Reference Manual
00809-0100-4002 Rev. BB
November 2012

Rosemount 1199 Seal Systems Manual

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Process Management

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00809-0100-4002, Rev BB
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Rosemount 1199 Seal Systems

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Within the United States, Rosemount Inc. has two toll-free assistance numbers:

Customer Central Technical support, quoting, and order-related questions.

Americas 1 800 999 9307

Europe +41 (0) 41 768 6111

Middle east +971 4 811 8100

Asia +65 6777 8211

North American Response Center Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of the United States, contact your local Emerson Process Management representative.

⚠CAUTION

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.

For information on Rosemount nuclear-qualified products, contact your local Emerson Process Management Sales Representative.

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Table of Contents

APPENDIX A
Reference Data

Section 1 Introduction

USING THIS MANUAL

This manual is designed to assist in installing, operating, and maintaining the Rosemount 1199 Seal Systems for Pressure Transmitters. The manual contains supplemental information about the seal system assemblies that are not covered in the corresponding transmitter manuals.

The information is organized into the following categories:

- **Section 2: Understanding DP Level**
- **Section 3: Installation**
- **Section 4: Ranging the Transmitter**
- **Section 5: Fill Fluids and Vapor Pressure Curves**
- **Section 6: Maintenance and Troubleshooting**
- **Appendix A: Reference Data**

See Product Data Sheet 00813-0100-4016 for more detailed information on specific Rosemount Remote Seals.

A remote seal system consists of a pressure transmitter, a remote diaphragm, and either a direct mount or capillary style connection filled with a secondary fill fluid.

During operation, the thin, flexible diaphragm and fill fluid separate the pressure sensor of the transmitter from the process medium. The capillary tubing or direct mount flange connects the diaphragm to the transmitter.

When process pressure is applied, the diaphragm is displaced, transferring the measured pressure through the filled system, by way of the capillary tubing, to the transmitter. This transferred pressure displaces the sensing diaphragm in the pressure sensor of the transmitter. This displacement is proportional to the process pressure and is converted electronically to an appropriate output current, digital HART® (Highway Addressable Remote Transducer), or FOUNDATION fieldbus output signal.

SERVICE SUPPORT

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

Within the United States, call the Emerson Process Management Instrument and Valve Services, 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 Process Management Instrument and Valve Services, Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

PRODUCT RECYCLING/DISPOSAL

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

Section 2 Understanding DP Level

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 sanitary connections.

TERMINOLOGY OF SYSTEM COMPONENTS

Figure 2-1 lists the basic components for seal assemblies.

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

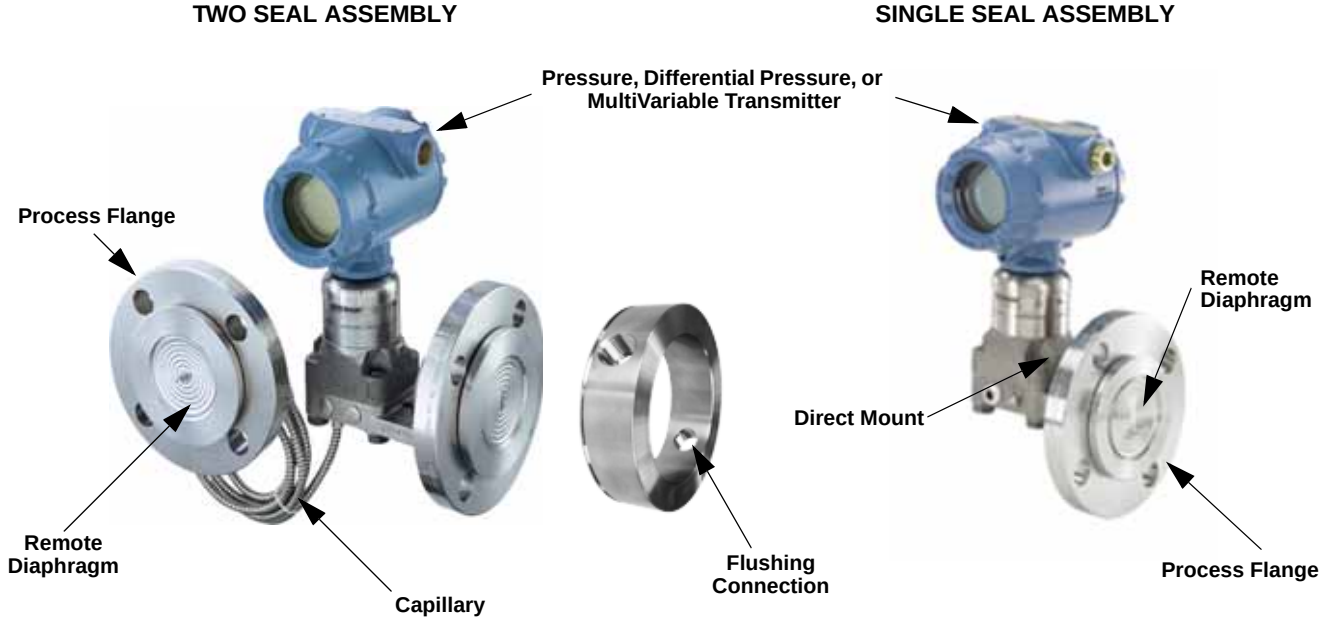
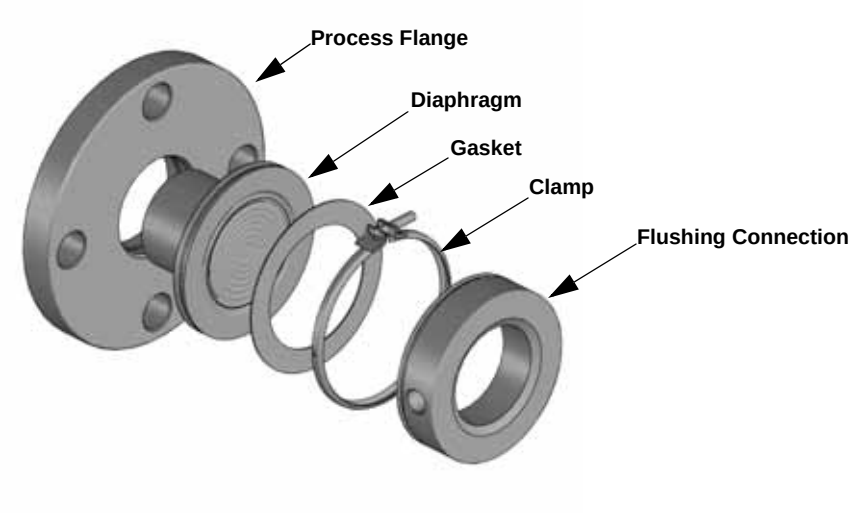


Figure 2-2. FFW Exploded View



UNDERSTANDING SEAL SYSTEM PERFORMANCE

Seal Temperature Effects (Process Temperature Error)

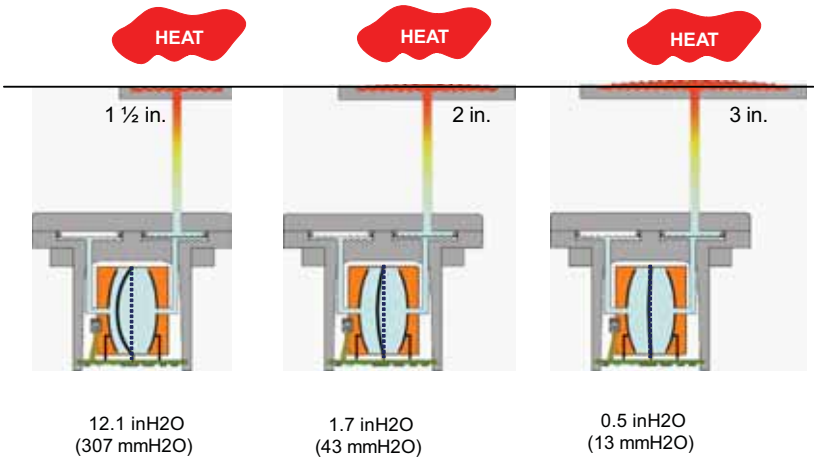
Fill fluids expand or contract with temperature changes, creating a volume change that is absorbed by the diaphragm seal and is seen as back pressure at the transmitter. This back pressure creates a shift in the transmitter reading. For symmetrical or balanced systems, this error is usually minimal due 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 on page 2-3 shows how diaphragm size can affect the measurement reading at the transmitter. For smaller seal sizes, such as the 1 $^{1}/_{2}$-in. size, the amount of back pressure on the transmitter causes an additional 12.1 inH_2O error. Moving to the 2-in. size gives 1.7 inH_2O and the largest 3-in. size shown only has 0.5 inH_2O error. Using a larger diaphragm can drastically improve performance and provides a more stable reading.

NOTE
Calculations done in Toolkit with Silicone 200 fill fluid with 3051 Transmitter.

Figure 2-3. Back pressure on diaphragm causing error



NOTE
Seal temperature effects decrease as seal size increases.

Head Temperature Effects (Ambient Temperature Error)

Head 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, equalling 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. Head 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.

System Time Response

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. Below is an example including 3 applications with the same process and ambient temperatures. The difference is one system is balanced (equal lengths of capillary), the other two are tuned systems (high pressure side is a direct mount with low pressure side connected via capillary) but one has a 0.040 in. capillary ID size and the other has the 0.075 in. capillary ID size.

Table 2-1. Response Time vs. Total Performance Example

	Application #1	Application #2	Application #3
Process Temperatures	-49 °F (-45 °C) to 401 °F (205 °C)	-49 °F (-45 °C) to 401 °F (205 °C)	-49 °F (-45 °C) to 401 °F (205 °C)
Ambient Temperatures	32 °F (0 °C) to 104 °F (40 °C)	32 °F (0 °C) to 104 °F (40 °C)	32 °F (0 °C) to 104 °F (40 °C)
Assembly Type	Balanced System	Tuned-System	Tuned-System
Capillary Length	15 meter	15 meter	15 meter
Capillary ID	0.075-in. (1.905 mm)	0.075-in. (1.905 mm)	0.04-in. (1.092 mm)
Response Time Ambient Temp. at 0, 20, and 40 °C	1.9, 1.3, 1.1 sec	1.6, 1.2, 1.0 sec	4.1, 2.6, 2.1 sec
Total Performance Ambient Temp. at 0 and 40 °C	±3.15%, ±1.89%	±0.90%, ±0.27%	±2.45%, ±1.31%

NOTE:
Calculations done in Toolkit with Silicone 200 fill fluid with 3051 Transmitter and FFW seal.

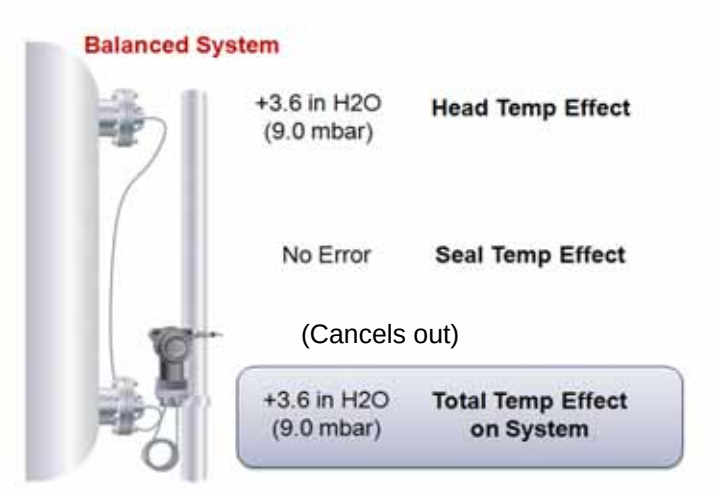
NOTE
0.075 capillary inner diameter with long lengths of capillary, over 25ft. (7.6m) can result in the diaphragm bottoming out in applications with cold ambient and cold process temperatures. For these applications, 0.075 in. should be avoided in cold conditions (cold ambient and cold process, as the seal system will bottom out) or deform at hot conditions. A smaller ID size, either 0.040 in. or 0.028 in. should be selected.

BALANCED VS. TUNED-SYSTEM™ ASSEMBLIES

A balanced system is a symmetrical system that has the same seal and equal amount of capillary on the high and low pressure sides. 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 2-4.

NOTE
Smaller diaphragms will cause a larger ± tolerance due to stiffness characteristics.

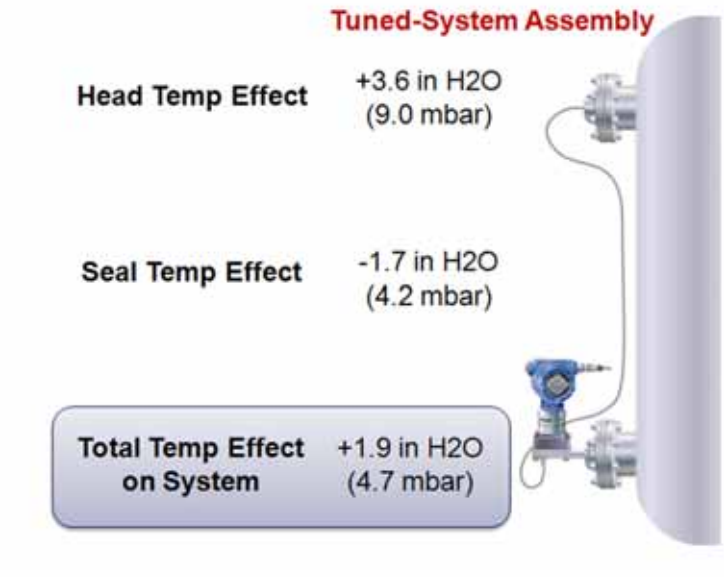
Figure 2-4. Balanced System



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

Tuned-Systems Assemblies are asymmetrical systems with one seal directly mounted and another seal connected 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 2-5. Tuned-System Assembly



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

SPECIFYING THE RIGHT SOLUTION FOR VACUUM APPLICATIONS

Vacuum Application Overview

When a vessel is under a vacuum 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.

Vacuum Applications

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

- Transmitter Mounting Position
- Fill Fluid Selection
- Seal System Construction

Seal System Construction for Vacuum Applications

Emerson offers Rosemount 1199 seal assemblies, welded-repairable, and All-Welded vacuum system construction. In vacuum applications below 6 psia (310 mmHga), specify the All-Welded vacuum construction. Gasket connections allow the potential for vacuum pressure to draw air into the capillary system causing drift or complete system failure. No air in the system eliminates the need to re-zero and thus improves plant availability by preventing unscheduled downtime and instrument repair or replacement.

The all welded vacuum construction was designed 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. This premium design is strongly suggested for vacuum pressures below 6 psia (310 mmHga).

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.

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 with a premium combination of vapor-pressure curve and high temperature limits like Silicone 704 or Silicone 705.

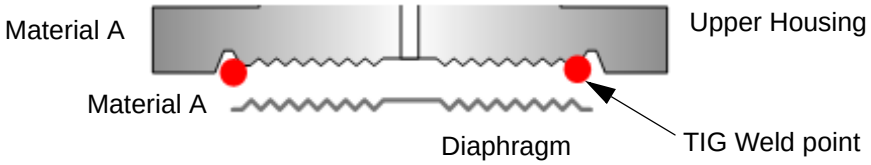
DIAPHRAGM WELD TYPES

Weld-type is factory-determined as best for the seal typed specified. PFW and FFW seals have ordering options that specify welding options.

Solid Faceplate Design

The solid faceplate design is used when diaphragm and upper housing material are the same or when the weld is not wetted. This design is:

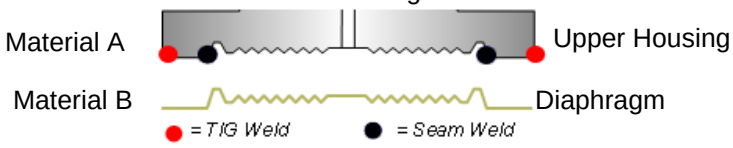
- The most efficient design to build and is the typical standard.
- TIG weld is used in solid faceplate design; this weld is wetted.



Seam Weld Design

This design is used when the upper housing material is different from the diaphragm material. The seam welded 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.

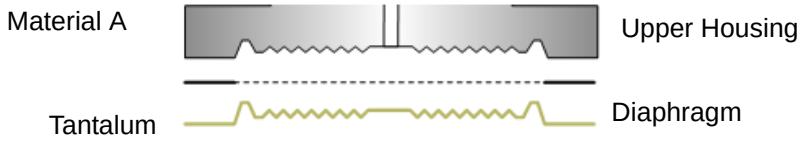
- Not used with wire-wound metal gaskets



Brazed Design

This process uses a 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.



DIFFERENCES BETWEEN ELECTRONIC REMOTE SENSORS AND CAPILLARY SYSTEMS

Electronic Remote Sensor technology consists of two 3051S pressure sensors that are connected by an electrical wire, and Differential Pressure is calculated electronically. Seals are not required, but may still be necessary on certain applications that include high temperature, corrosive, or viscous processes. For more information, please refer to the 3051S Series Product Data Sheet (document number 00813-0100-4801).

Figure 2-6. ERS vs. Capillary

INSTRUMENT TOOLKIT: SEAL ORDERING AND APPLICATION PROCESS

Instrument Toolkit is the user's guide to ensure the selected system will function properly for the specified application. Toolkit validates model numbers selected by the user and eliminates specification errors. This program analyzes each application and calculates the total system performance. This includes expected head and seal temperature effects and response times.

