smar - SR301

OPERATION & MAINTENANCE INSTRUCTIONS MANUAL

REMOTE SEAL

HART COMMUNICATION PROTOCOL

SEP / 12

SR301

S R 3 0 1 M E

INTRODUCTION

The **SR301** is a Remote Seal that allows the pressure transmitter to make measures in situations where the immediate contact of the transmitter diaphragm with the process fluid it is not allowed.

The remote seal is made up by one connection with the diaphragm and one capillary connection with filling fluid. The filling fluid transfers the pressure measured in the process fluid to the transmitter sensor. The capillary connection links the seal diaphragm to the transmitter.

The remote seals available in the **SR301** series are: Flanged "T" Type (SR301T), Threaded (SR301R), Pancake (SR301P) both models having an optional flush connection, Sanitary (SR301S), Flanged with Extension (SR301E) and Pancake with Extension (SR301Q).

The SR301 is assembled with gauge and differential pressure transmitters. When used in food applications the connections are sanitary type. Level models are also available.

The SR301T, SR301E and LD300L models are available with two flange types for process connection: integral and slip-on flange. To the integral flange model the diaphragm is welded directly on the flange. To the slip-on flange model the diaphragm is not welded on the flange, so it is possible to rotate the flange, becoming easier the assembly in the field. Using the slip-on flange model it is possible to choose a less noble material to the flange than the used to the diaphragm, as Coated Carbon Steel. The figures below illustrate these flange models.

Slip-on Flange Model

Integral Flange Model

The typical applications of the remote seal on the transmitter are:

- For corrosive process fluid;
- For viscous process fluid or with solids in suspension;
- The process fluid may freeze, crystallize or solidify;
- Processes that require easy cleaning and others.

The choice of the remote seal must be based on the recommendations of this manual.

The quality of measurement is important, because there is a growing demand for better electronic accuracy and stability on transmitters.

Some remote seal characteristics influence measurement, as capillary length, work temperature, response time, correct seal model and type of installation.

For example, in regard to the **remote seal model**, it is common practice to standardize the seal type and the capillary length in the longest extension offered by supplier, aiming to guarantee interchangeability in the entire plant without considering the application characteristics for each point of measurement.

As for the **installation**, not always the device life span is taken into consideration, as it suffers various mechanical aggressions as line and tank vibration, high agitation or turbulence of the process fluid, free or inadequately supported capillaries.
There are problems also in relation to mechanical assembly, inadequate installation of gaskets, plug point centralization and alignment, excessive squeeze or bad distribution of the holding bolts.

Thus, in choosing the seal size these factors must be considered according to each case in order to guarantee excellent performance and long life span.

This manual was made to help install, operate, and maintain the SR301. It contains information about transmitter/seal assembly, organized in the following categories:

- Installation;
- Selection;
- Operation;
- Maintenance;
- Examples;
- Types of Seal and Ordering Code.

Read these instructions carefully to get the most out of the **SR301**.

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

TABLE OF CONTENTS

CHAPTER 1 - INSTALLATION 1.1
APPLICATION 1.1
GENERAL RECOMMENDATIONS FOR REMOTE SEAL USE 1.1
TYPE OF REMOTE SEAL 1.2
RECEIVING AND HANDLING 1.2
MOUNTING OF TRANSMITTER WITH REMOTE SEAL 1.2

CHAPTER 2 - SELECTION 2.1
PROCEDURE FOR REMOTE SEAL SPECIFICATION 2.1
CHOOSING THE IDEAL ASSEMBLY FOR APPLICATION 2.2
TRANSMITTERS RANGE FOR REMOTE SEAL APPLICATION 2.3
DIAPHRAGM MATERIAL 2.4
FILLING FLUIDS 2.5
TEMPERATURE ERROR PRESENTED BY SEAL 2.6
CALCULATION OF TEMPERATURE ERRORS 2.7
EQUATIONS 2.7
DETERMINATION OF THE SEAL/LEVEL ERROR FOR HIGH (H) OR LOW (L) SIDES 2.8
ERROR FOR TWO SEALS INFLUENCED BY TEMPERATURE SYMMETRY 2.8
ASSEMBLY ACCURACY 2.13
TOTAL PROBABLE ASSEMBLY ERROR 2.14
REMOTE SEAL RESPONSE TIME 2.14
CALCULATION OF REMOTE SEAL RESPONSE TIME 2.15
CAPILLARY LENGTH 2.17
ERROR GUIDE TREND FOR TRANSMITTER ASSEMBLED WITH REMOTE SEAL 2.21
CASE 1 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (1:1) 2.22
CASE 2 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (1:1) 2.23
CASE 3 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (1:1) 2.24
CASE 4 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (10:1) 2.25
CASE 5 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (10:1) 2.26
CASE 6 – TPE % OF THE SPAN WITH CALIBRATION IN RANGEABILITY (10:1) 2.27

CHAPTER 3 - OPERATION 3.1
OPERATION OF THE REMOTE SEAL SENSOR 3.1
OPERATION START UP 3.1
CALIBRATION 3.1
OUTPUT SIGNAL TEST AND SETTING 3.1
RANGE BEGINNING CHANGE 3.2
SPAN CHANGE ON DIFFERENTIAL AND FLOW PRESSURE TRANSMITTERS 3.2
LEVEL TRANSMITTER SPAN CHANGE 3.3
CAPILLARIES FILLING FLUID EFFECT 3.3

CHAPTER 4 - MAINTENANCE 4.1
REMOTE SEAL CLEANING 4.1
DISASSEMBLING AND PACKING THE REMOTE SEAL TRANSMITTER 4.1
COMPONENT REPLACEMENT 4.1
RETURN OF MATERIALS 4.1
REMOTE SEAL SPARE PARTS 4.2

CHAPTER 5 - EXAMPLES 5.1
EXAMPLE 1 .... 5.1
ERROR CALCULATION BY TEMPERATURE 5.3
CALCULATION OF SEAL/LEVEL ERROR 5.5
CALCULATION OF THE TRANSMITTER ACCURACY WITH SEAL/LEVEL 5.6
CALCULATION OF THE GLOBAL ERROR OF TRANSMITTER ASSEMBLING WITH SEALS/LEVEL 5.6
CALCULATION OF THE RESPONSE TIME 5.7
CHECKING THE CAPILLARY LENGTH 5.7

EXAMPLE 2 ....5.9
ERROR CALCULATION BY TEMPERATURE 5.11
CALCULATION OF SEAL/LEVEL ERROR 5.11
CALCULATION OF THE TRANSMITTER ACCURACY WITH SEAL/LEVEL 5.12
CALCULATION OF THE GLOBAL ERROR OF TRANSMITTER ASSEMBLING WITH SEALS/LEVEL 5.12
CALCULATION OF THE RESPONSE TIME 5.12
CHECKING THE CAPILLARY LENGTH 5.13

CHAPTER 6 - TYPE OF SEAL AND ORDERING CODE 6.1

“T” TYPE FLANGED REMOTE SEAL - SR301T 6.1
DESCRIPTION 6.1
FLANGED REMOTE SEAL WITH EXTENSION - SR301E 6.2
DESCRIPTION 6.2
THREADED REMOTE SEAL – SR301R 6.4
DESCRIPTION 6.4
SANITARY REMOTE SEAL – SR301S 6.6
DESCRIPTION 6.6
PANCAKE REMOTE SEAL - SR301P 6.7
DESCRIPTION 6.7
PANCAKE REMOTE SEAL WITH EXTENSION - SR301Q 6.9
DESCRIPTION 6.9
LEVEL TRANSMITTER – LD300L 6.11
DESCRIPTION 6.11
SANITARY DIFFERENTIAL PRESSURE TRANSMITTER – LD300S 6.14
DESCRIPTION 6.14
TECHNICAL DATA 6.17
DIAPHRAGM HYDROGEN MIGRATION 6.20
STEPS TO FACILITATE THE MIGRATION 6.20
FORM TO INHIBIT THE HYDROGEN MIGRATION 6.20
GOLD PLATED STAINLESS STEEL DIAPHRAGM 6.20
RESISTANCE TO DIAPHRAGM HYDROGEN MIGRATION 6.20
SMAR INSULATOR KIT 6.21
SMAR INSULATOR KIT MOUNTING 6.21
APPLICATION WITH HALAR FOR SEALS AND LEVELS 6.22
TECHNICAL SPECIFICATION 6.22
PERFORMANCE SPECIFICATION 6.22
TPE – TOTAL PROBABLE ERROR (SOFTWARE) 6.23
DIMENSIONS 6.24
SR301T (RF/FF/RTJ) - “T” TYPE FLANGED REMOTE SEAL AND SR301E (RF/FF/RTJ) - FLANGED REMOTE SEAL WITH EXTENSION 6.24
SR301T (RF/FF/RTJ) - “T” TYPE FLANGED REMOTE SEAL AND SR301E (RF/FF/RTJ) - FLANGED REMOTE SEAL WITH EXTENSION 6.26
SR301R – THREADED REMOTE SEAL 6.27
SR301P – PANCAKE REMOTE SEAL WITHOUT EXTENSION AND SR301Q – PANCAKE REMOTE SEAL WITH EXTENSION 6.28
LOWER HOUSING 6.29
LD300L (RF/FF/RTJ) – LEVEL TRANSMITTER 6.30
LD300L (RF/FF/RTJ) – LEVEL TRANSMITTER 6.31
LD300S – SANITARY TRANSMITTER WITH EXTENSION 6.32
LD300S – SANITARY TRANSMITTER WITHOUT EXTENSION 6.33
SR301S – SANITARY REMOTE SEAL WITH EXTENSION 6.34
SR301S – SANITARY REMOTE SEAL WITHOUT EXTENSION 6.35

