

Rosemount™ Differential Pressure (DP) Level Transmitters and Diaphragm Seal Systems



Safety messages

⚠ WARNING

Follow instructions

Failure to follow these installation guidelines could result in death or serious injury.

Ensure only qualified personnel perform the installation.

⚠ WARNING

Explosion

Explosions could result in death or serious injury.

Do not remove the transmitter cover in explosive atmospheres when the circuit is live.

Before connecting a handheld communicator in an explosive atmosphere, ensure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Both transmitter covers must be fully engaged to meet explosion-proof requirements.

Verify the operating atmosphere of the gauge is consistent with the appropriate hazardous locations certifications.

⚠ WARNING

Electrical hazard

Electrical shock could cause death or serious injury.

If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on transmitter leads and terminals.

Use extreme caution when making contact with the leads and terminals.

⚠ WARNING

Process leaks

Process leaks could result in death or serious injury.

Install and tighten all four flange bolts before applying pressure.

Do not attempt to loosen or remove flange bolts while the transmitter is in service.

Replacement equipment or spare parts not approved by Emerson for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.

Use only bolts supplied or sold by Emerson as spare parts.

⚠ WARNING

Manifold installation

Improper assembly of manifolds to traditional flange can damage sensor module.

For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (also called bolt hole) but must not contact sensor module housing.

⚠ WARNING

Sensor module and electronics housing

Sensor module and electronics housing must have equivalent approval labeling in order to maintain hazardous location approvals.

When upgrading, verify sensor module and electronics housing certifications are equivalent. Differences in temperature class ratings may exist, in which case the complete assembly takes the lowest of the individual component temperature classes (for example, a T4/T5 rated electronics housing assembled to a T4 rated sensor module is a T4 rated transmitter.)

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental in protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

NOTICE

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

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1 Introduction

1.1 Product recycling/disposal

Consider recycling equipment and packaging.

Dispose of the product and packaging in accordance with local and national legislation.

2 Remote seal systems

2.1 Differential pressure (DP) level and remote seal system measurement

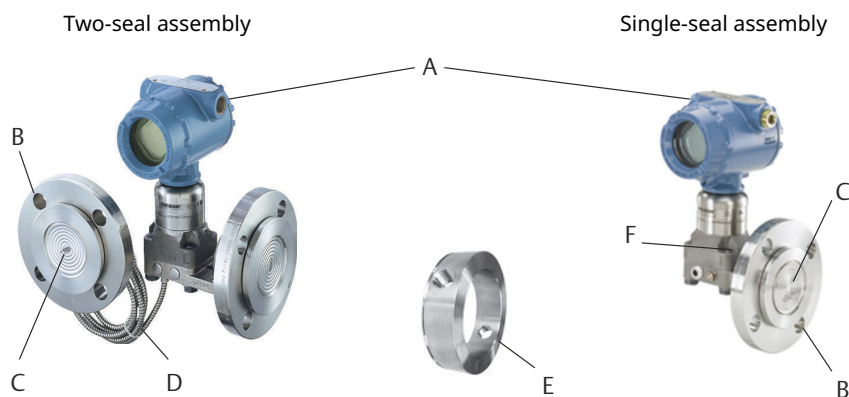
DP level is a reliable measurement solution for measuring level, density, interface, or mass of a process media inside a tank.

Remote seal system measurement is unaffected by agitation, foam, or internal obstacles. Remote diaphragm seals extend limitations due to process conditions, such as high and low temperatures, corrosive processes, viscous mediums, and hygienic applications.

2.2 Terminology of system components

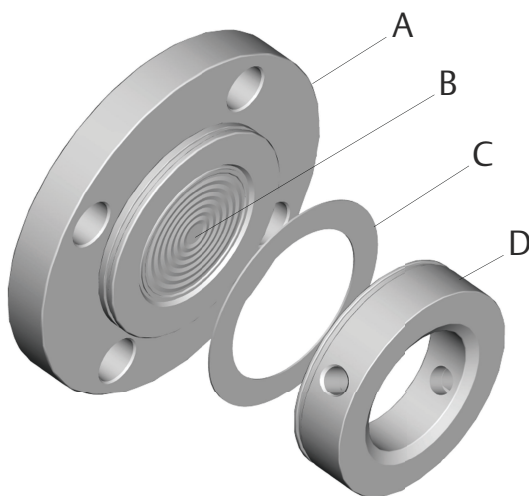
[Figure 2-1](#) lists the basic components for seal assemblies.

Figure 2-1: Components on a two-seal and single-seal assembly



- A. Pressure, differential pressure, or MultiVariable™ transmitter
- B. Process flange
- C. Remote diaphragm
- D. Capillary
- E. Flushing ring (optional)
- F. Direct mount

Figure 2-2: Flushed flanged (FFW) seal and components



- A. Process flange
 - B. Diaphragm
 - C. Gasket
 - D. Flushing ring (optional)
-

2.3 Seal system performance

2.3.1 Volume temperature effects (process temperature effects)

Fill fluids expand or contract with temperature changes, creating a volume change that is absorbed by the diaphragm seal and is seen as back pressure at the transmitter. This back pressure creates a shift in the transmitter reading. For symmetrical or balanced systems, this error is usually minimal, due to the back pressure being equal on both sides. However, head temperature effect is still present.

Note

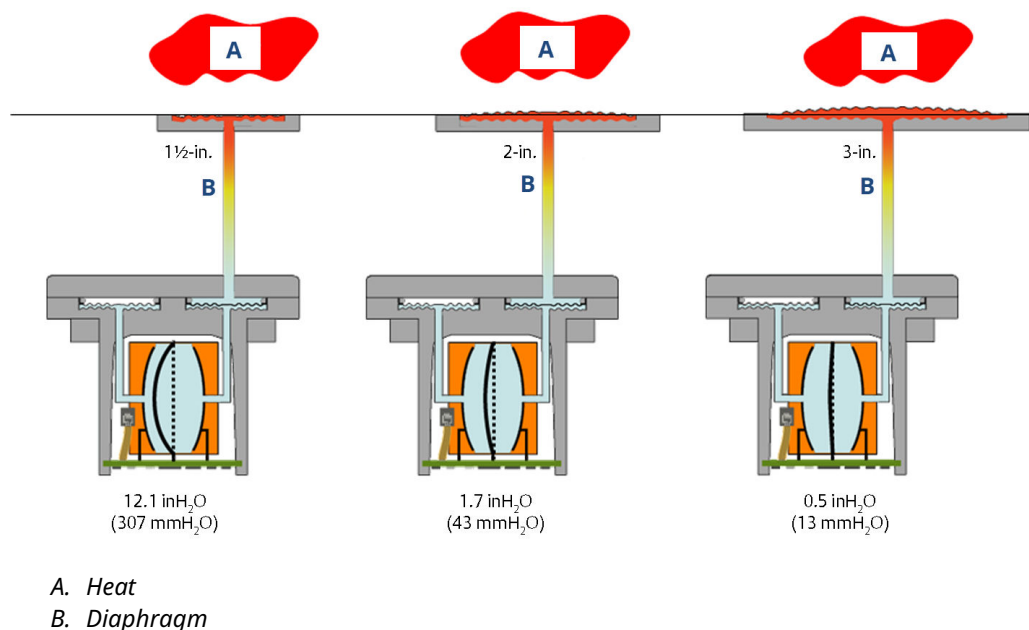
Other factors that affect seal temperature effect include diaphragm thickness, seal type and size, capillary length, and inner diameter.

[Figure 2-3](#) shows how diaphragm size can affect the measurement reading at the transmitter. For smaller seal sizes, such as the 1½-inch size, the amount of back pressure on the transmitter causes an additional 12.1 inH₂O (307 mmH₂O) error. Moving to the 2-inch size gives 1.7 inH₂O (43 mmH₂O) and the largest 3-inch size shown only has 0.5 inH₂O (13 mmH₂O) error. Using a larger diaphragm can drastically improve performance and provides a more stable reading.

Note

Calculations done in Instrument Toolkit™ with silicone 200 fill fluid with Rosemount 3051 Transmitter.

Figure 2-3: Back pressure on diaphragm causing error



Note

Diaphragm temperature effects decrease as seal size increases.

2.3.2 Density temperature effects (head temperature effects)

Density temperature effect is due to the change in specific gravity of the fill fluid caused by a change in ambient temperature.

When installed, the weight of the fill fluid will produce an initial pressure read by the transmitter, equaling the height between the high and low connection taps multiplied by the fill fluid's specific gravity. As ambient temperature changes, the fill fluid specific gravity will change causing the weight of the fill fluid to change, thus changing the pressure read by the transmitter. Density effect will be seen in both

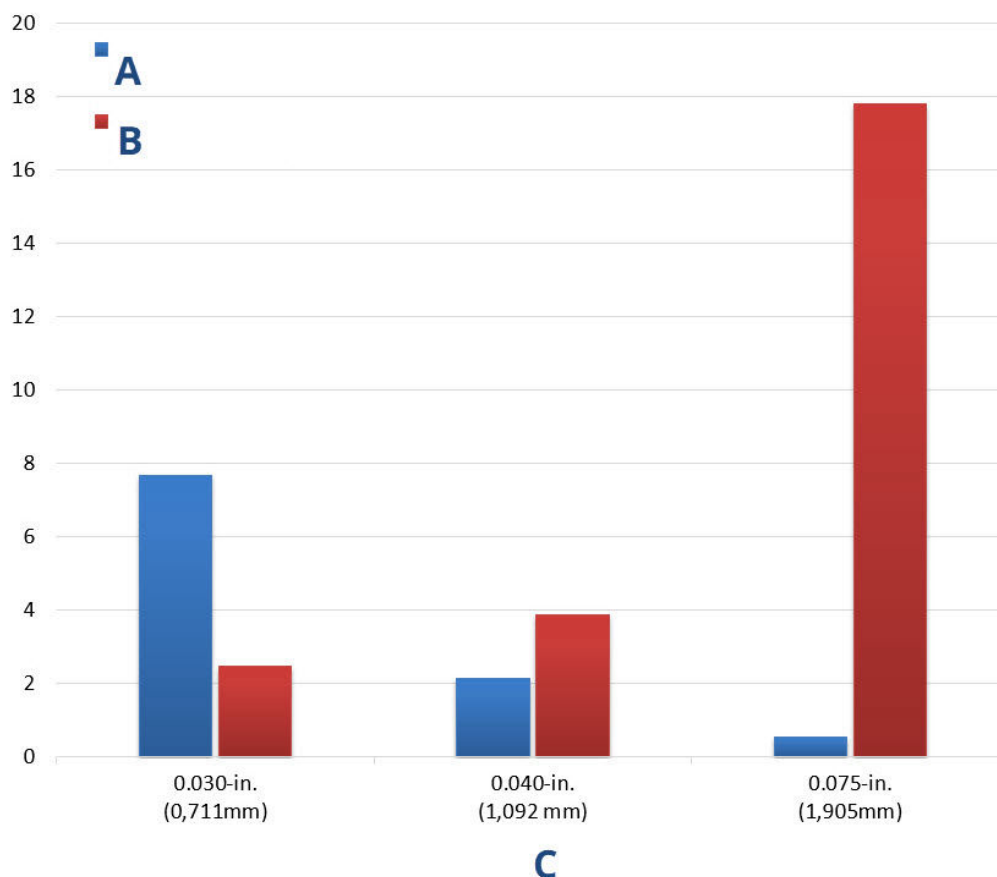
Tuned-System™ assemblies and balanced system assemblies and will have the same impact on the transmitter regardless of where the transmitter is mounted.

2.3.3 System time response and performance

The time response of a system is based on the type of transmitter, its sensor range, the length and inner diameter (ID) of the capillary, and the viscosity of the fill fluid (which is directly affected by the process and ambient temperatures). These factors all play a role in the overall performance of any seal system.

The relationship between system time response and temperature error is illustrated in [Figure 2-4](#). Changing the capillary ID has an inverse affect between the time response and temperature effect of a capillary system. As the capillary ID is increased, the time response of the system decreases while the temperature effect increases.

Figure 2-4: System response time and performance comparison by capillary size



System assumptions

- Silicone 200 fill fluid
 - Rosemount 3051CD2 Transmitter
 - 15-foot (4.6 m) capillary
 - 2-inch (51 mm) flush flanged weld (FFW) seal
 - Calibrated at +77 °F (+25 °C)
- A. Cold time response (seconds at -13 °F [-25 °C])
 B. Hot temperature effect (percent of span at +167 °F [+75 °C])
 C. Capillary ID

Note

Calculations conducted using Instrument Toolkit™.

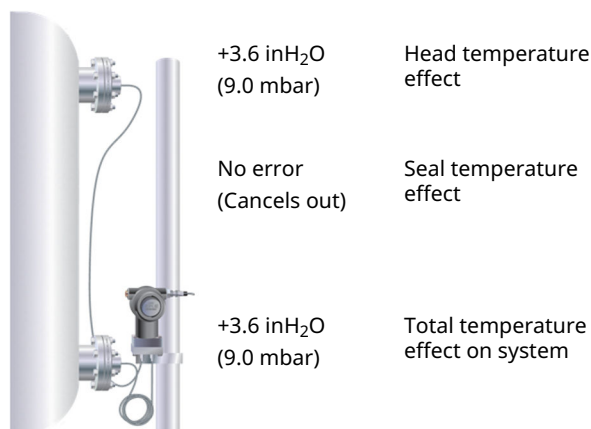
2.4 Balanced vs. Tuned-System™ assemblies

A balanced remote seal system uses equal seals and capillary lengths on both pressure sides of the transmitter to minimize seal temperature effects, while Tuned-System

assemblies are asymmetrical with unequal capillary lengths or different seals, which counter head pressure and reduce overall temperature effects.

A balanced remote seal system is a symmetrical system that uses 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 completely 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 as shown in [Figure 2-5](#).

Figure 2-5: Balanced system



Note

Temperature effects were calculated in Instrument Toolkit™ using a 2-inch (DN 50) flushed flanged weld (FFW) seal, silicone 200, 10 ft. (3 m) between the taps, over a 50 °F (28 °C) temperature change.

Tuned-System 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.

Figure 2-6: Tuned-System assembly

Head temperature effect	+3.6 inH ₂ O (9.0 mbar)
Seal temperature effect	-1.7 inH ₂ O (4.2 mbar)
Total temperature effect on system	+1.9 inH ₂ O (4.7 mbar)



Note

Temperature effects were calculated in Instrument Toolkit using a 2-inch (DN 50) FFW seal, silicone 200, 10 ft. (3 m) between the taps, over a 50 °F (28 °C) temperature change.

2.5 Specifying the right solution for vacuum applications

2.5.1 Vacuum application overview

When a vessel is operating in a vacuum (negative gauge pressure), it is important to specify the correct transmitter remote seal system to measure level accurately and reliably. Failure to do so can result in output drift or complete system failure. The combination of high process temperature and vacuum process pressure conditions creates additional requirements when specifying the transmitter remote seal system.

2.5.2 Vacuum applications

There are three primary transmitter-seal system components necessary to successfully specify vacuum application solutions:

- Seal system construction
- Fill fluid selection
- Transmitter mounting position

Seal system construction for vacuum applications

Emerson offers welded-repairable or all-welded vacuum system construction styles on diaphragm seal assemblies.

Emerson designed the all-welded vacuum construction specifically for vacuum applications. In this construction, the sensor module gaskets are removed and a disk is welded over the sensor isolators. This eliminates the possibility of air being drawn into the seal system in

deep vacuum conditions. Emerson strongly recommends this premium design for vacuum pressures below 6 psia (310 mmHg).

Fill fluid selection

When the process is under vacuum conditions, the fill fluid can vaporize at a lower temperature than when it is under normal atmospheric or greater pressure. Each fill fluid has a specific vapor-pressure curve. The vapor-pressure curve indicates the pressure and temperature relationship where the fluid is in a liquid or a vapor state. Proper seal operation requires the fill fluid to remain in a liquid state.

For vacuum applications, specify fluids that are specifically designed for use in these types of applications, such as silicone 704 for vacuum applications, silicone 705 for vacuum applications, or UltraTherm™ 805 for vacuum applications. These fluids have been specially processed to deliver the maximum vapor pressure curve performance possible. For more information on Rosemount diaphragm seal fill fluids, reference the [Rosemount DP Level Fill Fluid Specifications Technical Note](#).

Transmitter mounting position

Mounting the pressure transmitter at or below the bottom vessel tap is an important factor to ensure a stable measurement with vacuum applications. The static pressure limit for a differential pressure transmitter is 0.5 psia (25 mmHgA), which ensures the transmitter sensor module fill fluid remains within the liquid phase of the vapor pressure curve.

If the vessel static limit is below 0.5 psia, mounting the transmitter below the bottom tap provides a capillary fill fluid head pressure on the module. A general rule is to always mount the transmitter approximately 3 ft. (1 m) below the bottom tap of the vessel.

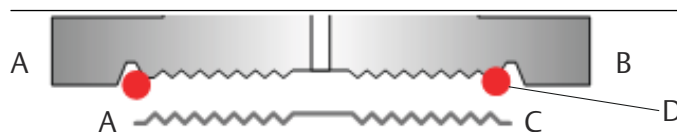
2.6 Diaphragm weld types

Emerson determines the best weld type for the seal type specified at the factory.

Pancake flanged weld (PFW) and flushed flanged weld (FFW) seals have ordering options that specify welding options.

2.6.1 Solid faceplate design

The solid faceplate design is used when diaphragm and upper housing material are the same.

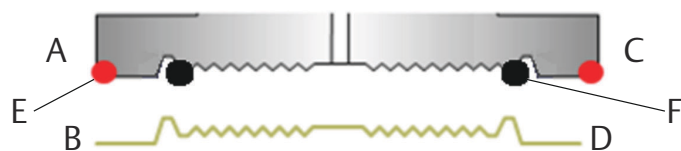


- A. Material A
- B. Upper housing
- C. Diaphragm
- D. TIG weld point

2.6.2 Seam weld design

A seam weld design is used when the upper housing material is different from the diaphragm material.

The seam weld design has a hermetic weld at the inner diameter of the diaphragm and a TIG weld at the outer edge. The diaphragm floats on the upper housing over the gasket surface area and could tear if a metallic gasket were used.

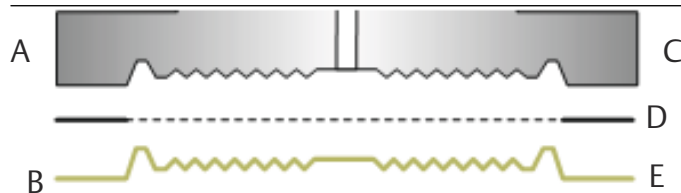


- A. Material A
- B. Material B
- C. Upper housing
- D. Diaphragm
- E. TIG weld point
- F. Seam weld point

2.6.3 Brazed design

This process uses a brazing ring where the metals are brazed to attach the diaphragm to the upper housing. This allows the gasket surface area to solidify as it is melted to the upper housing.

This option is used with tantalum diaphragm when a metallic gasket is required.



- A. Material A
- B. Tantalum
- C. Upper housing
- D. Brazing ring
- E. Diaphragm

2.7 Differences between electronic remote sensors and capillary systems

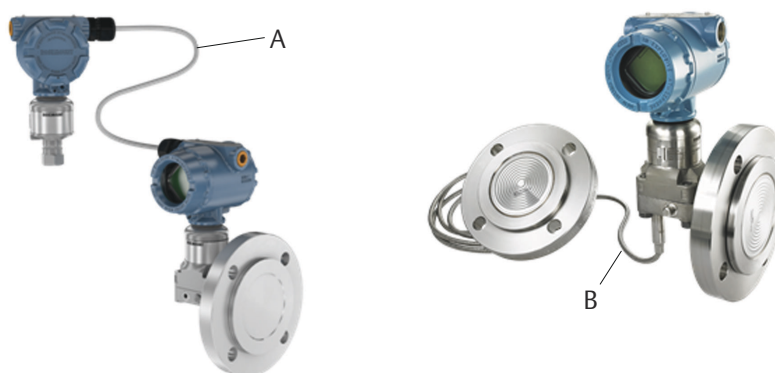
Rosemount 3051S Electronic Remote Sensors (ERS™) System technology uses two Rosemount 3051S Pressure Transmitters connected via an electrical wire instead of a single pressure transmitter with remote seals and capillary tubing.

As the 3051S ERS System calculates the differential pressure between the two transmitters, capillary tubing is not needed, and thus there is no head temperature effect on the system. Seals are not required, but may still be necessary on certain applications that include high temperature, corrosive, or viscous processes. For more information, refer to the [Rosemount 3051S Series Product Data Sheet](#).

Figure 2-7: ERS vs. capillary

3051S ERS

Traditional capillary system



A. Non-proprietary electrical cable

B. Oil-filled capillary system

2.8 Sizing and Selection: seal ordering and application process

Instrumentation specification assistance is available through the Differential Pressure (DP) Level Sizing and Selection tool or Rosemount Instrument Toolkit™.

These programs analyze application and process conditions against a specified seal system and calculates the total system performance, including expected head and seal temperature effects and system response times.

Visit the Emerson website for information on these tools.

2.9 Rosemount Thermal Range Expander: proper use and applications

The Thermal Range Expander increases the application range where differential pressure (DP) level technology can be used by expanding the ambient and process temperature ranges of the system.

