

How Limit Switches Can Stop Machines from Going Boom

A Honeywell White Paper



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Safety is one of the top criteria when selecting a limit switch for hazardous location environments. In many cases, these switches have to operate in the presence of explosive fumes or gases, in dirty or dust-filled environments, in remote parts of the world and around extremely harsh chemicals that breakdown electronics very quickly. These applications, including oil & gas drilling rigs, agricultural environments filled with pesticides and chemicals and outdoor locations with extreme weather conditions, all pose dangers to personnel, materials and equipment.

As an example, a hazardous area may have an atmosphere that could potentially ignite, burn or explode due to a spark caused by electrical equipment. This means the components selected for these applications need to be extremely safe as well as reliable, durable and long lasting.

To withstand these harsh environments, the limit switches must comply with explosion-proof switching requirements to ensure the safety of personnel, equipment and the environment. For example, Honeywell Sensing and Productivity Solution's MICRO SWITCH™ hazardous location switches can reduce the risk

of explosion by containing sparks and other electrical events inside the sealed switch body. Under normal conditions, these sparks or electrical events typically do not pose a lot of danger; however, in environments where there are substances that can potentially ignite or explode, sparking and arcing from electrical components is potentially dangerous. The MICRO SWITCH™ switches provide protection through a sealed switch cavity, which incorporates mechanical threads that contain or cool flames, minimizing the risk to the surrounding environment.

Hazardous location limit switches are used in a variety of industrial applications, ranging from mud pumps, valve positioning and pig position detectors to gate/door monitoring in grain conveyors and grain gates. Here are several examples of how these switches are used in hazardous or explosive environments.

Oil & Gas Drilling: Mud Pumps, Blow-out Preventers (BOP), Drilling Rigs, Pipeline Pigs

Mud pumps are used in oil and gas drilling applications to circulate the fluid that provides lubrication for the drill while pressurizing the bore hole to prevent well cavitations. These pumps use switches as pump stroke counters. These switches can be used to send a signal to cancel out the noise generated from the pump in order to gather sonic data to model the geographic formation of the oil well and to monitor the fluid, ensuring the safety of personnel and equipment.

Blow-out preventers (BOP) and BOP control units are used to seal, control and monitor erratic pressures and uncontrolled flow that can occur during oil and gas drilling. These critical pieces of equipment are vital for the safety of the crew, rig and environment and to maintain the integrity of the well. If there is any kind of disruption, an emergency system can disconnect the rig from the well, which automatically triggers a switch to close the BOP and choke valves.

Position switches are also implemented in heavy-duty drilling rigs where they are used to detect vertical or rotary position when a new drill tube is moved into place. If the position measurement is inaccurate it could damage the drill, drilling equipment and/or well, resulting in tens to hundreds of thousands of dollars in damage. These switches need to be extremely robust, offering environmental sealing, high operating temperatures and high accuracy.

Similarly, switches used in pipeline pigs, which are used to clean and inspect the integrity of a pipeline without stopping the flow of the fluid, need to be highly reliable and accurate. To detect when a pig has passed through a particular section of the pipe, these switches are used to trigger an electrical signal along the pipeline based on the indicators. These pipelines can be found in remote locations on land and under water.



Grain Conveyor/Grain Gates

Conveyors are often used in enclosed spaces in grain processing and handling facilities. These conveyors, which require complex systems for control and safety, use limit switches for position detection of equipment and materials.

Limit switches also can be used in grain gates that operate as valves in the grain storage and handling industry. These doors open or close and control the flow of grain. In this application, the switch detects the gate position, which is relayed to the central control unit, whereby the signal is used as process control or secondary indication. For these agricultural applications, the switches need to be sealed and be weather tight to keep out the grain particulates.



Painting Booths

In painting booths, which are used to control the environment for paint applications, including machinery and component manufacturing, these environments must be dust and debris free to reduce downtime and waste. A limit switch is used to indicate the position of the door in the painting booth. The painting process cannot start until the door is fully shut. These switches require sealed, weather tight enclosures to keep paint and/or debris particulates from interfering with their operation.



Switch Selection

Whether these hazardous location limit switches are used for position detection in grain conveyors/gates or to close blow-out preventers and choke valves in oil and gas drilling equipment, they need to be designed for rugged environments and long life cycles, requiring high quality materials and high quality manufacturing processes. Replacement costs can be very high in these environments so reliability is critical.

Most importantly, these switches need to meet hazardous location use approvals in order to be used in these environments. The two major certifications for electrical equipment are ATEX in Europe and UL or CSA for hazardous location approved equipment use in North America. However, not all switches meet global approvals. This is an important consideration particularly

when designing for global markets. Designers should look for switches that meet multiple safety approvals including UL, CSA, ATEX (CE), IEC Ex, NEPSI Ex (China), KOSHA (Korea), INMETRO (Brazil) and Customs Union (Russia, Belarus and Kazakhstan). These certifications also cover environmental requirements including operating temperature range and sealing.