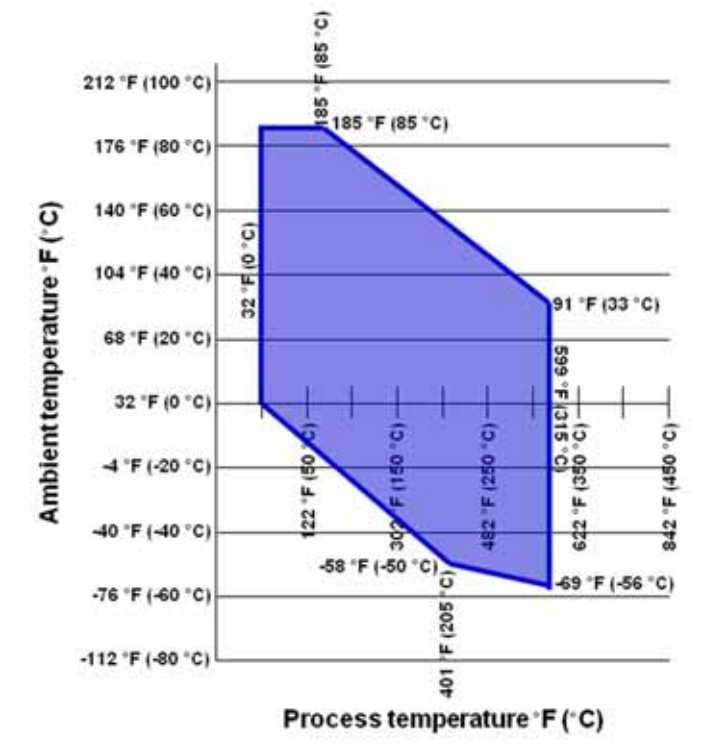
THERMAL OPTIMIZER: PROPER USE AND APPLICATIONS

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).

The Thermal Optimizer is designed for inline transmitters: Rosemount 3051S_T, Rosemount 3051T and Rosemount 2088. Standard 1/2-in. (13 mm) connection with flanged and threaded seal.

Figure 2-7. Thermal Optimizer with Silicone 704 Fill Fluid Temperature Limits



Thermal Optimizer Limitations

Figure 2-7 shows the process and ambient temperature limits for the Thermal Optimizer with Silicone 704 Fill Fluid. The shaded area represents 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 120 °F (40 °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.

Figure 2-8. Thermal Optimizer

Section 3 Installation

This section contains installation information for various types of Rosemount 1199 Remote Seals.

Additional specialized remote seals are available. Contact Emerson Process Management Technical Support for installation information on these seals.

SEALS HANDLING AND INSTALLATION CONSIDERATIONS

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).

When using heat or steam tracing, exercise caution if PVC coating is added onto capillary. The PVC coating on the armor can break down at temperatures around 212 °F (100 °C). Best practice for heat and steam tracing is to regulate the temperature above the maximum ambient temperature for a consistent result. To avoid accuracy effects and thermal stress, the capillary should not be partially heated.

⚠CAUTION

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.

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

The protective cover should remain 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. Even minor dents or scratches in the diaphragm material may impair the performance of the seal system assembly.

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 user is responsible to ensure the gasket used does not exceed the temperature limits of the process. Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

In addition, make sure the gasket does not press down upon the diaphragm face. Anything pressing on the diaphragm will be read by the transmitter as pressure. A misaligned gasket may cause a false reading.

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. Proper wetted material is required for specific process materials. Please contact your Emerson Process Management representative on questions regarding proper process-wetted materials.

GASKETS

The diaphragm gasket is supplied when the lower housing or flushing connection is provided. The default gaskets are listed below, based on seal type. The process gasket must be supplied by the end user. Tantalum diaphragms are not supplied with default gasket, so a gasket option must be selected when applicable.

Table 3-1. Gasket Materials

Seal Type	Gaskets
FFW	ThermoTork TN-9000
FCW	No gasket is supplied
FUW	No gasket is supplied
FVW	No gasket is supplied
RCW	C-4401
RFW	C-4401
FTW	C-4401
PFW	ThermoTork TN-9000
PCW	No gasket is supplied
WSP	C-4401

TAGGING

Each remote seal system is tagged in accordance with the customer requirements. The remote seal model number is identified on the transmitter label, shown in Figure 3-2.

Figure 3-1. Transmitter with Label

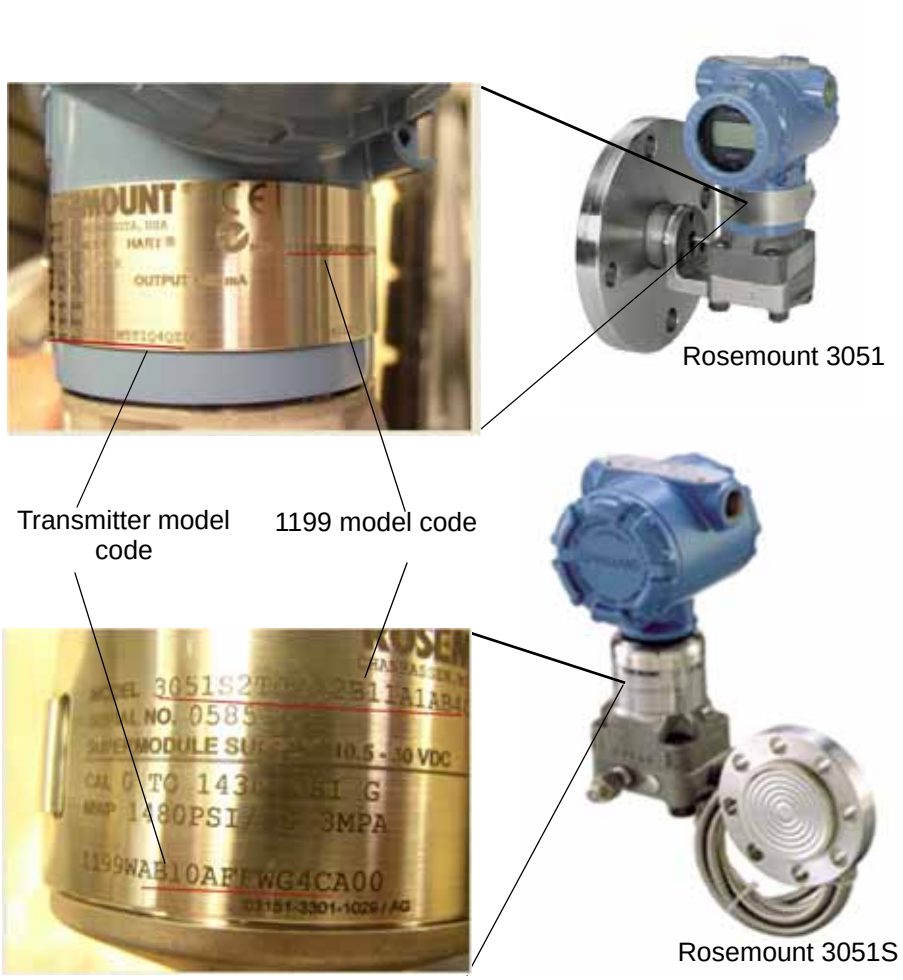


Figure 3-2. Sample Label

U.S. AND
FOREIGN PATENTS
ISSUED AND PENDING

ROSEMOUNT®
CHANHASSEN, MINNESOTA, USA

MODEL 3051S2CG2A2B11A1A
SERIAL NO. 2431980 08/11 Made in USA
SUPERMODULE SUPPLY 10.5 42.4 VDC **SUPERMODULE OUTPUT HART® 4-20 mA**
CAL 0 TO 250 IN H20
MWP 9PSI / 0.62BAR

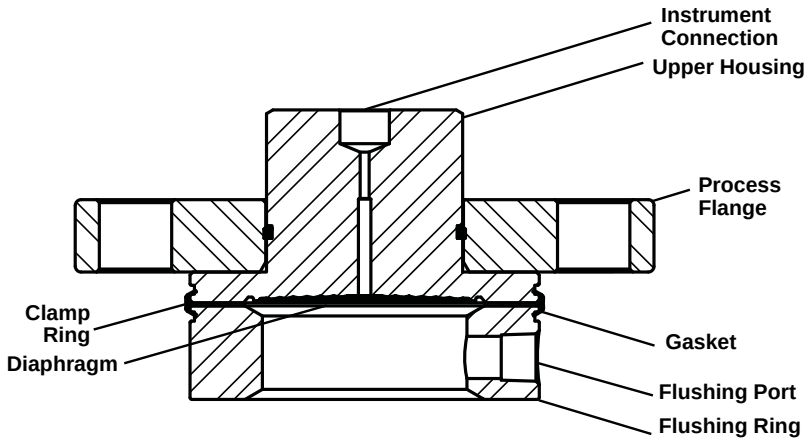
1199WDC10AFFW72CA00

The Maximum Working Pressure (MWP) of the seal system assembly is stamped on the transmitter neck tag. This is dependent upon the maximum pressure rating of the seal system or transmitter upper range limit.

FLANGED TYPE SEALS: FLUSH FLANGE (FFW) OR EXTENDED (EFW) DIAPHRAGM

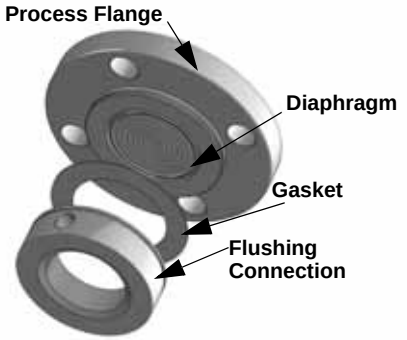
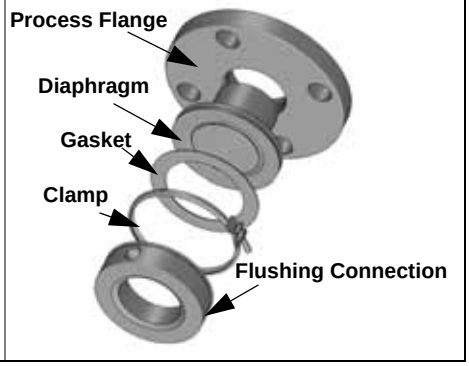
Figure 3-3. FFW Flush Flanged Remote Seal 2-D Diagram

Two-Piece Design (shown with flushing ring)



NOTE
For the Two-Piece Design, the seal assembly and process flange are separate.

Figure 3-4. FFW Flush Flanged Remote Seal 3-D Diagram

One-Piece Design (shown with flushing ring)	Two-Piece Design (shown with flushing ring)
	

NOTE
Clamp ring not available on FFW One-Piece Design.

Figure 3-5. EFW Extended Flush Flanged Remote Seal 2-D Diagram

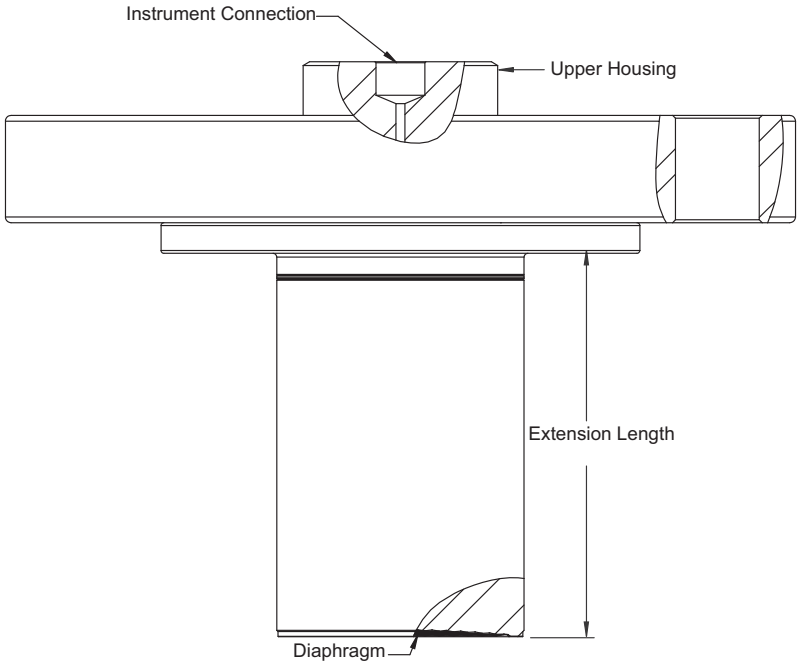
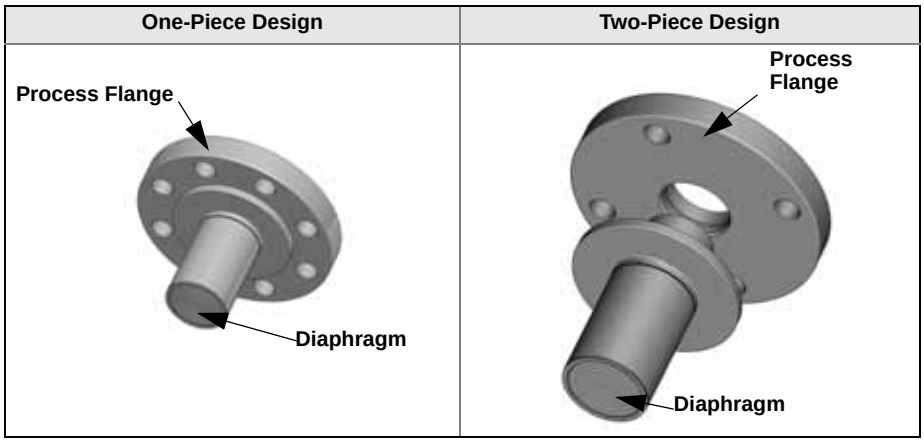


Figure 3-6. EFW Flush Flanged Remote Seal 3-D Diagram



Bolt Torquing

When connecting the process and mating flange, 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 customer supplied.

Flushing Connection Ring Installation (Flanged cont.)

The flanged type seals are available with an optional flushing connection ring.

Gasket Installation (Flanged cont.)

When connecting the remote seal, gasket, and flushing connection ring make sure the gasket is properly aligned on the gasket sealing surface. Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

RFW SEAL

Figure 3-7. RFW Remote Seal 2-D Diagram

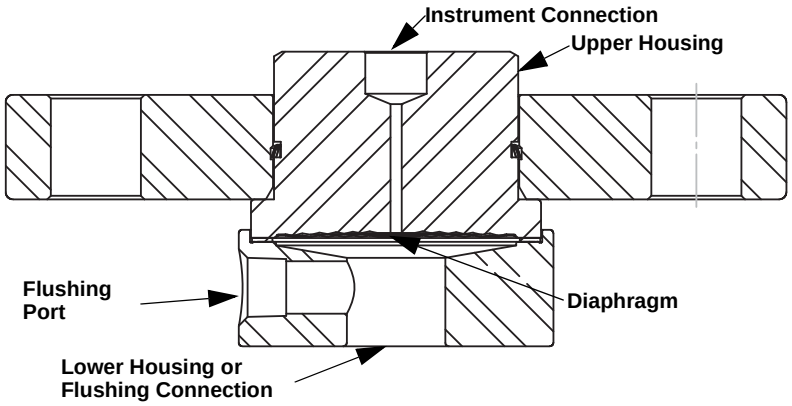
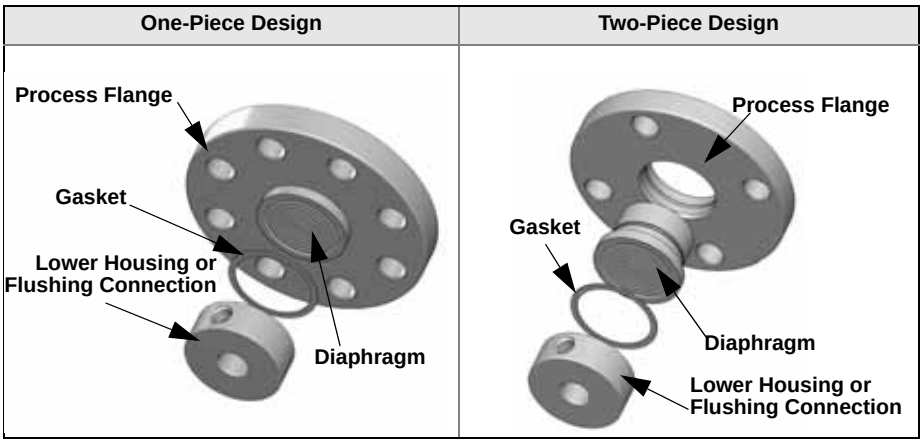


Figure 3-8. RFW Remote Seal 3-D Diagram



Bolt Torquing

When connecting the process and mating flange, 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 customer supplied.

Flushing Connection Lower Housing

A lower housing or flushing connection is **always** required for the RFW type seal.

Gasket Installation

When connecting the remote seal, gasket, and flushing connection ring make sure the gasket is properly aligned on the gasket sealing surface. Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

4.1-in. (104 mm) Diaphragm Diameter Option

The largest standard diaphragm size for the RFW seal is 2.4-in. (61 mm). A larger diaphragm option, 4.1-in (104mm), is offered which allows the RFW seal more flexibility and reduces temperature error when taking process measurements.

