Installation

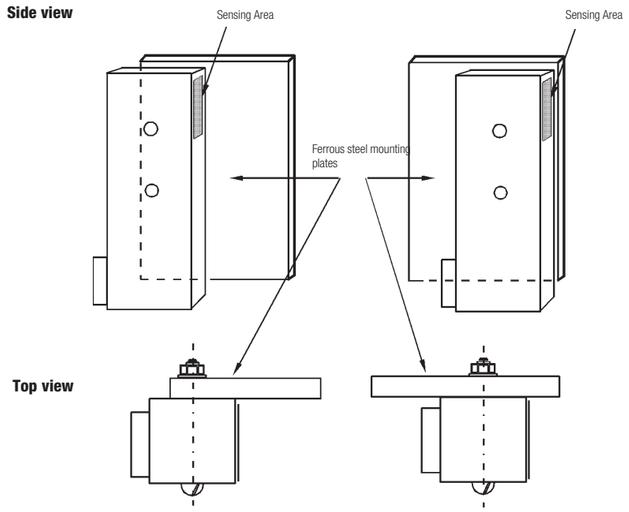
Installation Principle - Square Switches

- Non-ferrous brackets/plates are recommended (stainless steel or aluminum).
- GO Switches may be mounted on ferrous materials but it is not recommended. Loss of sensing range will result.
- It is recommended to mount switches 1" to 1-1/2" away from surrounding ferrous materials when possible.
- If mounting on ferrous material, insure uniform coverage of the switch, biasing the internal magnet(s) equally. (Fig. 2) If magnets are biased unequal, latching may occur. (Fig. 1)
- GO Switches sense ferrous materials such as mild steel, 400 series and 17/4 stainless steel.
- Avoid contact between target and switch. Configure mounting of switch and/or target so that target passes within proximity range of sensing area. Sensing range will vary according to model number and size (mass) of target used.
- Target magnets, available through TopWorx, will increase the sensing range of the switch. Reference sensing ranges in corresponding sections throughout the catalog.
- For optimum performance, provide sufficient mass of target, and choose the appropriate GO Switch model to match the application requirements for operating frequency, type of load, etc.
- The greater mass of target the better for maximum contact pressure, especially in low current applications.
- For heavy or inductive loads, arc suppression devices, or interposing relays are recommended for contact longevity. Contact factory for specifics.
- GO Switches may be mounted in any plane.
- When mounting GO Switches side by side, place 2-1/4" apart edge to edge, not center to center.
- Contact factory for side by side mounting.

See individual switch Ordering Guides for wiring diagrams and information on external target magnets for increased sensing ranges.

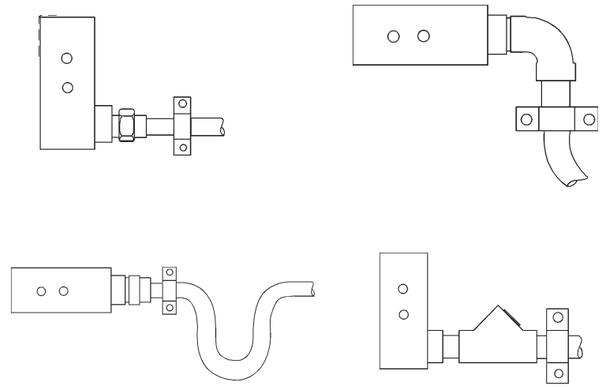
Figure 1
Incorrect

Figure 2
Correct



Attachment of Conduit or Cable

- Attach conduit or cable correctly
  - When using long runs of conduit or cable, place supports close to the switch to avoid pulling switch out of position.
  - If switch is mounted on a moving part, be sure flexible conduit is long enough to allow for movement, and positioned to eliminate binding or pulling.
  - For installation in hazardous locations, check local electrical codes. Switches must be installed according to local electrical codes.
  - In damp environments, use 1/4" thick non-conductive RTV or a similar moisture barrier to prevent water/condensation from entering conduit hub



Satisfy these 3 criteria to reduce possible premature failures

Sealing switches

In figure 1 something common has occurred; the conduit system has filled with water. Over a period of time this may cause the switch to fail prematurely.