APPENDIX A – SERVICE REQUEST FORM A.1

APPENDIX B – SMAR WARRANTY CERTIFICATE B.1

Chapter 1

INSTALLATION

Application

The SMAR Remote Seals must be used when:

- ✓ The process fluid is corrosive and the transmitter must be protected from this;
- ✓ The process fluid contains solids in suspension or is viscous enough to block the transmitter connections;
- ✓ The process fluid may freeze, crystallize or solidify inside the transmitter;
- ✓ It is necessary to maintain aseptic or sanitary conditions, as well as cleaning ease; and
- ✓ The process temperature is higher than 100°C.

The LD301 transmitter series manufactured by SMAR and used with remote seal keeps the characteristics of the insulated transmitters, such as external zero and span adjustments or via programmer, facilitating the device installation, functioning and maintenance.

General Recommendations for Remote Seal Use

The seals require a special construction for pressure below atmosphere (vacuum). Therefore, Data-Sheet must inform when they will be used in this condition.

The temperature variation may cause unacceptable errors in transmitter reading. To minimize this effect, see the necessary recommendations in Chapter 2 - "Temperature Error Presented by Seal".

For applications in corrosive environments, select materials compatible for contact with the process fluid. However, also consider materials not in contact with the process but subject to corrosive atmospheres or the spatter of fluids from the corrosion process.

The capillary length, the diaphragm sensitivity and the characteristics of the fill fluid (the coefficient of thermic expansion and the density) present error in the measurement making impracticable the application of the remote seal for ranges below to 0-625 mmH2O.

Should it be possible to empty the fill fluid due to puncture of the insulator diaphragm, verifies if its volume (less than 5 ml) may contaminate the process of inadmissible form. If this happen requests a seal with fill fluid compatible with the process.

Choose the fill fluid that does not evaporate at the pressure and process temperature conditions.

Type of Remote Seal

The types of remote seal, as well as the dimensions available are presented in the Chapter 6 of this Manual - "Type of Seal and Ordering Code".

Receiving and Handling

- Verify if the plate data are according to the order;
- The transmitter and the remote seal, with its respective capillary, must be in the package until installation to prevent possible damages;
- The set must not be handled by the capillary;
- The sealed bolts must not be handled. If this is done, the remote seal can be permanently damaged and lose the manufacturer's warranty.

Mounting of Transmitter with Remote Seal

In the Transmitter Manual see the suggested mounting positions. The Transmitter and the Remote Seal can be mounted according to the Figure 2.1 of Chapter 2 of this Manual.

The Remote Seals must be installed so that the process fluid wets all its surface. Installations that can provoke the deposition of any incrustation on the diaphragm must be avoided.

Choose a place free from mechanical shocks (seal and transmitter) that facilitates access to the measuring points. The ambient temperature must be within the limits allowed by the Transmitter Manual.

Use a valve in the process connection, before the seal, as this facilitates the transmitter calibration and the seal maintenance.

The maximum upper or lower height allowed for the transmitter on the remote seal, depends on the density of the seal fill fluid and the pressure on it. If this height is exceeded it may cause saturation in the transmitter due to difference of the hydrostatic columns in both sides.

The correct heights of the transmitter, in relation to the seal, are shown in Table 2.3 of Chapter 2 of this Manual.

The capillaries must be held firm to avoid oscillations in the reading.

Choose an installation site lowly sensitive to temperature variation or, instead, keep the temperature equal in both sides of the seal.

The minimum radius of the capillary bending is 70mm. In order to prevent damages, avoid twisting and folding the capillary.

The connections for the lower "L" side and higher "H" side are indicated in the transmitter by letters "L" and "H".

In the seals horizontally mounted, the gasket must be centralized and not be in contact with the diaphragm. Hold the set in the counterflange by applying equal torques in the bolts.

ATTENTION
In hot environment, the transmitter and the seals must be installed in a way to prevent the exposition to the sun, as much as possible. Also avoid the installation closed with lines and vases subject to high temperatures. The use of sun protector or heat shield to protect both devices from external heat source is recommended. The temperature increase, due to direct exposition to the sun, can cause a zero deviation, mainly if one of the sides will be exposed. The seal, due to its metal construction, can have an increase of 60ºC in the temperature when exposed to the sun. For example, a transmitter with a remote seal of 2", calibrated in 1000 mmH2O, with capillary of 1m, exposed to 20ºC of variation will have an error of 49 mmH20 (4.9%). Check Chapter 2 for more information about temperature effect.

Chapter 2

SELECTION

Procedure for Remote Seal Specification

Tables 2.1 and 2.2 show, respectively, the steps that must be followed for the ideal Remote Seal specification and the recommendations to improve its performance.

STEP	PROCEDURE	PAGE
1	Type of assembly and calculation of the transmitter range	2.2
	Transmitter Range	2.3
	Diaphragm Material according to chemical compatibility of the process	2.4
	Filling Fluid	2.4
2	Maximum Seal temperature variation in relation to calibration temperature	2.8
	Maximum capillary temperature variation in relation to calibration temperature	
	Maximum body temperature variation in relation to calibration temperature	
	Maximum and Minimum process pressure	-
	Type of Seal according to process connection	2.9
	Capillary Length	2.8
3	To inform about the error and accuracy of the pressure transmitter	-
4	Calculate temperature error	2.7
5	Transmitter Assembly Accuracy with the Remote Seal / Level	2.12
6	Transmitter Global Error with the Remote Seal / Level	2.13
7	Calculate the Response Time	2.14
8	Verify the Capillary Length	2.16
9	Use the guidelines shown in Table 2.2. Make changes possible in order to improve performance	2.1

Table 2.1 – Steps for Remote Seal Selection

OBJECTIVE / ACTION	Reduce the Error due to Temperature	Reduce the Response Time	Improve the Accuracy
Choose the oil with lesser coefficient of volumetric expansion (see Table 2.5)	☺	😐	😐
Choose the oil with lesser viscosity (see Table 2.5)	😐	☺	😐
Increase the seal diaphragm diameter	☺	😐	😐
Decrease the capillary length	☺	☺	😐
Specify the equal capillary lengths of both sides	☺	☹	😐
Install the equipment preferably where lesser variation of temperature occurs	☺	😐	😐
Choose the transmitter in the upper limit of the range (1:1)	😐	😐	☺

Table 2.2 – Recomendations to Improve the Remote Seal Performance

Legend: ☺ - Positive Action / 😐 - Neutral Action / ☹ - Negative Action

Choosing the Ideal Assembly for Application

Figure 2.1 shows the most common types of remote seal assembly and its applications.