PFW PANCAKE TYPE SEALS

Figure 3-9. PFW 2-D Diagram

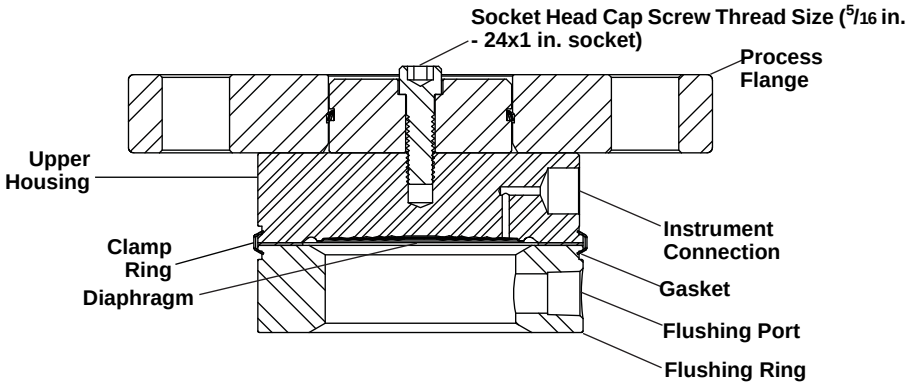
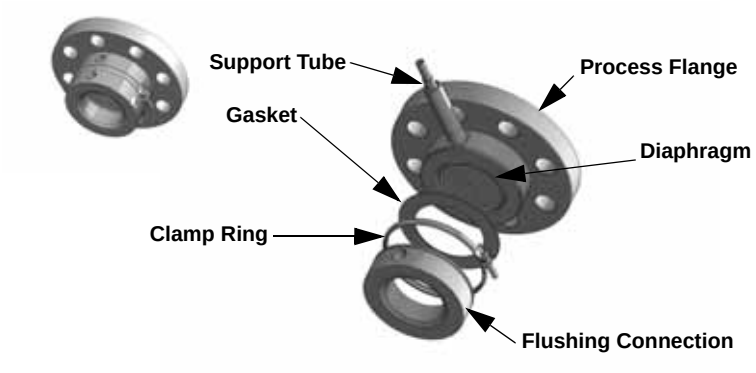


Figure 3-10. PFW Pancake Type Seal 3-D Diagram



Capillary Support Tube

A common option for the Pancake type seal is the capillary support tube. Due to the side capillary-to-seal connection, the support tube provides a handle for aligning the Pancake seal during installation. The support tube should not be used for supporting any weight.

Process Flange

Emerson Process Management offers the option of supplying the process flange, otherwise the process flange is furnished by the customer. For certain pancake seal assemblies, the Emerson supplied process flange has a machined hole through the center of the flange. This hole corresponds to a threaded connection in the back of the pancake seal upper housing. The flange can, therefore be connected to the seal prior to installation to make handling easier.

Bolt Torquing

When connecting the process and mating flange, 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 customer supplied.

Flushing Connection Ring Installation

The flanged type seals are available with an optional flushing connection ring.

Gasket Installation (pancake cont.)

When connecting the remote seal, gasket, and flushing connection ring make sure the gasket is properly aligned on the gasket sealing surface. Failure to properly install the gasket may cause process leaks, which can result in death or serious injury.

RTW THREADED TYPE SEALS

Figure 3-11. RTW Threaded Type Seal 2-D Diagram

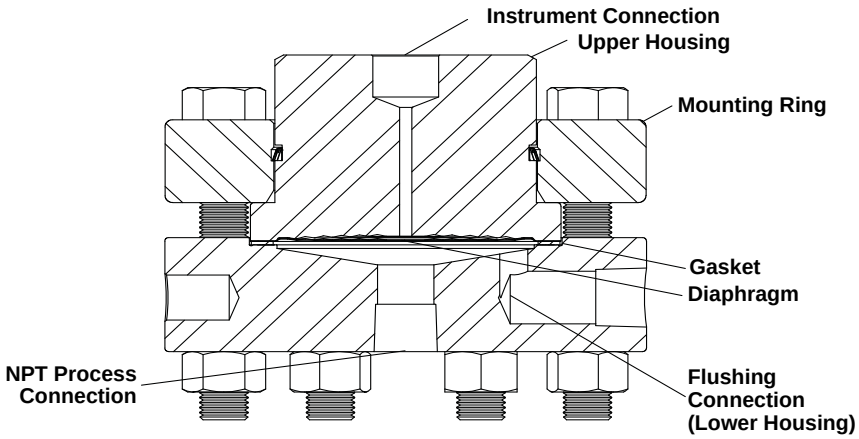
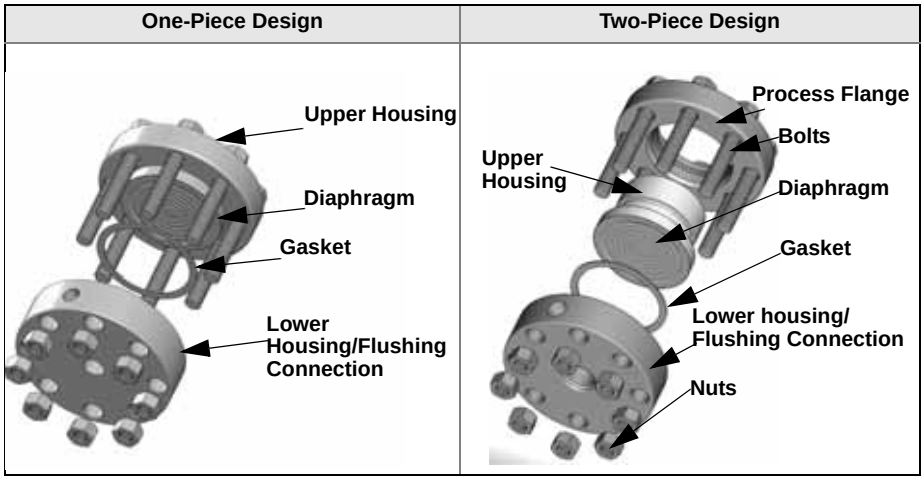


Figure 3-12. RTW Threaded Type Seal 3-D Diagram



Lower Housing Installation Procedure

The lower housing of the remote seal has either a male or female thread connection for attachment to a process pipe nipple. When threading the lower housing to the process pipe, care should be taken not to overtighten. The applied torque should comply to ANSI B1.20.1 or applicable torque requirements for pipe connections.

Upper Housing Installation

NOTE
These are torque values for RTW remote seals.

Material (Nuts and Bolts)	Bolt Thread Size	MWP (psi)	Torque
CS and SST	3/8-24 NF	1500	23 Ft-lbs
CS	3/8-24 NF	2500	23 Ft-lbs
SST	3/8-24 NF	2500	23 Ft-lbs
CS	3/8-24 NF	5000	53 Ft-lbs
SST	1/2-20 NF	5000	50 Ft-lbs
CS	1/2-20 NF	10000	105 Ft-lbs

This is 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.

Gasket Installation

Threaded seals with flushing connection rings come with a sealing gasket. When connecting the remote seal, gasket, and flushing connection ring make sure the gasket is properly aligned on the gasket sealing surface.

Alternative System Installation Procedure

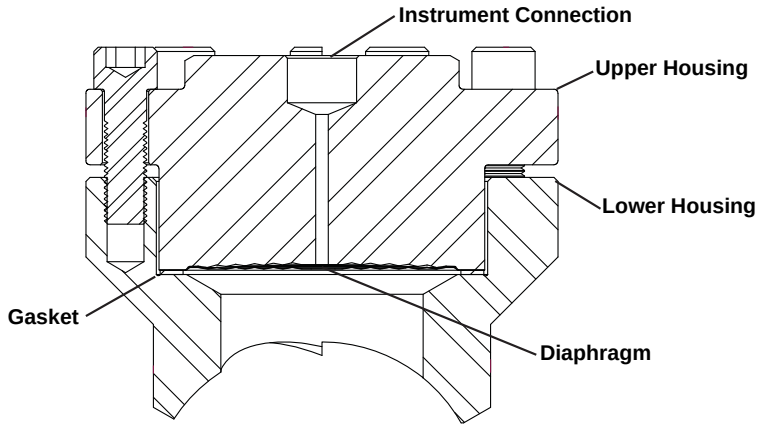
An alternative to threading the entire seal system assembly to the process piping is to unbolt the seal upper and lower housing and thread the lower housing to the hard piping separately. Bolt the upper and lower housings together to the required torque specification.

Note that gaskets need to be replaced once they have been torqued. Thus this alternative system installation procedure requires gasket replacement.

WSP SADDLE TYPE SEALS

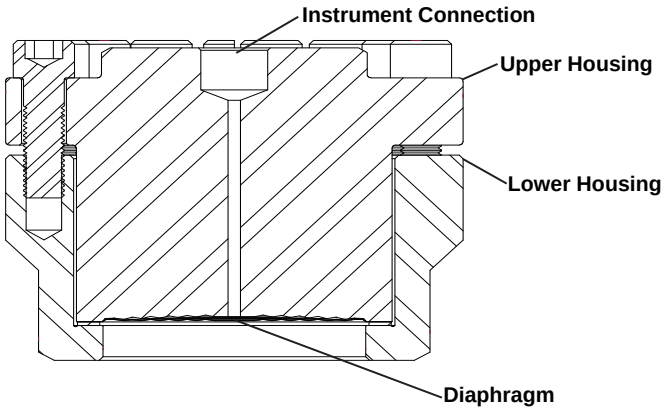
NOTE
For detailed manufacturing procedures designed to guide an operator through performing alignment and welds at the connections for a flow-through seal series, contact your local Emerson Process Management representative.

Figure 3-13. WSP 2-in. and 3-in. Design 2-D Diagram



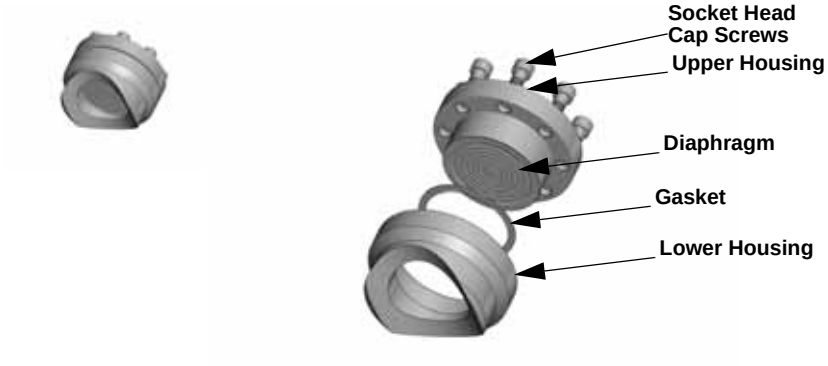
Pressure Rating: 1500 psig at 100 °F (86 bar at 38 °C) 8 bolt design

Figure 3-14. WSP 4-in. Design 2-D Diagram



Pressure Rating: 1500 psig at 100 °F (103 bar at 38 °C)

Figure 3-15. WSP 2-in. and 3-in. Design 3-D Diagram



Lower Housing Installation

For 4-in. line size, the lower housing is welded directly into the process pipe. For 2-in. and 3-in. line sizes, the lower housing is welded onto the process pipe. The upper housing must be removed from the system when welding the lower housing into the process pipe. Allow the pipe connection to cool before installing the seal upper housing.

Upper Housing Installation

The torque specifications for the saddle seal upper housings is 180 in-lb. (20 N-m) with stainless or carbon steel bolts. As it is necessary for the customer to torque the upper housing bolts during installation, each saddle seal includes a torque label with the specified torque.

Gasket Installation

The saddle comes standard with a sealing gasket. When connecting the upper and lower housings make sure the gasket is aligned properly on the gasket sealing surface.

TFS WAFER STYLE IN-LINE SEAL

Figure 3-16. TFS In-Line Flow Through 2-D Diagram

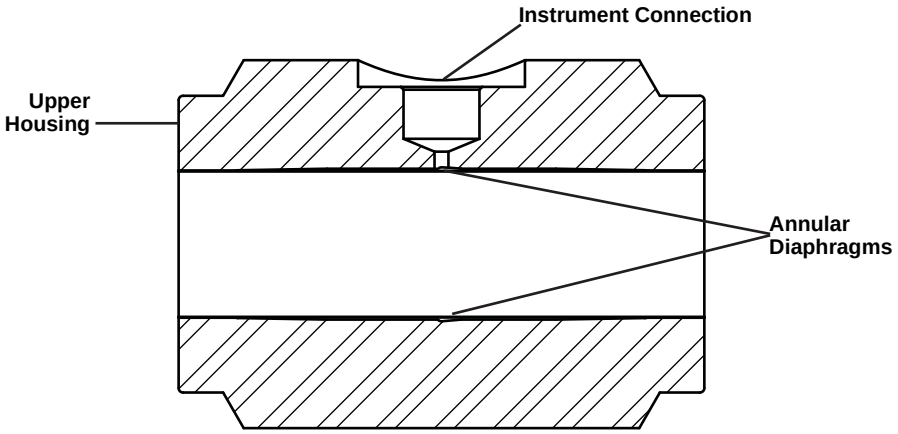


Figure 3-17. TFS In-line Flow Through Seal 3-D Diagram

Handling

Care should be taken to ensure the seal diaphragm is not dented or damaged during seal installation. The remote seal protective covers should remain on the seal until the seal is ready for installation.

Connection Styles

The in-line flow-through seal is attached to the process piping by either flange, clamp, or male threaded connections.

Flanged Type Connection

The flanged process connection sandwiches the flow-through seal between two process flanges. The bolts should be torqued to the specifications outlined by ANSI B16.5, EN 1092-1, or JIS B 2210 flange torque requirements. Required torque is a function of the gasket material and surface treatment of the bolts and nuts, which are customer supplied.

HYGIENIC TANK SPUD SEALS

Figure 3-18. SSW 2-D Diagram

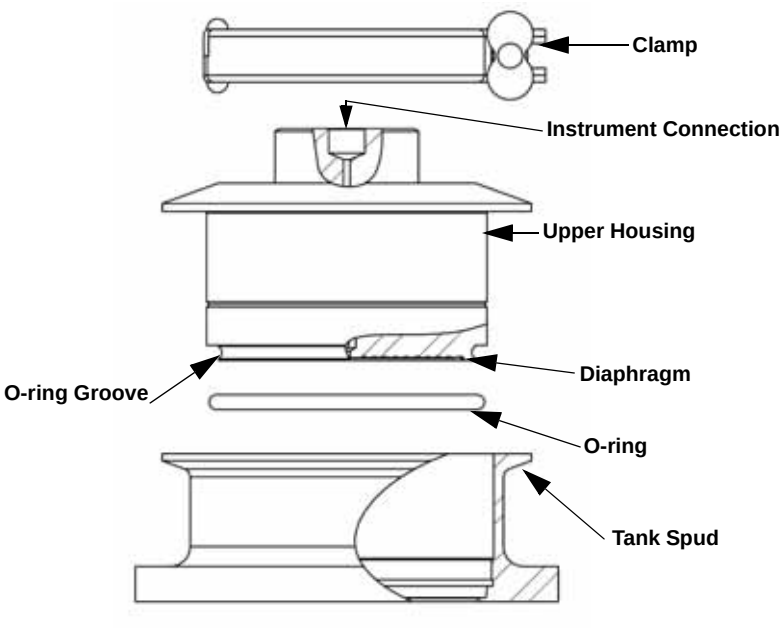


Figure 3-19. Hygienic Tank Spud Seal 3-D Diagram

HYGIENIC FLANGED TANK SPUD SEALS

Figure 3-20. EES 2-D Diagram

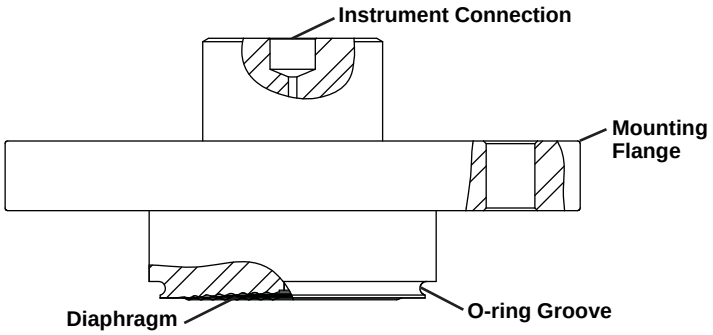
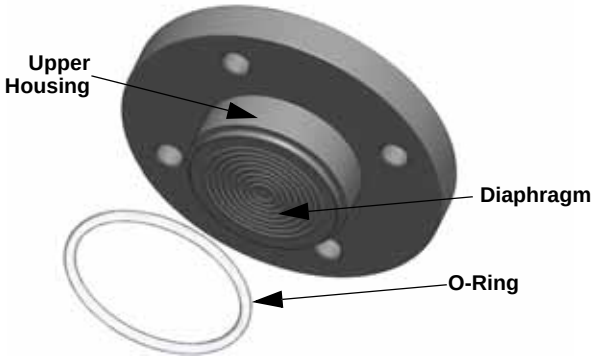


Figure 3-21. Hygienic Flanged Type Tank Spud Seal 3-D Diagram



Hygienic Approvals

Supplied 3-A approved hygienic seals are marked with a 3-A symbol.

Clamp Style Tank Spud (SSW)

For clamp style tank spud seals the procedures for welding the tank spud to the tank vessel are shipped with the tank spud. For the welding procedure refer to “Hygienic Tank Spud Welding Guidelines (SSW)” .

The clamp and O-ring are provided with the tank spud seal. Attach the clamp and hand-tighten the connection.

Flange Style Tank Spud (EES)

When connecting the process and mating flange, the bolts should be torqued to the specifications outlined by ANSI B16.5 or applicable flange requirements.