In figure 2, the termination of the switch has been filled with 1/4" thick non-conductive RTV to prevent water intrusion and to prevent premature switch failure. A drip loop with provision for water to escape has also been installed.

Incorrect

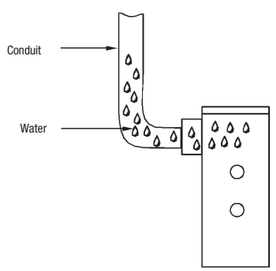


Figure 1

Correct

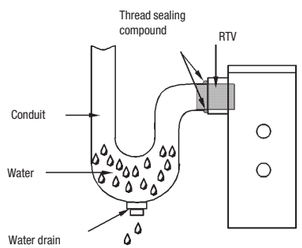


Figure 2

Target size

In figure 3, the ferrous target is too small to be detected reliably.

In figure 4, the target has sufficient size and mass for long term, reliable operation.

Incorrect

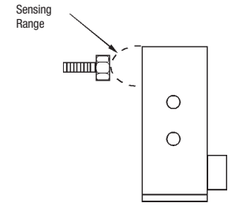


Figure 3

Correct

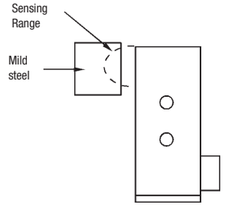


Figure 4

Target location

In figure 5, the target has been positioned to stop on the outside edge of the sensing range. This is a marginal condition for long term reliable operation.

In figure 6, the target has been positioned to stop well within the sensing range which will assure long term reliable operation.

Incorrect

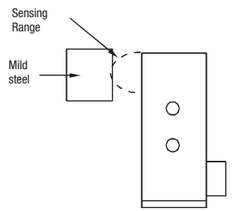


Figure 5

Correct

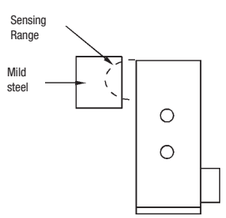


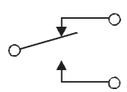
Figure 6

Contact arrangements vary according to type of switch. Refer to sections on each switch series for detailed information. Be sure that electrical load will not exceed rated capacity of the switch.
For two-circuit switches (DMDB), contacts must be connected same polarity only in order to minimize possibility of a line-to-line short.

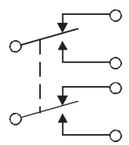
All GO® Switches are "pure"contact switches, meaning that they have **no voltage drop when closed, nor do they have any leakage current when open**. For multi-unit installation, switches may be wired in series or parallel, as shown below.

ATTENTION!

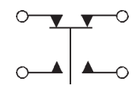
Please refer to individual switch sections for wiring diagrams.



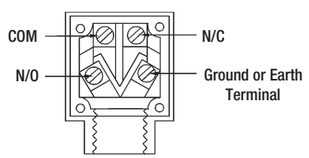
SPDT
Form C



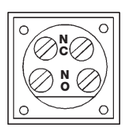
DPDT
2 Form C



DMDB
Form Z



Bottom view



Bottom view
Two circuit (DMDB)
Same polarity only

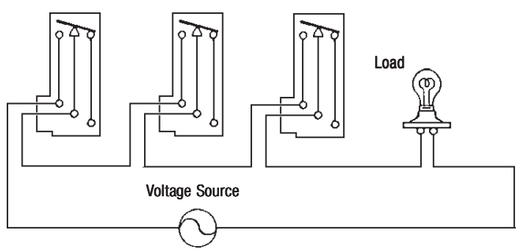
Series and Parallel Wiring

Series Wiring

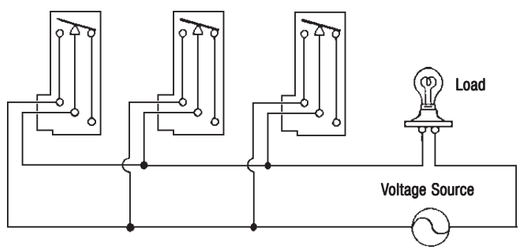
Any number of GO® Switches may be wired in series, without voltage drop. By contrast, conventional solid state switches have about two volts drop across the switch when operated. With a system of 12 volts and four switches in series, 8 volts is dropped across the switches and only 4V is left to operate the load. When using GO® Switches, 12V is still available to operate the load.