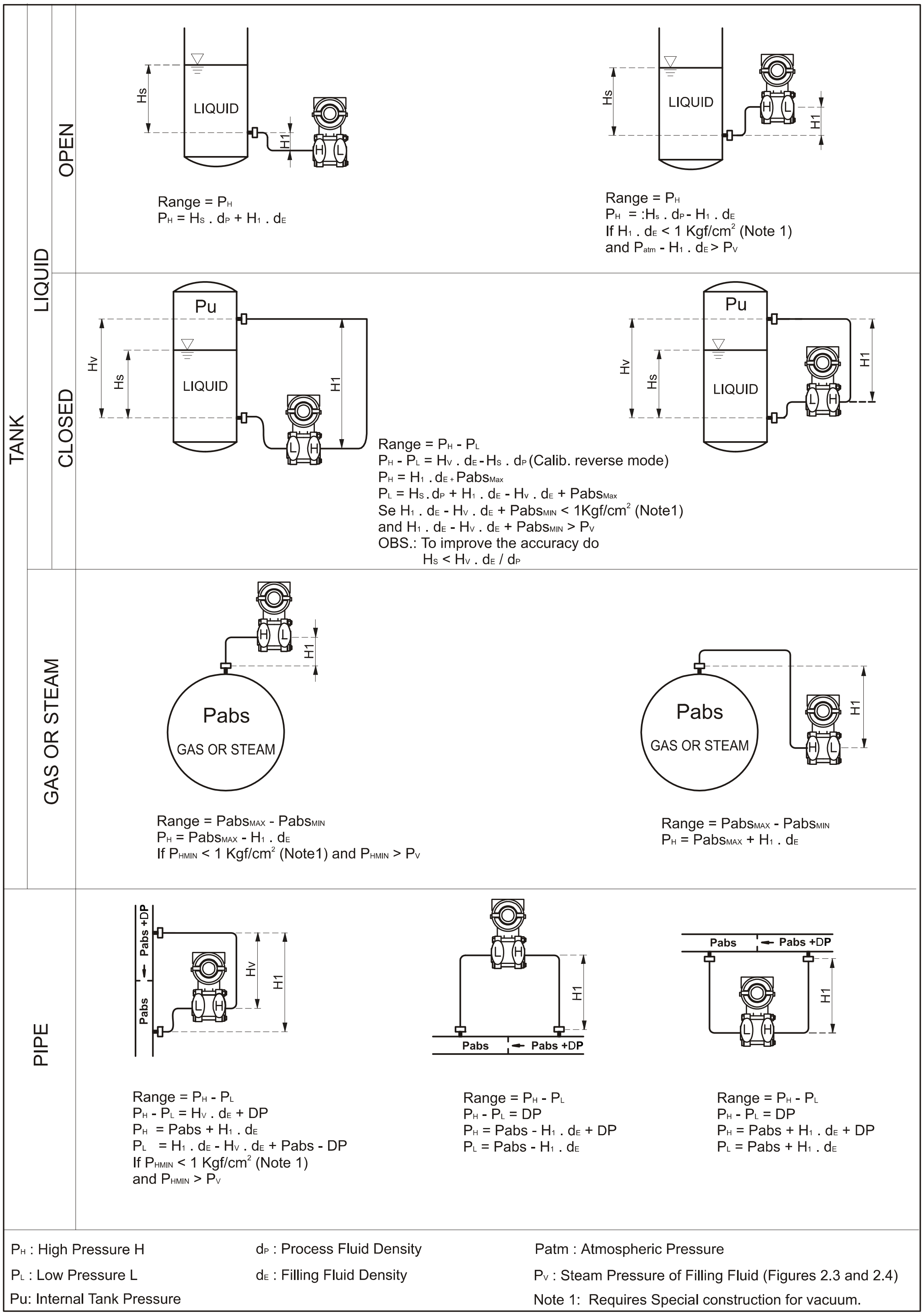


Figure 2.1 – Types of Remote Seal Assembly and Applications

Transmitters Range for Remote Seal Application

Verify in Table 2.3 the transmitter range, the pressure and overpressure limit and the applicable static pressure.

After calculating the ranges according to the type of installation, always try to work with the upper limits of each transmitter range to achieve the best equipment accuracy.

TRANSMITTER	LIMITS	TRANSMITTER RANGE (-URL TO URL) (1)				
		Range 2	Range 3	Range 4	Range 5	Range 6
LD30XD	Pressure	-50 to 50 kPa	-250 to 250 kPa	-2500 to 2500 kPa	----	----
	Overpressure and Static Pressure	160 bar	160 bar	160 bar	----	----
LD30XH	Pressure	-50 to 50 kPa	-250 to 250 kPa	-2500 to 2500 kPa	-25 to 25 MPa	----
	Overpressure and Static Pressure	320 bar	320 bar	320 bar	320 bar	----
LD30XM	Pressure	-50 to 50 kPa	-100 to 250 kPa	-100 to 2500 kPa	-0.1 to 25 MPa	-0.1 to 40 MPa
	Overpressure and Static Pressure	160 bar	160 bar	160 bar	400 bar	520 bar
LD30XA	Pressure	0 to 50 kPa	0 to 250 kPa	0 to 2500 kPa	0 to 25 MPa	0 to 40 MPa
	Overpressure and Static Pressure	160 bar	160 bar	160 bar	320 bar	520 bar
LD30XL / LD30XS	Pressure	-50 to 50 kPa	-250 to 250 kPa	-2500 to 2500 kPa	-25 to 25 MPa	----
	Overpressure and Static Pressure	(2)	(2)	(2)	(2)	----

(1) The calibration maximum limit of the remote seal or level/sanitary transmitter should be smallest value between the connection/flange pressure limit (Tables 1 to 6, chapter 6) and the upper range limit of the transmitter (URL).
(2) According to flange/connection pressure limit. See Tables 1, 2, 3, 5 and 6 – Chapter 6.

Table 2.3 – Transmitter Pressure Range, Overpressure Limits and Static Pressure

Where:
LD30XD: Differential Pressure Transmitter (Family 301, 302 and 303)
LD30XH: Differential Pressure Transmitter – High Static Pressure (Family 301, 302 and 303)
LD30XM: Gage Pressure Transmitter (Family 301, 302 and 303)
LD30XA: Absolute Pressure Transmitter (Family 301, 302 and 303)
LD30XL: Level Transmitter (Family 301, 302 and 303)
LD30XS: Sanitary Transmitter (Family 301, 302 and 303)

For more information, consult SMAR Pressure Transmitters Catalogs and Manuals.

NOTE
The overpressure shown in Table 2.3 above, does not damage the transmitter, although it will be necessary to recalibrate the transmitter.

Figure 2.2 below shows the Transmitter Operation Range, where the work range can be located in many positions within range.

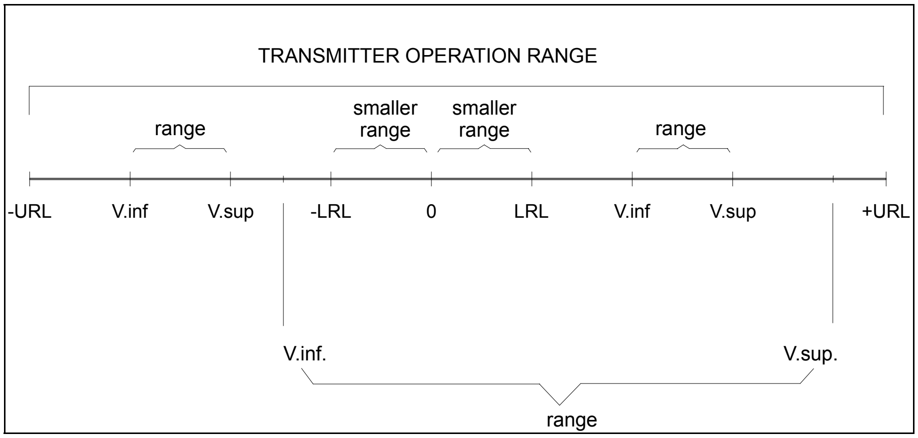


Figure 2.2 –Transmitter Operation Range

Where:
URL –Transmitter Range Upper Limit
LRL –Transmitter Range Lower Limit
V. sup. –Work Range Upper Value
V. inf – Work Range Lower Value

Diaphragm Material

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

For more information about materials corrosion, consult the Smar's Application Engineer.

Filling Fluids

Filling fluids must be selected considering its physical properties at extreme conditions of temperature, pressure, chemical compatibility with the process fluid and its contamination in a unacceptable way.

Table 2.4 shows the filling fluids used by Smar with some physical properties and types of application. On Figures 2.3 and 2.4 the Steam Pressure curves (mmHg) are shown against the Temperature (℃) of these fluids.

Fluid	Limit of ℃ Temperature (℉) to Pabs < 1 atm (Vacuum) (3)	Limit of ℃ Temperature (℉) to Pabs > 1 atm	Viscosity (cSt) at 25℃	Density (g/cm3) at 25℃	Volumetric Expansion Coefficient 1/ºC (1/ºF)	Types of Application
Sillicone DC200	-40 to 100 (-40 to 212) (3)	-40 to 170 (-40 to 338)	20	0.950	0.001070 (0.000594)	General (Atoxicity, not irritating, odorless, Food Processing)
Sillicone DC704	0 to 200 (+32 to 392) (3)	0 to 315 (+32 to 599)	39	1.070	0.000950 (0.000528)	General (High Temperatures and Vacuum)
Fluorolube MO-10	N.A. (2)	-20 to 100 (-4 to 212)	50	1.910	0.000874 (0.000486)	Oxygen, Chlorine, Nitric Acid
Syltherm 800	N.A. (2)	-40 to 350 (-40 to 662)	10	0.934	0.001500 (0.000833)	General (High Temperatures)
Neobee M20 (1)	-15 to 120 (+5 to 248) (3)	-15 to 225 (+5 to 437)	9.5	0.920	0.001008 (0.000560)	Foods, Beverage and Pharmaceuticals
Glycerin (50%) and Water (50%)	N.A. (2)	-15 to 93 (+5 to 199.4)	12.5	1.130	0.000500 (0.000280)	Foods
Fomblim	-20 to 100 (-4 to 212) (3)	-20 to 200 (-4 to 392)	48	1.87	0.000900 (0.000500)	Low toxicity, excellent compatibility with metals, plastics and elastomers, excellent performance in high vacuum
Krytox	-40 to 100 (-40 to 212) (3)	-40 to 120 (-40 to 248)	42	1.88	0.000900 (0.000500)	Inert, nontoxic, biologically inert, nonexplosive, nonreactive to all elastomers, plastics and metals, excellent performance in high vacuum
Halocarbon	-45 to 80 (-49 to 176) (3)	-45 to 130 (-49 to 266)	5.6	1.85	0.001199 (0.000667)	Inert, low odor, low toxicity, noncorrosive. Standard for manufacturers of oxygen and reactive liquids

Table 2.4 – Filling Fluid Characteristics

Legend: (1) Propylene Glycol Diester of Octanoato / Decanoato; (2) N.A. – Nonapplicable; (3) Consult graphs in the Figures 2.3 and 2.4 below when the vacuum pressure is known.