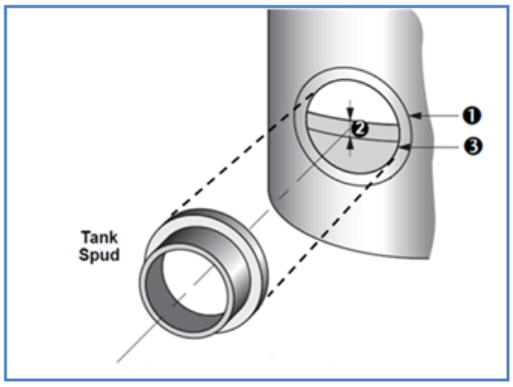
HYGIENIC TANK SPUD WELDING GUIDELINES (SSW)

This guideline is intended to provide general guidance only to achieve an acceptable installation of a sanitary tank spud in order to mitigate potential costly rework. It will discuss ways to minimize potential distortion of the tank spud via tank preparation and welding practices. Employ a skilled, experienced welder to achieve best results.

Tank Preparation

When preparing the tank, ensure an area with a minimum diameter of 9 ¼-in. (235 mm) is available to properly weld the tank spud, Figure 3-22 bullet 1. The center of the tank spud should be at least 1 ½-in. (38 mm) below the minimum measurement level, as shown in bullet 2 of Figure 3-22. In order to get a proper process fluid measurement, half of the remote seal diaphragm must be covered.

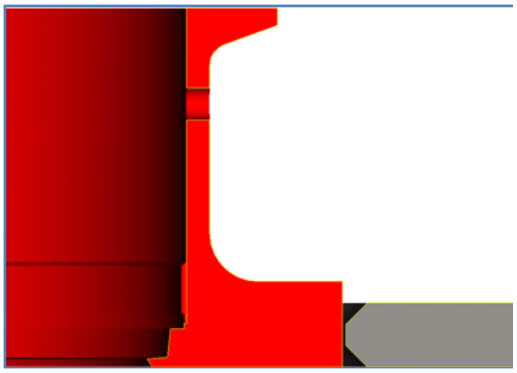
Figure 3-22. Tank Preparation



Bullet 3 shows the actual hole cut in the tank. Attempt to cut the hole as smoothly and as circular as possible. A torch cut is not recommended. The tank spud OD is 5.98-in. ±.010-in. (152 mm ± 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. It is recommended that the hole be no larger than 6.020-in. (153 mm). Anything larger than 6.020-in. (153 mm) could increase the amount of tank spud distortion.

If a bevel(s) is required, an angle no larger than 37.5º 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, as shown in Figure 3-23 below.

Figure 3-23. Bevel Example



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.

Welding

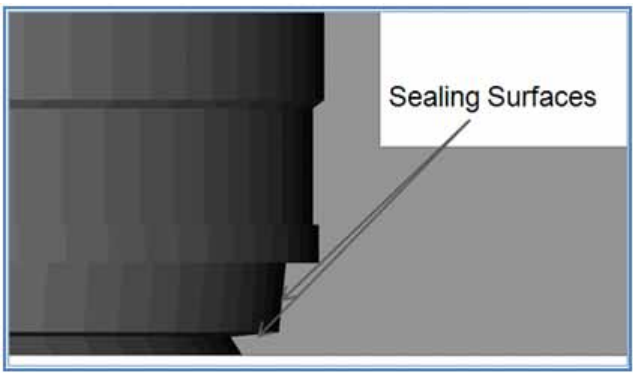
⚠CAUTION

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.

Do not nick the sealing surfaces of the tank spud, the inner angled surfaces where the o-ring sits shown in Figure 3-24, as any irregularities may cause leaks.

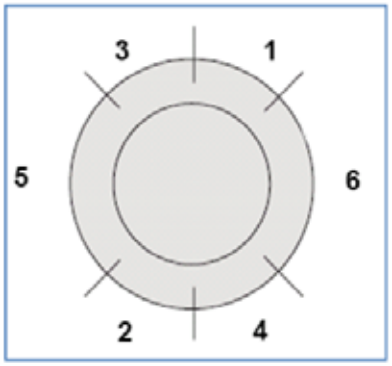
Figure 3-24. O-ring Sealing Surfaces



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 4 tack welds, 90º from each other.

Begin welding on the inside of vessel. Weld in sections similar to the sequence in Figure 3-25.

Figure 3-25. Welding Sections Diagram



Allow time to cool between weld sections. Weld should be cooled to 350 ºF (177 ºC) 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 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, a 1/16-in. (1.58 mm) diameter weld rod is recommended.

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

HYGIENIC TRI-CLAMP® SEALS (SCW)

Figure 3-26. SCW 2½, 3, and 4-in. 2-D Diagram

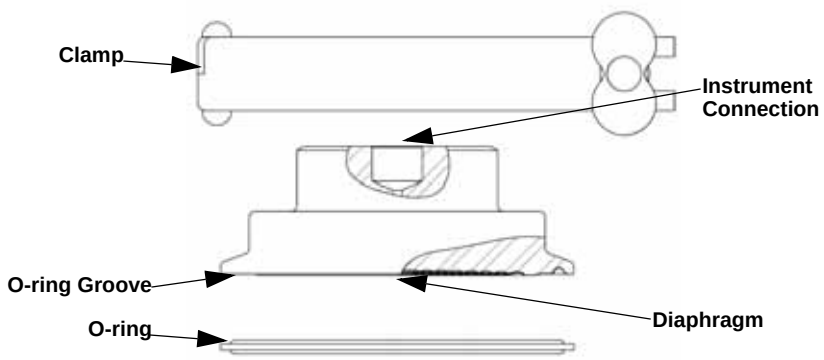
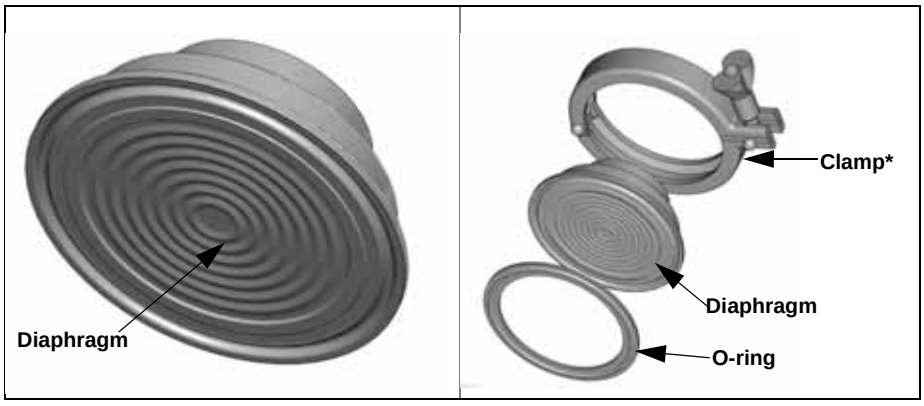


Figure 3-27. Hygienic Tri-Clamp Remote Seal 3-D Diagram



***Clamp and gasket are customer supplied**

Clamp and Gasket

The clamp and gasket are furnished by the user. Maximum pressure rating of the system is dependent upon the clamp pressure rating.

High Process Connection	MWP at 70F (psi)	MWP at 250F (psi)
1 1/2 in.	1500	1200
2 in.	1000	800
2 1/2 in.	1000	800
3 in.	1000	800
4 in.	1000	800

Section 4 Ranging the Transmitter

CALCULATING RANGE POINTS

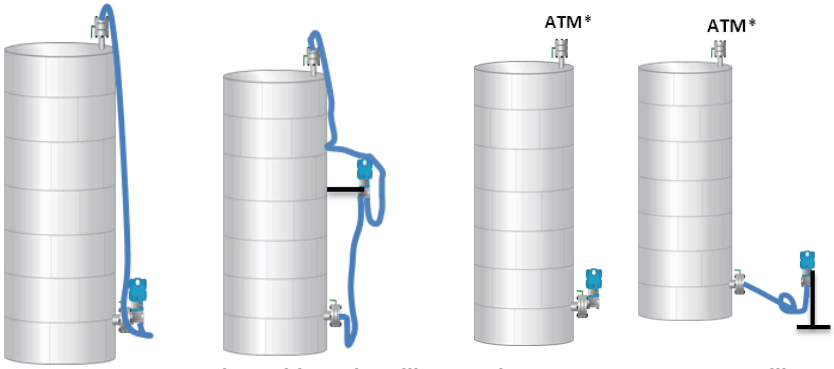
Remote Seals

Calculating Range points

- Open Tank (Zero base)(1)
- Open Tank (Non-zero base)
- Closed Tank (Non-zero base)

Transmitters installation Best Practice

- Open Tank (Zero based)
- Closed Tank (Non-zero based)
- Zero Trim Via HART Field communicator
- Re-range Via Zero button
- Re-range Via HART Field communicator
- Scale display



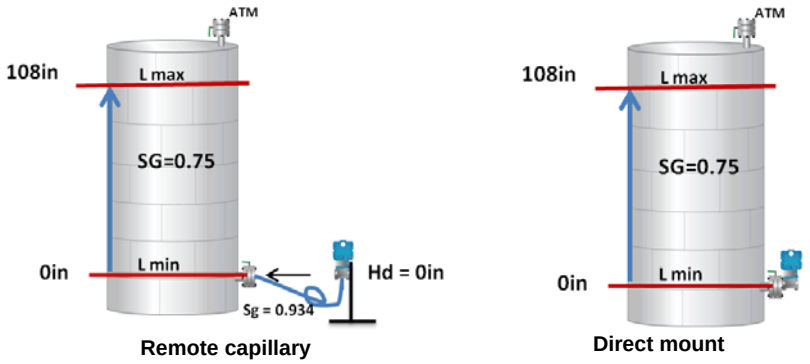
Tuned (Unequal capillary length) **Balanced (Equal capillary length and size seal)** **Direct Mount** **Remote Capillary**

ATM*: Open to Atmosphere

(1) "Zero based" means 4mA equals 0 inH_20

Zero-based lower range value

Figure 4-1.



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

L_{max} = the maximum level of process and typically the 20mA upper range value

Atm = Atmospheric pressure (vented tank)

SG = Specific gravity of the process

Sg = Specific gravity of the remote fill fluid

Tank span = L_{max} x SG

Tank Span: (108 in. x 0.75) = 81 inH_2O

4 mA = L_{min} x SG + Hd x Sg

(0 x 0.75) + (0 in x 0.934)= 0 inH_2O

4mA = 0 inH_2O

20 mA = L_{min} x SG + Hd x 0.934

(108in x 0.75) + (0)= 81 inH_2O

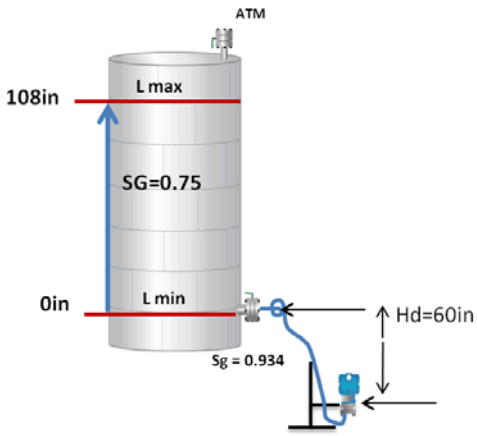
20mA = 81 inH_2O

NOTE
Both installations would have the same calculated range points.

NOTE
Silicone 200 has a specific gravity of 0.934.

Non-zero based lower range value

Figure 4-2. Remote capillary



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

L_{max} = the maximum level of process and typically the 20 mA upper range value

Hd = Capillary vertical distance from process to high side sensor

SG = Specific gravity of the process

Sg = Specific gravity of the remote fill fluid

ATM = Atmospheric pressure (vented tank)

Tank span = (L_{max} x SG)

Tank Span: 108in x 0.75 = 81inH_2O

Lmin

4 mA = L_{min} x SG + (Hd x Sg)
= (0 x 0.75) + (60in x 0.934)
= 56.04 inH_2O

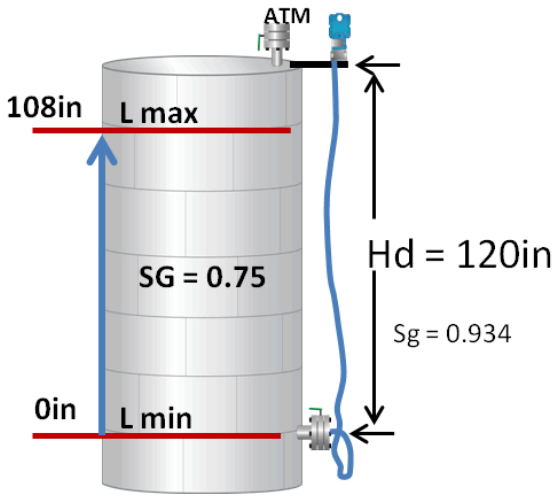
Lmax

20 mA = L_{max} x SG + (Hd x Sg)
=(108in x 0.75) + (56.04)
= 137.04 inH_2O

SPAN = 81inH_2O (137.04 - 56.04)

NOTE
Silicone 200 has a specific gravity of 0.934.

Figure 4-3. Remote Capillary



L_{min} = the minimum level of process and typically the 4mA set point.

L_{max} = the maximum level of process and typically the 20mA set point.

SG= Specific gravity of the process

Sg= Specific gravity of the remote fill fluid

Hd= Capillary vertical distance going to high side sensor

Tank span = (L_{max} x SG)

Example A

Tank Span: 108in X 0.75 = 81inH_2O

4mA = L_{min} x SG + (Hd x Sg)
= (0 x 0.75) + (120 in. x 0.934)
= -112.08 inH_2O

NOTE
Pressure pulling down on the high sensor side will register as a negative pressure value.

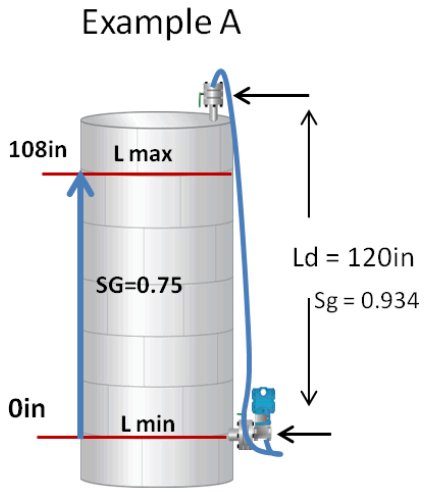
20mA = L_{max} x SG + (Ld X 0.934)
= (108 in. x 0.75) + (-112.08)
= -31.08 inH_2O

SPAN = 81 inH_2O (-112.08 to -31.08 inH_2O)

NOTE
The height of the transmitter (Hd X Sg) should not be greater than approx. 394in (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.

Figure 4-4. Tuned System



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

L_{max} = the maximum level of process and typically the 20mA upper range value

SG= Specific gravity of the process

Sg= Specific gravity of the remote fill fluid

Ld= Capillary vertical distance going to low side sensor

Tank span = (L_{max} x SG)

Example A

Tank Span: 108in X 0.75 = 81inH_2O

4mA = L_{min} x SG + (Ld x Sg)
= (0 x 0.75) + (120 in. x 0.934)
= -112.08 inH_2O

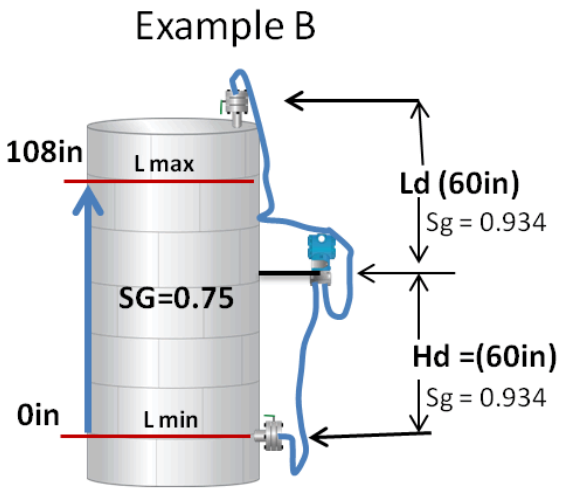
NOTE
Pressure applied to Low sensor side sensor will register as a negative digital value.

20mA = L_{max} x SG + (Ld X 0.934)
= (108 in. x 0.75) + (-112.08)
= -31.08 inH_2O

SPAN = 81 inH_2O (-112.08 to -31.08 inH_2O)

NOTE
Silicone 200 has a specific gravity of 0.934.

Figure 4-5. Balanced system



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

L_{max} = the maximum level of process and typically the 20mA upper range value

SG= Specific gravity of the process

Sg= Specific gravity of the remote fill fluid

Hd= Capillary vertical distance going to high side sensor

Ld= Capillary vertical distance going to low side sensor

Tank span = (L_{max} x SG)

Example B

Tank Span: 108in X 0.75 = 81inH_2O

4mA = L_{min} x SG + (Ld x Sg) + (Hd x Sg)
= (0 x 0.75) + (60 in. x 0.934) + (60 in. x 0.934)
= -112.08 inH_2O

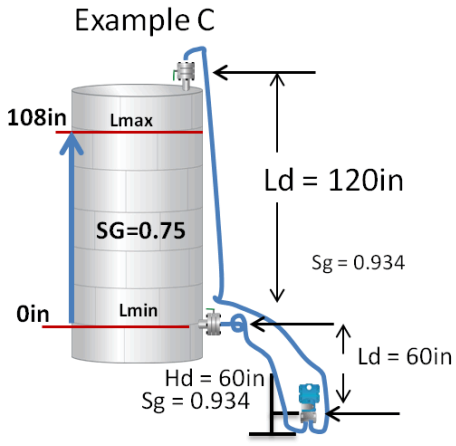
NOTE
Pressure (Ld) is applied to Low sensor side and will register as a negative digital pressure. Pressure (Hd) is pulling down on the high sensor side therefore would also register as a negative digital pressure therefore these values are additive.