Parallel Wiring

Any number of GO® Switches may be wired in parallel, with no current leakage and without drawing operating current.
When conventional solid state switches are wired in parallel, there is about 100 microamps leakage through each switch. If ten switches were wired in parallel, the total leakage current would be 1000 microamps or one milliamp -sufficient current to indicate an "ON" condition to a programmable logic controller (PLC).



No Voltage Drop with GO® Switches



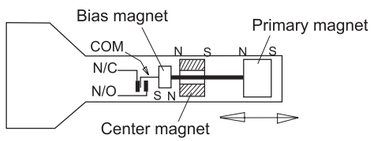
No Current Leakage with GO® Switches

Setting Up A 70 Series GO®Switch For Optimum Performance

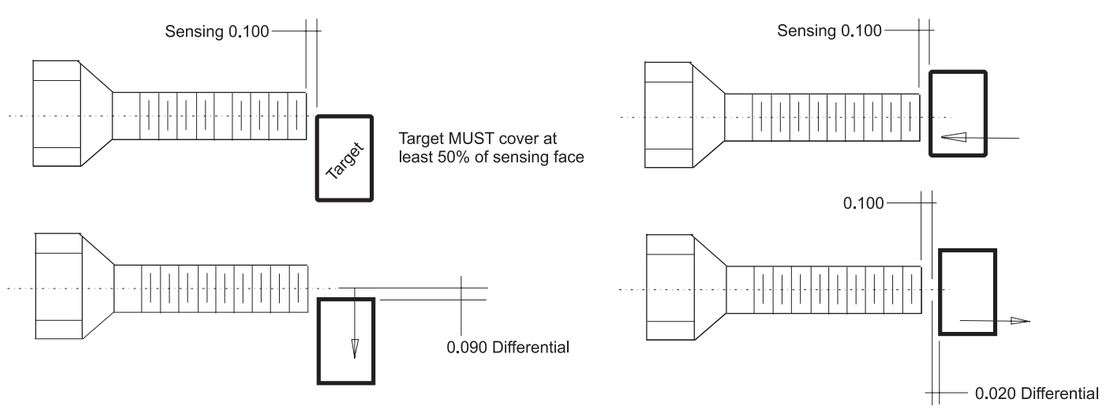
GO Switch 70 Series end sensing switches use three permanent magnets and a push-pull plunger to control a set of mechanical contacts. The center magnet simultaneously attracts the primary magnet and repels the bias magnet, pushing the connecting rod and common contact into the normally closed position, closing a contact circuit. When a ferrous or magnetic target enters the sensing area of the switch, it attracts the primary magnet, which pulls the connecting rod and common contact into the normally open position, closing the other contact circuit.

The **sensing distance** is the maximum distance between the switch and target when the switch first operates; the trip point. The **differential,** also known as deadband or hysteresis, is the distance that the target must move from the sensing area in order to allow the switch to reset.

The internal mechanism is shown here:



To apply the 70 Series GO Switch to obtain the least differential, the direction the target approaches the switch must be considered. Below are two possible orientations that illustrate the differences in target movement and the affects on switch differential.



The measurements shown are nominal and can vary as much as .030-.050" depending on the material and size of target used in the application. As you can see, the best scenario for least differential is to orient the switch and target as shown in **Orientation B**. However, in this application, the possibility of getting debris between the switch and target must also be considered.

When trying to determine differential of an application, it is directly proportional to the distance the target will travel in the application. For example: a linear valve stroke is 1". A switch is applied to indicate the closed position of the valve. Using **Orientation A,** the differential is 0.090 ". The 'deadband' is therefore 9% of travel. If the switch were re-oriented, as shown in the **Orientation B**, the deadband would be only 2% of the total valve travel.

