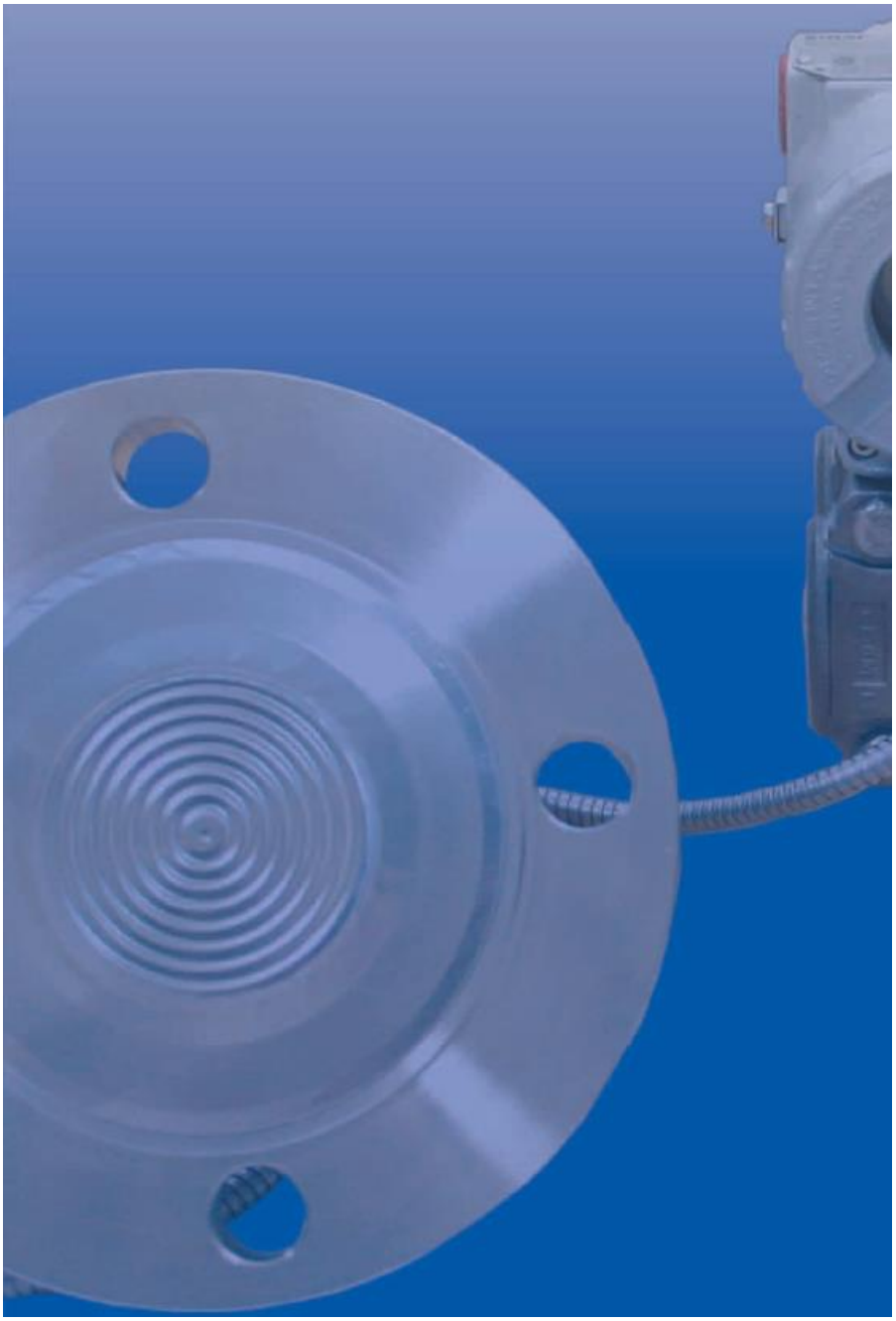
smar
International Corporation

Remote Seal Guide



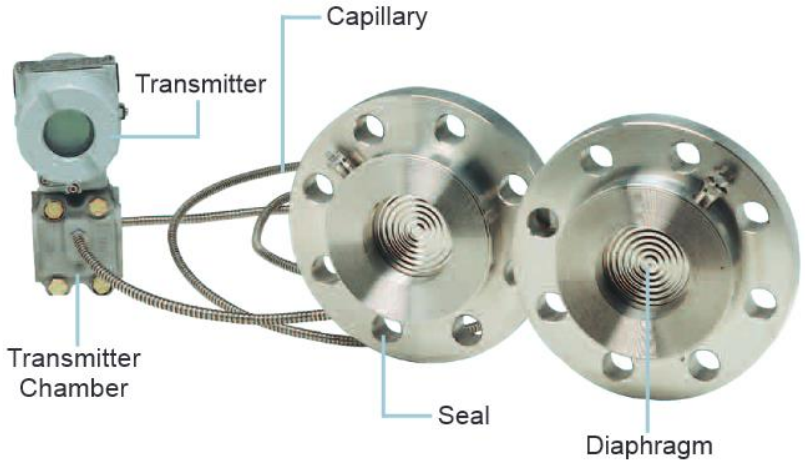
Contents

SMAR Remote Seal Guide

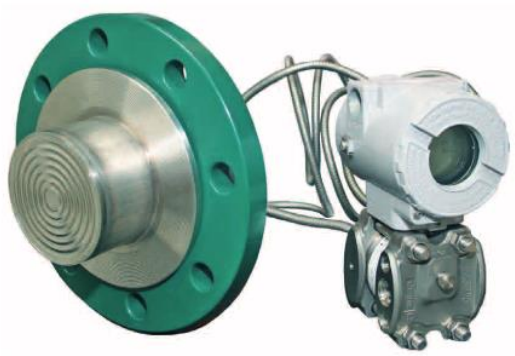
For SMAR remote seal solutions, please consult catalog SR301

What is a remote seal?

They allow the pressure transmitter to do measurements in situations where a direct contact of the transmitter's diaphragm with process fluid is not allowed. They do that by extending the transmitter pressure inlet with a capillarity to flanged pressure repeater that will be in touch with the process.



According to the application the user needs to specify the length of the capillarity, the material of the pressure repeater (diaphragm and connecting flange), and the fluid that fills the capillarity.



Slip-on Flange Model

Integral Flange Model

Examples to use a Remote Seal:

- Process with corrosion
- Process with viscosity or with suspended solids
- Process with possibility of solidifying, crystallizing or freezes

• Process that demand ease of cleaning

• Process with extreme temperature.

• When it is difficult or impossible to connect pressure transmitter directly to process.

Two categories of Remote Seals: Balanced and Tuned

Balanced:

A balanced remote seal system is a symmetrical system that utilizes equal seals and capillary length on the high- and low-pressure sides of the transmitter. Since the capillary lengths are the same, each side ideally has the same amount of fill fluid, minimizing or eliminating the seal temperature effect due to equal pressure on both sides of the transmitter diaphragm. The balanced systems are still affected by the head pressure.

Tuned:

Tuned-Systems assemblies are asymmetrical remote seal systems with one seal directly mounted to the high side of the differential pressure transmitter, and the other side connected to a seal via capillary. Another possible Tuned-System assembly is any remote seal system with unequal lengths of capillary or two different remote seals on the high- and low-pressure connections. Due to the unequal lengths of capillary, there are seal temperature effects. However, this seal temperature effect counters the head pressure from the oil-filled capillary and reduces total temperature effects on the entire system.