Figure 2-8: Thermal Range Expander



- A. Intermediate diaphragm
- B. High temperature fill fluid (viscous)
- C. Ambient temperature fill fluid

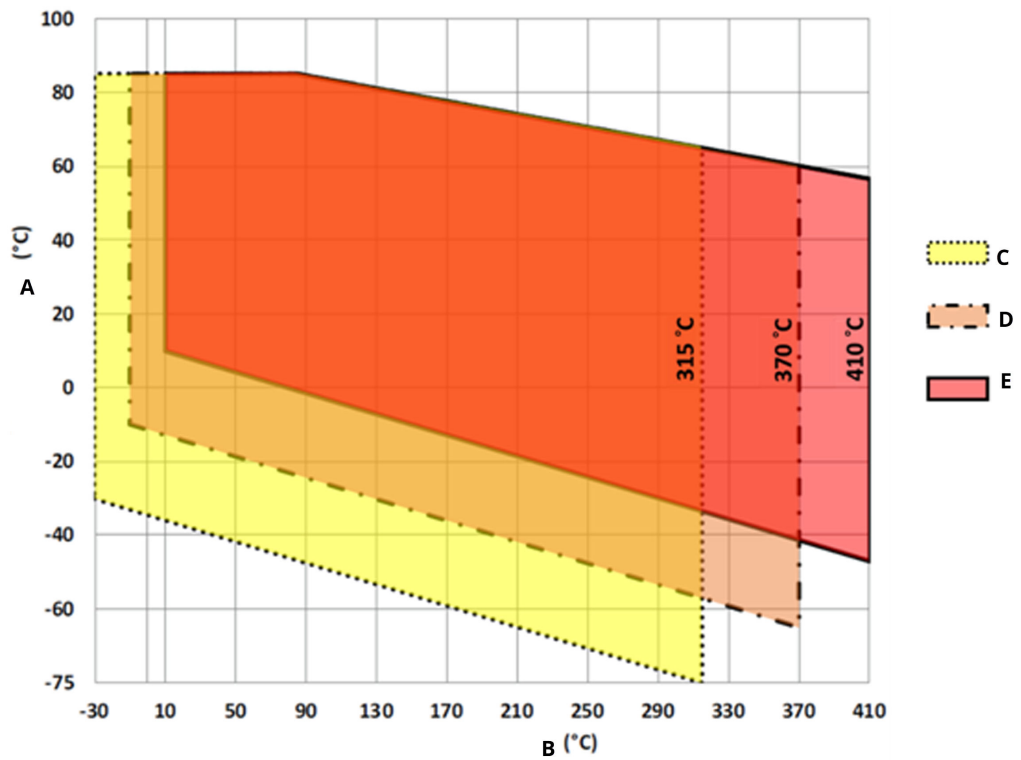
Traditional remote seal systems are filled with a single fill fluid to operate in applications with varying ambient and process conditions. Silicone 704 and 705 are commonly used fluids for hot process applications going above +570 °F (+300 °C); these fluids must be kept above +32 °F (0 °C) and +68 °F (+20 °C), respectively, in order to properly transmit the pressure signal to the transmitter. This can prove to be difficult for outdoor installations where extremely cold ambient conditions cause these fill fluids to gel.

The Thermal Range Expander is a seal system that uses two different fill fluids to extend the operating temperature range of the system. A high temperature fill fluid, which is next to the hot process, is kept warm enough to stay responsive. A second fill fluid, located on the other side of the intermediate diaphragm, operates over a wide ambient temperature range. The Thermal Range Expander can operate in ambient temperatures as low as -103 °F (-75 °C), and process temperatures up to +770 °F (+410 °C) and +850 °F (+454 °C) design temperature⁽¹⁾. This improves response time up to 46 percent and eliminates the need for mechanical heat tracing.

The Thermal Range Expander can be used with any Rosemount 3051S DP Level configuration including Balanced Systems, Tuned-System™ Assemblies, Electronic Remote Sensors (ERS™), or direct mounted to a transmitter.

(1) UltraTherm™ 805 supports maximum design temperature of +850 °F (+454 °C). Design temperature rating is for non-continuous use with a cumulative exposure time less of than 12 hours. Continuous use temperature is rated to +770 °F (+410 °C).

Figure 2-9: Thermal Range Expander temperature operating range



- A. Ambient temperature
- B. Process temperature
- C. Silicone 704
- D. Silicone 705
- E. UltraTherm 805

2.10 Thermal optimizer: proper use and applications

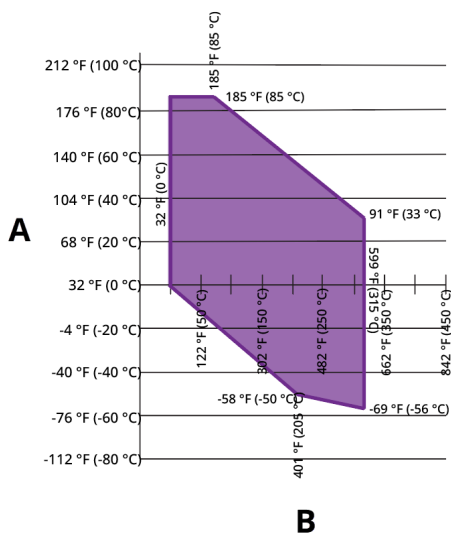


The thermal optimizer keeps fill fluids from gelling in cold ambient temperatures by using high process temperatures to heat the transmitter and capillary.

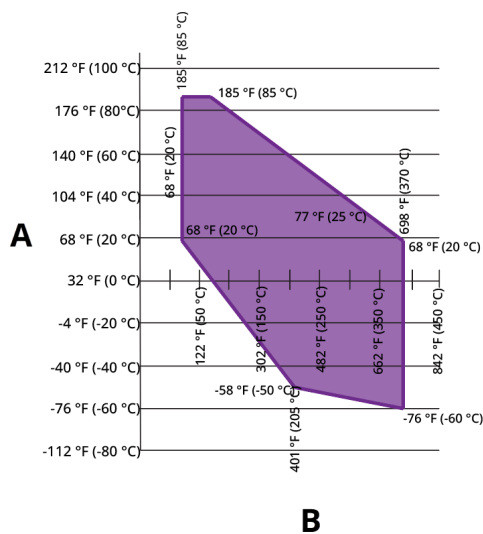
High temperature silicone fill fluid has a low temperature limit in ambient conditions below +32 °F (0 °C). The thermal optimizer allows direct mounting down to -94 °F (-70 °C).

Figure 2-10: Fill fluid temperature limits

Thermal optimizer with silicone 704



Thermal optimizer with silicone 705



A. Ambient temperature °F (°C)

B. Process temperature °F (°C)

2.10.1 Thermal optimizer limitations

[Figure 2-10](#) shows the process and ambient temperature limits for the thermal optimizer with silicone 704 and silicone 705 fill fluids respectively.

The shaded areas represent the temperature limitations; applications outside of the shaded area cannot be used with a thermal optimizer.

For example, an application with an ambient temperature of +50 °F (+10 °C) and a process temperature of +300 °F (+149 °C) is within the limits, a thermal optimizer can be used in this application.

However, an application with an ambient temperature of +122 °F (+50 °C) and a process temperature of +464 °F (+240 °C) is outside of the limits. These high temperatures would be detrimental to the transmitter electronics.

3 Installation

3.1 Seal handling and installation

3.1.1 Diaphragm

The remote seal diaphragm is designed to withstand pressure and wear from process, but outside of process connection conditions, remote seals are delicate and must be handled with care.

NOTICE

Even minor dents or scratches in the diaphragm material may impair the performance of the seal system assembly.

Leave the protective cover on the seal until the moment before installation.

Try to avoid touching the diaphragm with fingers or objects and refrain from setting the diaphragm side of the seal down on a hard surface.

Take care to ensure the seal diaphragm is not dented or damaged during seal installation.

3.1.2 Capillary

NOTICE

When unpacking or handling seal system assemblies, do not lift the seal or transmitter by gripping the capillaries. Avoid sharply bending or crimping the capillary tubing.

The minimum bending radius of the capillary tubing is 3 in. (8 cm).

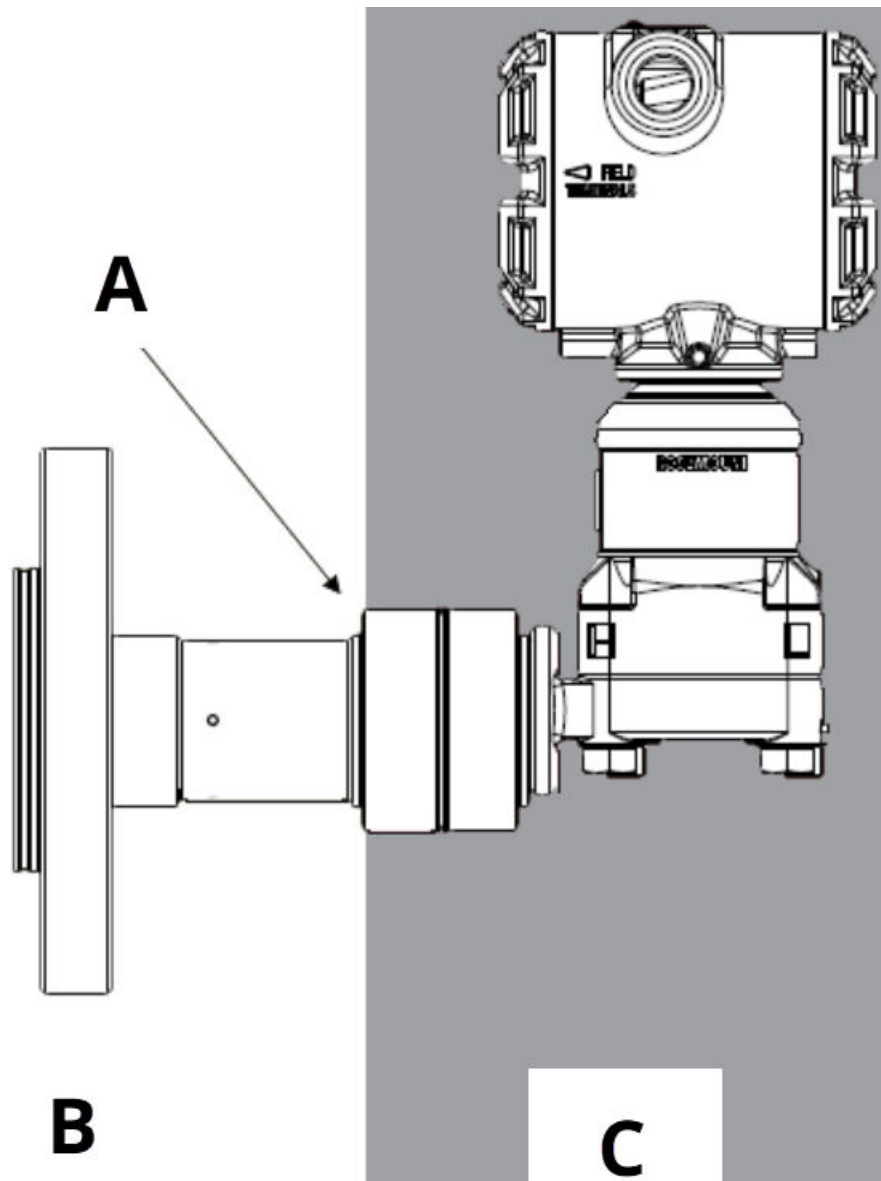
3.1.3 Rosemount Thermal Range Expander

The Thermal Range Expander system uses the heat from the process in order to keep both fluids within the system functioning properly; therefore, insulation is not always required. However, it is always best practice to insulate systems to keep them functioning with optimum performance.

NOTICE

Never insulate the Thermal Range Expander above the line marked on the seal itself.

Figure 3-1: Rosemount 3051SAL with Thermal Range Expander insulation guidelines



- A. Marking: Do not insulate above this line.
- B. OK to insulate
- C. Do not insulate

3.1.4 Heat tracing

When using heat or steam tracing, exercise caution if PVC coating is added onto capillary, as PVC coating cannot be exposed to temperatures above +212 °F (+100 °C) to avoid the possibility of thermal breakdown.

⚠ WARNING

Failing to recognize incorrect materials during installation may cause process leaks, which can result in damage to the diaphragm seal system or death and/or serious injury to personnel.

NEVER attempt to disconnect the seals or capillaries from the transmitter or loosen bolts. Doing so will result in loss of fill fluid and will void the product warranty. Proper wetted material is required for specific process materials.

NOTICE

Best practice for heat and steam tracing is to regulate the temperature slightly above the maximum ambient temperature for a consistent result. To avoid accuracy effects and thermal stress, do not partially heat the capillary.

3.2 Gaskets

Emerson supplies the intermediate gasket between the seal and lower housing when you order the lower housing or flushing connection on the Rosemount 1199.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

When installing remote seal systems which employ a gasket or a gasket and flushing connection ring, make sure the gasket is aligned properly on the gasket sealing surface. The operator is responsible for ensuring the gasket used does not exceed the temperature limits of the process.

NOTICE

The transmitter will read anything pressing on the diaphragm as pressure. A misaligned gasket may cause a false reading.

Make sure the gasket does not press down upon the diaphragm face.

The default gaskets are listed in [Table 3-1](#) based on seal type. The end user must supply the process gasket. Tantalum diaphragms are not supplied with default gasket; select a gasket option if applicable

If a lower housing is supplied, then the following gaskets are the default gaskets for each seal unless another gasket option is selected.

When ordering a Rosemount 1299 seal system, select the gasket in the model number; Emerson does not ship a default gasket.

Table 3-1: Gasket materials for 1199

Seal type	Gaskets
Flanged seals assemblies	
Flushed flanged weld (FFW)	Klingersil® C-4401
Remote flanged weld (RFW)	Klingersil C-4401
Extended flanged weld (EFW)	No gasket is supplied
Pancake flanged weld (PFW)	Klingersil C-4401
FCW	No gasket is supplied
RCW	Klingersil C-4401
FUW/FVW	No gasket is supplied
Threaded seal assemblies	
Remote threaded weld (RTW)	Klingersil C-4401
HTS	No gasket is supplied
Hygienic seal assemblies	
Sanitary clamp weld (SCW) ⁽¹⁾	No gasket is supplied
Spud seal weld (SSW)	Ethylene propylene O-ring
Sanitary tank weld (STW)	Ethylene propylene O-ring
EES	No gasket is supplied
VCS ⁽¹⁾	No gasket is supplied
SVS ⁽¹⁾	No gasket is supplied
SHP	No gasket is supplied
SLS ⁽¹⁾	No gasket is supplied
Specialty seals	
WSP	Klingersil C-4401
Union connection pipe (UCP)	Barium-Sulfate filled PTFE O-ring
Chemical tee weld (CTW)	No gasket is supplied
TFW	No gasket is supplied
WFW	Klingersil C-4401

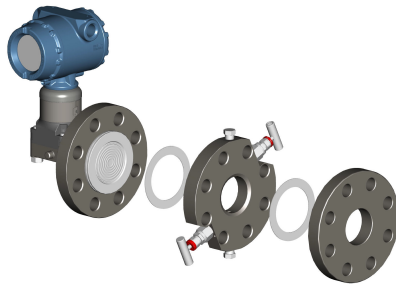
(1) Use EHEDG approved gasket for EHEDG conformity.

3.3 Flushing ring installation

Mount the flushing ring between the process flange and the diaphragm seal flange between two gaskets.

Orient flushing ports vertically so that the flushing fluid is most effectively drained.

Figure 3-2: Rosemount 319C Compact Flushing Ring installation orientation example

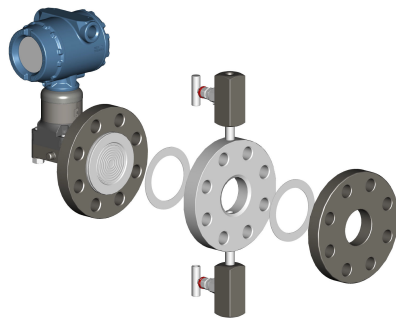


Note
[Figure 3-2](#) shown with optional plugs.

Note
319C compact designs are compatible with raised-face and full-faced remote seals and process flanges.

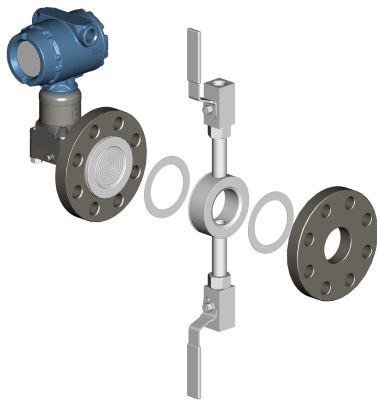
Rosemount 319T Traditional Flushing Ring installation orientation example

Figure 3-3: Bolt-through design



Note
Orient valves so that the valve handle faced towards the diaphragm seal. [Figure 3-3](#) depicts an optional 90 degree valve orientation.

Figure 3-4: Non-bolt-through design



Note
Figure 3-4 depicts a standard valve orientation.

3.4 Tagging

Each remote seal system is tagged in accordance with the end-user requirements. The remote seal model number is identified on the transmitter label, shown in Figure 3-5, Figure 3-6, and Figure 3-7.

Figure 3-5: Rosemount 3051S sample label

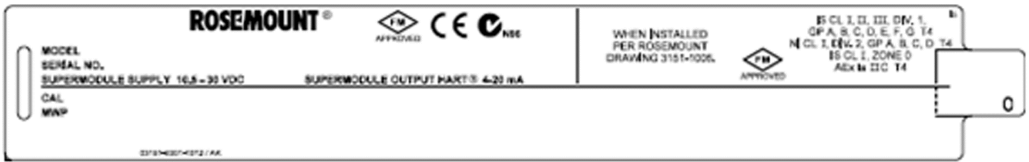
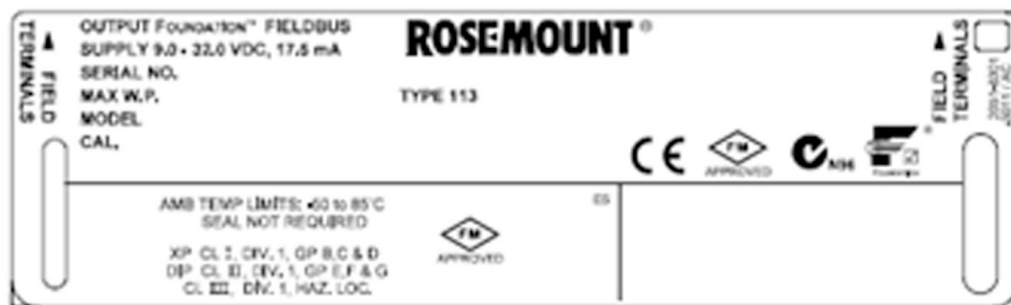


Figure 3-6: Rosemount 3051 sample label



Figure 3-7: Rosemount 2051 sample label



3.4.1 Maximum working pressure

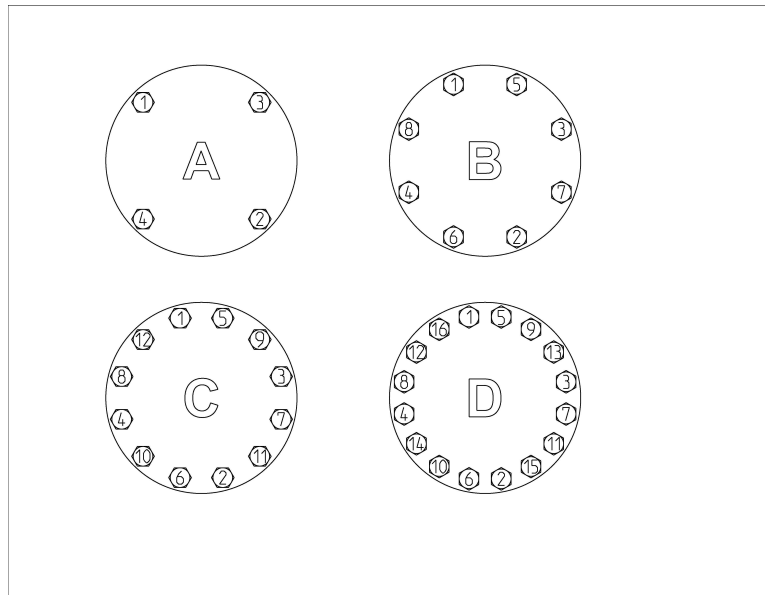
The maximum working pressure (MWP) of the seal system assembly is stamped on the transmitter neck tag.

This can be dependent upon the maximum pressure rating of the seal system or transmitter upper range limit.

3.5 Torque sequence

When tightening the assembly bolts, use a cross-pattern to ensure even installation. Best practice is to tighten 20 to 30 percent, check the gap, tighten 50 to 70 percent, check flange gap and uniformity, and continue to tighten in the appropriate pattern until you reach 100 percent torque value. Time permitting, wait a minimum of four hours and repeat the torque pattern to restore any short-term creep/relaxation in the connection.

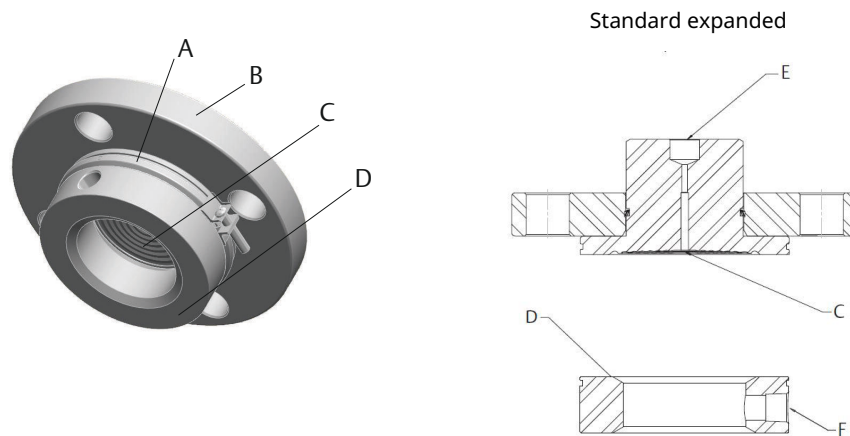
Figure 3-8: Cross-Pattern Sequence



- A. 4-bolt flange
- B. 8-bolt flange
- C. 12-bolt flange
- D. 16-bolt flange

3.6 Flush flanged weld (FFW) seal

Figure 3-9: FFW two piece design (shown with optional flushing ring)

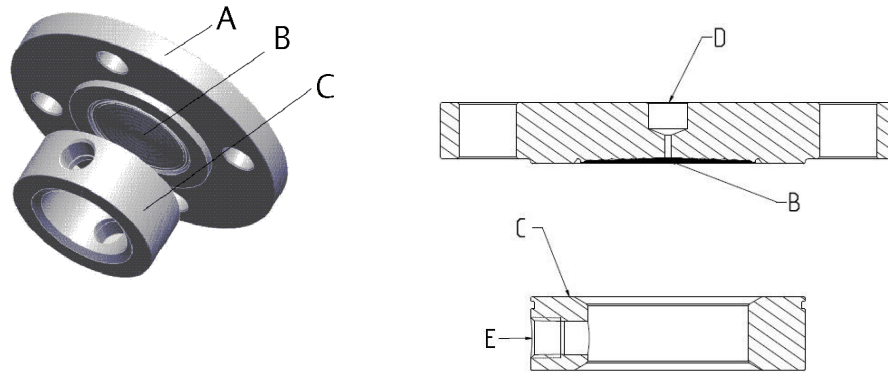


- A. Alignment clamp (option code SA)
- B. Process flange
- C. Diaphragm
- D. Flushing ring (optional)
- E. Connection to transmitter
- F. Flushing connection

Note

Two-piece design seal assembly and process flange are separate components and can be rotated independent of each other. You can order the alignment clamp on the Rosemount 1199 using option code SA.