Remember, there is no exact science to use when applying a GO Switch. However, once the switch is set, and the target travels to the same position every time (within .002"), the GO Switch will maintain calibration for life. **Set it and forget it!**

Installation Principle - Round Switches

- 70 Series GO Switches are inherently shielded, and are **unaffected by surrounding ferrous material, weld fields and RF interference.**
- GO Switches sense ferrous materials such as mild steel, 400 series and 17/4 stainless steel.
- Sensing and differential of switch may vary depending on target travel direction.
- Avoid contact between target and switch. Configure mounting of switch and/or target so that target passes within proximity range of sensing area. Sensing range will vary according to model number and size (mass) of target used.
- Target magnets, available through TopWorx, will increase the sensing range of the switch. Reference sensing ranges in corresponding sections through out the catalog.
- For optimum performance, provide sufficient mass of target, and choose the appropriate GO Switch model to match the application requirements for operating frequency, type of load, etc.
- The greater mass of target the better for maximum contact pressure, especially in low current applications.
- For heavy or inductive loads, arc suppression devices, or interposing relays are recommended for contact longevity. Contact factory for specifics.
- Do not use excessive force on external threads when installing. (36 in/lbs. max)
- Configure mounting so bracket dissects switch as close to the middle of the length of body as possible (Fig. 1). This eliminates undue stress caused by heavy cables, connectors, etc.
- Two appropriately sized jam nuts are included with switch. Lock washers are recommended in high vibration applications.

See individual switch Ordering Guides for wiring diagrams and information on external target magnets for increased sensing ranges.

For cylinder applications, see pg. 65 for set up recommendations.

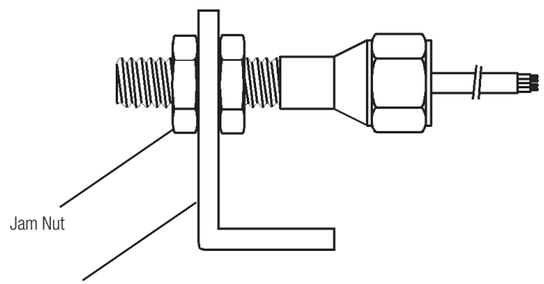
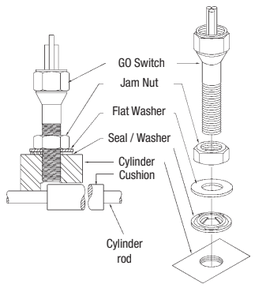


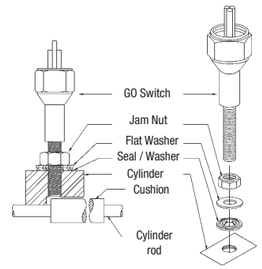
Figure 1
Mount as close to mid-point of length of switch

Pressure Sealing Methods

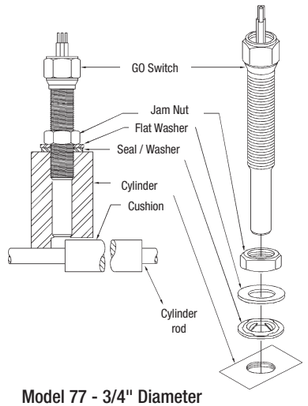
GO Switch recommends the use of our Parker ThredSeal® Washer Kits in lieu of other commercially available sealing hardware. Provided with the Parker ThredSeal® Washer Kit are torque values for specific pressure ratings as well as the maximum torque values.



Models 73-76 - 5/8" Diameter
Torque Jam Nuts to:
15 lbs-ft to achieve seal at 2,000 PSI
25 lbs-ft to achieve seal at 5,000 PSI
Do not exceed 30 lbs-ft



Models 71 & 72 - 3/8" Diameter
Torque Jam Nuts to:
15 lbs-in to achieve seal at 2,000 PSI
30 lbs-in to achieve seal at 5,000 PSI
Do not exceed 45 lbs-in



Model 77 - 3/4" Diameter
Torque Jam Nuts to:
20 lbs-ft to achieve seal at 2,000 PSI
65 lbs-ft to achieve seal at 5,000 PSI
Do not exceed 75 lbs-ft