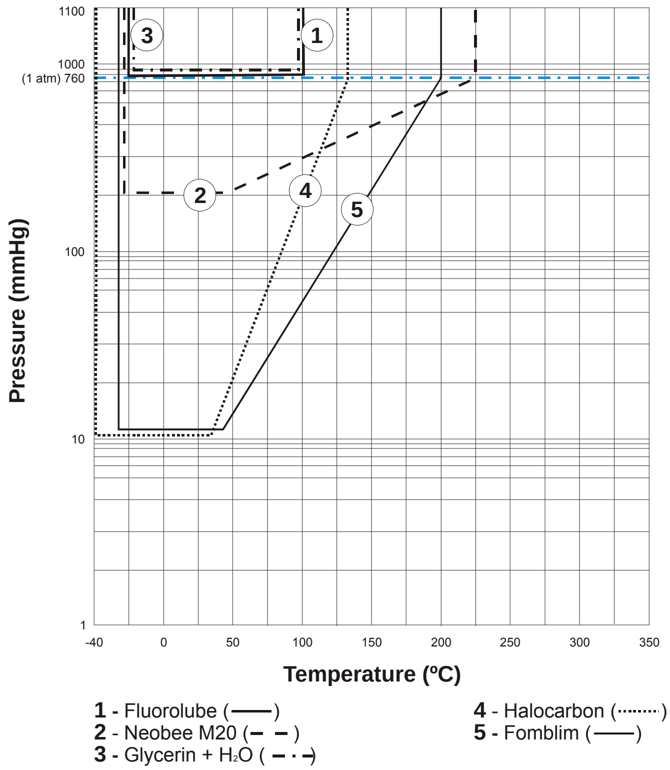


Figure 2.3 – Pressure x Temperature Curve (1)

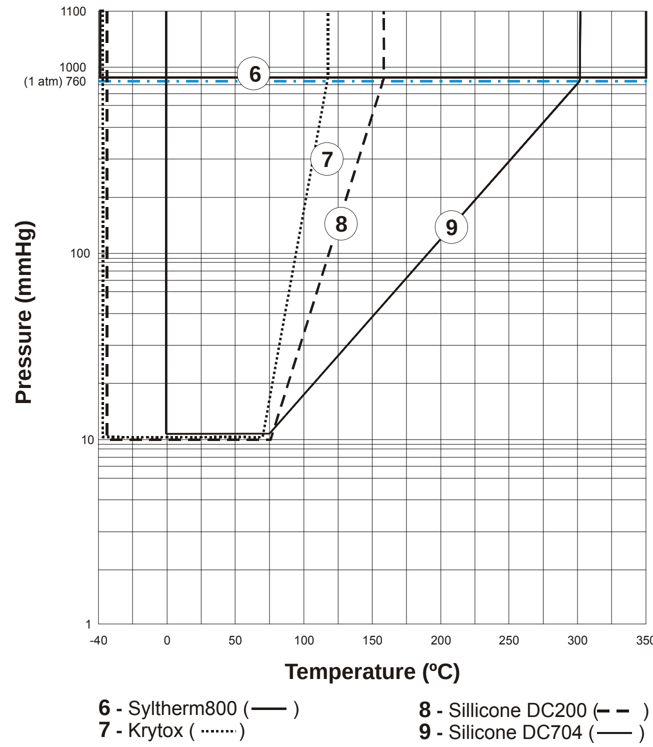


Figure 2.4 – Pressure x Temperature Curve (2)

Temperature Error Presented by Seal

With the variation of ambient or process temperature, the filling fluid, which fills the internal cavity of the remote seal and capillaries, its volume also varies. The volume variation provokes a displacement of the seal diaphragm. To absorb this volume variation, the diaphragm, due to its characteristic of rigidity, reacts with a change in pressure that it exerts on the filling fluid. This change causes a deviation in relation to the process pressure, which is the error caused by the temperature variation.

This error can be minimized if some important cautions are taken when choosing the remote seal model, the capillary length and the conditions of temperature and process ambient.

The seal model also counts, as the bigger is the diaphragm diameter of the remote seal, the less rigidity it presents, achieving more absorbing capability of volume variations without causing too many errors in the transmitter.

The capillary length has a direct effect, namely, the longer its length, the greater the volume of the filling fluid, causing higher volume variation with the temperature.

The influence of the temperature conditions can be reduced through the installation of the seal in places less susceptible to it. If possible choose a transmitter with identical seals in the two sides of the pressure plug, and that possess similar conditions of temperature variation and length, so that the two sides suffer the same temperature conditions. Thus the errors tend to minimize.

With basis on these information, it was developed a process of simplified calculation that takes into account the internal volumes of the remote seal, the capillary lengths, the rigidity of the sensing diaphragms and the coefficient of volume expansion of the filling fluid, thus supplying the approximate error calculation caused by the temperature variation.

Calculation of Temperature Errors

Remote seal temperature errors are due to the volume variation of the filling fluid in the transmitter body, extension, capillary and remote seal. Following, the necessary information for the error calculation are described.

Equations

To obtain a volume variation for each leg of the remote seal, the temperature variation in the seal, in the capillary and in the transmitter body must be known and then insert the value in the equations below.

$$\Delta T_{seal} = T_{seal} - Tref \quad (2.1)$$

$$\Delta T_{cap} = T_{cap} - Tref \quad (2.2)$$

$$\Delta T_{body} = T_{body} - Tref \quad (2.3)$$

$$\Delta V_{rdf} = V_{rdf} . \Delta T_{seal} . \gamma_{oil} \quad (2.4)$$

$$\Delta V_{ext} = (0.012 + 0.9 \cdot L_{ext}) . \Delta T_{seal} \cdot \gamma_{oil} \quad (2.5)$$

$$\Delta V_{cap} = (0.9 \cdot L_{cap}) . \Delta T_{cap} \cdot \gamma_{oil} \quad (2.6)*$$

$$\Delta V_{body} = (1.154) . \Delta T_{body} \cdot \gamma_{oil} \quad (2.7)$$

$$\Delta V_{Total} = \Delta V_{rdf} + \Delta V_{ext} + \Delta V_{cap} + \Delta V_{body} \quad (2.8)$$

$$V_{Total} = \Delta V_{total} \text{ , (diaphragm initial volume is zero)} \quad (2.9)$$

$$Error = Error\ (Graphic) . Fm \quad (2.10)$$

$$Error\ \% = \frac{Error}{Calibrated\ Span} \cdot 100 \quad (2.11)$$

Where:

ΔT_{seal} : Variation in the seal temperature in relation to the calibration temperature (°C)
ΔT_{cap} : Variation in the capillary temperature in relation to the calibration temperature (°C)
ΔT_{body} : Variation in the body temperature in relation to the calibration temperature (°C)
T_{seal} : Seal Temperature (°C)
T_{cap} : Capillary temperature (°C)
T_{body} : Transmitter body temperature (ºC)
T_{ref} : Reference Temperature equal to 25°C
V_{rdf} : Volume of the diaphragm reservoir (cm^3)
ΔV_{rdf}: Variation in the reservoir volume (cm^3)
ΔV_{ext}: Variation in the extension volume (cm^3)
ΔV_{cap}: Variation in the capillary volume (cm^3)
ΔV_{body}: Variation in the body volume (cm^3)
ΔV_{total}: Volume variation in the capillary, extension and seal set (cm^3)
V_{total}: Total diaphragm volume after contraction or expansion effect
γoil: Volume expansion coefficient of the oil presented in the Table 2.5 (1/ ºC)
L_{cap}: Capillary length (meters). For the LD30XL consider L = 0.5m
L_{ext}: Extension length (meters)
Error: Error (mmH_2O @ 4 ºC)
Error(Graphic): Error Removed from Figures 2.6, 2.7 and 2.8 in terms of the V_{total}, for diaphragm of 0.05 mm, 0.075 mm and 0.1mm respectively.
Error%: Error Percentage relative to Transmitter Calibration

Calibrated Span: Transmitter Calibration (mmH_2O @ 4 ºC)
Fm: Diaphragm Material Factor
*****Only for capillary standard diameter (≈1.0 mm)

ATTENTION
The temperature of reference for adjustment is 25 ^{o}C. The Errors in terms of the temperature occur with the deviation of the temperature beyond 25 °C.