20mA = L_{max} x SG + (Ld X 0.934) + (Hd X 0.934)
= (108 in. x 0.75) + (60 in. x 0.934) + (60 in. x 0.934)
= -31.08 inH_2O

SPAN = 81 inH_2O (-112.08 to -31.08 inH_2O)

NOTE
Silicone 200 has a specific gravity of 0.934.

Figure 4-6. Remote capillary



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

L_{max} = the maximum level of process and typically the 20mA upper range value

SG= Specific gravity of the process

Sg= Specific gravity of the remote fill fluid

Hd= Capillary vertical distance going to high side sensor

Ld= Capillary vertical distance going to low side sensor

Tank span = (L_{max} x SG)

Example C

Tank Span: 108in X 0.75 = 81inH_2O

4mA = L_{min} x SG + (Hd x Sg) + (Ld x Sg)

= (0 x 0.75) + (60 in. x 0.934) + (180 in. x 0.934)

= -112.08 inH_2O

NOTE
Pressure (Ld) is applied to Low sensor side and will register as a negative digital pressure. Pressure (Hd) is pulling down on the high sensor side therefore would also register as a negative digital pressure therefore these values are additive.

20mA = L_{max} x SG + (Hd X 0.934) + (Ld X 0.934)

= (108 in. x 0.75) + (-112.08)

= -31.08 inH_2O

SPAN = 81 inH_2O (-112.08 to -31.08 inH_2O)

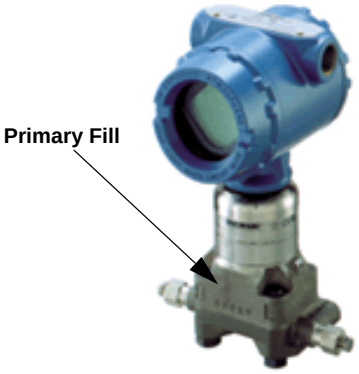
NOTE
Silicone 200 has a specific gravity of 0.934.

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

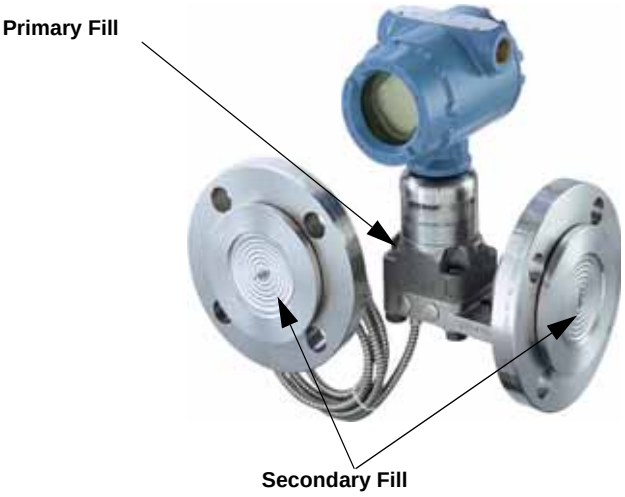
TRANSMITTERS INSTALLATION BEST PRACTICES

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 ± 1.25inH_20 worst case after installation. This is simply zeroed out using a HART 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.

PRESSURE TRANSMITTER



PRESSURE TRANSMITTER WITH REMOTE SEAL



What's important is the calculated span (level height X Specific gravity of the process). After the transmitter is mounted, it is common and best practice to re-range the transmitter so that the 4m point will be the installed digital value. The 20mA 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) 4mA = 0in H_2O** or **(Non Zero base) 4mA exceeds the ±3%** of the Upper Sensor Limit.

OPEN TANK (Zero Based)

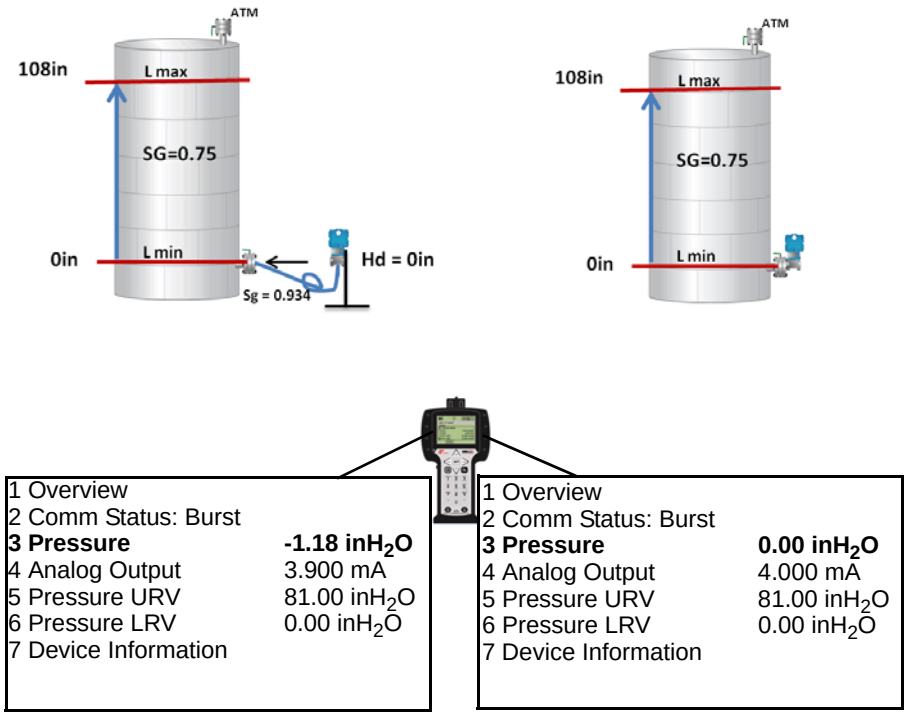
With open tank level applications this value can typically be zeroed out using a HART device as long as it is <3% USL. The maximum value that can be zeroed out is 3% of the Upper Sensor Limit or 7.5in H20 for a range 2 (250in H20) sensor.

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 (4mA) would equal the installed value. The 100%, (20mA) would be adjusted to the required calculated span.

Zero Based lower range value

Figure 4-7.

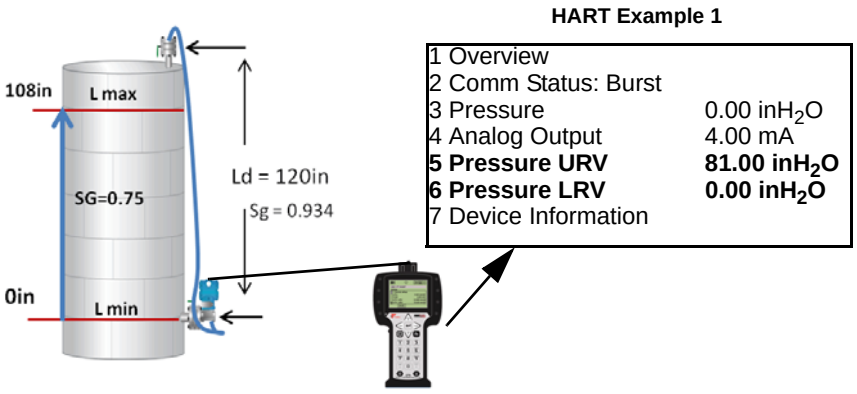


Perform a zero trim VIA HART Field communicator after installation for zero based lower range values.

Closed tank example (non-zero Based lower range value)

NOTE
For Fieldbus: refer to the AI Function Blocks in product manual

Figure 4-8. Tuned system



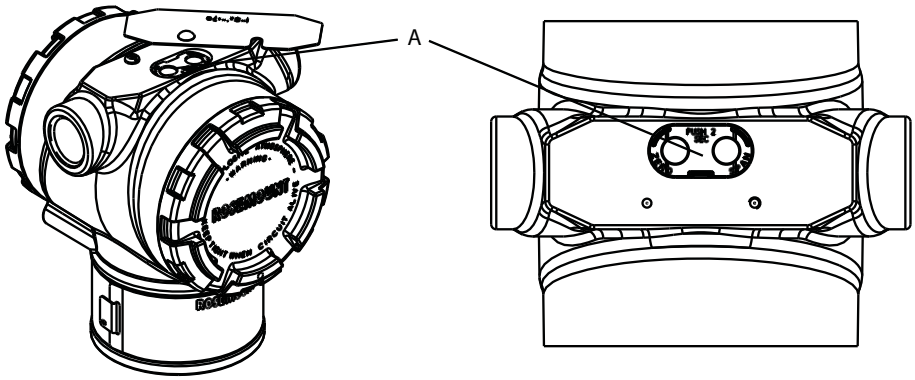
Tank Span (based on design) = 81 inH_2O

1. Initial bench set up for pressure verification if required (Range transmitter): Seals on same elevation.
   If the transmitter does not require bench pressure verification skip step 1 and proceed to step 2.
   (Pressure verification)
   Power and range the transmitter using a HART Field communicator to the required tank span. (Figure 4-8 example) With the required calibration fixture attached to the seal assemble apply pressure.
   4mA = 0 inH_2O
   20mA = 81inH_2O
2. Mount the transmitter and bolt the seal to the process taps. Most common is High sensor side is mounted to low process tap and Low sensor side is mounted to high process tap.
3. Wire and apply power to the transmitter.
4. If the transmitter has a Zero button, 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 20 mA URV will equal the span value.

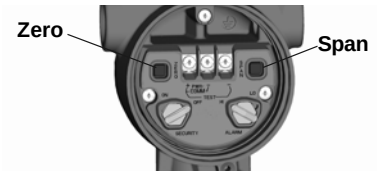
   Example

   With the transmitter ranged 4 mA = 0 and 20 mA = 81inH_2O per Figure 4-8, after mounting and pushing the zero button the transmitter would not be ranged 4mA = -112.08 and
   20 mA = -31.08inH_2O per HART Example 3.

NOTE
If you have a HART field communicator device hooked up when the zero button is pushed you have to re-boot the Hart field communicator to see the change.



A. Zero and span Buttons

PlantWeb	Junction Box
	

5. If the transmitter does not have a zero button use a HART field communicator and re-range the transmitter so that the **L**ower **R**ange **V**alue (**LRV**) = the current applied pressure. Example: After mounting transmitter pressure reads -112.08. Re-range transmitter so (4 mA point) LRV = -112.88 and the (20 mA point) URV = -31.88 inH_2O which is based on Span of 81in H20. **Values shown in HART Example 3.**

NOTE
This configuration is based on Figure 4-8 on page 4-10 measurement values.

(HART Example 2)
(After mounting)

1 Overview	
2 Comm Status: Burst	
3 Pressure	**-112.08 inH_2O**
4 Analog Output	3.900 mA
5 Pressure URV	81.00 inH_2O
6 Pressure LRV	0.00 inH_2O
7 Device Information	

(HART Example 3)
(After Re-range Via HART Field Communicator)

1 Overview	
2 Comm Status: Burst	
3 Pressure	**-112.08 inH_2O**
4 Analog Output	4.000 mA
5 Pressure URV	**-31.08 inH_2O**
6 Pressure LRV	**-112.08 inH_2O**
7 Device Information	

6. After mounting transmitter pressure reads -112.08. Re-range transmitter so (4 mA point) LRV = -112.88 and the (20 mA point) URV = -31.88 inH_2O which is based on Span of 81inH_2O. **Values shown in HART Example 3.**

If the device has a display and you want to configure it to something other than standard default, which is Engineering units & %, go to step 7.

Scale Display

7. After the transmitter is installed you can scale the display to match the DCS or PLC as required. As an example, in Figure 4-8 on page 4-10 if the required display should be 0 to 81 inH_2O, this can be done using a HART field communicator. See the following steps for the 3051S or the 3051C. Often 0 to 100% is sufficient.

NOTE
Depending on the HART device (Hand held/ AMS) 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.

1. Enter SV unit:
   (enter) **inH_2O**
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**

3051S go to Display (under manual setup)

1 Pressure	OFF
2 **Scaled Variable**	**ON**
3 Module Temperature	OFF
4 Percent of Range	OFF

For the **Rosemount 3051C**, in the HART communicator, go to **Configure Display** and follow the following steps:

1. Display Option
   (Select) **Custom meter Display**
2. Decimal Places
   (Enter) **3** (Send before step 3)
3. Upper Range Value
   (enter) **81.000**
4. Lower Range Value
   (enter) **0.000**
5. Transfer Function
   (select) **Linear**
6. Units
   (Enter) **inH_2O**

NOTE
In both cases with the transmitter ranged -112.08 to -31.08 inH_2O, the display will show 0 inH_2O at (4 mA) and 81.00 inH_2O at (20 mA).

Section 5 Fill Fluids and Vapor Pressure Curves

NOTE
Please refer to the Rosemount 1199 Fill Fluid Specification Technical Note (00840-2100-4016) at http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00840-2100-4016.pdf for more information

FILL FLUID SPECIFICATIONS – SILICONE 200

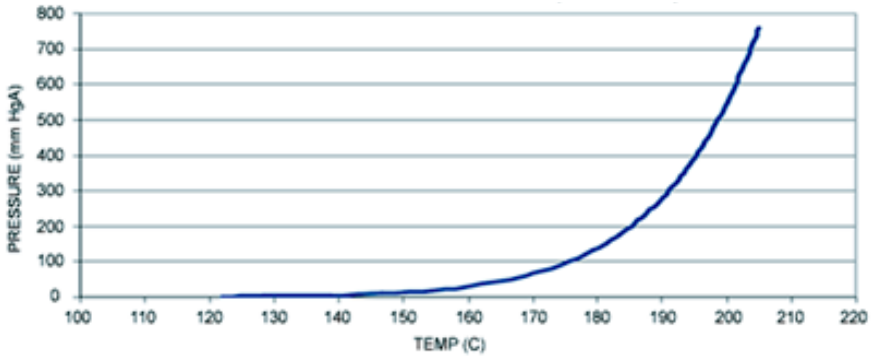
Temperature Limits	
At Atm Pressure	-45 to 205 °C (-49 to 400 °F)
Max Temp at Min. Pressure	125 °C / 257 °F @ 20 mm HgA
Viscosity at 25 °C (77 °F)	9.5 cs
Specific Gravity @ 25 °C (77 °F)	0.934
Coefficient of Thermal Expansion	0.00108 cc/cc/C (0.00060 cc/cc/F)
Chemical Name	Polydimethylsiloxane polymer
Chemical Composition	(CH3)3SiO[SiO(CH3)2]nSi(CH3)3
CAS Number	63148-62-9

Silicone 200 Description

Silicone 200 is a good general purpose fill fluid for industrial applications and is used in over half of all remote seal assemblies. Silicone 200 is made up of a mixture of linear polymers with an average viscosity of 10 cs. This fluid has a broad temperature range to cover ambient and process conditions and has a low viscosity for good time response. Silicone fluids have a unique combination of properties that give superior performance in a wide variety of applications. Silicone fluids are quite different from other fluids.

Hydrocarbon fluids are based on a backbone of carbon-to-carbon atoms, while silicone fluids have a backbone of silicon-oxygen linkages similar to the Si-O linkages in high temperature inorganic materials (quartz, glass and sand). Silicones provide excellent thermal stability and low vapor pressure. Manufacturer states its primary use is as an ingredient in cosmetic and personal care product formulations, but neither represents or tests this fluid for medical or pharmaceutical applications. Syltherm 800 heat-transfer fluid has been used in seal systems, but was obsoleted since it was found to have no long term advantages over standard Silicone 200.

Silicone 200 Vapor Pressure Results (ASTM E1782)



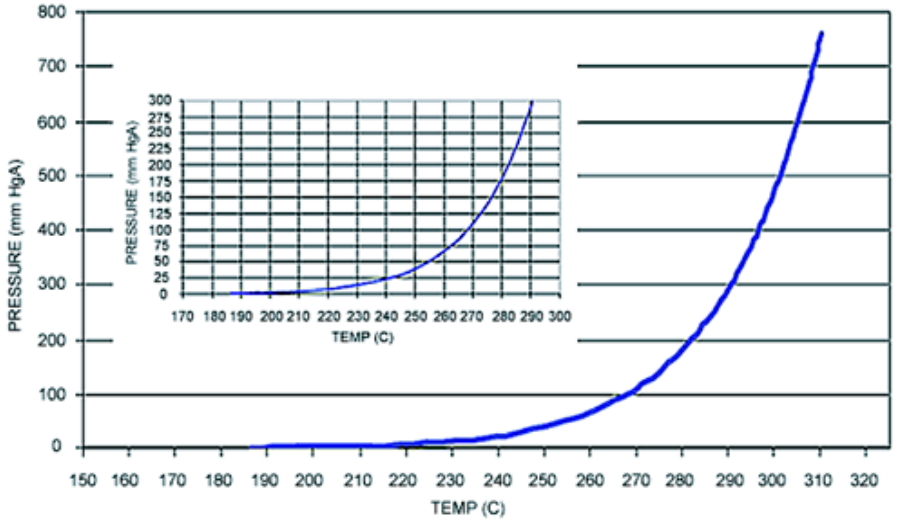
FILL FLUID SPECIFICATIONS – SILICONE 704

Temperature Limits	
At Atm Pressure	0 to 315 °C (32 to 600 °F)
Max Temp at Min. Pressure	See vapor-pressure curve
Viscosity at 25 °C (77 °F)	39 cs
Specific Gravity @ 25 °C (77 °F)	1.07
Coefficient of Thermal Expansion	0.00095 cc/cc/C (0.00053 cc/cc/F)
Chemical Name	Tetramethyltetraphenyltrisiloxane
CAS Number	3982-82-9

Silicone 704 Description

Silicone 704 is a silicone diffusion pump fluid for vacuum and high temperature industrial applications. This specialty silicone fluid has a much higher molecular weight than Silicone 200, which increases its operating temperature and lowers its vapor pressure. Its main limitation is its higher viscosity, and so heat tracing of capillaries is suggested for many outdoor applications. The 0.03 in. (0.7 mm) ID capillary is not allowed for Silicone 704 because of its higher viscosity. Manufacturer states it neither represents or tests this fluid for medical or pharmaceutical applications.