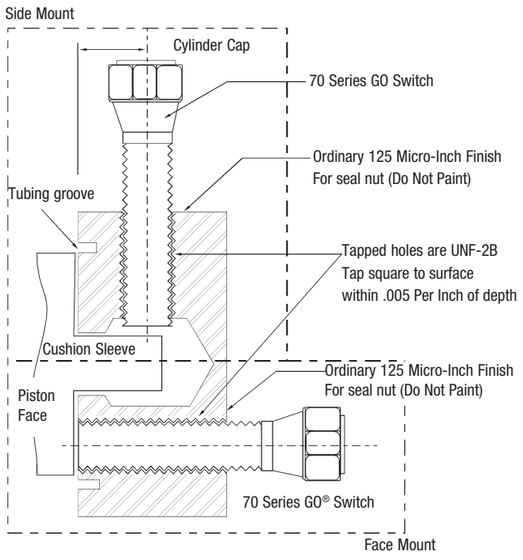
Air and Hydraulic Cylinders

A ferrous cylinder cushion or piston will actuate the switch.

To determine the correct thread length, measure the distance from the head cap surface to the cushion and add 1/2" for seal nut. 70 Series are rated 2,000 PSI operating pressure; 5,000 PSI operating and 10,000 PSI non-shock optional on models 73 through 77.

Thread seal nut onto switch. Screw switch into cylinder by hand until switch touches cushion. Back out 1/4 to 1/2 turn. Tighten seal nut.

- 70 Series GO® Switches areunaffected by surrounding ferrous steel.



Factors Affecting Contact Life

GO Switches are designed to provide optimum performance over a long period. Their premium grade components and inherently durable design keeps them working, trouble-free, year after year. Some of the conditions that can decrease contact life are:

Contact Erosion

There are two types of contact erosion, mechanical and electrical. Electrical contact erosion is caused by heavy electrical loads. The contacts may overheat and become molten if there isn't sufficient off time to allow cooling between cycles. Mechanical erosion occurs as a result of friction between contacts cycling at high speeds with little or no electrical load. Mechanical wear can also occur due to operating a switch at a frequency higher than its design capability. The high operating speed of GO Switches make them ideal for almost any application. For those with unusually high-frequency switching demands, please consult factory.

Electrical wear caused by arcing, can be eliminated by utilizing high quality contact materials, such as the gold-flashed silver cadmium oxide used in GO Switches, and by operating the switches within the voltage parameters for which they are designed. The use of arc suppressors such as resistor-capacitor combinations or blowout coils can also serve to prevent arcing, a consideration which is particularly important in certain hazardous operating environments.

Contact Transfer

When switches are operated above rated voltage or at high speeds, contact material can transfer from one contact to the other. For this reason, it is important to observe the input voltage specifications supplied for each GO Switch.

Welding or Sticking

The GO Switch design virtually eliminates welding or sticking due to mechanical armature hang-ups. Excessive voltage and the resultant arcing, however, can cause overheating of the contacts and welding or sticking. By operating the GO Switch within its specified parameters, this problem can be eliminated.

NEC 500-4 Protection Techniques for Hazardous Locations
- 500-4(a) Explosionproof Apparatus
- 500-4(e) Intrisically Safe Systems
- 500-4(f)(2) Nonincendive Equipment
- 500-4(h) Hermetically Sealed

NEC 500-5(a) Class I Group Classifications
NEC 500-5(b) Class II Group Classifications
NEC 500-7 Class I Locations Definitions
- 500-7(a) Class, I, Division 1.
- 500-7(b) Class I, Division 2

NEC 500-8 Class II Locations Definitions
- 500-8(a) Class II, Division 1
- 500-8(b) Class II, Division 2

NEC 500-9 Class III Locations Definitions
- 500-9(a) Class III, Division 1
- 500-9(b) Class III, Division 2

NEC 501-4 Wiring Methods
- 501-4(a) Class I, Division 1
- 501-4(b) Class I, Division 2

NEC 501-5 Sealing and Drainage
- 501-5(a) Conduit Seals, Class I, Division 1 (Conduit Seal Locations)
- 501-5(b) Conduit Seals, Class I, Division 2 (Conduit Seal Locations)
- 501-5(c) Class I, Divisions 1 and 2 (Seal Fitting Compliance)
- 501-5(d) Cable Seals, Class I, Division 1
- 501-5(e) Cable Seals, Class I, Division 2
  - Table 5.1 Conduit and Cable Seal Requirements for Hazardous Locations

