Are Monitored Valves really Safe?

During recent years there have been many developments within the safety industry about hydraulics and in particular pneumatic valves. These systems have predominately been applied to press applications and primary fluid power machine supply.

Historically, industry was on a trend to treat fluid power directional control valve monitoring whether it be hydraulic or pneumatic with the same regard as to a three-phase electrical contractor by monitoring an auxiliary contact of the device and incorporating this contact within the feedback control loop of a certified safety relay. What was overlooked in these applications is a three-phase contactor applied in a safety application is generally of a positive guided device where three separate contacts along with an auxiliary contact are being switched. Should one contact stick or become welded, the other contacts will break. There is also additional redundancy within this form of monitoring by the added security of either a thermal overload or motor circuit breaker, whereas should a contactor fail, the contactor may permit one phase to remain connected, in which case the motor protection would provide the additional redundancy therefore shutting down the control system with a feedback monitoring contact to indicate a system failure.

Formerly both hydraulic and pneumatic valves did not have multiple circuits for external monitoring devices and certainly didn't have any form of positive guidance for protection when in a single spool or poppet configuration. They were like a gate or guard circuit requiring full monitoring as there was no further redundancy to protect the system from failure.

Since those days, there has been three primary forms of valve monitoring techniques used; the first being an internally statically monitored type where two valves within the one housing cross monitor each other for faults. These valves have an extremely high level of integrity and are usually supplied with a declaration of conformity to the relevant safety standards, thus ensuring the failure modes of the valve can be detected without the loss of the safety function. As these valves are not monitored electrically, they sometimes have an optional pressure switch but have no safety certification and are of single-circuit configuration.

Another form of monitoring, more common within hydraulic valves, is the use of inductive proximity switches placed within the pressurised areas of the valve. Even though these monitoring devices are pressure-rated at 7000 psi, the basis for a category 3 or category 4 application as per AS4024 is to be able to detect any single component failure that can lead to the loss of the safety function. This component failure must also include the monitoring device itself and with their own internal circuitry we would need to assess each component within the monitoring device. These products have only one channel of feedback and are unable to be monitored directly into a dual-channel, certified, safety relay normally utilised in category 3 or 4 applications.

The third (and in our opinion: the best/most reliable) is a positive-driven plunger-switch, monitoring a poppet or spool. There are already several versions on the market – some with accreditation and some without. The placement and mounting of the monitoring switch is critical, especially where normally-closed circuits are used as there have been several incidents where a switch has been mounted externally of the valve and has come adrift of the valve body. In this situation, the primary valve switches. Whether it be in a monitored feedback loop or to a dedicated certified safety relay, this fault cannot be detected where the wiring is in series between two valves.

This is where the story of Fluidsentry products begin in 2001 when our founder Murray Hodges noticed these challenges system designers were facing in meeting safety requirements regarding the integrity of fluid power safety control systems.

While there were several products available in Europe and Australia for safety applications, as previously discussed the manufacturers could not demonstrate compliance with the key standards that outline the requirements for the safety related parts of control systems. There were many electronic safety devices in the market but nothing that could safely interlock with pneumatic or hydraulic devices.

So, Murray developed the first monitored pneumatic safety valve, using positive driven high precision safety switching for the monitoring function, was global first solution. This is still the technology we are using 20 years later. Today, Fluidsentry has joined Fortress Safety and has continued to expand the range of its monitored hydraulic and pneumatic valves to assist industry in complying with AS4024.1 and ISO 13849 requirements.