Components that make up a Remote Seal

Two seal assembly used on a differential pressure transmitter

Single seal assembly used on a Gauge Pressure or Absolute Pressure Transmitter

Components are:

- Process flange
- Remote diaphragm
- Capillary – Direct mount has no capillary
- Fill Fluid
- Flushing connection (optional). Also known as calibration ring. Smar designates this as a lower housing

Considerations for Remote Seal Specification

In the remote seal specification the following items should be considered:

- Process Pressure (minimum and maximum)
- Process Temperature (minimum and maximum)
- Process Fluid
- Connection to Process
- Seal Installation Type
- Distance between Pressure Tap and the Transmitter.

Common Errors to Avoid when selecting a Remote Seal

- Wetted materials not compatible with the process fluid. Consider normal operation as well as cleaning
- Fill fluid not compatible with the process fluid may cause hazardous situations in case of diaphragm ruptures and the fluids meet the process
- Vacuum below (-0.85 PSI, -23 INH2O, 44 mmHG) requires special considerations. Operation at these high vacuums is possible if done right.
- Process data such as pressure, temperature, required seal type and process fluid must be furnished to evaluate the application
- Only one seal or capillary with different lengths on a differential pressure transmitter causes zero shift as the temperature changes. Keep capillaries same length, if possible
- Long capillaries cause response time to increase and augment temperature effect
- The temperature is beyond the upper or lower operating temperature range of the fill fluid
- The process pressure exceeds the seal pressure rating at maximum process temperature
- Upper measurement ranges below (-0.85 PSI, -23 INH2O, 44 mmHG) will see errors as the remote seal reduces the sensitivity of the transmitter.