Determination of the Seal/Level Error for High (H) or Low (L) Sides

a) Upper Variation of Temperature

In this case adopt the temperature variation above zero line.

b) Lower Variation of Temperature

In this case adopt the temperature variation below zero line.

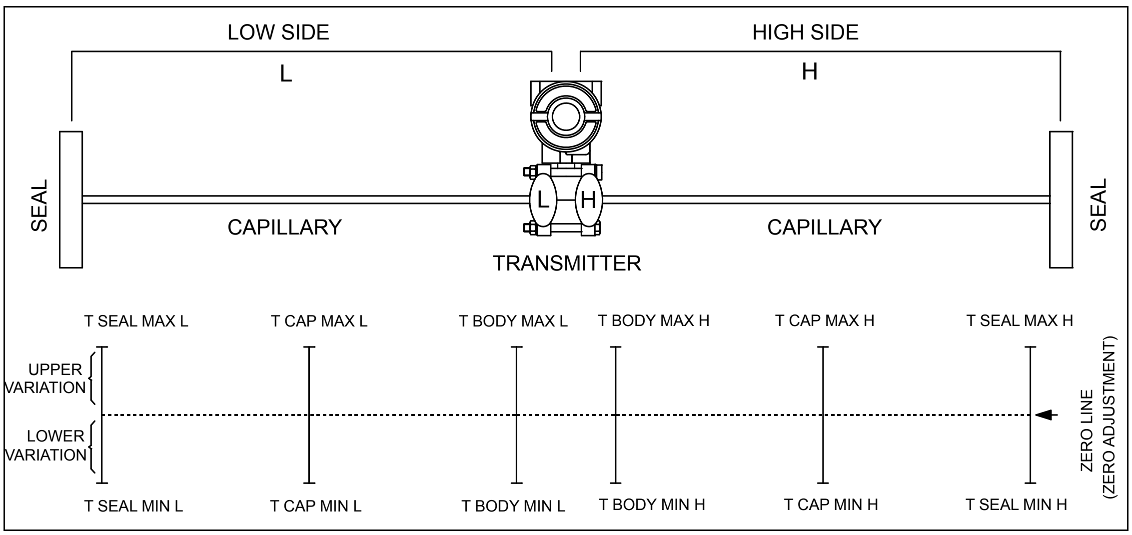


Figure 2.5 – Transmitter/Seal Set Temperatures

Where:
T seal max H: Maximum Temperature on the seal high Side (ºC)
T seal min H: Minimum Temperature on the seal high Side (ºC)
T cap max H: Maximum Temperature on the capillary high Side (ºC)
T cap min H: Minimum Temperature on the capillary high Side (ºC)
T body max H: Maximum Temperature on the body high Side (ºC)
T body min H: Minimum Temperature on the body high Side (ºC)
T seal max L: Maximum Temperature on the seal low Side (ºC)
T seal min L: Minimum Temperature on the seal low Side (ºC)
T cap max L: Maximum Temperature on the capillary low Side (ºC)
T cap min L: Minimum Temperature on the capillary low Side (ºC)
T body max L: Maximum Temperature on the body low Side (ºC)
T body min L: Minimum Temperature on the body low Side (ºC)

Error for Two Seals Influenced by Temperature Symmetry

If the transmitter has a remote seal, the error is directly obtained using Figures 2.6, 2.7 and 2.8. In case the transmitter has two remote seals, it will be necessary to know the thermal symmetry in the seals.

We can say that a Set of Seals/Level and Transmitter has thermal symmetry when the temperatures applied on the High side (H) are equal to the temperatures applied on the Low side (L). When they are different there is a Thermal Asymmetry.

After determining the thermal symmetry, the error for each one of the seals must be found independently (see Figures 2.6, 2.7 and 2.8). Then, substitute these values in equations 2.12 or 2.13.

Thermal Symmetry: $$Es = \sqrt{(E_H)^2 + (E_L)^2} \times \left(\frac{1}{\sqrt{6}} \right) \quad (2.12)$$

Thermal Asymmetry: $$Es = \sqrt{(E_H)^2 + (E_L)^2} \quad (2.13)$$

Where:

Es : Total error of both remote seals due to temperature variation (mmH2O @ 4ºC)

E_L : Error on the remote seal L side (mmH_2O @ 4ºC)

E_H : Error on the remote seal H side (mmH_2O @ 4ºC)

ATTENTION
The effects caused by geometric variations, as the increase of the capillary length or diameter are considered in the calculations of diaphragm errors in terms of the diaphragm families. Therefore, when calculating the errors of the High or Low sides, the differences between capillaries diameters and length are already taken into account.

Table 2.5 below shows the diaphragm family in terms of the transmitter/seal model.

Model / Diaphragm Family	LD301L (WITHOUT /EXT)	LD301L (WITH/ EXT)	SR301T	SR301E	LD/SR 301 S (WITHOUT/ EXT)	LD/SR 301 S (WITH/ EXT)	SR301 R	SR301P	SR301Q
0	—	—	1" DN25	—	1.1/2" (SMS;RJT *;IDF *;TC)	DN25	—	—	—
1	—	1.1/2" DN40	—	1.1/2" DN40	—	DN40 DN50 2" (SMS;RJT;IDF;TC) 1.1/2" (SMS;RJT;IDF;TC) *	—	—	1.1/2" DN40
2	—	2" DN50	—	2" DN50	DN40 DN50 2" (SMS;RJT;IDF; TC)	—	—	—	2" DN50
3	1.1/2" DN40	—	1.1/2" DN40	—	—	—	—	1.1/2" DN40	—
4	2" DN50	—	2" DN50	—	—	—	2500 PSI	2" DN50	—
5	—	2 1/2" (Special)	—	2 ½" (Special)	—	—	—	—	—
6	—	—	—	—	—	DN 80 3" (SMS;RJT;IDF;TC)	—	—	—
7	3" DN80	3" DN80	3" DN80	3" DN80	DN 80 3" (SMS *;RJT *;IDF *;TC)	—	—	3" DN80	3" DN80
8	4" DN100	4" DN100	4" DN100	4" DN100	—	—	—	4" DN100	4" DN100

* Projects in process.

Legend: SR301T – "T" Type Flanged; SR301R – Threaded; SR301S – Sanitary; SR301E – Flanged with Extension; SR301P – Pancake; SR301Q – Pancake with Extension; LD301L – LD Level; LD301S – Sanitary;.

Table 2.5 – Diaphragm Family

The Table 2.6 below shows the value of the diaphragm reservoir volume (Vrdf) for each family.

Diaphragm Family	Vrdf (x 10^{-2} cm^3)
0	18.1
1	20.4
2	24.8
3	29.2
4	38.4
5	47.7
6	82.8
7	105.6
8	274.2

Table 2.6 – Diaphragm Volume

The Table 2.7 below shows the value of the material factor (Fm) in function of the diaphragm material.

Diaphragm Material	Fm
316/316L SST	1.00
Hastelloy	1.08
Monel	0.96
Tantalum	0.99
Titanium	0.56
304/304L SST	1.00
Duplex	1.01
Super Duplex	1.05

Table 2.7 – Materials Factor

The Table 2.8 below shows the crescent classification (better to worst) of the diaphragms in relation to performance and mechanical resistance.

Diaphragm Material	Performance	Mechanical Resistance
316L SST	4	6
Hastelloy	7	4
Monel	2	5
Tantalum	3	7
Titanium	1	2
304L SST	4	8
Duplex	5	3
Super Duplex	6	1

Table 2.8 – Comparative

The Figure 2.6 shows the error of the remote seal in terms of the diaphragm total volume (V_{total}) for diaphragms of 0.05mm thick in 25°C.