Figure 3-10: FFW one-piece design (shown with optional flushing ring)



- A. Process flange
- B. Diaphragm
- C. Flushing ring (optional)
- D. Connection to transmitter
- E. Flushing connection

Note

Alignment clamp (option code SA) not available for FFW one-piece design.

3.6.1 Install flush flanged weld (FFW) seal

Prerequisites

If you order a flushing ring with no alignment clamp, Emerson recommends that two people install the FFW seal to ensure proper alignment.

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Note

Flushing rings include an Emerson-supplied gasket. If an alignment clamp is used, a Phillips or slotted screwdriver is required for installation

Verify the gasket materials are appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. If installing a flushing ring, ensure flushing connections are sealed before completing installation. You may border flushing rings with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves. If you did not purchase a flushing ring, proceed to [Step 3](#). Assemble the flushing ring, Emerson-supplied gasket, and remote seal together. If using an alignment clamp (option code SA on the Rosemount 1199) attach the flushing ring to the remote seal. Place the alignment clamp in the machined groove on both the remote seal and the flushing ring. Using the applicable screwdriver, tighten the screw on the clamp to hold the flushing ring in place.
3. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
4. Place the appropriate end-user-supplied gasket on the remote seal or flushing ring and align the gasket so that it is not inside the diaphragm weld as this will induce errors.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Using the previously installed bolts, attach the remote seal and gasket to the process connection. Secure with nuts and hand-tighten.
6. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
7. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation.

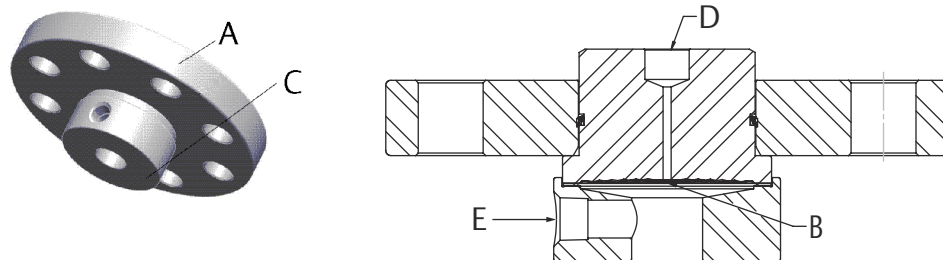
Make sure to torque the bolts to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.7 Offline remote flanged weld (RFW) seal

Figure 3-11: RFW standard design

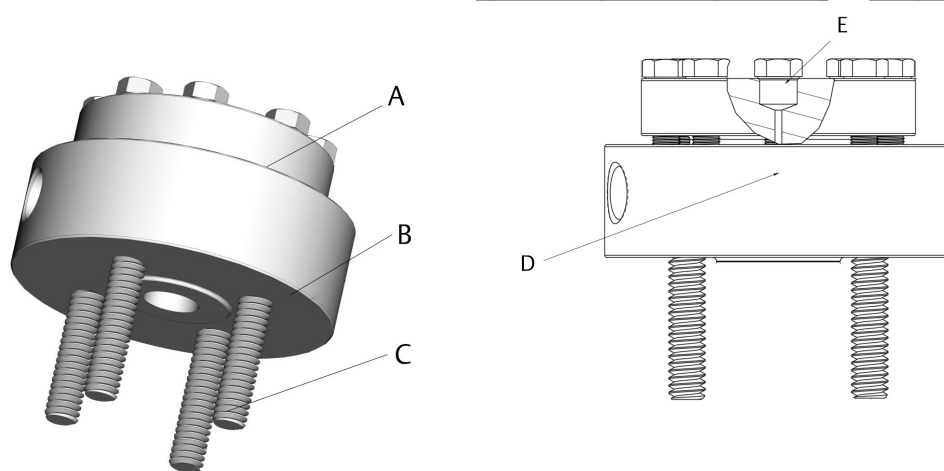


- A. Process flange
- B. Diaphragm
- C. Lower housing or flushing ring
- D. Connection to transmitter
- E. Flushing connection

Note

Lower housing always required for RFW remote flanged seal.

Figure 3-12: RFW stud bolt design



- A. Upper housing
- B. Lower housing or flushing ring
- C. Stud bolts
- D. Diaphragm
- E. Connection to transmitter

Table 3-2: RFW upper housing torque values

Bolt thread size	Material (nuts and bolts)	Diaphragm size (in.)	Class	Torque (ft.-lb)
3/8-24 NF	Stainless steel (SST)	2.4 or 4.1	150/300	23
3/8-24 NF	SST	2.4	600	23
3/8-24 NF	Carbon steel (CS)	2.4 or 4.1	150/300/600	53
1/2-20 NF	SST	4.1	600	50
1/2-20 NF	CS	2.4	900/1500	105
1/2-20 NF	SST	2.4	900	50
3/4-16 NF ⁽¹⁾	SST	2.4	1500	120
3/4-16 NF ⁽¹⁾	CS	2.4	2500	180
M10 x 1.50	SST	2.4 or 4.1	10K/20K/40K	23
M10 x 1.50	SST	2.4 or 4.1	PN10/PN40/PN63	23
M10 x 1.50	SST	2.4	PN100	23
M12 x 1.75	SST	4.1	PN100	50
M12 x 1.75	SST	2.4	PN160	50

(1) Thread lubricant required, such as anti-seize or thread paste.

Note

This is the specification for connecting the remote seal to the lower housing, not the torque specification for the lower housing onto the process flanged connection. Torque the lower housing bolts to the applicable flange requirements.

3.7.1 4.1-inch (104 mm) diaphragm diameter option

The standard diaphragm size for the seal is 2.4 in. (61 mm). Emerson offers a larger, 4.1-inch (104 mm) diaphragm size for small spans to reduce temperature error when taking process measurements.

3.7.2 Install standard design remote flanged weld (RFW) seal

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user supplied)
- Gasket, lower housing to process flange (end-user supplied)
- Gasket, remote seal to lower housing (Emerson-supplied on the Rosemount 1199. Rosemount 1299 requires selecting a gasket option.)

Note

Typically, the stud bolt design includes Emerson-supplied stud bolts.

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per application, such as ASME PCC-1.

Emerson recommends that two people install the standard design RFW remote flanged seal to ensure proper alignment during installation.

To install the standard design RFW remote flanged seal on an existing process flange:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Ensure flushing connections are sealed before completing installation.
You may order flushing rings with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves.
3. Assemble the flushing ring, Emerson-supplied gasket, and remote seal together. Place the Emerson-supplied gasket inside the recessed cavity within the flushing ring, which is designed to hold the gasket in place.
4. Assemble remote seal assembly to the process flange. Place the appropriate end-user-supplied gasket between the flushing ring and process flange. Ensure that the end-user-supplied gasket is centered on both the flushing ring and process flange. Ensure the flange bolt holes between the remote seal and the process flange are aligned.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Put the first end-user-supplied bolt through one of the holes on the bottom of the seal and process flange. Secure with a nut and hand-tighten.
6. Install the remaining end-user-supplied bolts in a cross pattern, hand-tightening each nut as the bolts are installed.
7. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements.
Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.7.3 Install stud bolts

To install the stud bolt design remote flanged weld (RFW) seal on an existing process flange:

Procedure

1. Ensure flushing connections are sealed before completing installation.

You may order lower housing with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves.

2. Install the stud bolts onto the lower housing.
3. Assemble the lower housing to the process flange. Place the appropriate end-user-supplied gasket between the lower housing and process flange. Ensure that the end-user-supplied gasket is centered on both the lower housing and process flange.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

4. Hand-tighten nuts onto the studs.
5. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the nuts to the applicable flange requirements.
6. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

7. Assemble the remote seal, Emerson-supplied gasket, and lower housing. Place the Emerson-supplied gasket inside the recessed cavity within the lower housing, which is designed to hold the gasket in place.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

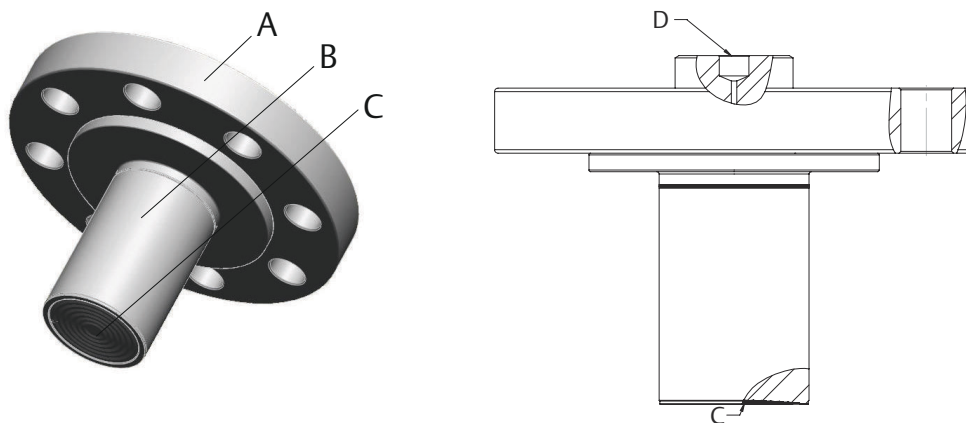
8. Install the bolts in a cross pattern and hand-tighten.
9. Using a torque wrench on the bolt, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts per [Offline remote flanged weld \(RFW\) seal](#) based on size and bolt material. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.8 Extended flanged weld (EFW) seal

Figure 3-13: EFW seal assembly



- A. Process flange
- B. Extension
- C. Diaphragm
- D. Connection to transmitter

Note

Flushing ring/lower housing not available for EFW seal.

3.8.1 Install extended flanged weld (EFW) seal

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

To install the EFW extended flanged seal on an existing process flange:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
3. Place the appropriate end-user-supplied gasket on the remote seal.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

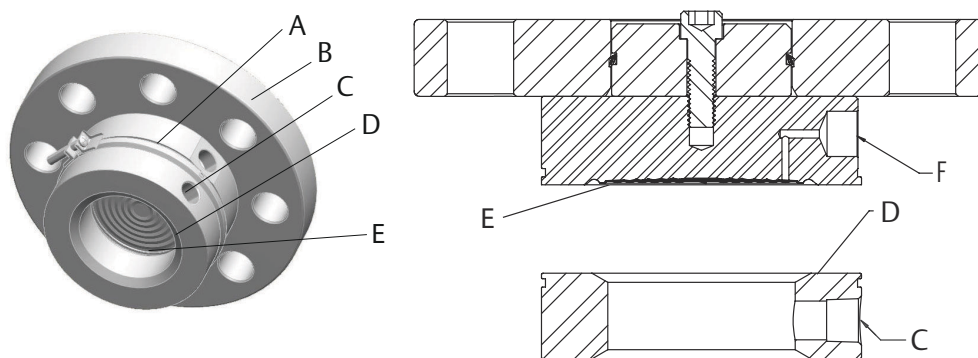
4. Using the previously installed bolts, attach the remote seal and gasket to the process flange. Secure with nuts and hand-tighten.
5. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
6. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements.
Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.9 Pancake flanged weld (PFW) seal

Figure 3-14: PFW seal



- A. Alignment clamp (option code SA)
- B. Process flange
- C. Flushing connection
- D. Flushing ring (optional)
- E. Diaphragm
- F. Connection to transmitter

Note

You can use option code SA to order alignment clamp on Rosemount 1199.

3.9.1 Capillary support tube

A common option for the pancake type seal is the 4-inch capillary support tube.

Due to the side capillary-to-seal connection, the support tube provides a handle for aligning the pancake seal during installation. Do not use the support tube to support any weight.

3.9.2 Process flange

Emerson offers the option of supplying the process flange. You may also provide your own process flange.

There is a 5/16–24 threaded connection on the back of the pancake flanged weld (PFW) seal. For certain pancake seal assemblies, the Emerson-supplied process flange has a machined hole through the center of the flange that corresponds to the threaded connection in the back of the pancake seal. This allows the flange to be connected to the seal before installation to make handling easier. If the process flange is furnished by the end-user, you can drill a 2 1/64-inch to 3/8-inch through hole into the flange to support ease of installation.

3.9.3 Install pancake flanged weld (PFW) seal

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Note

Flushing rings include an Emerson-supplied gasket. If using an alignment clamp, a Phillips or slotted screwdriver is required for installation.

Verify the gasket materials are appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

If you are not using an alignment clamp on the flushing ring, Emerson recommends that two people install the PFW pancake seal to ensure proper alignment during installation.

To install the PFW pancake seal on an existing process flange:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. If installing a flushing ring, ensure flushing connections are sealed before completing installation. You may order flushing rings with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves. If you did not buy a flushing ring, proceed to [Step 4](#).

3. Assemble the flushing ring, Emerson-supplied gasket, and remote seal together. If using an alignment clamp (option code SA) attach the flushing ring to the remote seal. Place the alignment clamp in the machined groove on both the remote seal and the flushing ring. Using the applicable screwdriver, tighten the screw on the clamp to hold the flushing ring in place.
4. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
5. Place the appropriate end-user-supplied gasket on the remote seal or optional flushing ring and align the gasket so that it is not inside the diaphragm weld as this will induce errors.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

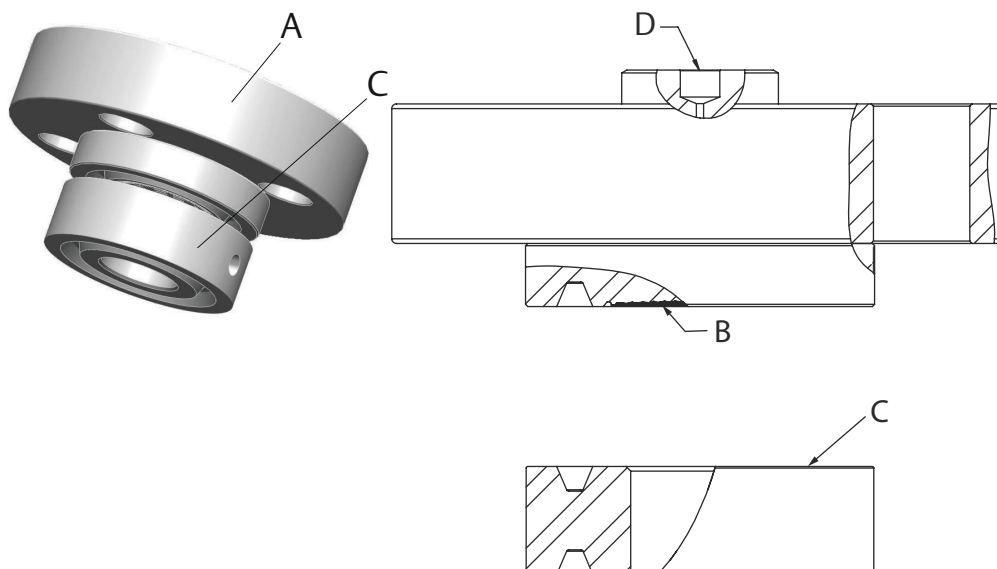
6. Using the previously installed bolts, attach the remote seal and gasket to the process flange. Secure with nuts and hand-tighten.
7. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
8. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements.
Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.10 FCW flush flanged seal—ring type joint (RTJ) gasket surface

Figure 3-15: FCW two-piece design (shown with flushing ring)



- A. Process flange
- B. Diaphragm
- C. Flushing ring (optional)
- D. Connection to transmitter

3.10.1 Install FCW seal

To install the FCW flush flanged seal with ring type joint (RTJ) gasket surface on an existing process flange:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user supplied)
- Gasket (end-user supplied)

Verify the gasket materials are appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application, such as ASME PCC-1.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. If installing a flushing ring, ensure flushing connections are sealed before completing installation. You may order flushing rings with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves. If you did not purchase a flushing ring, proceed to [Step 4](#).
3. Assemble the flushing ring, appropriate end-user-supplied gasket, and remote seal together.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, and measurement errors which can result in death or serious injury.

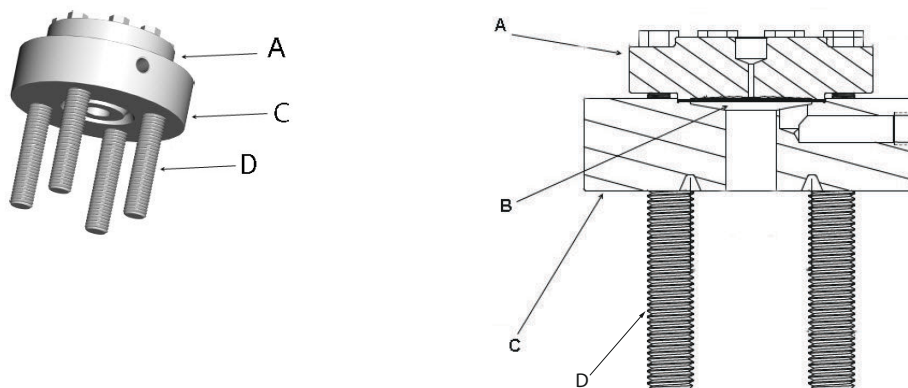
4. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
5. Place the appropriate end-user-supplied gasket on the remote seal or optional flushing ring.
6. Using the previously installed bolts, attach the remote seal and gasket to the process flange. Secure with nuts and hand-tighten.
7. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
8. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.11 RCW remote flanged seal - ring type joint (RTJ) gasket surface

Figure 3-16: RCW remote flanged seal RTJ and flushing connection ring



- A. Upper housing
- B. Diaphragm
- C. Lower housing or flushing ring
- D. Stud bolts

Note

A lower housing is always required for the RCW type seal.

Table 3-3: RCW upper housing torque values

Bolt thread size	Material (nuts and bolts)	Diaphragm size (in.)	Class	Torque (ft-lb.)
$\frac{3}{8}$ -24 NF	Stainless steel (SST)	2.4 or 4.1	150	23
$\frac{3}{8}$ -24 NF	SST	2.4	300/600	23
$\frac{3}{8}$ -24 NF	Carbon steel (CS)	2.4 or 4.1	150/300/600	53
$\frac{1}{2}$ -20 NF	SST	4.1	300/600	50
$\frac{1}{2}$ -20 NF	CS	2.4	900/1500	105
$\frac{1}{2}$ -20 NF	SST	2.4	900	50
$\frac{3}{4}$ -16 NF ⁽¹⁾	SST	2.4	1500	120
$\frac{3}{4}$ -16 NF ⁽¹⁾	CS	2.4	2500	180

(1) Thread lubricant required, such as antiseize or thread paste.

Note

This is the specification for connecting the remote seal to the lower housing, not the torque specification for the lower housing onto the process flanged connection. Torque the lower housing bolts to the applicable flange requirements.

3.11.1 4.1-inch (104 mm) diaphragm diameter option

The standard diaphragm size for the seal is 2.4 in. (61 mm). Emerson offers a larger, 4.1-inch (104 mm) diaphragm size for small spans to reduce temperature error when taking process measurements.

3.11.2 Install RCW remote flanged seal - ring type joint (RTJ) gasket

To install the RCW remote flanged seal with RTJ gasket surface on an existing process flange:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (lower housing to process connection) (end-user-supplied)
- Gasket (remote seal to lower housing) (Emerson-supplied on the Rosemount 1199. Rosemount 1299 requires a gasket option to be selected.)

Note

Typically, Emerson-supplied stud bolts are included.

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

Procedure

1. Ensure flushing connections are sealed before completing installation. You may order lower housing with or without, one or two threaded flushing connections, factory supplied plugs, or drain vent valves.
2. Install the stud bolts onto the lower housing.
3. Assemble the lower housing to the process flange. Place the appropriate end-user-supplied gasket between the lower housing and process flange.

WARNING

Failure to properly install the gasket may cause process leaks, and measurement errors which can result in death or serious injury.

