot has failed). It's a statistical number but is an important consideration when determining your $MTTF_d$. The higher the quality of your components the higher B10 life of your machine.

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