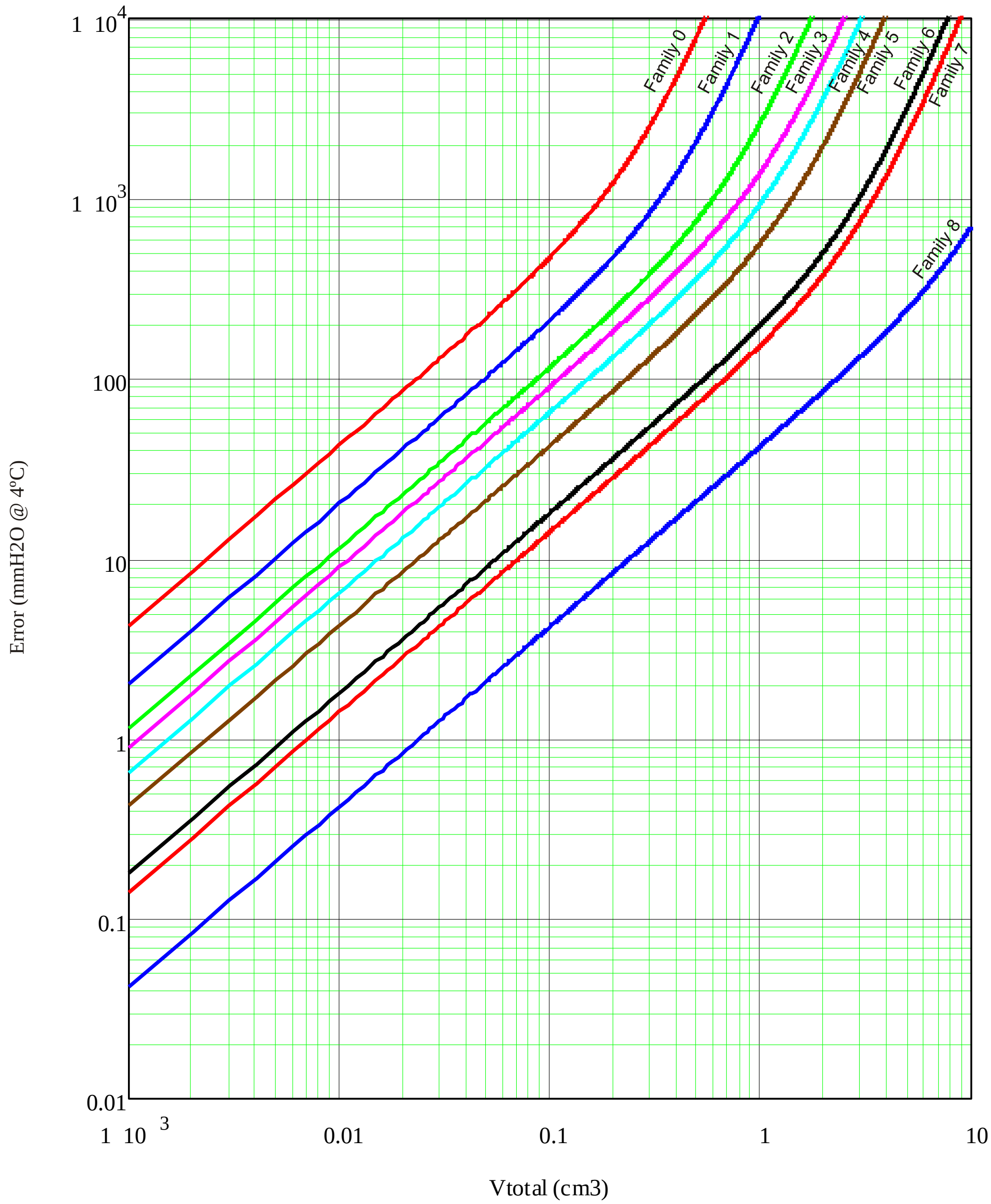


Figure 2.6 – Error for Diaphragms with 0.05mm thickness

The Figure 2.7 shows an error of the remote seal in terms of the diaphragm total volume (V_{total}) for diaphragms of 0.075mm thick in 25°C.

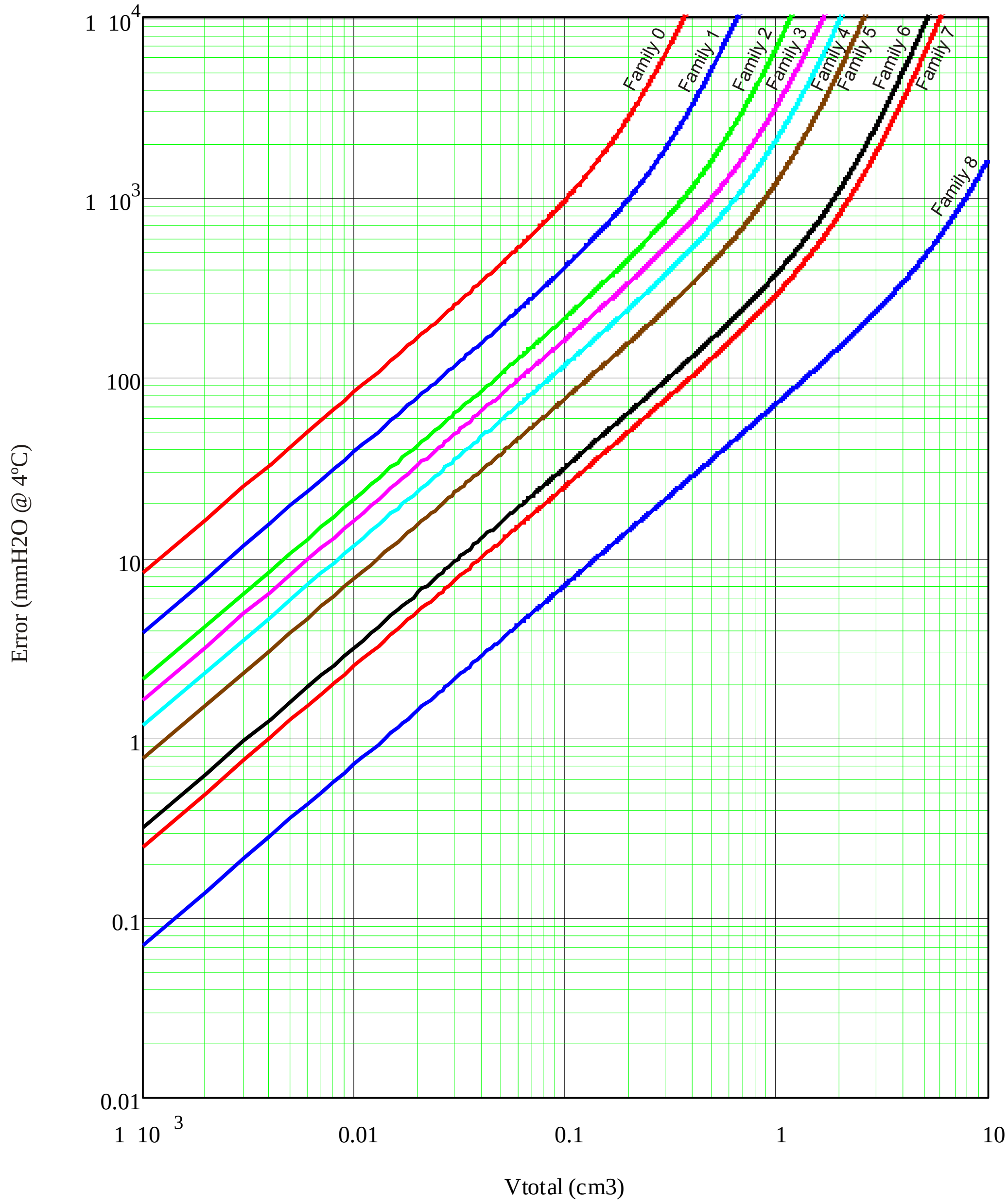


Figure 2.7 – Error for Diaphragms with 0.075mm thickness

The Figure 2.8 shows an error of the remote seal in terms of the diaphragm total volume (V_{total}) for diaphragms of 0.1mm thick in 25°C