4. Hand-tighten nuts onto the studs.
5. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the nuts to the applicable flange requirements.
6. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

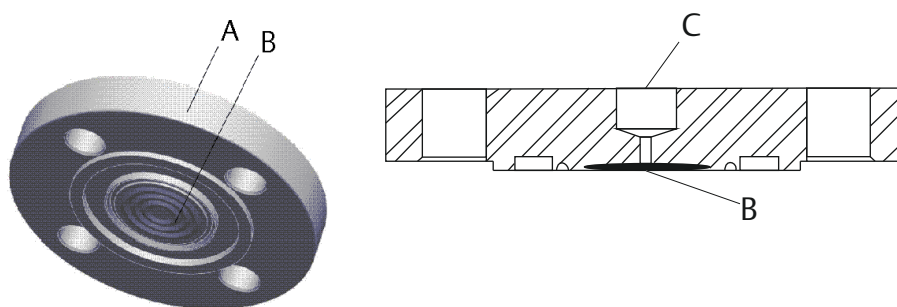
7. Assemble the remote seal, Emerson-supplied gasket, and lower housing. Place the Emerson-supplied gasket inside the recessed cavity within the lower housing which is designed to hold the gasket in place.
8. Install the bolts in a cross pattern and hand-tighten.
9. Using a torque wrench on the bolt, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts per [Table 3-3](#) based on size and bolt material. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.12 FUW flush flanged groove type seals

Figure 3-17: FUW flushed flanged type seal—EN1092-1 Type D



- A. Process flange
B. Diaphragm
C. Connection to transmitter

3.12.1 Install FUW flushed flanged groove type seal

To install the FUW flushed flanged groove type seal on an existing process flange:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as American Society of Mechanical Engineers (ASME) PCC-1.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
3. Place the appropriate end-user-supplied gasket on the remote seal.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

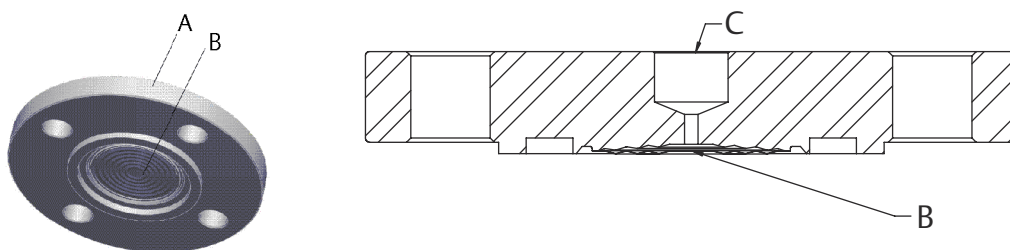
4. Using the previously installed bolts, attach the remote seal and gasket to the process flange. Secure with nuts and hand-tighten.
5. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
6. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.13 FVW flushed flanged tongue type seals

Figure 3-18: FVW flushed flanged type seal —EN1092-1 Type C



- A. Process flange
B. Diaphragm
C. Connection to transmitter

3.13.1 Install FVW flushed flanged tongue type seals

To install the FVW flushed flanged tongue type seal on an existing process flange:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
3. Place the appropriate end-user-supplied gasket on the remote seal.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

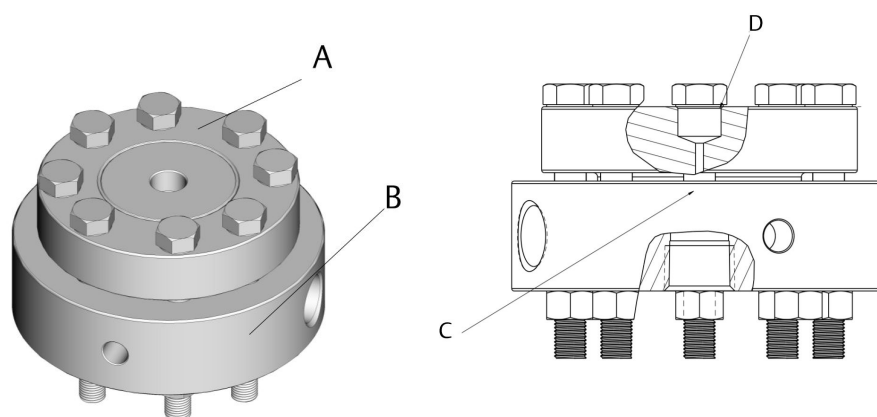
4. Using the previously installed bolts, attach the remote seal and gasket to the process flange. Secure with nuts and hand-tighten.
5. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
6. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

[Torque sequence](#)

3.14 RTW remote threaded type seals

Figure 3-19: RTW threaded seal



- A. Upper housing
- B. Lower housing or flushing ring
- C. Diaphragm
- D. Connection to transmitter

Note

A lower housing is always required for the RTW type seal.

Table 3-4: RTW upper housing torque values

Bolt thread size	Material (nuts and bolts)	Maximum working pressure (MWP)	Torque (ft-lb)
3/8-24 NF	Stainless steel (SST)	1,500 psi (103.4 bar) ⁽¹⁾	23
3/8-24 NF	Carbon steel (CS)	2,500 psi (172.4 bar)	53
1/2-20 NF	SST	1,500 psi ⁽¹⁾ (103.4 bar)	50
1/2-20 NF	SST	2,500 psi (172.4 bar)	50
1/2-20 NF	CS	5,000 psi (344.7 bar)	105
3/4-16 NF ⁽²⁾	SST	5,000 psi (344.7 bar)	120
3/4-16 NF ⁽²⁾	CS	10,000 psi (689.4 bar)	180
M12 x 1.75	SST	1,500 psi (103.4 bar) ⁽¹⁾	50
M12 x 1.75	SST	2,500 psi (172.4 bar)	50
M20 x 2.50	SST	5,000 psi (344.7 bar)	120

⁽¹⁾ 1500 psi MWP RTWs are only available on 4.1-inch diaphragm sizes.

⁽²⁾ Thread lubricant required, such as antiseize or thread paste.

Note

This is the specification for connecting the remote seal to the lower housing, not the torque specification for the lower housing onto the process threaded connection. Standard NPT torque values for the size threads in the lower housing should be applied here.

3.14.1 Install RTW remote threaded type seal

To install the RTW remote threaded type seal on an existing threaded process connection:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Spanner wrench
- Mounting hardware (Emerson-supplied)
- Gasket (Emerson-supplied on the Rosemount 1199. Rosemount 1299 requires a gasket option to be selected.)
- Thread sealant

Thread sealant must meet the requirements of the application. An example thread sealant is PTFE tape.

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as American Society of Mechanical Engineers (ASME) PCC-1.

Procedure

1. Apply thread sealant to the male threaded end of the connection.
This will be the process connection if using a female threaded lower housing or the remote seal itself if using a male threaded lower housing.
2. Thread the lower housing to the process connection.
The lower housing includes a small hole designed for a spanner wrench to facilitate installation and applying the required torque. The applied torque should comply with ANSI B1.20.1 for NPT connections or applicable torque requirements for pipe connections.
3. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

4. Place the Emerson-supplied gasket into the groove of the lower housing.
5. Place the remote seal on top of the gasket ensuring alignment with the lower housing groove.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

6. Install the bolts and hand-tighten.
7. Using a torque wrench on the bolt, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts per [Table 3-4](#) based on size and bolt material. Leak check the installation to ensure a robust connection.

Note

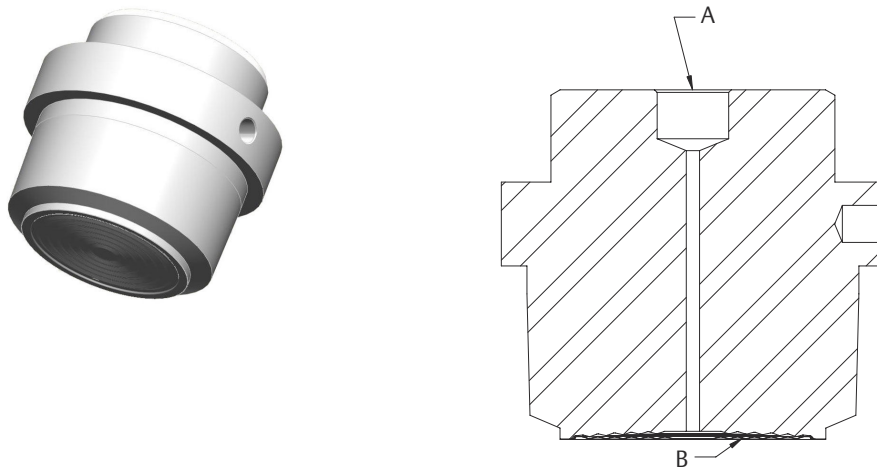
RTW remote threaded type seals with a 10,000 psi (689.5) pressure rating are supplied with carbon steel bolts only.

Related information

[Torque sequence](#)

3.15 HTS male threaded seal

Figure 3-20: HTS male threaded seal



- A. Connection to transmitter
B. Diaphragm
-

3.15.1 Install HTS male threaded seal

To install the HTS remote threaded seal on an existing process flange:

Prerequisites

Prior to installation, you will need the following:

- Thread sealant

Thread sealant must meet the requirements of the application. An example thread sealant is PTFE tape.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

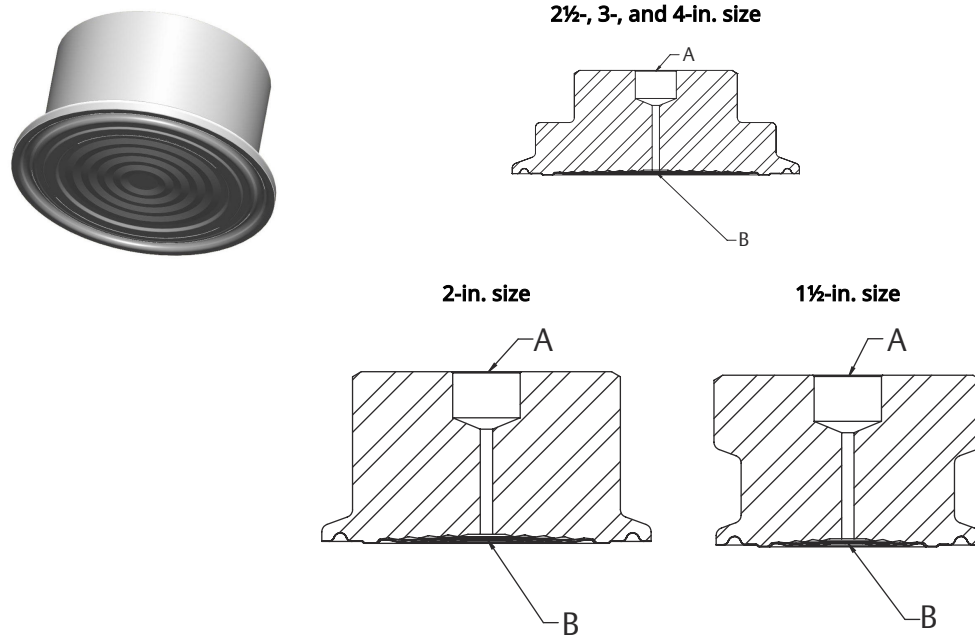
Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Apply the thread sealant to the male thread.
3. Thread the remote seal onto the process connection.

The remote seal is designed with a small hole to facilitate installation and applying torque. The applied torque should comply with ANSI B1.20.1 for NPT connections or applicable torque requirements for pipe connections.

3.16 SCW hygienic Tri-Clover Tri Clamp seals

Figure 3-21: SCW Tri Clamp seal



- A. Connection to transmitter
B. Diaphragm

3.16.1 Clamp and gasket

The clamp is furnished by the end-user, with the exception of an optional Emerson-supplied high pressure Ladish™ clamp.

Maximum pressure rating of the system is dependent upon the clamp pressure rating.

The gasket is furnished by the end-user, with the exception of an optional Emerson-supplied nitrile butadiene (NBR) gasket.

Table 3-5: High pressure Ladish clamp maximum working pressure

Process connection size	+70 °F (+21 °C)	+250 °F (+121 °C)
1½ in.	1,500 psi (103 bar)	1,200 psi (83 bar)
2 in.	1,000 psi (69 bar)	800 psi (55 bar)
2½ in.	1,000 psi (69 bar)	800 psi (55 bar)
3 in.	1,000 psi (69 bar)	800 psi (55 bar)
4 in.	600 psi (41 bar)	480 psi (34 bar)

3.16.2 Install SCW hygienic Tri-Clover Tri Clamp seal

To install the SCW hygienic Tri Clamp seal:

Prerequisites

Prior to installation, you will need the following:

- Clamp
- Gasket
- Wrench (optional, depending on clamp)

Verify the gasket material is appropriate for the application. Ensure to use an EHEDG approved gasket if EHEDG conformance is needed.

Procedure

1. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

2. Place the appropriate gasket for the application on the remote seal and align the gasket so that it is not contacting the diaphragm, as this may induce errors.

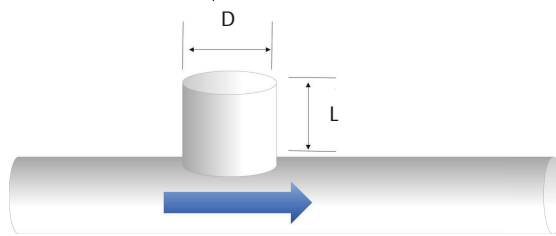
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

3. Ensure that the SCW hygienic Tri Clamp seal is flush with the process connection.
4. Install clamp and tighten to manufacturer's specifications

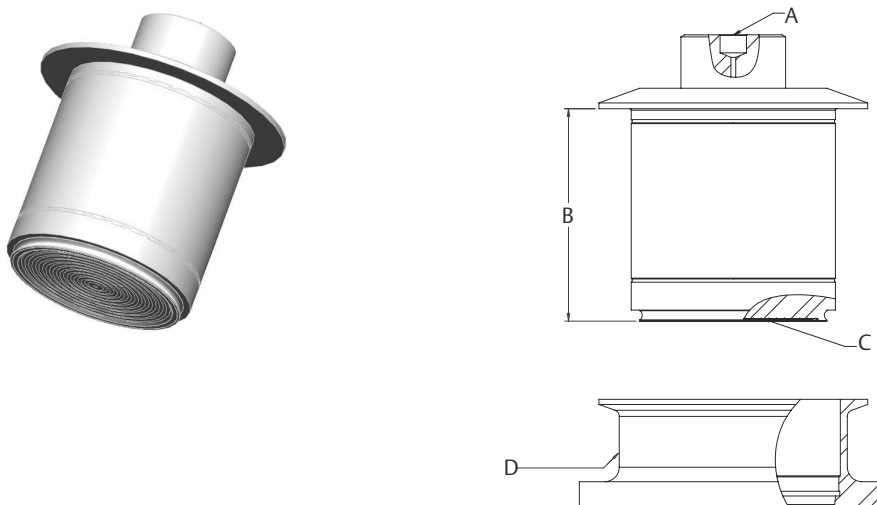
Note

EHEDG requirement on T-stub installations: the length (L) divided by the diameter (D) of the tee is to be less than 1 ($L/D < 1$).



3.17 SSW hygienic tank spud seal

Figure 3-22: SSW tank spud seal



- A. Connection to transmitter
- B. Extension length
- C. Diaphragm
- D. Tank spud

3.17.1 Install SSW hygienic tank spud seal

To install the SSW hygienic tank spud seal:

Prerequisites

Prior to installation, you will need the following:

- O-ring (Emerson-supplied)
- Clamp (Emerson-supplied)

Cutting and welding equipment required if installing a new tank spud.

Verify the O-ring material is appropriate for the application.

Procedure

1. Prepare the tank.
2. Weld the tank spud onto the tank per plant procedures. Ensure the tank spud is not assembled to the pressure transmitter and/or the remote seal prior to welding.
3. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

4. Place the Emerson-supplied O-ring onto the groove.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Insert the SSW hygienic tank spud seal into the tank spud.
6. Attach the Emerson-supplied clamp and hand-tighten the connection.

Related information

[Tank preparation](#)

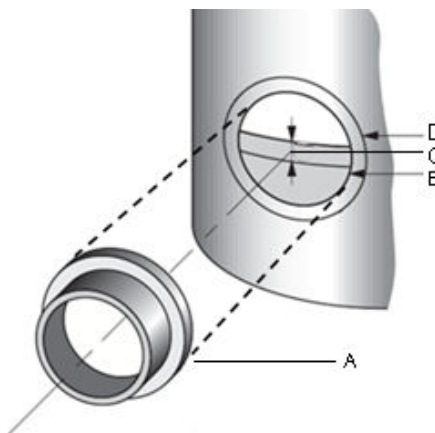
[Welding](#)

3.17.2 Tank preparation

When preparing the tank for welding the spud, ensure a 9¼-in. (235 mm) area is available, cut a smooth and circular hole with a maximum diameter of 6.020 in. (153 mm) to minimize spud distortion, and if required, use bevels with an angle no larger than 37.5° to reduce heat input and weld passes.

When preparing the tank, ensure an area with a minimum diameter of 9¼ in. (235 mm) is available to properly weld the tank spud. The center of the tank spud should be at least 1½ in. (38 mm) below the minimum measurement level. To get a proper process fluid measurement, make sure half of the remote seal diagram is covered.

Figure 3-23: Tank preparation



- A. Tank spud
- B. Hole cut
- C. Center of the hole
- D. Weld

Attempt to cut the hole as smoothly and as circular as possible. Emerson does not recommend a torch cut. The tank spud outer dimension (OD) is 5.98 in. $\pm$ 0.010 in. (152 mm $\pm$ 0.25 mm). When cutting the hole for the tank spud, the gap between the hole diameter and spud OD should be held to a minimum.

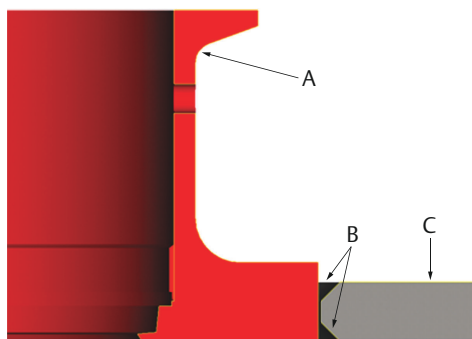
NOTICE

A hole larger than 6.02 in. (153 mm) could increase the amount of tank spud distortion.

Emerson recommends that the hole be no larger than 6.02 in. (153 mm).

If a bevel(s) is required, Emerson recommends an angle no larger than 37.5°; see American Society of Mechanical Engineers (ASME) B16.25 for more details. You can make bevels on one or both sides of the tank. Do not grind or cut the bevel to a sharp point. Attempt to leave a flat area.

Figure 3-24: Bevel example



- A. Tank spud
- B. Bevel
- C. Tank

Make sure the flat area is large enough to minimize spud distortion but small enough so that tank weld requirements can be met. Minimizing the bevel angle will decrease the amount of fill required during weld and minimize the number of weld passes. These best practices will decrease heat input and help mitigate distortion.

3.17.3 Welding

Ensure the tank spud is not assembled to the transmitter or remote seal before welding. Avoid nicking the sealing surfaces, properly position and tack weld the spud, and allow adequate cooling between weld passes to prevent distortion and meet tank weld standards.

NOTICE

Excessive heat will distort the tank spud.

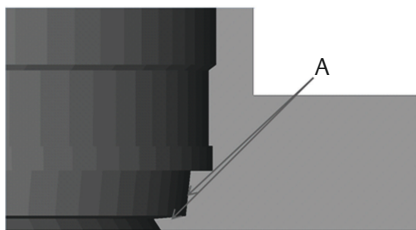
Allow adequate cooling time between passes.

Ensure spud is not assembled to transmitter and/or remote seal prior to welding.

NOTICE

Do not nick the sealing surfaces of the tank spud, the inner angled surfaces where the O-ring sits shown in [Figure 3-25](#), as any irregularities may cause leaks.

Figure 3-25: O-ring sealing surfaces

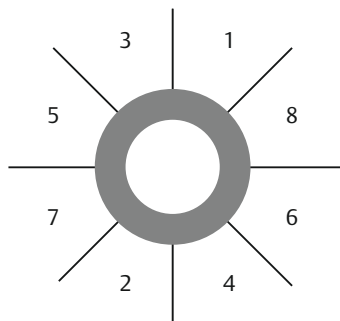


A. Sealing surfaces

With the spud centered in the tank hole, make sure the inner surface of the spud is flush with the inner surface of the tank. The leak detection hole in the spud should be at the bottom of the spud. With the spud properly located, tack weld it into place using four tack welds, 90° from each other.

Begin welding on the inside of vessel. Weld in sections similar to the sequence in [Figure 3-26](#).

Figure 3-26: Welding sections



Allow time to cool between weld sections. Cool weld to +350 °F (+177 °C) or less after each pass; being cool to the touch is preferred. Use a damp cloth or compressed air if rapid cooling is desired. Repeat procedure on the outside of the tank.

Note

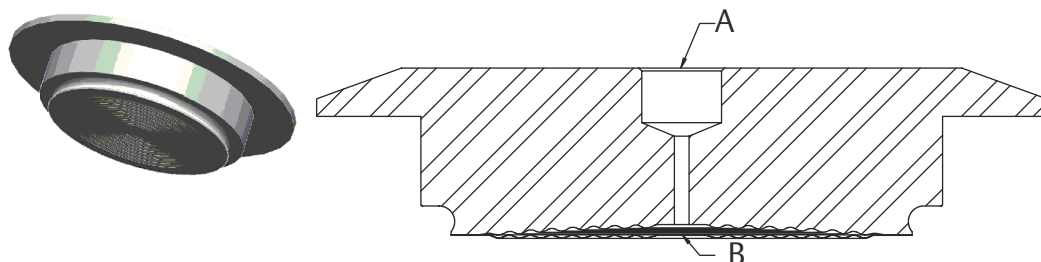
Keep the number of weld passes to a minimum while maintaining tank weld standards and sanitary requirements. Additional weld passes are a significant contributor to spud distortion due to additional heat input and added filler material in beveled area of hole. When fill passes are required, Emerson recommends a 1/16-in. (2 mm) diameter weld rod.

Note

For high pressure clamps up to 1,000 psi (69 bar), contact the factory.

3.18 STW hygienic thin wall tank spud seal

Figure 3-27: STW hygienic thin wall tank spud seal



- A. Connection to transmitter
B. Diaphragm

3.18.1 Install STW hygienic thin wall tank spud seal

To install the STW hygienic thin wall tank spud seal:

Prerequisites

Prior to installation, you will need the following:

- O-ring (Emerson-supplied)
- Clamp (Emerson-supplied)

Cutting and welding equipment required if installing a new tank spud.

Verify the O-ring material is appropriate for the application.

Procedure

1. Remove the plastic cover from the diaphragm of the remote seal.
2. Weld the tank spud onto the tank per plant procedures.

⚠ WARNING

Ensure the tank spud is not assembled to the pressure transmitter and/or the remote seal prior to welding.

3. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

4. Place the Emerson-supplied O-ring onto the groove.

WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

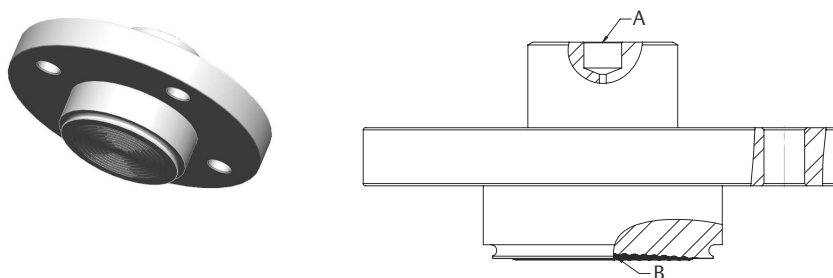
5. Insert the STW hygienic thin wall tank spud seal into the tank spud.
6. Attach the Emerson-supplied clamp and hand-tighten the connection.