Types of Remote Seals

SR301T Flanged Remote Seal - SR301T is a flanged seal with welded diaphragm. It can be supplied with an optional flush connection and housing. The flush connection removes deposits on the diaphragm without disconnecting the seal. If installed correctly, the seal flange is a non-wetted part and does not get wet in contact with the process fluid during normal operation. However, the diaphragm and housing are wetted.

SR301E Flanged Remote Seal with Extension - The SR301E is a flanged seal with welded diaphragm. The diaphragm is extended from the seal flange and welded to the extension. Different from Model SR301T, it is not supplied with a housing, because the diaphragm coincides with the internal wall of the tank.

SR301R Threaded Remote Seal - The SR301R is a threaded connection seal. The diaphragm is welded to the flange. This model is always supplied with housing because the process thread is in this part. The flush connection (optional) in the housing enables the removal of deposits on the diaphragm without disconnecting the seal. The parts are bolted together and sealed with a gasket.

SR301S Sanitary Remote Seal - The SR301S is a seal for food and other applications where the sanitary connections are necessary. The diaphragm is welded to the connection face, which can be Threaded type or Tri-Clamp, allowing an easy and fast connection/disconnection of the transmitter.

SR301P Pancake Remote Seal - The SR301P is a seal with welded diaphragm, whose assembly requires blind flanges. This model is supplied with housing and flush connection (optional). The flush connection removes deposits on the diaphragm without disconnecting the seal. The seal diaphragm and the housing are wetted (in contact with the process fluid). However, the blind flange does not get wet.

SR301Q Pancake Remote Seal with Extension - The SR301Q is a seal with welded diaphragm, whose assembly requires blind flanges. The diaphragm is extended from the seal flange and welded to the extension. Different from Model SR301P, it is not supplied with housing, because the diaphragm coincides with the internal wall of the tank.

LD300L Level Transmitter – The LD300L is a pressure or level transmitter using a high side flange. Its technical specifications and specifications for precision, drift and temperature effect are the same as the LD300L catalogue. The LD300L is a transmitter for industrial applications. The process connections can be supplied with housing when not having an extension.

LD300S Sanitary Transmitter – The LD300S is a transmitter for food and other applications, where sanitary connections are necessary. The process connections can be Threaded or Tri-Clamp, allowing a fast and easy connection and disconnection from the process. The standard of lining of the wet surface is 32 Ra, highly polished, so that the seal is free of the breach not allowing the lodging of the food or bacterium that can infect the process. The Smar's sanitary equipment (LD300S and SR301S) can be supplied according to 3A standard, the sanitary pattern widely accepted in the food industry, beverage, and pharmaceutical industries.

NOTE: There are many other types of Remote Seals such as Saddle Seals, Inline Flow Through seals, Pulp and Paper seals to name a few. You can contact Smar International for more details on how to order these and other Remote Seals not specified above.

WETTED MATERIALS

The diaphragm material should be selected considering its chemical resistance to external agents, process fluid and temperature involved.

Diaphragm Material Types:

Smar pressure transmitter remote seals include a wide variety of materials of construction to cover almost any application. The following discussion will aid in the understanding of various materials offered. It should be noted that for special applications, other materials of construction not listed in this paper may be offered. Only the most widely used materials are presented.

- 316L Stainless steel - Type 316 SST has a high resistance to corrosion. It is rust resistant in the atmosphere and is resistant to most concentrations of nitric acid. However, it is attacked by nonoxidizing acids such as sulfuric and hydrochloric acid in most concentrations. Most salt solutions have little effect on type 316 SST, although the halide salts (fluorine, chlorine, bromine, iodine) can cause severe pitting and possibly stress-corrosion cracking. Type 316 SST has good resistance to alkaline solutions, organic acids, and other organic compounds

- Hastelloy C276 - This alloy also retains a considerable degree of resistance to nonoxidizing conditions. For example, Hastelloy C-276 withstands oxidizing acids and the acid salts such as ferric and cupric chlorides. Hydrochloric and sulfuric acids in most concentrations do not affect

Alloy C-276 at moderate temperatures. Alloy C-276 is well suited to provide protection against alkalines, organic acids, and other organic compounds. C-276 can be susceptible to hydrogen permeation and is thus not the best fit for hydrogen rich applications. If hydrogen permeation is a risk, gold-plated 316 SST or gold-plated Alloy-400 should be considered. Both Monel-400 and Hastelloy C-276 have excellent corrosion resistance against atmospheric conditions and fresh water. In addition, Hastelloy C-276 is resistant to stagnant seawater.