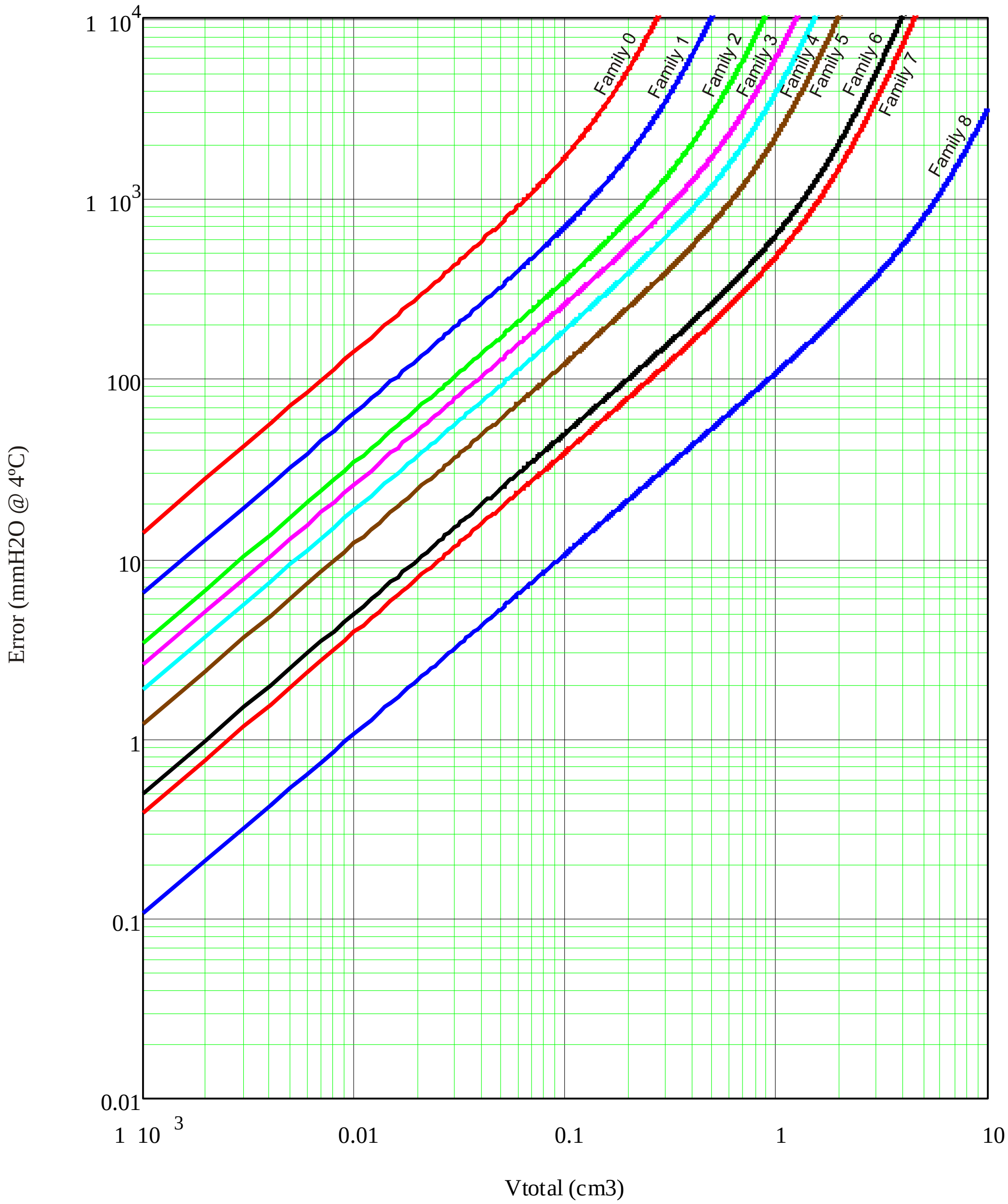


Figure 2.8 – Error for Diaphragms with 0.1mm thickness

Assembly Accuracy

The transmitter accuracy is not significantly modified by the addition of seals/level. However, the error of resulting measurement of the combination significantly increases due to geometric and physical parameters in terms of the temperature variation.

Total Probable Assembly Error

The Total Probable Error (TPE) of the transmitter and seal/level assembly is a measure that involves all the probable error sources in this measurement, such as: transmitter accuracy, ambient temperature, static pressure, vibration and changes in the transmitter power supply.

To know the TPE of the transmitter and remote seal assembly, use the method of the square root addition for each error as shown in equation 2.14:

$$ETP = \sqrt{(E_S)^2 + (E_T)^2} \quad (2.14)$$

ETP : Total Probable Error of the transmitter and remote seal assembly (mmH_2O)

E_S : Total Error of both remote seals due to temperature variation (mmH_2O)

E_T : Pressure Transmitter Error (mmH_2O) – See the Transmitter Manual

Remote Seal Response Time

The response time of a measurement system having a remote seal with capillary and a transmitter is defined as the time the transmitter pressure takes to read 63% of the pressure variation value applied on a 10% to 90% range of the measured pressure, as in Figure 2.9.

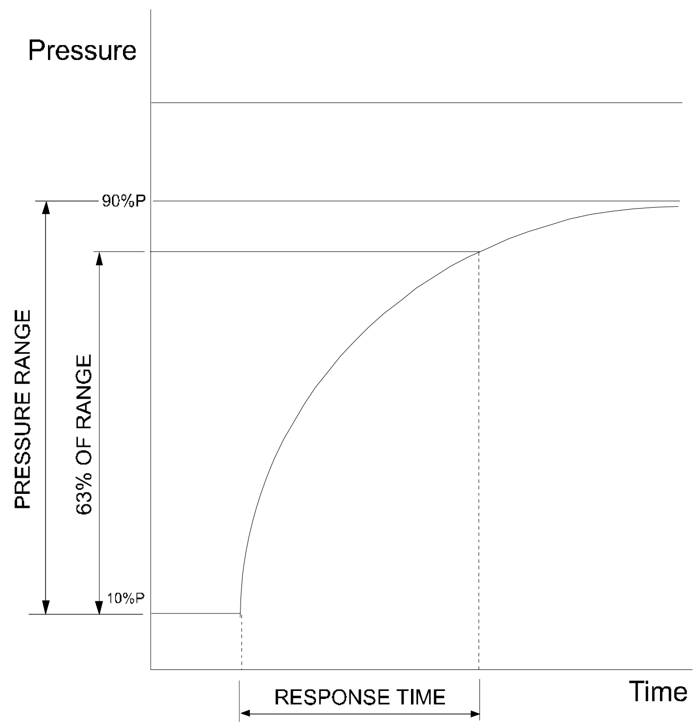


Figure 2.9 – Response Time

The response time is the result of the resistance of the oil displacement in the capillary, so that, the bigger the capillary and the oil viscosity are, the longer will be the response time. The transmitter range influences the response time due to the rigidity of the sensor diaphragm, so that the wider the range, the quickest the response time.

The response time is also influenced by the viscosity of the filling fluid, which varies with the temperature. The higher the temperature, the lesser the viscosity of the filling fluid, which, consequently, reduces the response time.

Calculation of Remote Seal Response Time

The response time is obtained through the equation 2.15, below:

$$TR_S = TR_{listed} \cdot L \tag{2.15}$$

Where:

TR_S : Remote seal response time (seconds)

TR_{listed} : Response Time through the capillary length (seconds/meters) – See Table 2.10

L : Capillaty length (meters)

NOTE
The values obtained for the seal response time do not consider the response time of the transmitter. Therefore, the response time of the seal and transmitter set will be the addition of both.

NOTE
Capillary lengths whose difference of response time between H and L sides exceeds 0.5s must be avoided. This measure prevents wrong measurements.