Related information

[Welding](#)

3.19 EES hygienic flanged tank spud extended seal

Figure 3-28: EES hygienic flanged tank spud extended seal



- A. Connection to transmitter
B. Diaphragm

3.19.1 Install EES hygienic flanged tank spud extended seal

To install the EES hygienic flanged tank spud extended seal:

Prerequisites

Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- O-ring (Emerson-supplied)

Cutting and welding equipment required if installing a new tank spud.

Verify the O-ring material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application, such as American Society of Mechanical Engineers (ASME) PCC-1.

Procedure

1. Prepare the tank.
2. Weld the tank spud onto the tank per plant procedures.
Ensure the tank spud is not assembled to the pressure transmitter and/or the remote seal prior to welding.
3. Remove the protective cover from the diaphragm of the remote seal.

NOTICE

Use extreme caution during installation to ensure the diaphragm is not damaged.

4. Insert end-user-supplied bolts in the bottom two bolt holes of the flange on the remote seal.
5. Place the Emerson-supplied O-ring onto the groove.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

6. Insert the EES hygienic flanged tank spud extended seal into the tank spud.
7. Using the previously installed bolts, attach the remote seal and gasket to the process connection. Secure with nuts and hand-tighten.
8. Insert end-user-supplied bolts in the top two bolt holes of the flange on the remote seal. Secure with nuts and hand-tighten.
9. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation. Torque the bolts to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are end-user-supplied. Leak check the installation to ensure a robust connection.

Related information

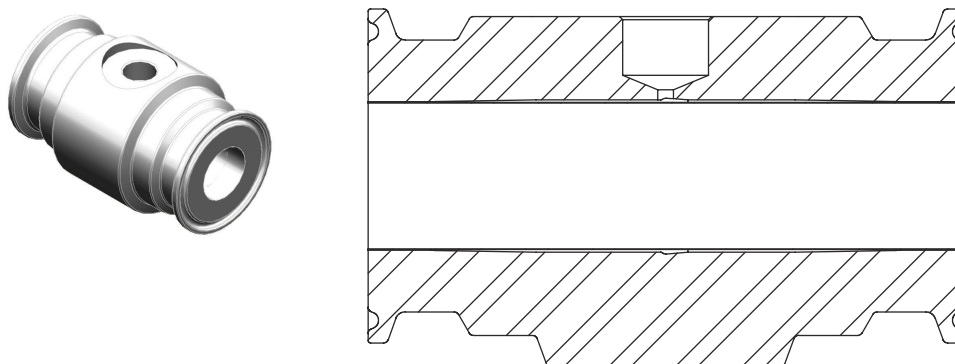
[Tank preparation](#)

[Welding](#)

[Torque sequence](#)

3.20 VCS Tri Clamp in-line seal

Figure 3-29: VCS Tri Clamp In-line Seal



3.20.1 Parts required for installation

The parts required to install the VCS hygienic Tri Clamp seal will be defined here. Prior to installation, you will need the following:

- Clamps (end-user-supplied)
- Gaskets (end-user-supplied)
- Wrench (optional, depending on clamp)

Verify the gasket material is appropriate for the application. Ensure to use an EHEDG approved gasket if EHEDG conformance is needed.

3.20.2 Installation steps

Follow these steps to install the VCS hygienic Tri Clamp seal:

Procedure

1. Place the appropriate end-user-supplied gasket for the application on the remote seal.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

2. Align one end of the VCS hygienic Tri Clamp seal flush with the process piping.
3. Attach the clamp and tighten to manufacturer's specifications (wrench might be required depending on clamp style).
4. Place the second appropriate end-user-supplied gasket for the application on the remote seal.

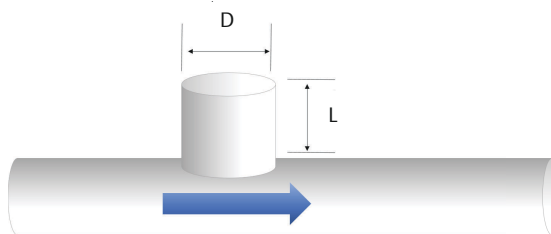
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Align the other end of the VCS hygienic Tri Clamp seal with the process piping.
6. Attach the clamp and tighten to manufacturer's specifications (wrench might be required depending on clamp style).

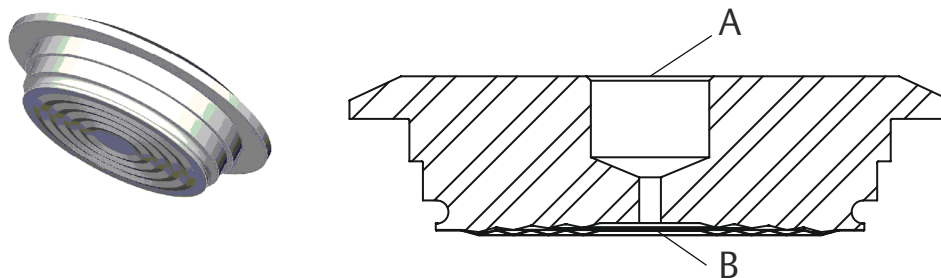
Note

EHEDG requirement on T-stub installations: the length (L) divided by the diameter (D) of the tee is to be less than 1 (i.e. $L/D < 1$).



3.21 SVS VARIVENT® compatible hygienic connection seal

Figure 3-30: SVS VARIVENT Compatible Connection Seal



- A. Connection to transmitter
B. Diaphragm

3.21.1 Parts required for installation

The parts required to install the SVS VARIVENT seal will be defined here. Prior to installation, you will need the following:

- Clamp (end-user-supplied)
- Gasket (end-user-supplied)
- Wrench (optional, depending on clamp)

Verify the gasket material is appropriate for the application. Ensure to use an EHEDG approved gasket if EHEDG conformance is needed.

3.21.2 Installation steps

Follow these steps to install the SVS VARIVENT seal:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
2. Place the appropriate gasket for the application on the remote seal.

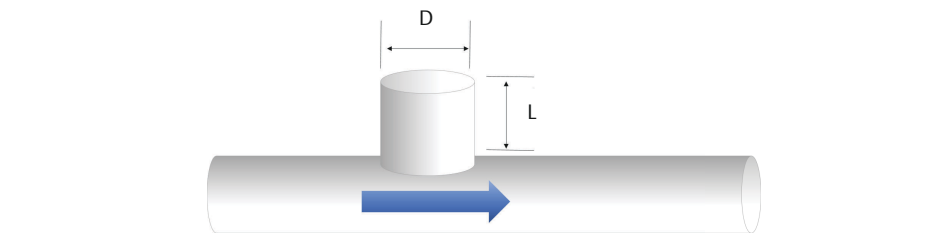
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

3. Ensure that the SVS VARIVENT seal is flush with the process connection.
4. Install clamp and tighten to manufacturer's specifications.

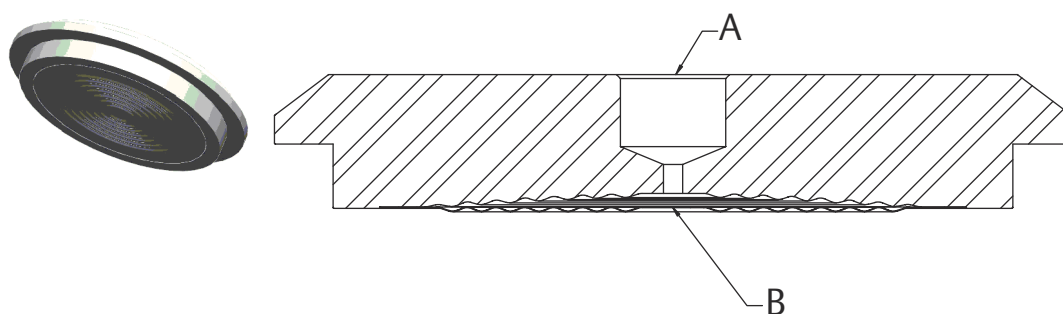
Note

EHEDG requirement on T-stub installations: the length (L) divided by the diameter (D) of the tee is to be less than 1 (i.e. $L/D < 1$).



3.22 SHP hygienic Cherry-Burrell® “I” line seal

Figure 3-31: SHP Cherry-Burrell “I” Line Seal



- A. Connection to transmitter
B. Diaphragm

3.22.1 Parts required for installation

The parts required to install the SHP Cherry-Burrell seal will be defined here. Prior to installation, you will need the following:

- Clamp (end-user-supplied)
- Gasket (end-user-supplied)
- Wrench (optional, depending on clamp)

Verify the gasket material is appropriate for the application.

3.22.2 Installation steps

Follow these steps to install the SHP Cherry-Burrell seal:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
2. Place the appropriate gasket for the application on the remote seal.

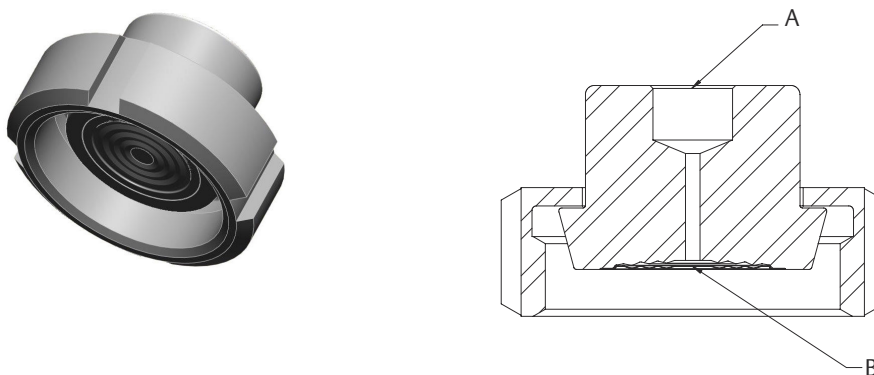
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

3. Ensure that the SHP Cherry-Burrell seal is flush with the process connection.
4. Install clamp and tighten to manufacturer's specifications.

3.23 SLS dairy process connection-female thread seal per DIN 11851

Figure 3-32: SLS Hygienic Dairy Process Connection Female Thread Seal per DIN 11851



3.23.1 Parts required for installation

The parts required to install the SLS dairy process connection seal will be defined here. Prior to installation, you will need the following:

- Gasket (end-user-supplied)
- Wrench (optional, depending on clamp)

Verify the gasket material is appropriate for the application. Ensure to use an EHEDG approved gasket if EHEDG conformance is needed.

3.23.2 Installation steps

Follow these steps to install the SLS dairy process connection seal:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
2. Place the appropriate gasket for the application on the remote seal.

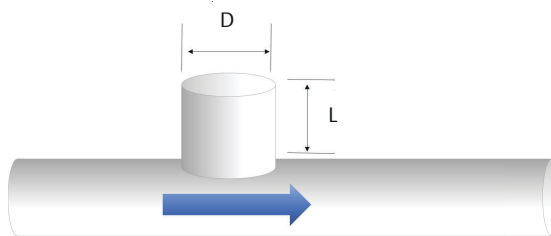
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

3. Ensure that the SLS dairy process connection seal is flush with the process connection.
4. Tighten the nut onto the process connection per DIN 11851. Care should be taken not to overtighten.

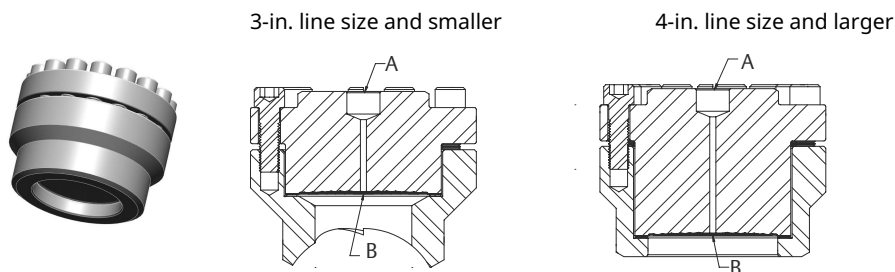
Note

EHEDG requirement on T-stub installations: the length (L) divided by the diameter (D) of the tee is to be less than 1 (i.e. $L/D < 1$).



3.24 WSP saddle seal

Figure 3-33: WSP Saddle Seal



- A. Connection to transmitter
B. Diaphragm

3.24.1 Parts required for installation

The parts required to install the WSP saddle seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (Emerson-supplied)
- Gasket (Emerson-supplied)

Cutting and welding equipment required if installing a new saddle lower.

Verify the gasket material is appropriate for the application.

3.24.2 Installation steps

Follow these steps to install the WSP saddle seal:

Procedure

1. Prepare the tank and weld the saddle lower onto the tank per plant procedures. Ensure the saddle lower is not assembled to the pressure transmitter and/or the remote seal prior to welding.

⚠ CAUTION

Excessive heat will distort the saddle lower. Allow adequate cooling time between passes.

2. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
3. Place the appropriate gasket for the application on the remote seal.

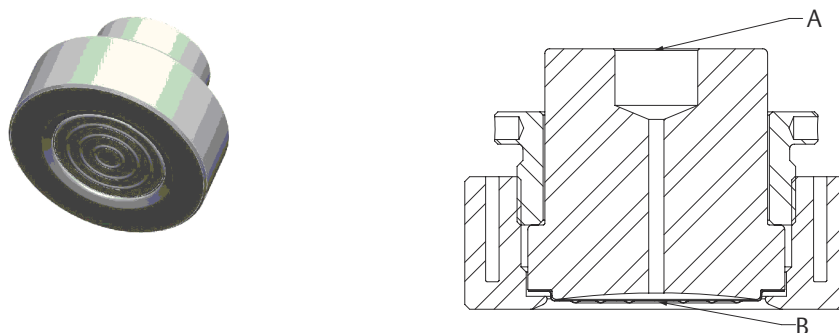
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

4. Insert the WSP saddle seal into the saddle lower.
5. Install the bolts in a cross pattern and hand-tighten.
6. Using a torque wrench on the bolt, tighten the assembly in a cross-pattern to ensure even installation (see [Torque sequence](#)). The bolts should be torqued to 180 in-lb (20 N-m) with stainless or carbon steel bolts. Consider leak checking the installation to ensure a robust connection.

3.25 UCP union connection pipe mount seal

Figure 3-34: UCP Threaded Pipe Mount Seal



- A. Connection to transmitter
B. Diaphragm

3.25.1 Parts required for installation

The parts required to install the UCP union connection seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Gasket (Emerson-supplied)

Cutting and welding equipment required if installing a new lower housing.

Verify the gasket material is appropriate for the application.

3.25.2 Installation steps

Follow these steps to install the UCP union connection seal:

Procedure

1. Using the appropriate size hole saw, cut a hole in the process vessel to accept the lower housing. The diameter for a lower housing with a heat isolator groove is 2.37-in. (60 mm). The hole should produce a tight, uniform fit when coupled with the lower housing.
2. Bevel the edge of the vessel hole to accept filler material (see [Figure 3-35](#)). An angle no larger than 37.5° is recommended; see ASME B16.25 for more details. Bevels can be made on one or both sides of the tank. Do not grind or cut the bevel to a sharp point. Attempt to leave a flat area. The flat area should be large enough to minimize spud distortion but small enough so that tank weld requirements can be met. Minimizing the bevel angle will decrease the amount of fill required during weld and minimize the number of weld passes. These best practices will decrease heat input and help mitigate distortion.
3. Position the lower housing weld spud in the vessel hole, place heat sink and tack the housing in place using the welding sequence shown in [Figure 3-35](#). Cool each section with a wet cloth before proceeding to the next section.

⚠ CAUTION

Do not place the seal in the lower housing prior to welding. Do not nick the sealing surfaces of the weld spud, the inner angled surfaces where the gasket sits shown, weld spud where the gasket sits, shown in [Figure 3-35](#), as any irregularities may cause leaks.

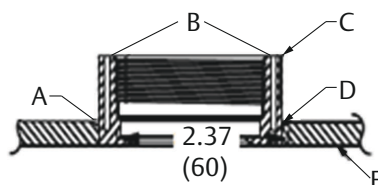
4. Weld the housing in place using 0.030- to 0.045-in. (0,762 to 1,143 mm) stainless steel rod as filler in the beveled area. Using between 100 and 125 A, adjust the amperage for 0.080-in. (2,032 mm) penetration. Allow time to cool between weld sections. Weld should be cooled to 350 °F (177 °C) or less after each pass while being cool to the touch is preferred. Use of a damp cloth or compressed air is allowed if rapid cooling is desired. Repeat procedure on the outside of the tank.

Note

The number of weld passes should be kept to a minimum while maintaining tank weld standards and process requirements. Additional weld passes are a significant contributor to spud distortion due to additional heat input and added filler material in beveled area of hole.

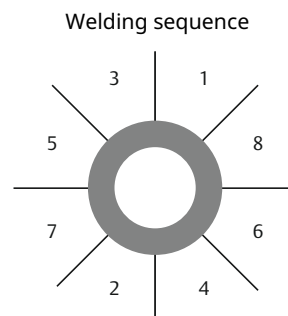
Figure 3-35: Installing the Weld Spud

Preparing the vessel hole



- A. 100–125 A recommended
- B. Heat isolation grooves
- C. Weld spud
- D. Bevelled edge
- E. Process vessel

Dimensions are in inches (millimeters).



5. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
6. Place the gasket into the lower housing make sure the gasket is properly aligned on the gasket sealing surface.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

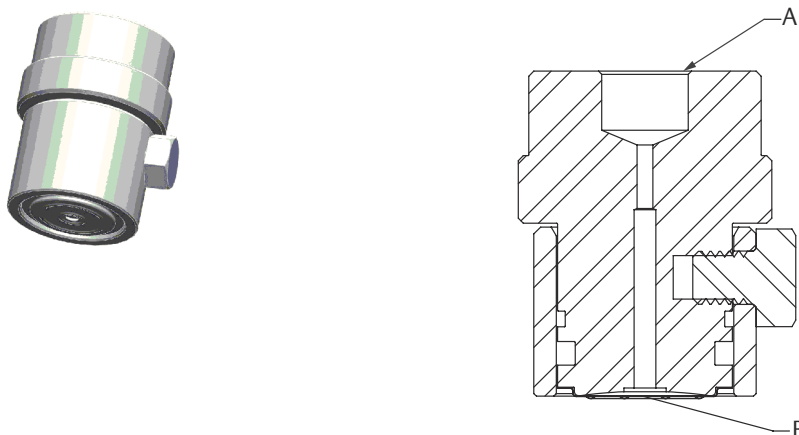
7. Insert the UCP union connection seal into the lower housing and tighten the jam nut.

⚠ CAUTION

Excessive heat will distort the weld spud. Allow adequate cooling time between passes.

3.26 PMW paper mill sleeve seal

Figure 3-36: PMW Threaded Pipe Mount Seal



- A. Connection to transmitter
B. Diaphragm

3.26.1 Parts required for installation

The parts required to install the PMW paper mill seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Gasket (Emerson-supplied)

Cutting and welding equipment required if installing a new lower housing.

Verify the gasket material is appropriate for the application.

3.26.2 Installation steps

Follow these steps to install the PMW paper mill seal:

Procedure

1. Using the appropriate size hole saw, cut a hole in the process vessel to accept the lower housing. The diameter for a lower housing with a heat isolator groove is 1.32-in. (33,4 mm). The hole should produce a tight, uniform fit when coupled with the lower housing.
2. Bevel the edge of the vessel hole to accept filler material (see [Figure 3-37](#)). An angle no larger than 37.5° is recommended; see ASME B16.25 for more details. Bevels can be made on one or both sides of the tank. Do not grind or cut the bevel to a sharp point. Attempt to leave a flat area. The flat area should be large enough to minimize spud distortion but small enough so that tank weld requirements can be met. Minimizing the bevel angle will decrease the amount of fill required during weld and minimize the number of weld passes. These best practices will decrease heat input and help mitigate distortion.

3. Position the weld spud in the vessel hole, place heat sink and tack the housing in place using the welding sequence shown in [Figure 3-37](#). Cool each section with a wet cloth before proceeding to the next section.

⚠ WARNING

Do not place the seal in the lower housing prior to welding. Do not nick the inner angled sealing surfaces of the weld spud where the gasket sits, shown in [Figure 3-37](#), as any irregularities may cause leaks.

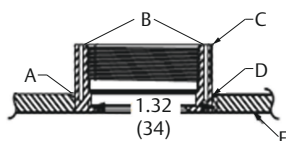
4. Weld the housing in place using 0.030- to 0.045-in. (0,762 to 1,143 mm) stainless steel rod as filler in the beveled area. Using between 100 and 125 A, adjust the amperage for 0.080-in. (2,032 mm) penetration. Allow time to cool between weld sections. Weld should be cooled to 350 °F (177 °C) or less after each pass while being cool to the touch is preferred. Use of a damp cloth or compressed air is allowed if rapid cooling is desired. Repeat procedure on the outside of the tank.

Note

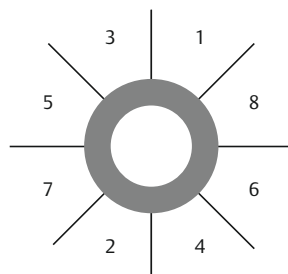
The number of weld passes should be kept to a minimum while maintaining tank weld standards and process requirements. Additional weld passes are a significant contributor to spud distortion due to additional heat input and added filler material in beveled area of hole.

Figure 3-37: Installing the Weld Spud

Preparing the vessel hole



Welding sequence



- A. 100 to 125 A recommended
- B. Heat isolation grooves
- C. Weld spud
- D. Bevelled edge
- E. Process vessel

Dimensions are in inches (millimeters).

⚠ CAUTION

Excessive heat will distort the weld spud. Allow adequate cooling time between passes.

5. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
6. Place the O-rings onto the seal body.

