

Sealing Requirements for Pressure Applications

1 Sealing requirements for electrical equipment

Sealing is a serious concern for industrial process control due to the nature of the hazardous materials used in the process industry. The considerations for transmitter sealing are outlined below:

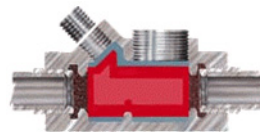
- For explosion-proof/flameproof approved transmitters, seals may be necessary to prevent the propagation of flame through the cable or conduit system.
- For transmitter sensors with wetted parts, additional sealing may be necessary to prevent the process from entering the electrical system and migrating from hazardous areas to safe or unclassified areas.

Most facilities have rules and regulations for sealing. In addition, there are national regulations or standards that address sealing requirements. The most common are listed below:

- NEC[®] 2014 Articles 501.15, 501.17, 502-15, 505.16, 505.26, and 506.16
- CEC[®] C22.1-12 Rule 18-072, 18-092, 18-108, 18-154, 18-204, and 18-254
- IEC/EN 60079-14:2013 Clauses 5.9, 9.4, and 14.4
- ANSI/API RP 14F Section 6.8.2.2

2 Flameproof/Explosion-proof seals

A flameproof/explosion-proof seal (commonly referred to as a conduit/cable seal) is installed at the entry of electrical equipment to prevent flame propagation from one portion of the electrical system to another. The seal is either a poured seal (potted) or a compression fitting. Flameproof/explosion proof seals are required on all installations where conduit or cable passes from one hazardous location to another or to a safe area. These seals are not designed to contain process fluids and typically hold a maximum pressure of 6 inH₂O (14.9 mbar) before allowing process fluids to pass. A typical poured seal is shown below.



FM and CSA standards require explosion pressure testing be performed on the transmitter to eliminate the need for conduit seals. Equipment that passes this testing is typically marked “Factory Sealed” or “Seal not Required”.

3 Process seals

A process seal prevents flammable process fluids from getting into the electrical system and moving from a hazardous area to a non-hazardous area, such as a control room. Process seals must be robust to withstand the pressure, temperature, corrosion and cyclic effects associated with industrial processes. They must be considered for any installation where a flammable process fluid is present. Thermowells and welded diaphragms are examples of process seals.

4 ANSI/ISA 12.27.01 Standard for process sealing

In 2000, user members of the ISA (International Society of Automation) SP12 committee pushed for the development of a standard for process sealing of electrical equipment used in hazardous locations that would allow the equipment to be exempted from the NEC process sealing requirements. ANSI/ISA 12.27.01 was the result of this effort. This standard identifies two sealing methods. The first sealing method is to test and certify a single high integrity seal, referred to as single seal. Testing includes temperature and fatigue testing of the seal, where it is subjected to 100,000 pressure cycles at worst case temperatures. Following this testing, the seal is subjected to leakage and burst overpressure tests.

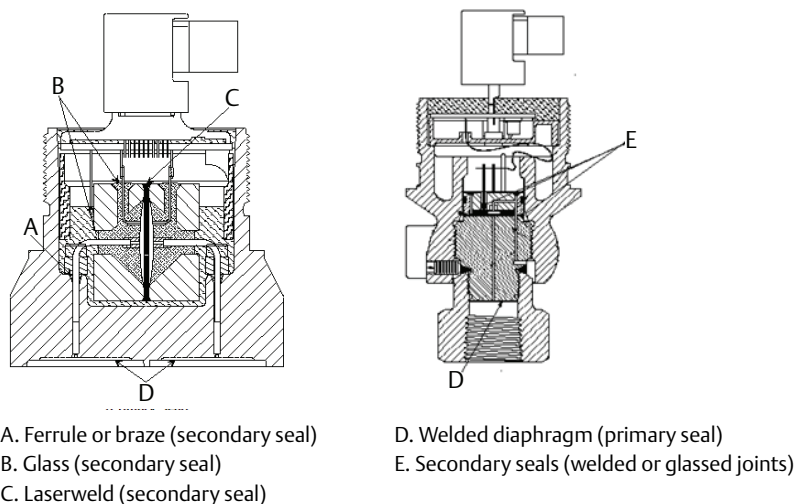
The second sealing method is to test and certify a multiple seal configuration, referred to as dual seal. Refer to ANSI/ISA 12.27.01 for dual seal testing of devices with and without annunciation of the primary seal failure.

Both methods provide adequate measures to prevent process fluid from entering into the electrical system.

5 Pressure process sealing compliance

All Rosemount® pressure transmitter designs incorporate multiple components to produce high integrity seals that eliminate the need for an additional seal as identified in the regulations and standards listed above. Figure 1-1 identifies these components within a typical transmitter sensor module.

Figure 1-1. Pressure Seal Components



These components include welded diaphragms, stainless steel tubes, glassed headers, and multiple sensor welds. During sensor development the sensor design is subjected to multiple pressure cycle tests of 100,000 cycles each using both air and oil to evaluate sensor robustness. In addition, the welds on every sensor are verified using a helium leak test as part of the production process.

The electronics housing is also designed as dual compartment to further isolate the process from the electrical system.

Rosemount pressure transmitters with FM or CSA approval are labeled “Factory Sealed” or “Seal not required” for users in the United States and Canada. This is an indicator to installers that separate process seals and explosion-proof seals (conduit seals) are not required. As is true for all interpretations of the NEC and CEC, the final acceptance of the installation must be obtained from the local authority having jurisdiction.

CSA International has certified multiple Rosemount pressure transmitters to ANSI/ISA 12.27.01-2003. The associated markings are now included on any CSA approved product. This certification was achieved without modification to the transmitter, so transmitters built prior to certification also meet CEC requirements without additional sealing.

6 Summary

The majority of Rosemount transmitters can be installed without the need for additional sealing. This information has been provided as reference only. Users should seek guidance of the local authority having jurisdiction (AHJ) for final approval of all electrical installations.

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