NEC 501-6 Switches, Circuit Breakers, Motor Controllers and Fuses.
- 501-6(a) Class I, Division 1
- 501-6(b) Class I, Division 2
  - 501-6(1) Type Required
    - 501-6(1)(a) Hermetic seal
    - 501-6(1)(b) Factory seal
    - 501-6(1)(d) Solid state switch

NEC 501-7 Control Transformers and Resistors (Solenoids)
NEC 501-12 Receptacles and Attachment Plugs, Class I, Divisions 1 & 2 (Disconnect Plugs)
NEC 501-16 Grounding, Class I, Divisions 1 & 2

NEC 502-4 Wiring Methods
- 502-4(a) Class II, Division 1
- 502-4(b) Class II, Division 2

NEC 502-5 Sealing, Class II, Divisions 1 & 2
NEC 502-6 Switches, Circuit Breakers, Motor Controllers and Fuses
- 502-6(a) Class II, Division 1
  - 502-6(a)(1) Type required
  - 502-6(a)(2) Isolating Switches
  - 502-6(a)(3) Metal dusts
- 502-6(b) Class II, Division 2

NEC 502-7 Control Transformers and Resistors (Solenoids)
- 502-7(a) Class II, Division 1

502-7(b) Class II, Division 2

NEC 504 Intrinsically Safe Systems
504-2 Definitions
- Associated apparatus
- Control drawing
- Intrinsically safe apparatus
- Simple apparatus

504-4 Equipment Approval
504-10 Equipment Installation
- 504-10(a) Control drawing
- 504-10(b) Location

504-20 Wiring Methods

505 Class I, Zone 0, 1 and 2 Locations
505-3 Location and General Requirements
- 505-3(a) Classification of locations

505-4 Protection Techniques
- 505-4(a) Flameproof “d”
- 505-4(c) Intrinsically safe
- 505-4(d) Type of protection “n”
- 505-4(f) Increased safety “e”
- 505-4(g) Encapsulation “m”

505-5 Reference Standards
505-7 Grouping and Classification
- 505-7(a) Group IIC
- 505-7(b) Group IIB
- 505-7(c) Group IIA

505-9 Zone Classification
- 505-9(a) Class I, Zone 0
- 505-9(b) Class I, Zone 1
- 505-9(c) Class I, Zone 2

505-10 Listing, Marking and Documentation
- 505-10(a) Listing
- 505-10(b) Marking
- 505-10(c) Documentation

505-15 Wiring Methods
- 505-15(a) Zone 0
- 505-15(b) Zone 1
- 505-15(c) Zone 2

505-20 Equipment
- 505-15(a) Zone 0
- 505-15(b) Zone 1
- 505-15(c) Zone 2

Definitions as referenced by NEC Article 100

Ampacity
The current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Approved
Acceptable to the authority having jurisdiction.

Bonding
The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.

Bonding jumper
A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected.

Device
A unit of an electrical system that is intended to carry but not utilize electric energy.

Disconnecting
A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Dustproof
Constructed or protected so that dust will not interfere with its successful operation.

Dusttight
Constructed so that dust will not enter the enclosing case under specified test conditions.

Enclosure
The case or housing of apparatus…to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

Explosionproof apparatus
Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosions of gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Ground
A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded
Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.

Labeled
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed
Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or services meets identified standards or has been tested and found suitable for a specified purpose.

Live parts
Electric conductors, buses, terminals, or components that are uninsulated or exposed and a shock hazard exists.

Nonincendive circuit
A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, or igniting the flammable gas, vapor, or dust-air mixture. See Section 500-4(f) for details regarding this protection method allowable in Class I and II, Division 2 classified areas.

Qualified person
One familiar with the construction and operation of the equipment and the hazards involved.

Rainproof
Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions.

Raintight
Constructed or protected so that exposure to a beating rainwill not result in the entrance of water under specified test conditions.

Watertight
Constructed so that moisture will not enter the enclosure under specified test conditions.

Weatherproof
Constructed or protected so that exposure to the weather will not interfere with successful operation.