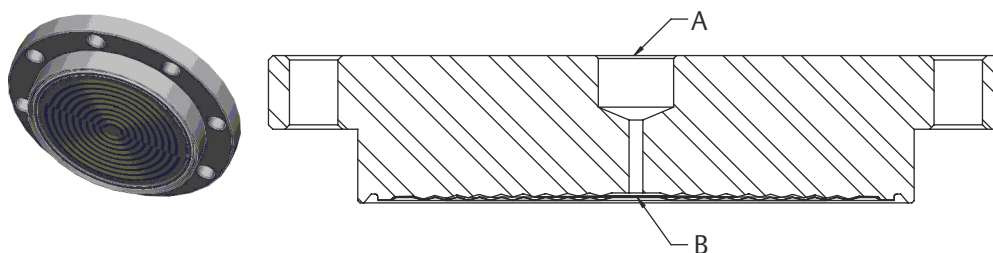
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

7. Insert the PMW paper mill seal into the lower housing.
8. Install capture bolt and torque to 7.5 ft-lb.

3.27 CTW chemical tee seal

Figure 3-38: CTW Chemical Tee Seal



- A. Connection to transmitter
B. Diaphragm

3.27.1 Parts required for installation

The parts required to install the CTW chemical tee seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

3.27.2 Installation steps

Follow these steps to install the CTW chemical tee seal on an existing flanged process connection:

Procedure

1. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
2. Place the appropriate end-user-supplied gasket on the remote seal.

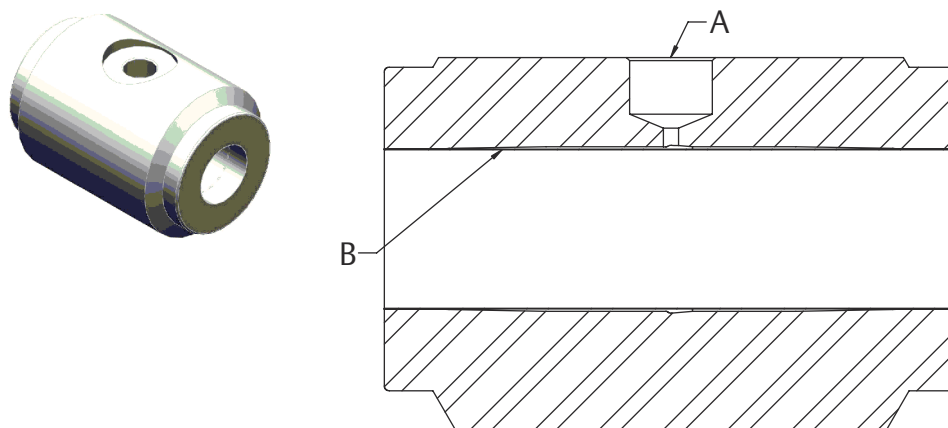
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

3. Attach the remote seal and gasket to the process connection. Insert end-user-supplied bolts, secure with nuts, and hand-tighten.
4. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation (see [Torque sequence](#)). The bolts should be torqued to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Consider leak checking the installation to ensure a robust connection.

3.28 TFS wafer style In-line seal

Figure 3-39: TFS Wafer Style In-Line Seal



- A. Connection to transmitter
B. Diaphragm

3.28.1 Parts required for installation

The parts required to install the TFS wafer style In-line seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (end-user-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

3.28.2 Installation steps

Follow these steps to install the TFS wafer style In-line seal on an existing flanged process connection:

Procedure

1. Place the appropriate end-user-supplied gasket for the application on one end of the remote seal.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

2. Align that end of the TFS wafer style In-line seal flush with the process flange.
3. Insert end-user-supplied bolts, secure with nuts, and hand-tighten
4. Place the second appropriate end-user-supplied gasket for the application on the other end of the remote seal.

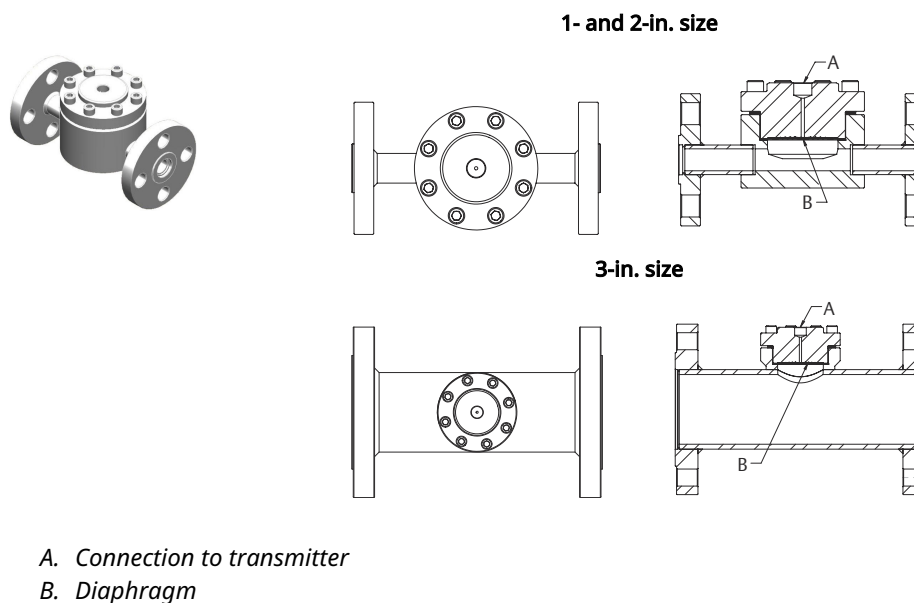
⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Align that end of the TFS wafer style In-line seal flush with the process flange.
6. Insert end-user-supplied bolts, secure with nuts, and hand-tighten.
7. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation (see [Torque sequence](#)). The bolts should be torqued to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Consider leak checking the installation to ensure a robust connection.

3.29 WFW flow-thru flanged seal

Figure 3-40: WFW Flow-Thru Flanged Seal



3.29.1 Parts required for installation

The parts required to install the WFW flow-thru flanged seal will be defined here. Prior to installation, you will need the following:

- Torque wrench
- Mounting hardware (end-user-supplied)
- Gasket (lower housing to process flange) (end-user-supplied)
- Gasket (remote seal to lower housing) (Emerson-supplied)

Verify the gasket material is appropriate for the application.

Inspect bolts to ensure the material is compatible with industry standards per the application such as ASME PCC-1.

3.29.2 Installation steps

Follow these steps to install the WFW flow-thru flanged seal on an existing process piping system:

Procedure

1. Place the appropriate end-user-supplied gasket for the application on one end of the lower housing flange.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

2. Align that end of the WFW flow-thru flanged seal flush with the process flange.
3. Insert end-user-supplied bolts, secure with nuts, and hand-tighten.
4. Place the second appropriate end-user-supplied gasket for the application on the other end of the lower housing flange.

⚠ WARNING

Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

5. Align that end of the WFW flow-thru flanged seal flush with the process flange.
6. Insert end-user-supplied bolts, secure with nuts, and hand-tighten
7. Using a torque wrench on the nut, tighten the assembly in a cross-pattern to ensure even installation (see [Torque sequence](#)). The bolts should be torqued to the applicable flange requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts which are end-user-supplied. Consider leak checking the installation to ensure a robust connection.
8. Remove the protective cover from the diaphragm of the remote seal. Use extreme caution during installation to ensure the diaphragm is not damaged.
9. Assemble the remote seal, Emerson-supplied gasket, and lower housing. Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.
10. Install the bolts in a cross pattern and hand-tighten.
11. Using a torque wrench on the bolt, tighten the assembly in a cross-pattern to ensure even installation (see [Torque sequence](#)). The bolts should be torqued to 180 in-lb (20 N-m) with stainless or carbon steel bolts. Consider leak checking the installation to ensure a robust connection.

4 Configuration

4.1 Calculating range points

4.1.1 Remote seals

Calculating range points

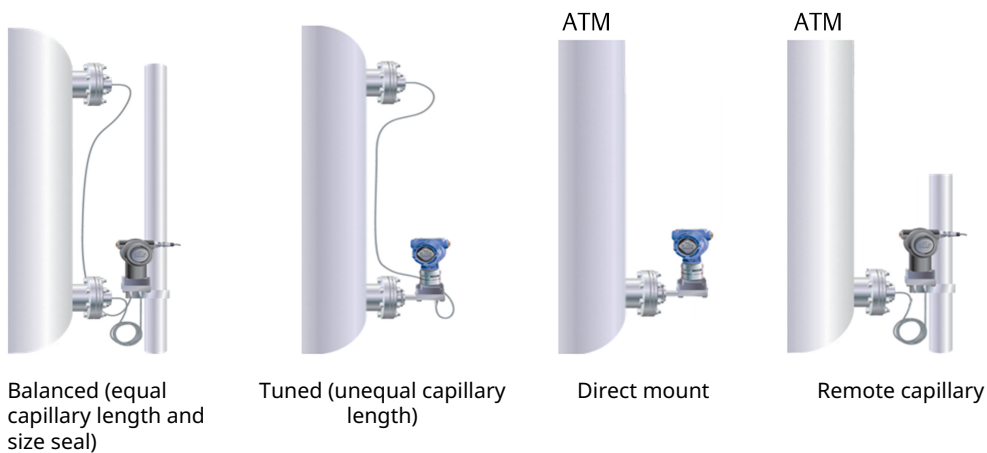
- Open tank (zero based)⁽²⁾
- Open tank (non-zero based)
- Closed tank (non-zero based)

Transmitters installation best practice

- Open tank (zero based)⁽²⁾
- Closed tank (non-zero based)
- Zero trim via Field Communicator
- Re-range via zero button
- Re-range via Field Communicator
- Scale display

Figure 4-1: Remote Seals

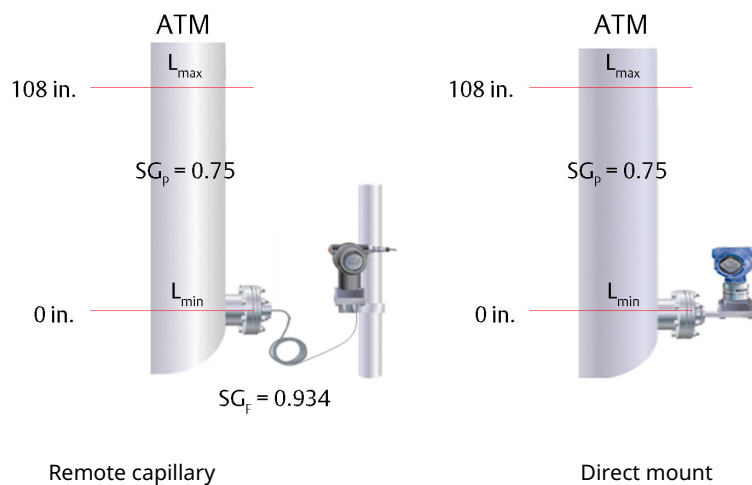
ATM = open to atmosphere



⁽²⁾ "Zero based" means 4 mA equals 0 inH₂O.

4.1.2 Zero-based lower range value

Figure 4-2: Remote Capillary and Direct Mount



ATM = open to atmosphere

d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

Tank span	$= L_{max} \times SG_P - L_{min} \times SG_P$ $= (108 \text{ in.} \times 0.75) - (0 \text{ in.} \times 0.75) = 81 \text{ inH}_2\text{O}$
4 mA	$= L_{min} \times SG_P + d_H \times SG_F$ $= (0 \text{ in.} \times 0.75) + (0 \text{ in.} \times 0.934) = 0 \text{ inH}_2\text{O}$
20 mA	$= L_{max} \times SG_P + d_H \times SG_F$ $= (108 \text{ in.} \times 0.75) + (0 \text{ in.} \times 0.934) = 81 \text{ inH}_2\text{O}$
Span	$= 81 \text{ inH}_2\text{O} (81 \text{ to } 0 \text{ inH}_2\text{O})$

Note

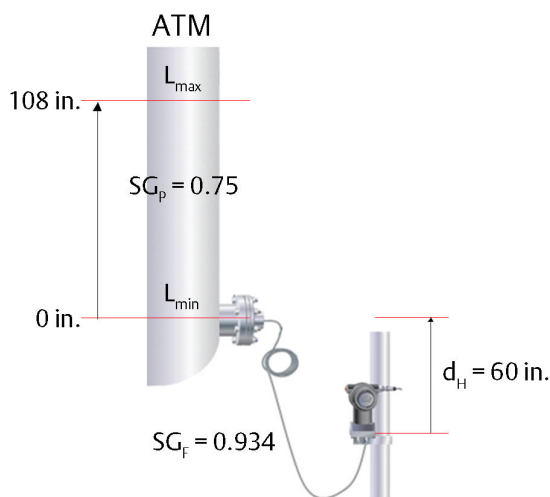
Both installations would have the same calculated range points.

Note

Silicone 200 has a specific gravity of 0.934.

4.1.3 Non-zero based lower range value

Figure 4-3: Remote Capillary



ATM = open to atmosphere

d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

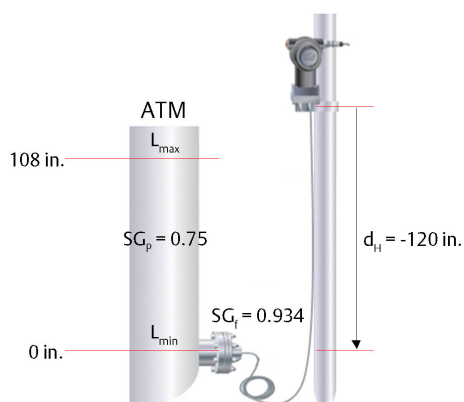
Tank span	$= L_{max} \times SG_P - L_{min} \times SG_P$ $= (108 \text{ in.} \times 0.75) - (0 \text{ in.} \times 0.75) = 81 \text{ inH}_2\text{O}$
4 mA	$= L_{min} \times SG_P + (d_H \times SG_F)$ $= (0 \text{ in.} \times 0.75) + (60 \text{ in.} \times 0.934) = 56.04 \text{ inH}_2\text{O}$
20 mA	$= L_{max} \times SG_P + (d_H \times SG_F)$ $= (108 \text{ in.} \times 0.75) + (56.04 \text{ inH}_2\text{O}) = 137.04 \text{ inH}_2\text{O}$
Span	$= 81 \text{ inH}_2\text{O} (137.04 \text{ to } 56.04 \text{ inH}_2\text{O})$

Note

Silicone 200 has a specific gravity of 0.934.

4.1.4 Non-zero based lower range value (transmitter mounted above seal)

Figure 4-4: Remote Capillary



ATM = open to atmosphere

d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

Tank span	$= L_{max} \times SG_P - L_{min} \times SG_P$ $= (108 \text{ in.} \times 0.75) = 81 \text{ inH}_2\text{O}$
4 mA	$= L_{min} \times SG_P + (d_H \times SG_F)$ $= (0 \text{ in.} \times 0.75) + (-120 \text{ in.} \times 0.934) = -112.08 \text{ inH}_2\text{O}$
20 mA	$= L_{max} \times SG_P + (d_H \times SG_F)$ $= (108 \text{ in.} \times 0.75) + (-120 \text{ in.} \times 0.934) = -31.08 \text{ inH}_2\text{O}$
Span	$= 81 \text{ inH}_2\text{O} (-112.08 \text{ to } -31.08 \text{ inH}_2\text{O})$

Note

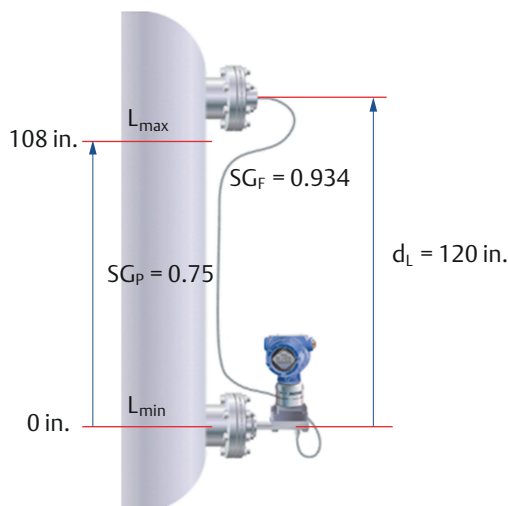
The height of the transmitter ($H_d \times S_g$) should not be greater than approximately 394 inH₂O (14.2 PSI) not to exceed the 0.5 PSIA sensor limits of a coplanar DP or GP.

Note

Silicone 200 has a specific gravity of 0.934.

4.1.5 Non-zero based lower range value (Tuned-System assembly)

Figure 4-5: Tuned-System™



d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

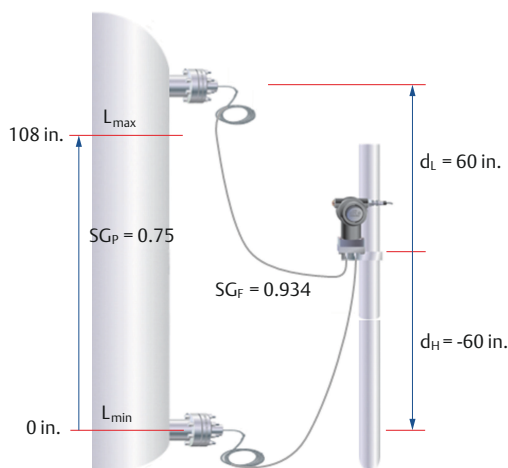
Tank span	$= L_{max} \times SG_P - L_{min} \times SG_P$ $= (108 \text{ in.} \times 0.75) = 81 \text{ inH}_2\text{O}$
4 mA	$= L_{min} \times SG_P - (d_L \times SG_F)$ $= (0 \text{ in.} \times 0.75) - (120 \text{ in.} \times 0.934) = -112.08 \text{ inH}_2\text{O}$
20 mA	$= L_{max} \times SG_P - (d_L \times SG_F)$ $= (108 \text{ in.} \times 0.75) - (120 \text{ in.} \times 0.934) = -31.08 \text{ inH}_2\text{O}$
Span	$= 81 \text{ inH}_2\text{O} (-112.08 \text{ to } -31.08 \text{ inH}_2\text{O})$

Note

Silicone 200 has a specific gravity of 0.934.

4.1.6 Non-zero based lower range value (balanced system with transmitter between seals)

Figure 4-6: Balanced System



d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

$$\begin{aligned}\text{Tank span} &= L_{max} \times SG \\ &= 108 \text{ in.} \times 0.75 = 81 \text{ inH}_2\text{O}\end{aligned}$$

$$\begin{aligned}\text{4 mA} &= L_{min} \times SG_P - (d_L \times SG_F) + (d_H \times SG_F) \\ &= (0 \text{ in.} \times 0.75) - (60 \text{ in.} \times 0.934) + (-60 \text{ in.} \times 0.934) = -112.08 \text{ inH}_2\text{O}\end{aligned}$$

$$\begin{aligned}\text{20 mA} &= L_{max} \times SG_P - (d_L \times SG_F) + (d_H \times SG_F) \\ &= (108 \text{ in.} \times 0.75) - (60 \text{ in.} \times 0.934) + (-60 \text{ in.} \times 0.934) = -31.08 \text{ inH}_2\text{O}\end{aligned}$$

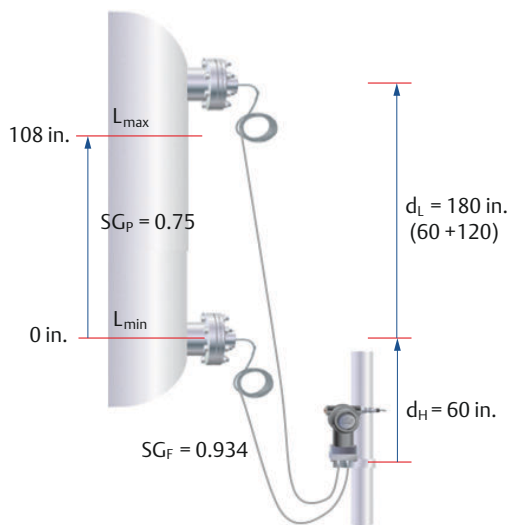
$$\text{Span} = 81 \text{ inH}_2\text{O} (-112.08 \text{ to } -31.08 \text{ inH}_2\text{O})$$

Note

Silicone 200 has a specific gravity of 0.934.

4.1.7 Non-zero based lower range value(balanced system with transmitter below seals)

Figure 4-7: Remote Capillary



d_H = vertical distance from transmitter to high pressure seal

d_L = vertical distance from transmitter to low pressure seal

L_{max} = the maximum level of process above the high pressure seal and typically the 20 mA lower range value

L_{min} = the minimum level of process above the high pressure seal and typically the 4 mA lower range value

SG_F = specific gravity of fill fluid

SG_P = specific gravity of process fluid

$$\begin{aligned}\text{Tank span} &= L_{\max} \times SG \\ &= 108 \text{ in.} \times 0.75 = 81 \text{ inH}_2\text{O}\end{aligned}$$

$$\begin{aligned}\text{4 mA} &= L_{\min} \times SG_P - (d_L \times SG_F) + (d_H \times SG_F) \\ &= (0 \text{ in.} \times 0.75) - (180 \text{ in.} \times 0.934) + (60 \text{ in.} \times 0.934) = -112.08 \text{ inH}_2\text{O}\end{aligned}$$

$$\begin{aligned}\text{20 mA} &= L_{\max} \times SG_P - (d_L \times SG_F) + (d_H \times SG_F) \\ &= (108 \text{ in.} \times 0.75) - (180 \text{ in.} \times 0.934) + (60 \text{ in.} \times 0.934) = -31.08 \text{ inH}_2\text{O}\end{aligned}$$

$$\text{Span} = 81 \text{ inH}_2\text{O} (-112.08 \text{ to } -31.08 \text{ inH}_2\text{O})$$

Note

Silicone 200 has a specific gravity of 0.934.