Silicone 704 Vapor Pressure Results (ASTM E1782)

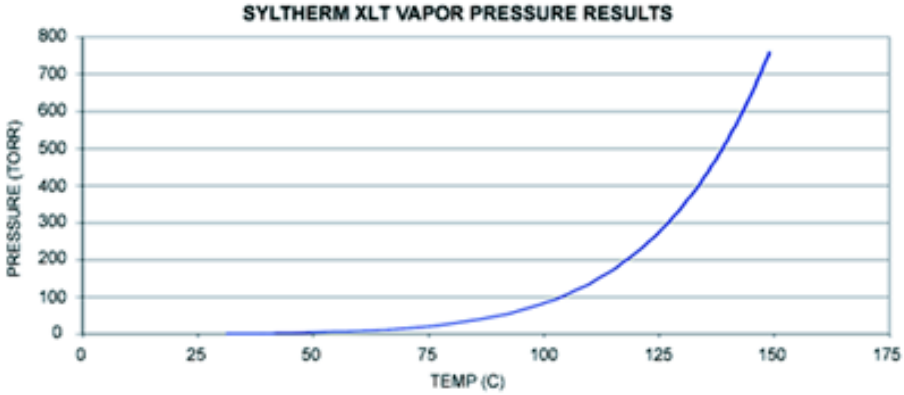


FILL FLUID SPECIFICATIONS – SYLTHERM XLT SILICONE

Temperature Limits	
At Atm Pressure	-73 to 149 °C (-100 to 300 °F)
Max Temp at Min. Pressure	See vapor-pressure curve
Viscosity at 25 °C (77 °F)	1.6 cs
Specific Gravity @ 25 °C (77 °F)	0.85
Coefficient of Thermal Expansion	0.001198 cc/cc/C (0.00066 cc/cc/F)
Chemical Name	Dimethyl Polysiloxane
CAS Number	063148-62-9

Syltherm XLT Description

Syltherm XLT is a low viscosity silicone fluid used specifically for cold temperature applications. It has been reported to work satisfactorily for cryogenic applications down to –87 °C (–125 °F). The published freeze point for Syltherm XLT is –111 °C (–168 °F).



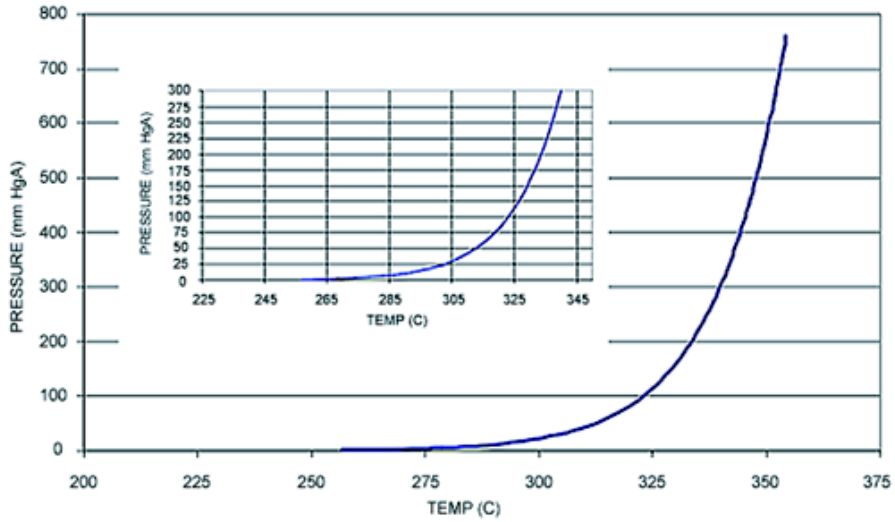
FILL FLUID SPECIFICATIONS – SILICONE 705

Temperature Limits	
At Atm Pressure	20 to 350 °C (68 to 662 °F)
Short Term Exposure: (1 Hour max)	20 to 400 °C (68 to 752 °F)
Max Temp at Min. Pressure	See vapor-pressure curve
Viscosity at 25 °C (77 °F)	175 cs
Specific Gravity @ 25 °C (77 °F)	1.09
Coefficient of Thermal Expansion	0.00077 cc/cc/C (0.00043 cc/cc/F)
Chemical Name	Trimethylpentaphenyl trisiloxane
CAS Number	3390-61-2

Silicone 705 Description

Silicone 705 is a silicone fluid for high vacuum and high temperature industrial applications. Silicone 705 has a higher molecular weight than even Silicone 704, which extends seal operating temperatures. Its main limitation is high viscosity 175 cSt at 25 °C (77 °F), and so heat tracing of capillaries is often needed for acceptable response time. The 0.03 in. (0.7 mm) ID capillary is not allowed for Silicone 705 because of its higher viscosity. Manufacturer states it neither represents or tests this fluid for medical or pharmaceutical applications.

Silicone 705 Vapor Pressure Results (ASTM E1782)

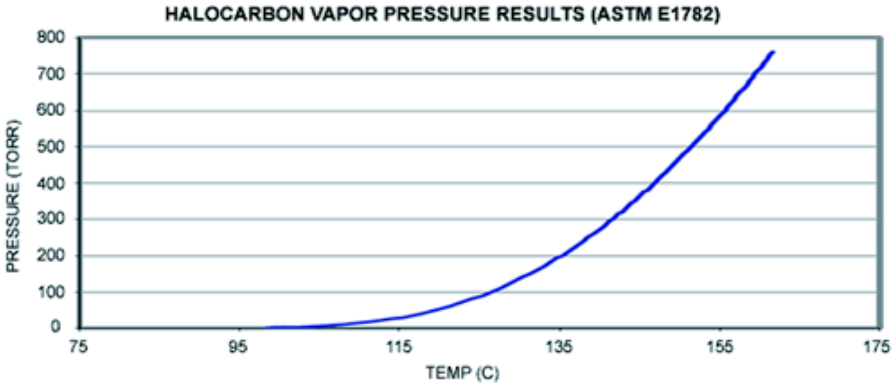


FILL FLUID SPECIFICATIONS – INERT (HALOCARBON)

Temperature Limits	
At Atm Pressure	-45 to 160 °C (-49 to 320 °F)
Viscosity at 25 °C (77 °F)	6.5 cs (4.2 cs at 100 °F)
Specific Gravity @ 25 °C (77 °F)	1.85
Coefficient of Thermal Expansion	0.000864 cc/cc/C (0.00060 cc/cc/F)
Chemical Name	Chlorotrifluoroethylene polymer (CTFE)
CAS Number	9002-83-9

Halocarbon Description

Halocarbon is the Inert Fill offering with our remote seals. Halocarbon 4.2 fill fluid refers to the viscosity in centistokes at 100 °F. It is essentially non-reactive to a wide range of chemicals, including halogens, oxygen, and other specialty gas applications. Other applications to consider Halocarbon include those in which silicone fluids are banned due to product contamination problems (i.e. paint manufacturing). It's higher vapor pressure than standard Silicone 200 silicone does restrict applications, especially if vacuum service. It should not be used for Food Grade applications. CTFE oils are available in various viscosity from 0.8 cSt to 1000 cSt at 1000 °F. Halocarbon 0.8 cSt is available as a 1199 special fill fluid mainly for cryogenic applications. The 0.8 cst fluid ASTM D97 Pour Point is –200 °F. Halocarbon 27 cSt is also available for vacuum services that cannot use silicones.

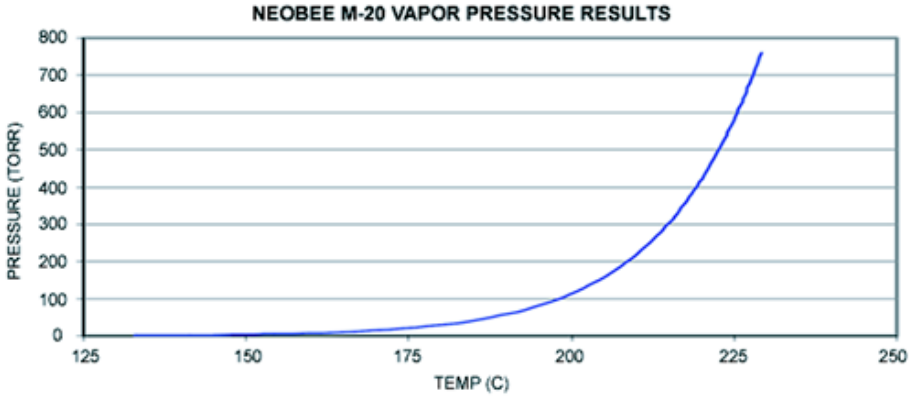


FILL FLUID SPECIFICATIONS – NEOBEE M-20

Temperature Limits	
At Atm Pressure	-15 to 225 °C (5 to 437 °F)
Viscosity at 25 °C (77 °F)	9.8 cs
Specific Gravity @ 25 °C (77 °F)	0.94
Coefficient of Thermal Expansion	0.001008 cc/cc/C (0.00056 cc/cc/F)
Chemical Composition	Derived from coconut oil and propylene glycol: Dicaprylate/Dicaprate
CAS Number	68583-51-7

Neobee M-20 Description

Neobee M-20 is the most commonly used fill fluid for sanitary applications because of its low viscosity and thermal stability. It is a polyol diester of short chain naturally derived fatty acids (coconut oils). Neobee is approved under 21CFR 172.856 as a direct food additive and under 21CFR 174.5 as an indirect food additive. It is soluble in alcohol containing up to 20% water, has a smooth non-oily feel and unusually low viscosity, similar to Silicone 200. Neobee properties make it a good all purpose fill fluid. On colder applications the response time should be evaluated due to increased viscosity. Neobee M-5 is also available as an ‘M’ number. It offers lower vapor pressure and improved thermal stability. However, viscosity more than doubles compared to M-20.



FILL FLUID SPECIFICATIONS – GLYCERIN AND WATER

Temperature Limits	
At Atm Pressure	-17 to 93 °C (0 to 200 °F)
Viscosity at 25 °C (77 °F)	12.5 cs
Specific Gravity @ 25°C (77 °F)	1.13
Coefficient of Thermal Expansion	0.000342 cc/cc/C (0.00019 cc/cc/F)
Chemical Composition	50% glycerin and 50% water (by volume)

Glycerin and Water Description

Glycerin is commonly used in many food, pharmaceutical, and cosmetic products. Glycerin is mixed with water in order to decrease its viscosity. Being a Generally Recognized As Safe (GRAS) substance, it may be used as a fill fluid in food, beverage, dairy, and pharmaceutical applications. Since it has a low coefficient of thermal expansion, it is also a good choice in applications requiring high performance as long as the temperature limits are not exceeded. FDA Code of Federal Regulations reference number: 21CFR 182.1320.

USP grade: These chemicals are manufactured under current Good Manufacturing Practices (cGMP). These materials meet the requirements listed in the United States Pharmacopeia (USP). The USP lists each chemical along with certain specifications the product must meet in order to be considered a USP product.

FCC grade: These products meet the specifications listed in the Food Chemicals Codex. This is a book of specifications written by the Food and Nutrition Board, the Institute of Medicine, and the National Academy of Sciences. The chemicals that carry the FCC name are considered “Food Grade.”

A vapor pressure curve does not exist for Glycerin and water.

FILL FLUID SPECIFICATIONS – PROPYLENE GLYCOL & WATER

Temperature Limits:	
At Atm Pressure	-17 to 93 °C (0 to 200 °F)
Viscosity at 25 °C (77 °F)	2.85 cs
Specific Gravity @ 25 °C (77 °F)	1.02
Coefficient of Thermal Expansion	0.00034 cc/cc/C (0.00019 cc/cc/F)
Chemical Composition:	30% USP & FCC grade propylene glycol and 70% water (by volume)

Propylene Glycol Description

Propylene glycol is commonly used as a raw material for paints and polyester and alkyd resins, a basic component of brake fluids, an ingredient for deicing / antifreeze fluids, and a heat transfer fluid. The food grade is also used as a solvent for flavors, extracts and drugs, as food antioxidants, lubricants, and mold inhibitors. Being a Generally Recognized As Safe (GRAS) substance, it may be used as a fill fluid in food, beverage, dairy, and pharmaceutical applications. Since it has a low coefficient of thermal expansion, it is also a good choice in applications requiring high performance as long as the temperature limits are not exceeded. FDA Code of Federal Regulations reference number: 21CFR 184.1666.

USP grade: These chemicals are manufactured under current Good Manufacturing Practices (cGMP). These materials meet the requirements listed in the United States Pharmacopeia (USP). The USP lists each chemical along with certain specifications the product must meet in order to be considered a USP product.

FCC grade: These products meet the specifications listed in the Food Chemicals Codex. This is a book of specifications written by the Food and Nutrition Board, the Institute of Medicine, and the National Academy of Sciences. The chemicals that carry the FCC name are considered “Food Grade.”

A Vapor Pressure Curve does not exist for Propylene Glycol and Water.

Section 6 Maintenance and Troubleshooting

CLEANING

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

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 Process Management 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.

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. The table below lists possible problems, their potential sources, and, where applicable, a corrective action

Table 6-1. Troubleshooting Seal Systems.

PROBLEM NO RESPONSE Symptom	**Potential Source**	**Corrective Action**
No output	Electrical problem	See the troubleshooting section of the transmitter manual for more extensive information. Check for adequate voltage to the transmitter. Check the milliampere rating of the power supply against the total current being drawn for all transmitters being powered. Check for shorts and multiple grounds. Check for proper polarity at the transmitter terminal. Check loop impedances. **⚠CAUTION** Do not use higher than the specified voltage to check the loop, or the transmitter electronics may be damaged. See if the transmitter is in a multidrop mode.The multidrop mode locks the output at 4 mA.
SLOW RESPONSE Symptom	**Potential Source**	**Corrective Action**
Slow response	Damping too high Cold Temperature	See the “Damping Adjustment” information in the Calibration section of the transmitter manual. 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.
DRIFTING Symptom	**Potential Source**	**Corrective Action**
Drifting	Temperature effect	If pressure measurement is changing, refer to “Understanding Seal System Performance” on page 2-2 for more information. Running Instrument Toolkit will calculate the expected performance for the seal system. Refer to “Instrument Toolkit: Seal Ordering and Application Process” on page 2-8 for more information.
Output reads negative pressure	Mounting effect	The output will read negative as the remote fill fluid is applying pressure to the low side. See Section 4: Ranging the Transmitter.
Will not respond to change in pressure	Damaged diaphragm	Remove seal and inspect diaphragm

Appendix A Reference Data

ROSEMOUNT 1199 DIRECT MOUNT SEAL SYSTEMS

Tuned-System Assembly Comprised of 3051_L with 1199 Flanged Seal

Rosemount 1199 Direct Mount Seals are used commonly at the bottom of the vessel. Their advanced design minimizes oil volume improving performance and eliminates the need for mounting hardware.

Product features and capabilities include:

- Direct Mount gage or absolute seal system can be used for open or vented to atmosphere tank applications
- Tuned-System Assemblies can be used for DP measurements in closed or pressurized tank applications
- Variety of process connections
- Quantified performance for the entire transmitter / seal assembly (QZ option)

Rosemount 1199 Direct Mount Seal

The 1199 Direct Mount Seal also requires specification of a Rosemount pressure transmitter. See the appropriate Product Data Sheet for the desired transmitter and include the option indicated in the table below for the configuration desired.

Table A-1. When ordering Rosemount 1199 Direct and Remote Mount Seals, please make sure to add the correct seal system ordering code to the transmitter model

Transmitter Model	2 Seals	1 Seal
3051S_C	B12	B11
3051C - Welded-Repairable	S2	S1
3051C - All Welded	S8 or S9	S7 or S0
2051C	S2	S1
3051T, 2051T, 2088	—	S1

A 1199 Direct Mount Seal consists of 2 parts. First, specify the direct mount connection model codes found on page A-2. Then, specify a remote seal found on page A-4.