Engineers should also look for switches that offer greater installation flexibility to fit the needs of their applications. Switches such as those offered by Honeywell's hazardous location limit switches, including the BX, CX, EX, GSX and LSX Series, offer a variety of options for levers, actuators, circuitry designs, operating temperature range, contacts and housing materials to meet a variety of harsh industrial applications. They also are available in a variety of sizes to meet application needs.



Honeywell's MICRO SWITCH™ BX/BX2 Series of hazardous location limit switches can be used in hazardous or explosive environments around the globe. They offer a variety of options for actuators, housing materials, contacts, and sealings, as well as meet global certifications.



The MICRO SWITCH™ hazardous location switches offer a variety of actuator styles, including side rotary, plunger and roller plunger. Many of the lines also offer a stainless steel housing version for offshore or coastal environments, and the CX product line provides a bronze option for marine applications. The single-pole or double-pole basic switches are available with gold or silver contacts for low energy or power-duty switching. These switches often provide operating temperature ranges as low as -40 °F and as high as 250 °F.

By offering multiple options and parts, designers can quickly drill-down to the devices that specifically meet their applications without running up against product launch delays and additional costs for custom parts. As an example, the MICRO SWITCH™ EX Series, the original hazardous area MICRO SWITCH™, offers a variety of levers and actuators, along with high-temperature options and optional gold contacts for low-power loads. For greater design flexibility, it mounts from any of four sides.

For extreme temperature and explosive environments, the MICRO SWITCH™ LSX and BX Series of rugged, weather-sealed switches also offer a variety of actuators and levers along with silver or gold contact options and a stainless steel version. These switches can be used globally with ATEX, IEC and UL/CSA certifications. The operating temperature range of the switches is -40 °C to 250 °F.

Engineers also should look for design elements that help extend switch life cycles such as dual bearing designs, and enable operation in extreme temperature ranges such as fluorosilicon seals that extend operating temperatures down to -40 °F. The dual bearing design on side rotary construction increases resistance to side loading, which extends the life of the switch.



In addition to dual bearing designs and fluorosilicon seal options, Honeywell's hazardous location switches offer sintered bronze bearings for longer operating life and increased resistance in corrosive environments, and a unique all-metal drive train for extended life and reliable operating characteristics even at high temperatures. Twin shaft seals promote additional environmental conditions, and phosphate-treated and epoxy-finished enclosures offer rugged, corrosion resistance.

The variety of form factors, switch actuators, contact and housing materials and sealing options make the Honeywell portfolio of hazardous location limit switches suitable for nearly any application. With decades of experience in reliability and safety, Honeywell offers a broad portfolio of limit switches and engineering expertise to help design engineers solve their technical challenges and select the right switch for their harsh industrial application.

MICRO SWITCH™ Hazardous Area Switches, Hazardous Location Approvals

This guide will help to define Hazardous Area Approvals for both North American and Global applications, as well as define the approvals MICRO SWITCH™ Hazardous Area Switches carry.

Agency Approval Hazardous Designations Sealing Operating Temperature									
									BX
14CE100	GXE	CLSX	LSX	EX	GSX	CX	WBX	BX	EAC (GOST-R)
ATEX (CE)	ATEX (CE)	IEC Ex	Groups B, C, D	Div I & 2, Class II	II 2 G Ex d IIC T6	II 2 D Ex tD A21 T85C	Zone 1 Ex ia IIC T4	Zone 0 Ex ia IIC T4	II 2 D Ex tD A21 T85C
II 2 G Ex d IIC T6	II 2 G Ex d IIC T6	Div I & 2, Class II	Groups E, F, G	Groups E, F, G	II 2 D Ex tD A21 T85C	II 2 D Ex tD A21 T85C	Zone 1 Ex ia IIC T4	Zone 0 Ex ia IIC T4	II 2 G Ex d IIC T6
II 2 D Ex tD A21 T85C	II 2 D Ex tD A21 T85C	Groups E, F, G	IP67	II 2 G EEx d IIB H2T6 T6	IP67	IP66/67	IP67 (self-certified)	IP67	IP67
IP65/66/67	IP66/67	NEMA 1, 3, 4, 7, 9, 13	NEMA 1, 3, 4, 6, 13	NEMA 1, 7, 9	NEMA 1, 4, 6, 7, 9, 12, 13	NEMA 1, 3, 4, 4X, 6, 6P, 7, 9, 13	NEMA 1, 3, 4, 6, 13	NEMA 1, 3, 4, 13	NEMA 1, 3, 4, 13
0 °C to 70 °C	-25 °C to 75 °C	-25 °C to 40 °C	-12 °C to 121 °C	-40 °C to 71 °C	-25 °C to 80 °C	-20 °C to 85 °C	-40 °C to 70 °C	-40 °C to 70 °C	-40 °C to 70 °C

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