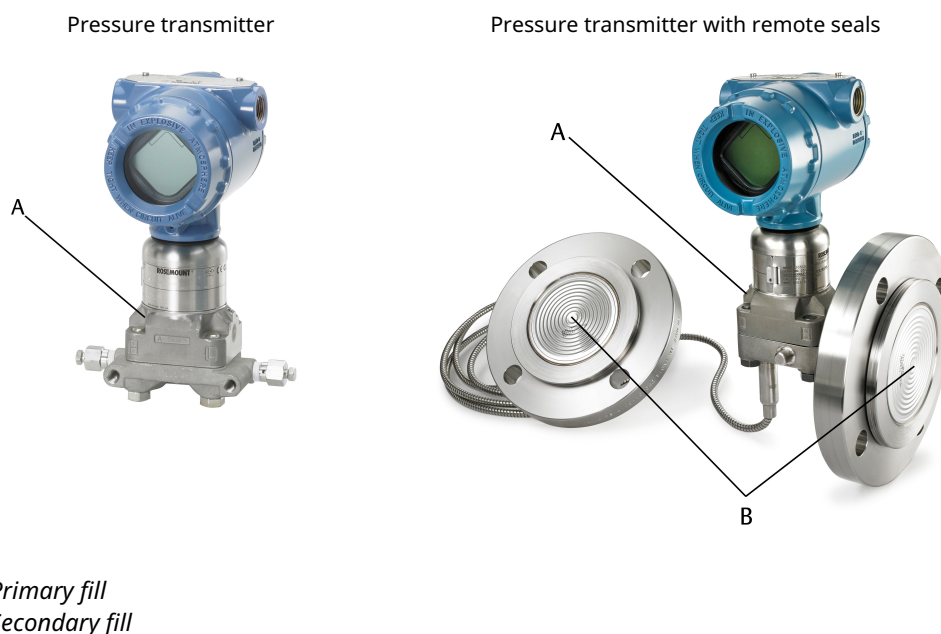
Note

The transmitter location in a closed tank does not effect the 4 mA and 20 mA set points as shown in example A, B, and C.

4.2 DP Level transmitter installation best practices

Pressure transmitters have a sensor module with a primary fill fluid. Therefore, the mounting position of a standard transmitter with silicon fill could read approx ± 1.25 inH₂O worst case after installation. This is simply zeroed out using a Field Communicator after installation so that it will read zero pressure. With a remote seal attached you have additional components that will create additive pressure that would increase the amount of potential shift. This would include the secondary fill fluid in the remote seal assembly along with the potential of torquing effects when the assembly is bolted to the process. For these reasons, the transmitter's digital output will most likely not match the exact values calculated on paper. Even a redundant transmitter would most likely not read the exact digital values after being installed. For these reasons, a re-range function is common practice after all installations.

Figure 4-8: Installation Example



What is important is the calculated span (level height $\times$ specific gravity of the process). After the transmitter is mounted, it is common and best practice to re-range the transmitter so that the 4 mA point will be the installed digital value. The 20 mA point would then be set based on the calculated span value setting it above the installed digital value.

The procedure would be based on mounting configuration (zero based) 4 mA = 0 inH₂O or (non-zero based) 4 mA exceeds the $\pm 3\%$ of the upper sensor limit (USL).

4.2.1 Open tank (zero based)

With open tank level applications this value can typically be zeroed out using a HART device as long as it is $< 3\%$ USL. The maximum value that can be zeroed out is 3% of the USL or 7.5 inH₂O for a range 2 (250 inH₂O) sensor.

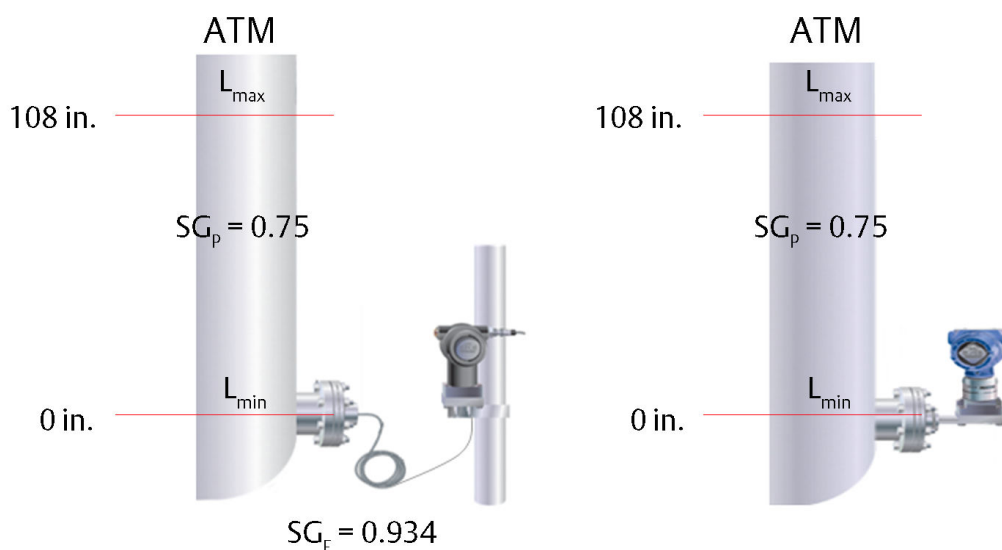
4.2.2 Closed tank (non-zero based)

For closed tank level applications, this value is most likely too high and cannot be zeroed out due to the applied pressure of the secondary fill fluid. For this reason, the transmitter would simply be re-ranged so that the 0% value (4 mA) would equal the installed value. The 100 percent, (20 mA) would be adjusted to the required calculated span.

4.2.3 Open tank example (zero-based lower range value) with Field Communicator

Perform a zero trim via Field Communicator after installation for zero based lower range values.

Figure 4-9: Open Tank



ATM: open to atmosphere.

Figure 4-10: Before Zero Trim Using Field Communicator

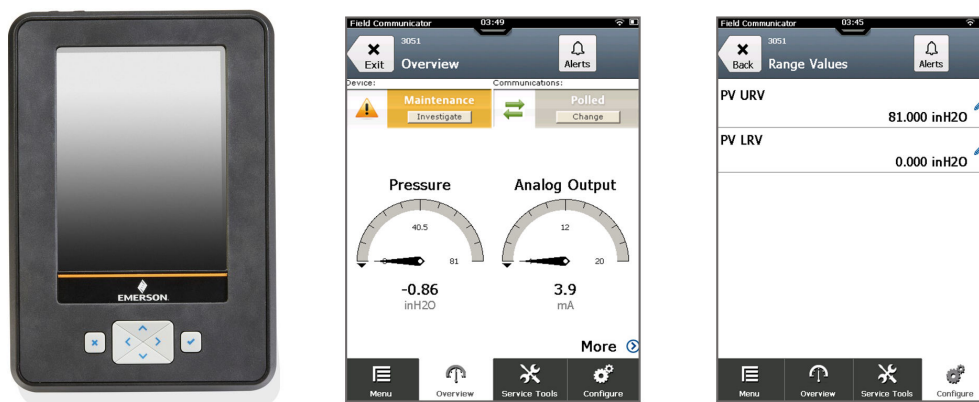
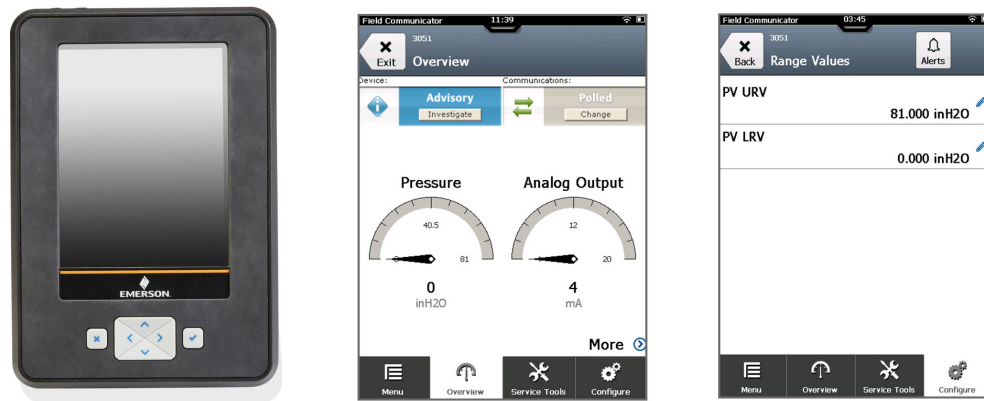


Figure 4-11: After Zero Trim Using Field Communicator

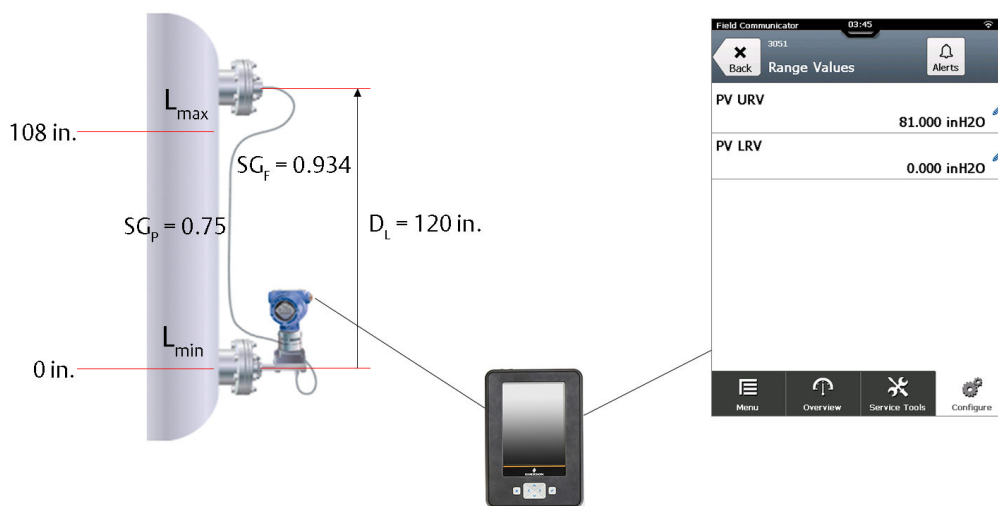


4.2.4 Closed tank example (non-zero based lower range value)

Note

For FOUNDATION™ Fieldbus, refer to the AI Function Blocks in reference manual.

Figure 4-12: Tuned-System



Procedure

1. Set seals at the same elevation for bench pressure verification, if required to range transmitter. If the transmitter does not require bench pressure verification, proceed to [Step 2](#).

Bench pressure verification

Power and range the transmitter using a Field Communicator to the required tank span. (Figure 4-12 example) With the required calibration fixture attached to the seal assemble apply pressure.

4 mA = 0 inH₂O

20 mA = 81 inH₂O

2. Install the tuned system by assembling the seals to the process taps. Common practice is to mount the high-pressure side seal to the low process tap and the low-pressure side seal to the high process tap.
3. Wire and apply power to the transmitter.
4. If the transmitter has a zero button, see [Figure 4-13](#) and [Figure 4-14](#), push the Zero button. This will automatically re-range the transmitter so the LRV (4 mA) will equal the current applied pressure value and the URV (20 mA) will be adjusted to the required calculated span.

Example 1: Re-range using transmitter zero button

Transmitter is ranged per [Figure 4-12](#):

4 mA = 0 inH₂O

20 mA = 81 inH₂O

After installing and pushing the **Zero** button, the transmitter will now be ranged per example from [Figure 4-5](#):

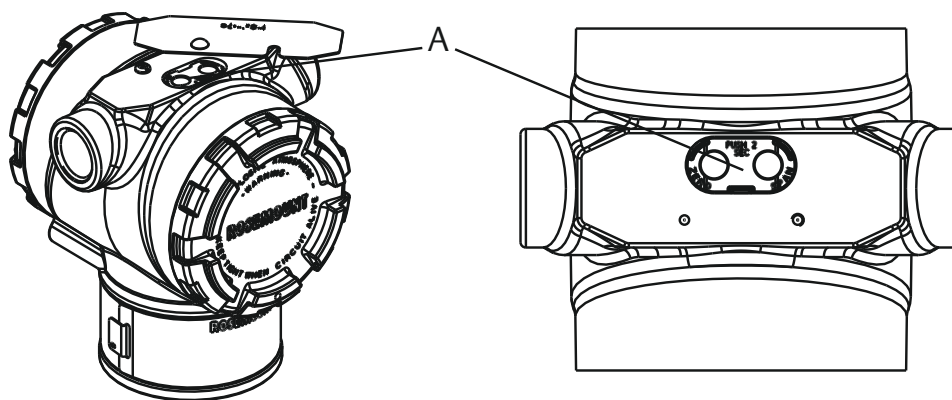
4 mA = -112.08 inH₂O

20 mA = -31.08 inH₂O

Note

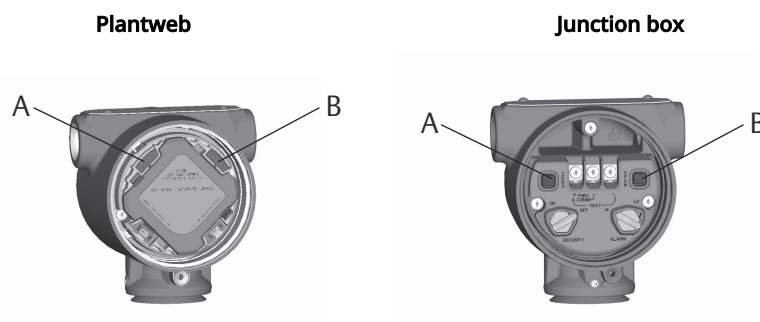
If you have a Field Communicator device connected when the **Zero** button is pushed, you must re-boot the Field Communicator to see the change.

Figure 4-13: Zero and Span Buttons on Rosemount 2088, 2051, and 3051



A. Zero and span buttons

Figure 4-14: Zero and Span Buttons on Rosemount 3051S



A. Zero
B. Span

5. If the transmitter does not have a Zero button, use a Field Communicator to re-range the transmitter.

Example 2: Re-range using a Field Communicator

Transmitter is ranged per [Figure 4-13](#):

4 mA = 0 inH₂O

20 mA = 81 inH₂O

After mounting transmitter, the pressure reads -112.08 inH₂O, see [Figure 4-14](#).

Using a Field Communicator, re-range the transmitter, see [Figure 4-14](#). The transmitter will now be ranged per example from [Figure 4-5](#):

4 mA = -112.08 inH₂O

20 mA = -31.08 inH₂O

Figure 4-15: Before Re-range Using Field Communicator

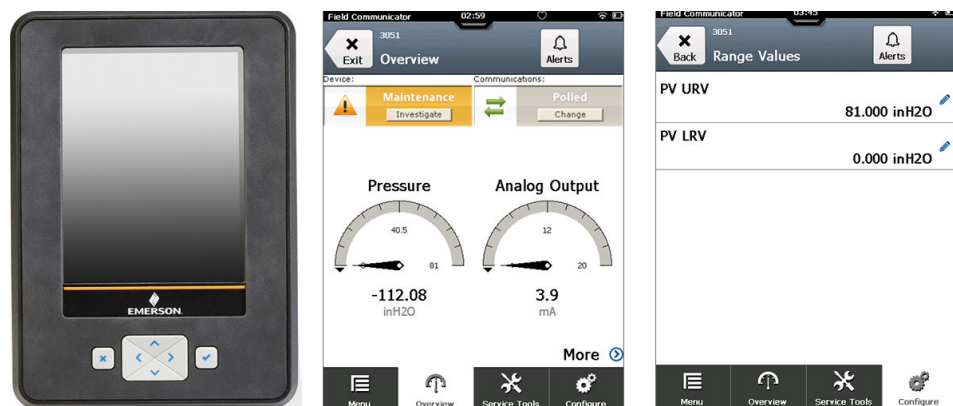
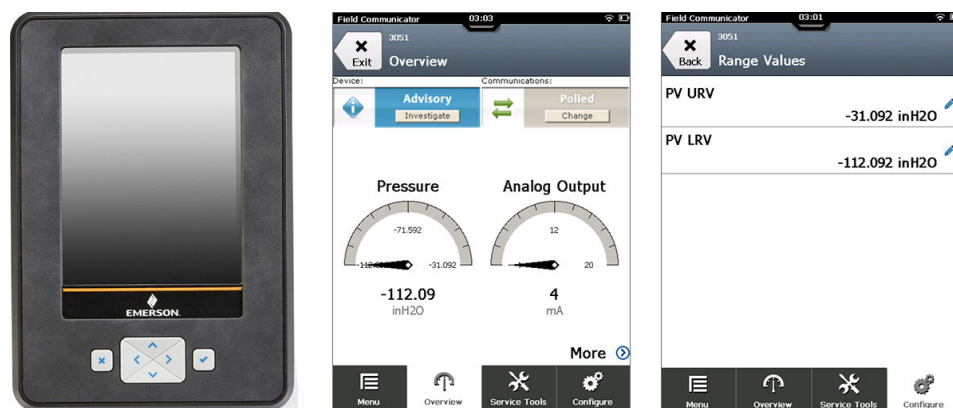


Figure 4-16: After Re-range Using Field Communicator



6. If the device has a display and you want to configure the output to an engineering unit other than the standard defaults, go to [Scale display with Field Communicator](#).

4.2.5 Scale display with Field Communication

After the transmitter is installed, you can scale the display to match the DCS or PLC as required but, often 0 to 100 percent is sufficient. As an example, in [Figure 4-12](#), the display should be 0 to 81 inH₂O. This can be done using a Field Communicator, example shown below for the Rosemount 3051S. See the transmitter reference manual for steps to configure the display.

Note

Depending on the HART device (Field Communicator/AMS Wireless Configurator) DD the following steps may be slightly different.

For the Rosemount 3051S, in the HART menu tree, go to the **Scaled variable Config** (under guided set up). Follow the steps below: Bold text indicates entered value.

Procedure

1. Enter SV unit: (enter) **inH₂O**
2. Select Scaled data option: (select) **Linear**
3. Enter Pressure value position 1: (enter) **-112.08**
4. Enter Scaled Variable position 1: (enter) **0**
5. Enter Pressure value position 2: (enter) **-31.08**
6. Enter Scaled Variable position 2: (enter) **81**
7. Enter Linear Offset: (enter) **0.00**
8. Go to **Display** (under manual setup).
9. Pressure: **OFF**
10. Scaled Variable: **ON**
11. Module Temperature: **OFF**
12. Percent of range: **OFF**

Note

The transmitter is ranged -112.08 to -31.08 inH₂O, but the display will show 0 inH₂O at (4 mA) and 81 inH₂O at (20 mA).

5 Fill Fluids

This section discusses the process of selecting the appropriate fill fluid using vapor pressure curves. To see the list of available Rosemount fill fluids, view the Rosemount DP Level Fill Fluid Specifications [Technical Note](#), or reference the Rosemount DP Level Transmitters and 1199 Remote Seals [Product Data Sheet](#) or the 1299 Remote Seals Product Data Sheet.

5.1 Quality

5.1.1 Specialized processing

Emerson has implemented proprietary processes to eliminate impurities and contaminations in the fill fluid. This additional processing ensures stable measurement and optimal performance under extreme temperatures and vacuum conditions. The proprietary equipment and procedures used to build remote seal systems for high temperature/high vacuum applications are continuously improved to deliver products that meet ever increasing application demands. Tight quality control measures such as helium leak checking of system welds ensures the reliability of every seal system. Additional quality checks include continual station leak and health tests to confirm the fill quality of the finished seal system.

5.1.2 Testing

Emerson's vapor pressure curves are derived from empirical lab testing in real devices at both vacuum conditions and at the maximum continuous temperature at one atmosphere of pressure. The maximum continuous temperature at one atm of pressure correlates to the thermal stability of the fill fluid, which is the maximum temperature the fill fluid will remain in its original molecular form. Over time, exceeding the maximum recommended temperature may result in the decomposition or vaporization of the fill fluid, resulting in device failure.

5.2 Fill fluid selection

Fill fluid selection is very important to the safety and reliability of your measurement application.

5.2.1 Type of 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.

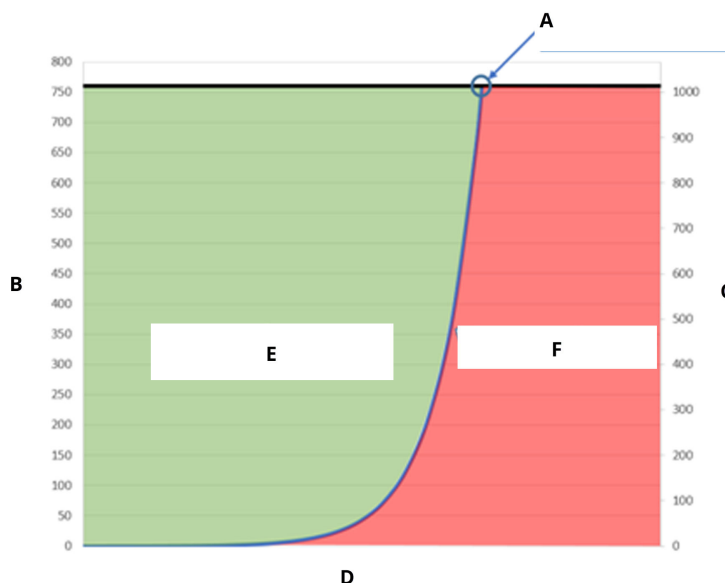
5.2.2 Maximum and minimum temperatures

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.

5.2.3 Process pressure and temperature

When the process is under vacuum conditions (below 14.7 psia), the fill fluid will vaporize at a lower temperature than when it is operating under normal atmospheric or greater pressure. If the fill fluid vaporizes, the seal system is permanently damaged. Emerson offers numerous types of fill fluids for remote seal systems, each fill fluid has a specific vapor-pressure curve. The vapor-pressure curve indicates the pressure and temperature relationship where the fluid is in a liquid or vapor state. Safe and reliable system operation requires the fill fluid to remain in a liquid state.

Figure 5-1: Liquid vs. Pressure State Under Vacuum



- A. Maximum continuous operating temperature
- B. Pressure (Torr absolute)
- C. Pressure (mbar absolute)
- D. Temperature
- E. Liquid state
- F. Vapor state

The thermal stability point of a fill fluid is equal to its maximum temperature at one atmosphere. This point translates to the maximum continuous operating temperature of the fill fluid.