Ordering Codes

1199 _

Direct Mount Connection page A-2

Seal Connection page A-4

Table A-2. Rosemount 1199 Direct Mount Seal Systems Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description			
1199	Seal Systems			
Connection Type		**Seal System**	**Seal Location**	
Standard				**Standard**
3051S and 2051C Coplanar Transmitters (3051S_C and 2051C)				
W	Welded-Repairable	One or Two Seal System	High Side of Transmitter	★
R(1)	All Welded	One Seal System	High Side of Transmitter	★
T(1)	All Welded	Two Seal System	High Side of Transmitter	★
All In-Line Transmitters (3051S_T, 3051T, 2051T, 2088)				
W	All Welded	One or Two Seal System	High Side of Transmitter	★
3051C Coplanar Transmitters (3051C)				
W	Determined by Transmitter Code	One or Two Seal System	High Side of Transmitter	★

			Temperature Limits (Ambient Temperature of 70 °F (21 °C))				
Fill Fluid		**Specific Gravity**	**Direct Mount No Extension**	**Direct Mount 2-inch (50 mm) Extension**	**Direct Mount 4-inch (100 mm) Extension**	**Thermal Optimizer**	
Standard							**Standard**
A	Syltherm XLT	0.85	–102 to 293 °F –75 to 145 °C	–102 to 293 °F –75 to 145 °C	–102 to 293 °F –75 to 145 °C	–102 to 293 °F –75 to 145 °C	★
C	Silicone 704	1.07	32 to 401 °F 0 to 205 °C	32 to 464 °F 0 to 240 °C	32 to 500 °F 0 to 260 °C	32 to 599 °F 0 to 315 °C	★
D	Silicone 200	0.93	–49 to 401 °F –45 to 205 °C	–49 to 401 °F –45 to 205 °C	–49 to 401 °F –45 to 205 °C	–49 to 401 °F –45 to 205 °C	★
H	Halocarbon (Inert)	1.85	–49 to 320 °F –45 to 160 °C	–49 to 320 °F –45 to 160 °C	–49 to 320 °F –45 to 160 °C	–49 to 320 °F –45 to 160 °C	★
G(2)	Glycerin and Water	1.13	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	★
N(2)	Neobee M-20	0.92	5 to 401 °F –15 to 205 °C	5 to 437 °F –15 to 225 °C	5 to 437 °F –15 to 225 °C	5 to 437 °F –15 to 225 °C	★
P(2)	Propylene Glycol/Water	1.02	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	5 to 203 °F –15 to 95 °C	★

Seal Connection Type				
Standard				**Standard**
A	Direct Mount			★
Direct Mount Connection Type				
	Extension Length	**Seal System**	**Connection Type**	
Standard				**Standard**
All Coplanar Transmitters (3051S_C, 3051C, and 2051C)				
94	Direct Mount, No Extension	Tuned-System Assembly, two seals	Welded-Repairable	★
93	Direct Mount, No Extension	One Seal System	Welded-Repairable	★
96	Direct Mount, No Extension	Tuned-System Assembly, two seals	All Welded	★
97	Direct Mount, No Extension	One Seal System	All Welded	★
B4	Direct Mount, 2 in. (50 mm) Extension	Tuned-System Assembly, two seals	Welded-Repairable	★
B3	Direct Mount, 2 in. (50 mm) Extension	One Seal System	Welded-Repairable	★
B6	Direct Mount, 2 in. (50 mm) Extension	Tuned-System Assembly, two seals	All Welded	★
B7	Direct Mount, 2 in. (50 mm) Extension	One Seal System	All Welded	★
D4	Direct Mount, 4 in. (100 mm) Extension	Tuned-System Assembly, two seals	Welded-Repairable	★
D3	Direct Mount, 4 in. (100 mm) Extension	One Seal System	Welded-Repairable	★
D6	Direct Mount, 4 in. (100 mm) Extension	Tuned-System Assembly, two seals	All Welded	★
D7	Direct Mount, 4 in. (100 mm) Extension	One Seal System	All Welded	★

Table A-2. Rosemount 1199 Direct Mount Seal Systems Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

All In-Line Transmitters (3051S_T, 3051T, 2051T, 2088)				
95	Direct Mount, No Extension	One Seal System	All Welded	★
D5	Thermal Optimizer	One Seal System	All Welded	★

(1) All welded system connection types require either a 316L SST or Alloy C-276 isolating diaphragm in the pressure transmitter model codes.
(2) This is a food grade fill fluid.

Continue specifying a completed model number by choosing a remote seal type below:

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

		● = Transmitter Availability — = Unavailable					
			Coplanar Extensions				
Flanged Seal Assemblies		**Inline**	**0 in.**	**2-in.**	**4-in.**	**Process Connections**	
Standard							**Standard**
	FFW Flush Flanged Seal	●	(1)	●	●	2-in. / DN 50 / 50A 3-in. / DN 80 / 80A 4-in. / DN 100 / 100A	★
	RFW Flanged Seal	●	—	●	●	1/2-in. / DN 15 3/4-in. 1-in. / DN 25 / 25A 1 1/2-in. / DN 40 / 40A	★
	EFW Extended Flanged Seal	●	(1)	●	●	1 1/2-in. / DN 40 / 40A 2-in. / DN 50 / 50A 3-in. / Headbox / DN 80 / 80A 4-in. / Headbox / DN 100 / 100A	★
Expanded							
	FCW Flush Flanged Seal – Ring Type Joint (RTJ) Gasket Surface	●	(1)	●	●	2-in. 3-in.	
	RCW Ring Type Joint (RTJ) Flanged Seal	●	—	●	●	½-in. ¾-in. 1-in. 1 ½-in.	
	FUW and FVW Flush Flanged Type Seals	●	●	●	●	DN 50 DN 80	

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Threaded Seal Assemblies		Inline	Coplanar Extensions			Process Connections	
			0 in.	2-in.	4-in.		
Standard							**Standard**
	RTW Threaded Seal	●	—	●	●	¼ –18 NPT 3/8 –18 NPT ½ –14 NPT ¾ –14 NPT 1 – 11.5 NPT 1 ¼ –11.5 NPT 1 ½ –11.5 NPT G1/2 A DIN 16288 R1/2 per ISO 7/1	★
Expanded							
	HTS Male Threaded Seal	●	●	●	●	G1 G1 ½ G2 1-11.5 NPT 1 ½ -11.5 NPT 2-11.5 NPT	

Hygienic Seal Assemblies		Inline	Coplanar Extensions			Process Connections	
			0 in.	2-in.	4-in.		
Standard							**Standard**
	SCW Hygienic Tri-Clover Style Tri-Clamp Seal	●	●	●	●	1 ½-in. 2-in. 2 ½-in. 3-in. 4-in.	★
	SSW Hygienic Tank Spud Seal	●	●	●	●	2-in. Extension 6-in. Extension	★
Expanded							
	STW Hygienic Thin Wall Tank Spud Seal	●	—	●	●	0.8 in Extension	
	EES Hygienic Flanged Tank Spud Extended Seal	●	●	●	●	DN 50 DN 80	
	VCS Tri-clamp® In-Line Seal	●	—	—	—	1-in. 1 ½-in. 2-in. 3-in. 4-in.	
	SVS Varivent Compatible Hygienic Connection Seal	●	●	●	●	Tuchenhagen Varivent® Compatible	

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

	SHP Hygienic Cherry-Burrell “I” Line Seal	●	—	—	—	2-in. 3-in.	
	SLS Dairy Process Connection - Female Thread Seal per DIN 11851	●	—	—	—	DN 40 DN 50	
Specialty Seal Assemblies		**Inline**	**Coplanar Extensions**			**Process Connections**	
			0 in.	**2-in.**	**4-in.**		
Expanded							
	WSP Saddle Seal	●	—	●	●	2-in. 3-in. 4-in. or Larger	
 	UCP Male Threaded Pipe Mount Seals and PMW Paper Mill Sleeve Seals	●	●	—	—	1 ½-in. with Threaded Knurled Nut 1-in. with Cap Screw Retainer	
	CTW Chemical Tee Seal	●	—	●	●	Retro-fit	
	TFS Wafer Style In-Line Seal	●	—	—	—	1-in. / DN 25 1 ½-in. / DN 40 2-in. / DN 50 3-in. / DN 80 4-in. / DN 100	
	WFW Flow-Thru Flanged Seal	●	—	●	●	1-in. 2-in. 3-in.	

(1) Available with ANSI Class 300 or less.

ROSEMOUNT 1199 REMOTE MOUNT SEAL SYSTEMS

Tuned-System Assembly Comprised of 3051_L with 1199 Flanged Seal

Rosemount 1199 Remote Mount Seals are used commonly at the top of the vessel when a DP measurement is required. They are available in three different diameters to optimize time response and reduce temperature effects.

Product features and capabilities include:

- Remote Mount Seals can be used for high temperature applications
- Remote Mount Seals are used on the low pressure side of the transmitter for Tuned-System Assemblies that can be used for DP measurements in closed or pressurized tank applications
- Variety of process connections
- Quantified performance for the entire transmitter / seal assembly (QZ option)

Rosemount 1199 Remote Mount Seal

The 1199 Direct Mount Seal also requires specification of a Rosemount pressure transmitter. See the appropriate Product Data Sheet for the desired transmitter and include the option indicated in the table below for the configuration desired.

Table 1. When ordering Rosemount 1199 Direct and Remote Mount Seals, please make sure to add the correct seal system ordering code to the transmitter model

Transmitter Model	2 Seals	1 Seal
3051S_C	B12	B11
3051C - Welded-Repairable	S2	S1
3051C - All Welded	S8 or S9	S7 or S0
2051C	S2	S1
3051T, 2051T, 2088	—	S1

A 1199 Remote Mount Seal consists of 2 parts. First, specify the capillary model codes found on page A-8. Then, specify a remote seal found on page A-10.

Ordering Codes

1199 _

Remote Mount Connection page A-8

Seal Connection page A-9

Capillary/Fill Fluid

NOTE
Use Table A-3 for Capillary Type Connections. Use Table A-2 for Direct Mount Type Connections.

Table A-3. Rosemount 1199 Remote Mount Seal Systems Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description			
1199	Seal System			
Connection Type		**Seal System**	**Seal Location**	
Standard				**Standard**
3051S and 2051 Coplanar Transmitters (3051S_C and 2051C)				
W	Welded-Repairable	One or Two Seal System	High Side of Transmitter	★
M	Welded-Repairable	One or Two Seal System	Low Side of Transmitter	★
D	Welded-Repairable	Two Seal System	Balanced System - Same Seal on Low and High Side	★
R(1)	All Welded	One Seal System	High Side of Transmitter	★
T(1)	All Welded	Two Seal System	High Side of Transmitter	★
S(1)	All Welded	Two Seal System	Low Side of Transmitter	★
All In-Line Transmitters (3051S_T, 3051T, 2051T, 2088)				
W	All Welded	One or Two Seal System	High Side of Transmitter	★
3051 Coplanar Transmitters (3051C)				
W	Determined by Transmitter Code	One or Two Seal System	High Side of Transmitter	★
M	Determined by Transmitter Code	One or Two Seal System	Low Side of Transmitter	★
D	Determined by Transmitter Code	Two Seal System	Balanced System - Same Seal on Low and High Side	★
Fill Fluid		**Specific Gravity**	**Temperature Limits (Ambient Temperature of 70 °F (21 °C))**	
Standard				**Standard**
A(2)	Syltherm XLT	0.85	–75 to 145 °C (–102 to 293 °F)	★
C(2)	Silicone 704	1.07	0 to 315 °C (32 to 599 °F)	★
D	Silicone 200	0.93	–45 to 205 °C (–49 to 401 °F)	★
H	Inert (Halocarbon)	1.85	–45 to 160 °C (–49 to 320 °F)	★
G(3)	Glycerin and Water	1.13	–15 to 95 °C (5 to 203 °F)	★
N(3)	Neobee M-20	0.92	–15 to 225 °C (5 to 437 °F)	★
P(3)	Propylene Glycol and Water	1.02	–15 to 95 °C (5 to 203 °F)	★
Seal Connection Type / Capillary ID, Description				
Standard				**Standard**
B	0.03-in. (0.711 mm) ID, SST Armored			★
C	0.04-in. (1.092 mm) ID, SST Armored			★
D	0.075-in. (1.905 mm) ID, SST Armored			★
E	0.03-in. (0.711 mm) ID, SST Armored, PVC Coated			★
F	0.04-in. (1.092 mm) ID, SST Armored, PVC Coated			★
G	0.075-in. (1.905 mm) ID, SST Armored, PVC Coated			★
H	0.03-in. (0.711 mm) ID, SST Armored, 4-in. Support Tube without Compression Fitting			★
J	0.04-in. (1.092 mm) ID, SST Armored, 4-in. Support Tube without Compression Fitting			★
K	0.075-in. (1.905 mm) ID, SST Armored, 4-in. Support Tube without Compression Fitting			★
M(4)	0.03-in. (0.711 mm) ID, SST Armored, PVC Coated, Support Tube with Compression Fitting			★
N(4)	0.04-in. (1.092 mm) ID, SST Armored, PVC Coated, Support Tube with Compression Fitting			★
P(4)	0.075-in. (1.905 mm) ID, SST Armored, PVC Coated, Support Tube with Compression Fitting			★

Table A-3. Rosemount 1199 Remote Mount Seal Systems Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Capillary Length / Direct Mount		
Standard		**Standard**
01	1 ft (0.3 m)	★
05	5 ft (1.5 m)	★
10	10 ft (3.0 m)	★
15	15 ft (4.5 m)	★
20	20 ft (6.1 m)	★
51	0.5 m (1.6 ft)	★
52	1.0 m (3.3 ft)	★
53	1.5 m (4.9 ft)	★
54	2.0 m (6.6 ft)	★
55	2.5 m (8.2 ft)	★
56	3.0 m (9.8 ft)	★
57	3.5 m (11.5 ft)	★
58	4.0 m (13.1 ft)	★
59	5.0 m (16.4 ft)	★
60	6.0 m (19.7 ft)	★
Expanded		
25	25 ft (7.6 m)	
30	30 ft (9.1 m)	
35	35 ft (10.7 m)	
40	40 ft (12.2 m)	
45	45 ft (13.7 m)	
50	50 ft (15.2 m)	
61	7.0 m (23 ft)	
62	8.0 m (26.2 ft)	
63	9.0 m (29.5 ft)	
64	10.0 m (32.8 ft)	
65	11.0 m (36.1 ft)	
66	12.0 m (39.4 ft)	
67	13.0 m (42.6 ft)	
68	14.0 m (45.9 ft)	
69	15.0 m (49.2 ft)	

(1) All welded system connection types require either a 316L SST or Alloy C-276 isolating diaphragm in the pressure transmitter model codes.
(2) Not available with Capillary Seal connection inside diameter codes B, E, H, or M.
(3) This is a food grade fill fluid.
(4) Compression fitting does not provide a hermetic seal.

Continue specifying a completed model number by choosing a remote seal type below:

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Flanged Seal Assemblies		**Process Connections**	
Standard			**Standard**
	FFW Flush Flanged Seal	2-in. / DN 50 / 50A 3-in. / DN 80 / 80A 4-in. / DN 100 / 100A	★
	RFW Flanged Seal	1/2-in. / DN 15 3/4-in. 1-in. / DN 25 / 25A 1 1/2-in. / DN 40 / 40A	★
	EFW Extended Flanged Seal	1 1/2-in. / DN 40 / 40A 2-in. / DN 50 / 50A 3-in. / Headbox / DN 80 / 80A 4-in. / Headbox / DN 100 / 100A	★
	PFW Pancake Seal	2-in. / DN 50 3-in. / DN 80	★
Expanded			
	FCW Flush Flanged Seal – Ring Type Joint (RTJ) Gasket Surface	2-in. 3-in.	
	RCW Ring Type Joint (RTJ) Flanged Seal	½-in. ¾-in. 1-in. 1 ½-in.	
	FUW and FVW Flush Flanged Type Seals	DN 50 DN 80	
Threaded Seal Assemblies		**Process Connections**	
Standard			**Standard**
	RTW Threaded Seal	¼ –18 NPT 3/8 –18 NPT ½ –14 NPT ¾ –14 NPT 1 – 11.5 NPT 1 ¼ –11.5 NPT 1 ½ –11.5 NPT G1/2 A DIN 16288 R1/2 per ISO 7/1	★
Expanded			
	HTS Male Threaded Seal	G1 G1 ½ G2 1-11.5 NPT 1 ½ -11.5 NPT 2-11.5 NPT	

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

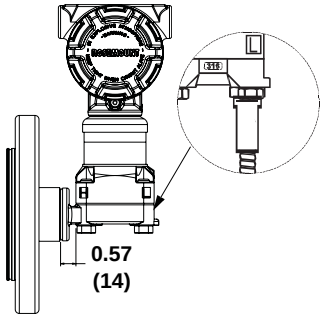
Hygienic Seal Assemblies		Process Connections	
Standard			**Standard**
	SCW Hygienic Tri-Clover Style Tri-Clamp Seal	1 ½-in. 2-in. 2 ½-in. 3-in. 4-in.	★
	SSW Hygienic Tank Spud Seal	2-in. Extension 6-in. Extension	★
Expanded			
	STW Hygienic Thin Wall Tank Spud Seal	0.8 in Extension	
	EES Hygienic Flanged Tank Spud Extended Seal	DN 50 DN 80	
	VCS Tri-clamp® In-Line Seal	1-in. 1 ½-in. 2-in. 3-in. 4-in.	
	SVS Varivent Compatible Hygienic Connection Seal	Tuchenhagen Varivent Compatible	
	SHP Hygienic Cherry-Burrell “I” Line Seal	2-in. 3-in.	
	SLS Dairy Process Connection - Female Thread Seal per DIN 11851	DN 40 DN 50	

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Specialty Seal Assemblies		Process Connections	
Expanded			
	WSP Saddle Seal	2-in. 3-in. 4-in. or Larger	
 	UCP Male Threaded Pipe Mount Seals and PMW Paper Mill Sleeve Seals	1 ½-in. with Threaded Knurled Nut 1-in. with Cap Screw Retainer	
	CTW Chemical Tee Seal	Retro-fit	
	TFS Wafer Style In-Line Seal	1-in. / DN 25 1 ½-in. / DN 40 2-in. / DN 50 3-in. / DN 80 4-in. / DN 100	
	WFW Flow-Thru Flanged Seal	1-in. 2-in. 3-in.	