- Monel 400 - Monel-400 has good resistance at ambient temperatures to most of the nonoxidizing acids, such as hydrofluoric, sulfuric, and phosphoric acids. It also resists nonoxidizing salts. The nickel in the alloy improves its resistance toward alkalies. One challenge with Monel-400 material is that it is more susceptible to hydrogen permeation. Therefore, Monel-400 should not be used as a diaphragm material when the process is hydrogen gas or when hydrogen atoms are present unless other protection mechanisms, such as gold plating, are used. Gold-plated Mone-400 may be a good choice for Hydrofluoric Acid service.

- Tantalum - Tantalum has proven to be a useful material in corrosive applications involving hydrochloric acid and acidic ferric chloride solutions. This accounts for the wide acceptance of tantalum in the chemical industry. Tantalum has a high melting point and good strength even at elevated temperatures. Its high strength allows thin sections to be used. This is important because tantalum is very expensive. Tantalum has superior corrosive resistance to most acids, chemical solutions, and organic compounds. In general, tantalum has good resistance to hydroiodic, hydrobromic, boiling hydrochloric, nitric, phosphoric, and sulfuric acids. Liquid metals generally do not affect tantalum. In addition, it has good resistance to most other acids. However, tantalum can be attacked severely by hydrofluoric acid, fluosilicic acid, hot fuming sulfuric acid, and fluorine. Also, it is attacked by strong alkaline solutions and by fused alkalines. Tantalum can suffer severe embrittlement if in service with high-temperature oxygen or nitrogen, or with hydrogen at any temperature.

FILL FLUID

Different types of fill fluids exist to meet the needs of different applications. An all-purpose fill fluid can be used in most applications. However, some processes might require a fill fluid that is chemically inert to avoid reactions with oxygen. In the food and pharmaceutical industries, a hygienic fill fluid may be needed that meets various industry standards. When selecting a fill fluid, the process and ambient temperatures must be within the specified temperature range of the fill fluid. Too hot can cause the fill fluid to vaporize or yield thermal stability issues. Too cold can cause the fill fluid to gel, which slows the time response or can even render the system unresponsive.

- Silicone DC200 - Temperature Range: -40 to 170°C Application: General (Atoxicity, not irritating, odorless, Food Processing)
- Silicone DC704 - Temperature Range: 0 to315°C Application: General (high Temperatures and Vacuum)

- Fluorolube MO-10 - Temperature Range: -20 to 100°C Application: Oxygen, Chlorine, Nitric Acid
- Syltherm 800 - Temperature Range: -40 to 350°C Application: General (Positive and Negative External Temperature
- Neobee M20 – Temperature Range: -15 to 225°C Application: Foods, Beverage, and Pharmaceuticals
- Glycerin and Water – Temperature Range: -15 to 93°C Application: Foods
- Fomblim – Temperature Range: -20 to 200°C Application: Low toxicity, excellent compatibility with metals, plastics and elastomers, excellent performance in high vacuum
- Krytox – Temperature Range: -40 to 120°C Application: Inert, nontoxic, nonexplosive, nonreactive to all elastomers, plastics and metals, excellent performance in high vacuum
- Halocarbon -40 to 80°C Application: Inert, low odor, low toxicity, noncorrosive. Standard for manufacturers of oxygen and reactive liquids

Pressure Ratings

Pressure Rating Designation

The Pressure Rating for flanges are given in Classes.

Class, followed by a dimensionless number, is the designation for pressure-temperature ratings as follows: Class 150 300 400 600 900 1500 2500.

Different names are used to indicate a Pressure Class. For example. 150 lb, 150 lbs, 150# or Class 150, all means the same.

But there is only one correct indication, and that is Pressure Class, according to ASME B16.5. (The pressure rating is a dimensionless number).

Flanges can withstand different pressures at different temperatures. As temperature increases, the pressure rating of the flange decreases. For example, a Class 150 flange is rated to approximately 270 PSIG at ambient conditions, 180 PSIG at approximately 400°F, 150 PSIG at approximately 600°F, and 75 PSIG at approximately 800°F.
In other words, when the pressure goes down, the temperature goes up and vice versa. Additional factors are that flanges can be constructed from different materials, such as stainless steel, cast and ductile iron, carbon steel etc. Each material has different pressure ratings.

Important Note:

For details on how to specify the correct Class according to Temperature, please refer to our Catalog SR301