5.3 Fill fluid vapor pressure curves

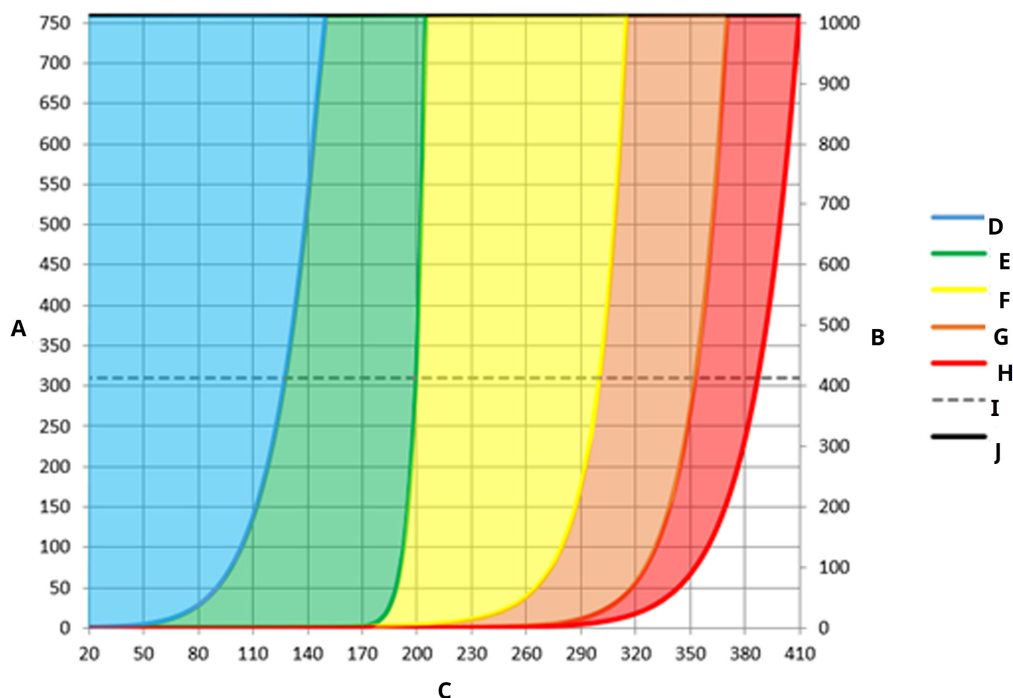
5.3.1 How to use vapor pressure curves

Take each temperature and pressure of your process cycle and find where each point falls on the graph above (Figure 5-1). Whichever fill fluid that is farthest to the right containing a point of your process cycle is most likely the correct fill fluid for your application.

Note

Fill fluids can operate at lower temperatures than their shaded section shown in [Figure 5-2](#). For exact minimum operating temperatures, consult the Rosemount DP Level Fill Fluid Specifications [Technical Note](#).

Figure 5-2: Vapor Pressure Curves of General Use Fill Fluids



- A. Pressure (Torr absolute)
- B. Pressure (mbar absolute)
- C. Temperature (°C)
- D. Syltherm XLT
- E. Silicone 200 for vacuum applications
- F. Silicone 704 for vacuum applications
- G. Silicone 705 for vacuum applications
- H. UltraTherm 805 for vacuum applications
- I. Requires all-welded
- J. Atmospheric pressure

5.3.2 Fill fluid selection example

In an application that has a maximum process temperature of 284 °F (140 °C) and a maximum pressure of 700 Torr, SYLTHERM™ XLT would be recommended. However, say the process pressure drops to 200 Torr and 284 °F (140 °C) at one point during the process cycle, then Silicone 200 for vacuum applications would be recommended because it is the fill fluid farthest to the right that the process falls into.

5.3.3 Fill fluid specifications

Rosemount fill fluid properties, vapor pressure curves, and specifications can be found in the Rosemount DP Level Fill Fluid Specifications [Technical Note](#).

6 Maintenance and Troubleshooting

6.1 Cleaning

Avoid using abrasive agents or high pressure water jets when cleaning the remote seals.

6.2 Troubleshooting

Remote seal systems are factory filled systems that cannot be refilled in the field. Do not attempt to disconnect the seals or capillaries from the transmitter. Doing so can damage the seal system assembly and voids the product warranty. Listed below are the possible problems, their potential causes, and, where applicable, a corrective action.

6.2.1 No output

Potential cause

Electrical problem

Recommended actions

1. See the troubleshooting section of the transmitter manual for more extensive information.
2. Check for adequate voltage to the transmitter.
3. Check the milliampere rating of the power supply against the total current being drawn for all transmitters being powered.
4. Check for shorts and multiple grounds.
5. Check for proper polarity at the transmitter terminal.
6. Check loop impedances.

⚠ CAUTION

Do not use higher than the specified voltage to check the loop, or the transmitter electronics may be damaged.

6.2.2 Slow response

Potential cause

Damping too high

Recommended actions

See the "Damping Adjustment" information in the Calibration section of the transmitter manual.

Potential cause

Cold temperature

Recommended actions

Fill fluid viscosity is temperature dependent. Less viscous fill fluid enhances time response. Heat traced capillaries can be added as an option to maintain constant temperatures to fill fluid.

6.2.3 Drifting

Recommended actions

If pressure measurement is changing, refer to [Seal system performance](#) for more information. Running a performance sizing will calculate the expected performance for the seal system. Refer to [Sizing and Selection: seal ordering and application process](#) for more information.

6.2.4 Output reads negative pressure

Potential cause

Mounting effect

Recommended actions

The output will read negative as the remote fill fluid is applying pressure to the low side. See [Configuration](#).

6.2.5 No response to change in pressure

Potential cause

Damaged diaphragm

Recommended actions

Remove seal and inspect diaphragm.

6.2.6 Not responding to change in pressure

Potential cause

Multidrop mode

Recommended actions

See if the transmitter is in a multidrop mode. The multidrop mode locks the output at 4 mA.

6.3 Return of materials

Within the United States, call the North American Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

Outside of the United States, contact your local Emerson representative (support center addresses and phone numbers are on the Title Page of this manual).

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the name of the process material the product was last exposed to.

⚠ WARNING

Mishandling products exposed to a hazardous substance can cause death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

6.4 Service support

To expedite the return process outside of the United States, contact the nearest Emerson representative.

Within the United States, call the Emerson Instrument and Valves Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

⚠ CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

Emerson Instrument and Valves Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

7 Reference data

7.1 Product certifications

To view current product certification, follow these steps:

Procedure

1. Go to the product page on [Emerson.com/Rosemount-1199](https://emerson.com/Rosemount-1199). For 1299, use the product page on this link.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. Click **Manuals & Guides**.
4. Select the appropriate Quick Start Guide.

7.2 Ordering information, specifications, and drawings

To view current ordering information, specifications, and drawings, follow these steps:

Procedure

1. Go to the product page on [Emerson.com/Rosemount-1199](https://emerson.com/Rosemount-1199). For 1299, use the product page on this link.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, click **Data Sheets & Bulletins** and select the appropriate Product Data Sheet.

7.3 Spare parts

Table 7-1: Flush Flanged (FFW) and Pancake (PFW) Lower Housings

Material	Size	Part number			
		One ¼-in.	Two ¼-in.	One ½-in.	Two ½-in.
316 SST	2-in.	DP0002-2111-S6	DP0002-2121-S6	DP0002-2112-S6	DP0002-2122-S6
	3-in.	DP0002-3111-S6	DP0002-3121-S6	DP0002-3112-S6	DP0002-3122-S6
	4-in./DN 100	DP0002-4111-S6	DP0002-4121-S6	DP0002-4112-S6	DP0002-4122-S6
	DN 50	DP0002-5111-S6	DP0002-5121-S6	DP0002-5112-S6	DP0002-5122-S6
	DN 80	DP0002-8111-S6	DP0002-8121-S6	DP0002-8112-S6	DP0002-8122-S6
Alloy C-276	2-in.	DP0002-2111-HC	DP0002-2121-HC	DP0002-2112-HC	DP0002-2122-HC
	3-in.	DP0002-3111-HC	DP0002-3121-HC	DP0002-3112-HC	DP0002-3122-HC
	4-in./DN 100	DP0002-4111-HC	DP0002-4121-HC	DP0002-4112-HC	DP0002-4122-HC
	DN 50	DP0002-5111-HC	DP0002-5121-HC	DP0002-5112-HC	DP0002-5122-HC
	DN 80	DP0002-8111-HC	DP0002-8121-HC	DP0002-8112-HC	DP0002-8122-HC

Table 7-1: Flush Flanged (FFW) and Pancake (PFW) Lower Housings (continued)

Material	Size	Part number			
		One ¼-in.	Two ¼-in.	One ½-in.	Two ½-in.
Alloy 400	2-in.	DP0002-2111-M4	DP0002-2121-M4	DP0002-2112-M4	DP0002-2122-M4
	3-in.	DP0002-3111-M4	DP0002-3121-M4	DP0002-3112-M4	DP0002-3122-M4
	4-in./DN 100	DP0002-4111-M4	DP0002-4121-M4	DP0002-4112-M4	DP0002-4122-M4
	DN 50	DP0002-5111-M4	DP0002-5121-M4	DP0002-5112-M4	DP0002-5122-M4
	DN 80	DP0002-8111-M4	DP0002-8121-M4	DP0002-8112-M4	DP0002-8122-M4

Table 7-2: Gaskets for Flush Flanged (FFW) and Pancake (PFW) Lower Housings

Material	Size	Part number			
		Klinger C-4401	Virgin PTFE	GHB GRAFOIL®	Gylon 3510
316 SST	2-in.	DP0007-0201-KF	DP0007-0201-TF	DP0007-0201-GF	DP0007-0201-GY
	3-in.	DP0007-0301-KF	DP0007-0301-TF	DP0007-0301-GF	DP0007-0301-GY
	4-in./DN 100	DP0007-0401-KF	DP0007-0401-TF	DP0007-0401-GF	DP0007-0401-GY
	DN 50	DP0007-0601-KF	DP0007-0601-TF	DP0007-0601-GF	DP0007-0601-GY
	DN 80	DP0007-0801-KF	DP0007-0801-TF	DP0007-0801-GF	DP0007-0801-GY

Table 7-3: Alignment Clamps for Flush Flanged (FFW) and Pancake (PFW) Lower Housings

	Size	Part number
ANSI/JIS	2-in.	DP0127-2000-S1
	3-in.	DP0127-3000-S1
	4-in.	DP0127-4000-S1
DIN	DN 50	DP0127-5000-S1
	DN 80	DP0127-8000-S1
	DN 100	DP0127-4000-S1

Table 7-4: Plugs for Flush Flanged (FFW) and Pancake (PFW) Lower Housings

Material	¼-in.	½-in.
SST	01199-7000-0502	01199-7000-0504
Alloy C-276	01199-7000-0602	01199-7000-0604

Table 7-5: Remote Flanged (RFW) Lower Housings

Material	Size	Part number				
		No flushing connection	One ¼-in.	Two ¼-in.	One ½-in.	Two ½-in.
316 SST	1-in.	DP0422-S300-S6	DP0422-S311-S6	DP0422-S121-S6	DP0422-S112-S6	DP0422-S122-S6
	1½-in.	DP0422-S500-S6	DP0422-S511-S6	DP0422-S521-S6	DP0422-S512-S6	DP0422-S522-S6

Table 7-5: Remote Flanged (RFW) Lower Housings (continued)

	DN 25	DP0422-S700-S6	DP0422-S711-S6	DP0422-S721-S6	DP0422-S712-S6	DP0422-S722-S6
	DN 40	DP0422-S800-S6	DP0422-S811-S6	DP0422-S821-S6	DP0422-S812-S6	DP0422-S822-S6
Alloy C-276	1-in.	DP0422-S300-HC	DP0422-S311-HC	DP0422-S321-HC	DP0422-S312-HC	DP0422-S322-HC
	1½-in.	DP0422-S500-HC	DP0422-S511-HC	DP0422-S521-HC	DP0422-S512-HC	DP0422-S522-HC
	DN 25	DP0422-S700-HC	DP0422-S711-HC	DP0422-S721-HC	DP0422-S712-HC	DP0422-S722-HC
	DN 40	DP0422-S800-HC	DP0422-S811-HC	DP0422-S821-HC	DP0422-S812-HC	DP0422-S822-HC
Carbon steel	1-in.	DP0422-S300-Z1	DP0422-S311-Z1	DP0422-S321-Z1	DP0422-S312-Z1	DP0422-S322-Z1
	1½-in.	DP0422-S500-Z1	DP0422-S511-Z1	DP0422-S521-Z1	DP0422-S512-Z1	DP0422-S522-Z1
	DN 25	DP0422-S700-Z1	DP0422-S711-Z1	DP0422-S721-Z1	DP0422-S712-Z1	DP0422-S722-Z1
	DN 40	DP0422-S800-Z1	DP0422-S811-Z1	DP0422-S821-Z1	DP0422-S812-Z1	DP0422-S822-Z1
Alloy 400	1-in.	DP0422-S300-M4	DP0422-S311-M4	DP0422-S321-M4	DP0422-S312-M4	DP0422-S322-M4
	1½-in.	DP0422-S500-M4	DP0422-S511-M4	DP0422-S521-M4	DP0422-S512-M4	DP0422-S522-M4
	DN 25	DP0422-S700-M4	DP0422-S711-M4	DP0422-S721-M4	DP0422-S712-M4	DP0422-S722-M4
	DN 40	DP0422-S800-M4	DP0422-S811-M4	DP0422-S821-M4	DP0422-S812-M4	DP0422-S822-M4

Table 7-6: Gaskets for Remote Flanged (RFW) Lower Housings

Material	Size	Part number				
		C4401 Aramid fiber	PTFE	Barium sulfate filled PTFE	GHB GRAFOIL	Ethylene propylene
316 SST	1-in.	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER
	1½-in.	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER
	DN 25	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER
	DN 40	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER

Table 7-7: Plugs for Remote Flanged (RFW) Lower Housings

Material	¼-in.	½-in.
SST	01199-7000-0502	01199-7000-0504
Alloy C-276	01199-7000-0602	01199-7000-0604

Table 7-8: Threaded (RTW) Lower Housings

Material	Size	Part number				
		No flushing connection	One ¼-in.	Two ¼-in.	One ½-in.	Two ½-in.
316 SST	¼-18 NPT	DP0421-2101-S6	DP0421-2112-S6	DP0421-2122-S6	DP0421-2114-S6	DP0421-2124-S6
	3/8-18 NPT	DP0421-2101-S6	DP0421-2212-S6	DP0421-2222-S6	DP0421-2214-S6	DP0421-2224-S6
	½-14 NPT	DP0421-2301-S6	DP0421-2312-S6	DP0421-2322-S6	DP0421-2314-S6	DP0421-2324-S6
	¾-14 NPT	DP0421-2401-S6	DP0421-2412-S6	DP0421-2422-S6	DP0421-2414-S6	DP0421-2424-S6
	1-11.5 NPT	DP0421-2501-S6	DP0421-2512-S6	DP0421-2522-S6	DP0421-2514-S6	DP0421-2524-S6
	1¼-11.5 NPT	DP0421-2601-S6	DP0421-2612-S6	DP0421-2622-S6	DP0421-2614-S6	DP0421-2624-S6
	1½-11.5 NPT	DP0421-2701-S6	DP0421-2712-S6	DP0421-2722-S6	DP0421-2714-S6	DP0421-2724-S6
	G½-14 BSP	DP0421-2901-S6	DP0421-2912-S6	DP0421-2922-S6	DP0421-2914-S6	DP0421-2924-S6
Alloy C-276	¼-18 NPT	DP0421-2101-HC	DP0421-2112-HC	DP0421-2122-HC	DP0421-2114-HC	DP0421-2124-HC
	3/8-18 NPT	DP0421-2201-HC	DP0421-2212-HC	DP0421-2222-HC	DP0421-2214-HC	DP0421-2224-HC
	½-14 NPT	DP0421-2301-HC	DP0421-2312-HC	DP0421-2322-HC	DP0421-2314-HC	DP0421-2324-HC
	¾-14 NPT	DP0421-2401-HC	DP0421-2412-HC	DP0421-2422-HC	DP0421-2414-HC	DP0421-2424-HC
	1-11.5 NPT	DP0421-2501-HC	DP0421-2512-HC	DP0421-2522-HC	DP0421-2514-HC	DP0421-2524-HC
	1¼-11.5 NPT	DP0421-2601-HC	DP0421-2612-HC	DP0421-2622-HC	DP0421-2614-HC	DP0421-2624-HC
	1½-11.5 NPT	DP0421-2701-HC	DP0421-2712-HC	DP0421-2722-HC	DP0421-2714-HC	DP0421-2724-HC
	G½-14 BSP	DP0421-2901-HC	DP0421-2912-HC	DP0421-2922-HC	DP0421-2914-HC	DP0421-2924-HC
Carbon Steel	¼-18 NPT	DP0421-2101-Z1	DP0421-2112-Z1	DP0421-2122-Z1	DP0421-2114-Z1	DP0421-2124-Z1
	3/8-18 NPT	DP0421-2201-Z1	DP0421-2212-Z1	DP0421-2222-Z1	DP0421-2214-Z1	DP0421-2224-Z1
	½-14 NPT	DP0421-2301-Z1	DP0421-2312-Z1	DP0421-2322-Z1	DP0421-2314-Z1	DP0421-2324-Z1
	¾-14 NPT	DP0421-2401-Z1	DP0421-2412-Z1	DP0421-2422-Z1	DP0421-2414-Z1	DP0421-2424-Z1
	1-11.5 NPT	DP0421-2501-Z1	DP0421-2512-Z1	DP0421-2522-Z1	DP0421-2514-Z1	DP0421-2524-Z1

Table 7-8: Threaded (RTW) Lower Housings (continued)

	1¼-11.5 NPT	DP0421-2601-Z1	DP0421-2612-Z1	DP0421-2622-Z1	DP0421-2614-Z1	DP0421-2624-Z1
	1½-11.5 NPT	DP0421-2701-Z1	DP0421-2712-Z1	DP0421-2722-Z1	DP0421-2714-Z1	DP0421-2724-Z1
	G½-14 BSP	DP0421-2901-Z1	DP0421-2912-Z1	DP0421-2922-Z1	DP0421-2914-Z1	DP0421-2924-Z1
Alloy 400	¼-18 NPT	DP0421-2101-M4	DP0421-2112-M4	DP0421-2122-M4	DP0421-2114-M4	DP0421-2124-M4
	3/8-18 NPT	DP0421-2201-M4	DP0421-2212-M4	DP0421-2222-M4	DP0421-2214-M4	DP0421-2224-M4
	½-14 NPT	DP0421-2301-M4	DP0421-2312-M4	DP0421-2322-M4	DP0421-2314-M4	DP0421-2324-M4
	¾-14 NPT	DP0421-2401-M4	DP0421-2412-M4	DP0421-2422-M4	DP0421-2414-M4	DP0421-2424-M4
	1-11.5 NPT	DP0421-2501-M4	DP0421-2512-M4	DP0421-2522-M4	DP0421-2514-M4	DP0421-2524-M4
	1¼-11.5 NPT	DP0421-2601-M4	DP0421-2612-M4	DP0421-2622-M4	DP0421-2614-M4	DP0421-2624-M4
	1½-11.5 NPT	DP0421-2701-M4	DP0421-2712-M4	DP0421-2722-M4	DP0421-2714-M4	DP0421-2724-M4
	G½-14 BSP	DP0421-2901-M4	DP0421-2912-M4	DP0421-2922-M4	DP0421-2914-M4	DP0421-2924-M4

Table 7-9: Gaskets for Threaded (RTW) Lower Housings

Size	Part number						
	C4401 Aramid Fiber	PTFE	Barium Sulfate filled PTFE	GHB GRAFOIL	Ehtylene Propylene	Alloy 400	Alloy C-276
2500 psi MWP	DP0007-240 1-K4	DP0007-240 1-TF	DP0007-240 1-GY	DP0007-240 1-GF	DP0007-240 1-ER	N/A	N/A
5000 psi MWP	DP0007-240 1-K4	DP0132-340 0-TF	DP0007-240 1-GY	DP0007-240 1-GF	PP0006-203 4-ER	DP0007-240 3-M4	DP0007-240 5-HC
10000 psi MWP	DP0007- E201-K4	N/A	N/A	N/A	N/A	DP0007- E203-M4	DP0007- E205-HC

Table 7-10: Plugs for Threaded (RTW) Lower Housings

Material	¼-in.	½-in.
SST	01199-7000-0502	01199-7000-0504
Alloy C-276	01199-7000-0602	01199-7000-0604

Table 7-11: Sanitary Tank Spud Seal (SSW) Parts

Part description	Part number
Sanitary tank spud	
2-in. extension	01199-0061-0001

Table 7-11: Sanitary Tank Spud Seal (SSW) Parts
(continued)

Part description	Part number
6-in. extension	01199-0061-0002
Sanitary tank spud plug	
2-in. extension	01199-0552-0001
6-in. extension	01199-0552-0002
Sanitary tank spud clamp	
Clamp	01199-0526-0002
Sanitary tank spud plug	
Buna N O-ring	01199-7001-0001
Viton O-ring	01199-7001-0002
Ethylene Propylene O-ring	01199-7001-0003

Table 7-12: Sanitary Tri Clamp Seal (SCW and VCS) Parts

Part description	Part number
¾-in.	01199-0035-0105
1½-in.	01199-0035-0115
2-in.	01199-0035-0120
2½-in.	01199-0035-0125
3-in.	01199-0035-0130
4-in.	01199-0035-0140

Table 7-13: Sanitary Thin Wall Tank Spud Seal (STW) Parts

Part description	Part number
Thin wall spud	01199-0073-0001
Clamp	01199-0526-0004
Ethylene Propylene O-ring	01199-7001-1003

Table 7-14: Sanitary Pipe Mount Seal (UCP) and Sleeve Seal (PMW) Parts

Part description	Part number
PTFE gasket (package of 12)	02088-0078-0001
316 SST weld spud (for UCP)	02088-0295-0003
316 SST plug/heat sink (for UCP)	02088-0196-0001
316 SST weld spud (for PMW)	02088-0285-0001

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