DIMENSIONAL DRAWINGS

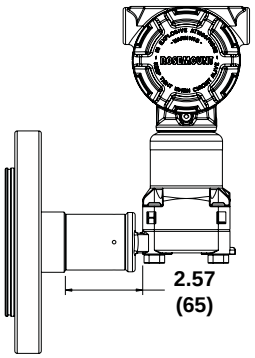
Rosemount 1199 Direct Mount Connection Types for General Purpose Seal Systems



Rosemount 3051
One-Seal System
1199 _ _ _ 93
1199 _ _ _ 97

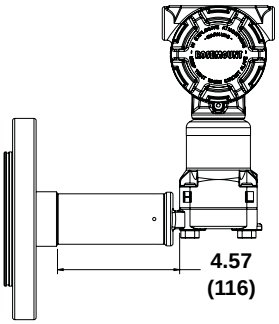
Rosemount 3051
Two-Seal System
1199 _ _ _ 94
1199 _ _ _ 96
(Add Low Side Capillary)

Low Side Capillary Connection



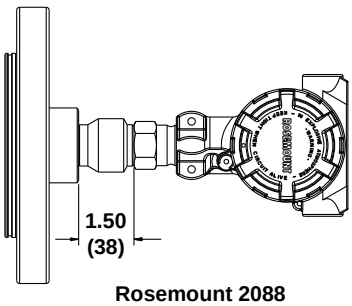
Rosemount 3051
One-Seal System
1199 _ _ _ B3 (2-in. Connection)
1199 _ _ _ B7 (2-in. Connection)

Rosemount 3051
Two-Seal System
1199 _ _ _ B4 (2-in. Conn.)
1199 _ _ _ B6 (2-in. Conn.)
(Add Low Side Capillary)

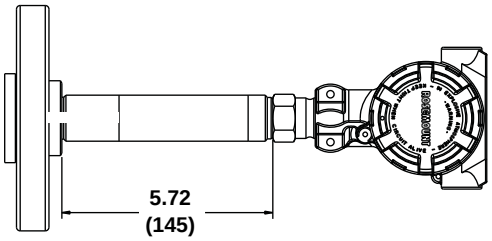


Rosemount 3051
One-Seal System
1199 _ _ _ D3 (4-in. Connection)
1199 _ _ _ D7 (4-in. Connection)

Rosemount 3051
Two-Seal System
1199 _ _ _ D4 (4-in. Conn.)
1199 _ _ _ D6 (4-in. Conn.)
(Add Low Side Capillary)



Rosemount 2088
1199 _ _ _ 95



Rosemount 2088
1199 _ _ _ D5

NOTES
Dimensions are in inches (millimeters).
Transmitters are shown with Flush Flanged (FFW) Seals.

SPARE PARTS

Table A-4. Flush Flanged (FFW) Lower Housings

Material		One 1/4-in.	Two 1/4-in.	One 1/2-in.	Two 1/2-in.
316 SST	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2”	DP0002-2111-S6	DP0002-2121-S6	DP0002-2112-S6	DP0002-2122-S6
	3"	DP0002-3111-S6	DP0002-3121-S6	DP0002-3112-S6	DP0002-3122-S6
	4" / 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	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2"	DP0002-2111-HC	DP0002-2121-HC	DP0002-2112-HC	DP0002-2122-HC
	3"	DP0002-3111-HC	DP0002-3121-HC	DP0002-3112-HC	DP0002-3122-HC
	4" / 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
Alloy 400	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2"	DP0002-2111-M4	DP0002-2121-M4	DP0002-2112-M4	DP0002-2122-M4
	3"	DP0002-3111-M4	DP0002-3121-M4	DP0002-3112-M4	DP0002-3122-M4
	4" / 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 A-5. Gaskets for Flush Flanged (FFW) Lower Housings

Size	Thermo-Tork 9000	Virgin PTFE	GHB Grafoil	Gylon 3510
316 SST	**Part Number**	**Part Number**	**Part Number**	**Part Number**
2"	DP0007-0201-TT	DP0007-0201-TF	DP0007-0201-GF	DP0007-0201-GY
3"	DP0007-0301-TT	DP0007-0301-TF	DP0007-0301-GF	DP0007-0301-GY
4" / DN 100	DP0007-0401-TT	DP0007-0401-TF	DP0007-0401-GF	DP0007-0401-GY
DN 50	DP0007-0601-TT	DP0007-0601-TF	DP0007-0601-GF	DP0007-0601-GY
DN 80	DP0007-0801-TT	DP0007-0801-TF	DP0007-0801-GF	DP0007-0801-GY

Table A-6. Alignment Clamps for Flush Flanged (FFW) Lower Housings

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

Table A-7. Plugs for Flush Flanged (FFW) Lower Housings

	1/4-in.	1/2-in.
SST	C-502460502	C-502460504
Alloy C-276	C-502460602	C-502460604

Table A-8. Pancake (PFW) Lower Housings

Material		One 1/4-in.	Two 1/4-in.	One 1/2-in.	Two 1/2-in.
316 SST	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2"	DP0002-2111-S6	DP0002-2121-S6	DP0002-2112-S6	DP0002-2122-S6
	3"	DP0002-3111-S6	DP0002-3121-S6	DP0002-3112-S6	DP0002-3122-S6
	4" / 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	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2"	DP0002-2111-HC	DP0002-2121-HC	DP0002-2112-HC	DP0002-2122-HC
	3"	DP0002-3111-HC	DP0002-3121-HC	DP0002-3112-HC	DP0002-3122-HC
	4" / 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
Alloy 400	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	2"	DP0002-2111-M4	DP0002-2121-M4	DP0002-2112-M4	DP0002-2122-M4
	3"	DP0002-3111-M4	DP0002-3121-M4	DP0002-3112-M4	DP0002-3122-M4
	4" / 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 A-9. Gaskets for Pancake (PFW) Lower Housings

Size	Thermo-Tork 9000	Virgin PTFE	GHB Grafoil	Gylon 3510
316 SST	**Part Number**	**Part Number**	**Part Number**	**Part Number**
2"	DP0007-0201-TT	DP0007-0201-TF	DP0007-0201-GF	DP0007-0201-GY
3"	DP0007-0301-TT	DP0007-0301-TF	DP0007-0301-GF	DP0007-0301-GY
4" / DN 100	DP0007-0401-TT	DP0007-0401-TF	DP0007-0401-GF	DP0007-0401-GY
DN 50	DP0007-0601-TT	DP0007-0601-TF	DP0007-0601-GF	DP0007-0601-GY
DN 80	DP0007-0801-TT	DP0007-0801-TF	DP0007-0801-GF	DP0007-0801-GY

Table A-10. Alignment Clamps for Pancake (PFW) Lower Housings

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

Table A-11. Plugs for Pancake (PFW) Lower Housings

	1/4-in.	1/2-in.
SST	C502460502	C502460504
Alloy C-276	C502460602	C502460604

Table A-12. Remote Flanged (RFW) Lower Housings

Material		No Flushing Connection	One 1/4-in.	Two 1/4-in.	One 1/2-in.	Two 1/2-in.
316 SST	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1-in.	DP0004-1100-S6	DP0004-1111-S6	DP0004-1121-S6	DP0004-1112-S6	DP0004-1122-S6
	1 1/2-in.	DP0004-1600-S6	DP0004-1611-S6	DP0004-1621-S6	DP0004-1612-S6	DP0004-1622-S6
	DN 25	DP0004-1700-S6	DP0004-1711-S6	DP0004-1721-S6	DP0004-1712-S6	DP0004-1722-S6
	DN 40	DP0004-1900-S6	DP0004-1911-S6	DP0004-1921-S6	DP0004-1912-S6	DP0004-1922-S6
Alloy C-276	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1-in.	DP0004-1100-HC	DP0004-1111-HC	DP0004-1121-HC	DP0004-1112-HC	DP0004-1122-HC
	1 1/2-in.	DP0004-1600-HC	DP0004-1611-HC	DP0004-1621-HC	DP0004-1612-HC	DP0004-1622-HC
	DN 25	DP0004-1700-HC	DP0004-1711-HC	DP0004-1721-HC	DP0004-1712-HC	DP0004-1722-HC
	DN 40	DP0004-1900-HC	DP0004-1911-HC	DP0004-1921-HC	DP0004-1912-HC	DP0004-1922-HC
Carbon Steel	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1-in.	DP0004-1100-Z1	DP0004-1111-Z1	DP0004-1121-Z1	DP0004-1112-Z1	DP0004-1122-Z1
	1 1/2-in.	DP0004-1600-Z1	DP0004-1611-Z1	DP0004-1621-Z1	DP0004-1612-Z1	DP0004-1622-Z1
	DN 25	DP0004-1700-Z1	DP0004-1711-Z1	DP0004-1721-Z1	DP0004-1712-Z1	DP0004-1722-Z1
	DN 40	DP0004-1900-Z1	DP0004-1911-Z1	DP0004-1921-Z1	DP0004-1912-Z1	DP0004-1922-Z1
Alloy 400	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1-in.	DP0004-1100-M4	DP0004-1111-M4	DP0004-1121-M4	DP0004-1112-M4	DP0004-1122-M4
	1 1/2-in.	DP0004-1600-M4	DP0004-1611-M4	DP0004-1621-M4	DP0004-1612-M4	DP0004-1622-M4
	DN 25	DP0004-1700-M4	DP0004-1711-M4	DP0004-1721-M4	DP0004-1712-M4	DP0004-1722-M4
	DN 40	DP0004-1900-M4	DP0004-1911-M4	DP0004-1921-M4	DP0004-1912-M4	DP0004-1922-M4

Table A-13. Gaskets for Remote Flanged (RFW) Lower Housings

Size	C4401 Aramid Fiber	PTFE	Barium Sulfate Filled PTFE	GHB Gragoil	Ethylene Propylene
316 SST	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
1-in.	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER
1 1/2-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 A-14. Plugs for Remote Flanged (RFW) Lower Housings

	1/4-in.	1/2-in.
SST	C502460502	C502460504
Alloy C-276	C502460602	C502460604

Table A-15. Threaded (RTW) Lower Housings

Material		No Flushing Connection	One 1/4-in.	Two 1/4-in.	One 1/2-in.	Two 1/2-in.
316 SST	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1/4-18 NPT	DP0070-1101-S6	DP0070-1112-S6	DP0070-1122-S6	DP0070-111A-S6	DP0070-112A-S6
	3/8-18 NPT	DP0070-1201-S6	DP0070-1212-S6	DP0070-1222-S6	DP0070-121A-S6	DP0070-122A-S6
	1/2-14 NPT	DP0070-1301-S6	DP0070-1312-S6	DP0070-1322-S6	DP0070-131A-S6	DP0070-132A-S6
	3/4-14 NPT	DP0070-1401-S6	DP0070-1412-S6	DP0070-1422-S6	DP0070-141A-S6	DP0070-142A-S6
	1-11.5 NPT	DP0070-1501-S6	DP0070-1512-S6	DP0070-1522-S6	DP0070-151A-S6	DP0070-152A-S6
	1 1/4-11.5 NPT	DP0070-1601-S6	NA	NA	NA	NA
	1 1/2-11.5 NPT	DP0070-1701-S6	NA	NA	NA	NA
	G1/2A DIN 16288	DP0070-1901-S6	DP0070-1912-S6	DP0070-1922-S6	DP0070-191A-S6	DP0070-192A-S6
Alloy C-276	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1/4-18 NPT	DP0070-1101-HC	DP0070-1112-HC	DP0070-1122-HC	DP0070-111A-HC	DP0070-112A-HC
	3/8-18 NPT	DP0070-1201-HC	DP0070-1212-HC	DP0070-1222-HC	DP0070-121A-HC	DP0070-122A-HC
	1/2-14 NPT	DP0070-1301-HC	DP0070-1312-HC	DP0070-1322-HC	DP0070-131A-HC	DP0070-132A-HC
	3/4-14 NPT	DP0070-1401-HC	DP0070-1412-HC	DP0070-1422-HC	DP0070-141A-HC	DP0070-142A-HC
	1-11.5 NPT	DP0070-1501-HC	DP0070-1512-HC	DP0070-1522-HC	DP0070-151A-HC	DP0070-152A-HC
	1 1/4-11.5 NPT	DP0070-1601-HC	NA	NA	NA	NA
	1 1/2-11.5 NPT	DP0070-1701-HC	NA	NA	NA	NA
	G1/2A DIN 16288	DP0070-1901-HC	DP0070-1912-HC	DP0070-1922-HC	DP0070-191A-HC	DP0070-192A-HC
Carbon Steel	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1/4-18 NPT	DP0070-1101-Z1	DP0070-1112-Z1	DP0070-1122-Z1	DP0070-111A-Z1	DP0070-112A-Z1
	3/8-18 NPT	DP0070-1201-Z1	DP0070-1212-Z1	DP0070-1222-Z1	DP0070-121A-Z1	DP0070-122A-Z1
	1/2-14 NPT	DP0070-1301-Z1	DP0070-1312-Z1	DP0070-1322-Z1	DP0070-131A-Z1	DP0070-132A-Z1
	3/4-14 NPT	DP0070-1401-Z1	DP0070-1412-Z1	DP0070-1422-Z1	DP0070-141A-Z1	DP0070-142A-Z1
	1-11.5 NPT	DP0070-1501-Z1	DP0070-1512-Z1	DP0070-1522-Z1	DP0070-151A-Z1	DP0070-152A-Z1
	1 1/4-11.5 NPT	DP0070-1601-Z1	NA	NA	NA	NA
	1 1/2-11.5 NPT	DP0070-1701-Z1	NA	NA	NA	NA
	G1/2A DIN 16288	DP0070-1901-Z1	DP0070-1912-Z1	DP0070-1922-Z1	DP0070-191A-Z1	DP0070-192A-Z1
Alloy 400	**Size**	**Part Number**	**Part Number**	**Part Number**	**Part Number**	**Part Number**
	1/4-18 NPT	DP0070-1101-M4	DP0070-1112-M4	DP0070-1122-M4	DP0070-111A-M4	DP0070-112A-M4
	3/8-18 NPT	DP0070-1201-M4	DP0070-1212-M4	DP0070-1222-M4	DP0070-121A-M4	DP0070-122A-M4
	1/2-14 NPT	DP0070-1301-M4	DP0070-1312-M4	DP0070-1322-M4	DP0070-131A-M4	DP0070-132A-M4
	3/4-14 NPT	DP0070-1401-M4	DP0070-1412-M4	DP0070-1422-M4	DP0070-141A-M4	DP0070-142A-M4
	1-11.5 NPT	DP0070-1501-M4	DP0070-1512-M4	DP0070-1522-M4	DP0070-151A-M4	DP0070-152A-M4
	1 1/4-11.5 NPT	DP0070-1601-M4	NA	NA	NA	NA
	1 1/2-11.5 NPT	DP0070-1701-M4	NA	NA	NA	NA
	G1/2A DIN 16288	DP0070-1901-M4	DP0070-1912-M4	DP0070-1922-M4	DP0070-191A-M4	DP0070-192A-M4

Table A-16. Gaskets for Threaded (RTW) Lower Housings

Size	C4401 Aramid Fiber	PTFE	Barium Sulfate Filled PTFE	GHB Grafoil	Ehtylene Propylene	Alloy	Alloy C-276
	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
2500 psi MWP	DP0007-2401-K4	DP0007-2401-TF	DP0007-2401-GY	DP0007-2401-GF	DP0007-2401-ER	NA	NA
5000 psi MWP	DP0007-2401-K4	TBD	DP0007-2401-GY	DP0007-2401-GF	NA	NA	NA
10000 psi MWP	DP0007-2401-K4	NA	NA	NA	NA	DP0007-2403-M4	DP0007-2403-HC

Table A-17. Plugs for Threaded (RTW) Lower Housings

	1/4-in.	1/2-in.
SST	C502460502	C502460504
Alloy C-276	C502460602	C502460604

Table A-18. Sanitary Tank Spud Seal (SSW) Parts

Part Description Sanitary Tank Spud	Part Number
2-inch extension	01199-0061-0001
6-inch extension	01199-0061-0002
Sanitary Tank Spud Plug	
2-inch extension	01199-0552-0001
6-inch extension	01199-0552-0002
Clamp	01199-0526-0002
Buna N O-ring	C103750175-0341
Viton O-ring	C502790075-0341
Ethylene Propylene O-ring	C531850070-0341

Table A-19. Sanitary Tri-Clamp Seal (SCW and VCS) Parts

Part Description Buna N Gasket	Part Number
3/4 inch	01199-0035-0105
1 1/2 inch	01199-0035-0115
2 inch	01199-0035-0120
2 1/2 inch	01199-0035-0125
3 inch	01199-0035-0130
4 inch	01199-0035-0140

Table A-20. 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	C531850070-0336

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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Rosemount 1199

Emerson Process Management

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1-800-999-9307
T (International) (952) 906-8888
F (952) 906-8889

www.rosemount.com

Emerson Process Management GmbH & Co.
Argelsrieder Feld 3
82234 Wessling
Germany
T 49 (8153) 9390
F 49 (8153) 939172

Emerson Process Management Asia Pacific Private Limited
1 Pandan Crescent
Singapore 128461
T (65) 6777 8211
F (65) 6777 0947/65 6777 0743
Enquiries@AP.EmersonProcess.com

00809-0100-4002 Rev BB, 11/12

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