TRANSMITTER RANGE	CAPILLARY TEMPERATUR E(°C)	Response Time in seconds/meter of capillary (s/m)[6]								
		DC 200	DC 704	FLUOROLUBE	SYLTHERM 800	NEOBEE M20	Glycerin 50% + Water 50%	FOMBLIM	KYTROX	HALOCARBOM
2	100[4]	2.69E-01	3.99E-01	1.72E-01	1.09E-01	5.59E-02	2.16E-02	2.66E-01	3.08E-01	8.37E-02
	75	3.38E-01	5.75E-01	2.84E-01	1.52E-01	8.89E-02	4.32E-02	4.46E-01	4.83E-01	1.19E-01
	50	4.55E-01	9.29E-01	7.86E-01	2.23E-01	1.57E-01	1.19E-01	1.00E+00	9.85E-01	1.88E-01
	25	6.98E-01	1.72E+00	3.78E+00	3.47E-01	3.15E-01	5.32E-01	3.41E+00	2.90E+00	3.80E-01
	10	9.87E-01	2.69E+00	1.28E+01	4.67E-01	5.09E-01	2.01E+00	9.03E+00	6.92E+00	6.90E-01
	0	1.30E+00	3.74E+00	3.26E+01	5.77E-01	7.21E-01	6.20E+00	1.94E+01	1.37E+01	1.13E+00
	-10	1.78E+00	N.A.	9.18E+01	7.21E-01	1.04E+00	N.A.	4.62E+01	2.99E+01	1.99E+00
	-20	2.56E+00	N.A.	2.86E+02	9.12E-01	N.A.	N.A.	1.22E+02	7.19E+01	3.86E+00
	-40	6.10E+00	N.A.	N.A.	1.51E+00	N.A.	N.A.	N.A.	5.76E+02	1.98E+01
3	100[4]	5.39E-02	7.97E-02	3.45E-02	2.18E-02	1.12E-02	4.32E-03	5.32E-02	6.17E-02	1.67E-02
	75	6.75E-02	1.15E-01	5.68E-02	3.03E-02	1.78E-02	8.65E-03	8.91E-02	9.67E-02	2.38E-02
	50	9.09E-02	1.86E-01	1.57E-01	4.45E-02	3.15E-02	2.38E-02	2.01E-01	1.97E-01	3.76E-02
	25	1.40E-01	3.45E-01	7.56E-01	6.94E-02	6.30E-02	1.06E-01	6.81E-01	5.80E-01	7.60E-02
	10	1.97E-01	5.38E-01	2.56E+00	9.34E-02	1.02E-01	4.02E-01	1.81E+00	1.38E+00	1.38E-01
	0	2.60E-01	7.48E-01	6.53E+00	1.15E-01	1.44E-01	1.24E+00	3.88E+00	2.75E+00	2.25E-01
	-10	3.57E-01	N.A.	1.84E+01	1.44E-01	2.09E-01	N.A.	9.24E+00	5.98E+00	3.98E-01
	-20	5.12E-01	N.A.	5.72E+01	1.82E-01	N.A.	N.A.	2.45E+01	1.44E+01	7.73E-01
	-40	1.22E+00	N.A.	N.A.	3.03E-01	N.A.	N.A.	N.A.	1.15E+02	3.96E+00
4	100[4]	4.86E-03	7.19E-03	3.11E-03	1.97E-03	1.01E-03	3.90E-04	4.80E-03	5.56E-03	1.51E-03
	75	6.09E-03	1.04E-02	5.13E-03	2.74E-03	1.60E-03	7.80E-04	8.04E-03	8.72E-03	2.14E-03
	50	8.20E-03	1.68E-02	1.42E-02	4.02E-03	2.84E-03	2.15E-03	1.81E-02	1.78E-02	3.39E-03
	25	1.26E-02	3.11E-02	6.82E-02	6.26E-03	5.68E-03	9.60E-03	6.15E-02	5.24E-02	6.86E-03
	10	1.78E-02	4.85E-02	2.31E-01	8.42E-03	9.18E-03	3.62E-02	1.63E-01	1.25E-01	1.25E-02
	0	2.35E-02	6.75E-02	5.89E-01	1.04E-02	1.30E-02	1.12E-01	3.50E-01	2.48E-01	2.03E-02
	-10	3.22E-02	N.A.	1.66E+00	1.30E-02	1.89E-02	N.A.	8.33E-01	5.39E-01	3.59E-02
	-20	4.61E-02	N.A.	5.16E+00	1.65E-02	N.A.	N.A.	2.21E+00	1.30E+00	6.97E-02
	-40	1.10E-01	N.A.	N.A.	2.73E-02	N.A.	N.A.	N.A.	1.04E+01	3.57E-01
5	100[4]	2.11E-04	3.13E-04	1.35E-04	8.54E-05	4.38E-05	1.69E-05	2.09E-04	2.42E-04	6.56E-05
	75	2.65E-04	4.50E-04	2.23E-04	1.19E-04	6.96E-05	3.39E-05	3.49E-04	3.79E-04	9.31E-05
	50	3.56E-04	7.28E-04	6.16E-04	1.75E-04	1.23E-04	9.32E-05	7.87E-04	7.72E-04	1.47E-04
	25	5.47E-04	1.35E-03	2.96E-03	2.72E-04	2.47E-04	4.17E-04	2.67E-03	2.27E-03	2.98E-04
	10	7.74E-04	2.11E-03	1.00E-02	3.66E-04	3.99E-04	1.57E-03	7.08E-03	5.42E-03	5.41E-04
	0	1.02E-03	2.93E-03	2.56E-02	4.52E-04	5.65E-04	4.86E-03	1.52E-02	1.08E-02	8.82E-04
	-10	1.40E-03	N.A.	7.20E-02	5.65E-04	8.19E-04	N.A.	3.62E-02	2.34E-02	1.56E-03
	-20	2.00E-03	N.A.	2.24E-01	7.15E-04	N.A.	N.A.	9.59E-02	5.64E-02	3.03E-03
	-40	4.78E-03	N.A.	N.A.	1.19E-03	N.A.	N.A.	N.A.	4.52E-01	1.55E-02
6	100[4]	1.66E-04	2.46E-04	1.06E-04	6.71E-05	3.44E-05	1.33E-05	1.64E-04	1.90E-04	5.16E-05
	75	2.08E-04	3.54E-04	1.75E-04	9.34E-05	5.48E-05	2.66E-05	2.75E-04	2.98E-04	7.32E-05
	50	2.80E-04	5.73E-04	4.84E-04	1.37E-04	9.70E-05	7.33E-05	6.19E-04	6.07E-04	1.16E-04
	25	4.30E-04	1.06E-03	2.33E-03	2.14E-04	1.94E-04	3.28E-04	2.10E-03	1.79E-03	2.34E-04
	10	6.08E-04	1.66E-03	7.89E-03	2.88E-04	3.13E-04	1.24E-03	5.56E-03	4.26E-03	4.25E-04
	0	8.01E-04	2.31E-03	2.01E-02	3.56E-04	4.44E-04	3.82E-03	1.20E-02	8.46E-03	6.93E-04
	-10	1.10E-03	N.A.	5.66E-02	4.44E-04	6.44E-04	N.A.	2.85E-02	1.84E-02	1.23E-03
	-20	1.58E-03	N.A.	1.76E-01	5.62E-04	N.A.	N.A.	7.54E-02	4.43E-02	2.38E-03
	-40	3.76E-03	N.A.	N.A.	9.33E-04	N.A.	N.A.	N.A.	3.55E-01	1.22E-02

Table 2.9 – Remote Seal Response Time

Notes:

(1) The response time is defined as the time that the indication of the instrument pressure takes to show 63% of the pressure variation value applied in the 10% to 90% range of the measured pressure.
(2) If the transmitter has two capillaries add their lengths to calculate the response time.
(3) N.A: No applicable due to temperature limit.
(4) The temperature limit for (Water 50% + Glycerin 50%) is 93°C.
(5) The user will have to analyze the total response time to the related application.
(6) Without the transmitter response time.
(7) The table above is only for capillary standard diameter (≈1.0 mm)

Capillary Length

The capillary length is a variable defined in terms of the application need, as for example, the tank height or distance of the remote point to be measured.

To evaluate the maximum capillary length, three conditions must be fulfilled:

1) To check if the expanded or contracted volume relative to the initial volume of the corrugated is within Lower and Upper limits (VC_{min} and VC_{max});

$$VC_{\min} \leq V_{total} \leq VC_{\max} \tag{2.16}$$

Where:

V_{total} : Total diaphragm volume after expansion or contraction effect (defined in this Chapter)

$VC_{\min}$: Minimum Critical Volume of the Seal

$VC_{\max}$: Maximum Critical Volume of the Seal

To obtain the $VC_{\max}$ value, use Tables 2.10 to 2.17, where the maximum critical volume for different materials and diaphragm thickness in function of temperature is presented

To obtain the $VC_{\min}$ value use the Table 2.18, where the minimum critical volume for the transmitter range and applied process pressure is presented.

$$\%VC_{\min} = \frac{MVP}{URL} \times 100 \tag{2.17}$$

Where:

$\%VC_{\min}$: Percentage of $VC_{\min}$ regarding URL

MVP : The higher value between $|V.\sup|$ and $|V.\inf|$

2) Verify if the response time is compatible with the process variables and there will be enough time so that the pressure transmission guarantees the application control limits.

3) Verify if the assembly global error is within client expectations.

After these three analysis, the maximum remote seal capillary length needed is acceptable.

Tp (°C)	VCmax (10^{-2} x cm^3) for 316L Stainless Steel Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	9.6	15.9	24.3	29.8	36.6	47.9	86.6	100.6	248.9	8.1	13.4	21.2	26.7	32.6	42.2	76.6	88.4	231.4
75	9.0	14.8	22.6	27.6	34.0	44.5	80.5	93.7	230.5	7.6	12.6	19.8	24.7	30.5	39.5	71.8	82.9	215.7
125	8.2	13.6	20.7	25.2	31.0	40.8	73.7	85.9	210.0	7.0	11.6	18.2	22.9	28.0	36.4	66.2	76.7	198.0
175	7.6	12.5	19.0	23.1	28.5	37.5	67.9	79.2	192.6	6.4	10.8	16.9	21.1	25.9	33.7	61.4	71.2	182.8
225	7.1	11.7	17.7	21.4	26.5	34.9	63.0	73.6	178.5	6.0	10.1	15.7	19.6	24.1	31.5	57.4	66.6	170.1
275	6.7	11.0	16.6	20.1	24.9	32.8	59.3	69.3	167.7	5.7	9.5	14.9	18.5	22.7	29.8	54.2	63.0	160.4
325	6.4	10.5	15.9	19.2	23.8	31.4	56.8	66.4	160.2	5.5	9.1	14.3	17.7	21.8	28.6	52.1	60.5	153.6
375	6.2	10.3	15.5	18.8	23.2	30.7	55.4	64.8	156.2	5.3	8.9	13.9	17.3	21.3	27.9	50.9	59.2	150.0

Table 2.10 – Maximum Critical Volume for 316L Stainless Steel Diaphragm (See Note - page 2.20)

Tp (°C)	VCmax (10^{-2} x cm^3) for Hastelloy Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	14.0	23.0	35.9	45.0	54.9	70.8	128.0	147.5	379.8	11.5	18.9	30.2	39.0	47.0	59.8	108.2	123.7	336.0
75	13.5	22.1	34.4	43.1	52.6	68.0	122.9	141.8	363.1	11.1	18.3	29.1	37.5	45.2	57.7	104.2	119.5	323.2
125	12.8	21.1	32.7	40.8	49.9	64.6	116.7	134.9	343.3	10.6	17.5	27.8	35.7	43.1	55.2	99.8	114.4	307.8
175	12.2	20.1	31.1	38.6	47.3	61.4	110.7	128.3	324.7	10.1	16.7	26.5	33.9	41.1	52.7	95.4	109.5	293.2
225	11.6	19.1	29.5	36.6	44.8	58.3	105.4	122.0	307.3	9.7	16.0	25.3	32.3	39.2	50.4	91.3	104.8	279.3
275	11.1	18.2	28.1	34.7	42.6	55.5	100.3	116.2	291.2	9.2	15.3	24.2	30.8	37.4	48.2	87.3	100.4	266.3
325	10.6	17.4	26.8	33.0	40.5	52.9	95.6	110.9	276.6	8.8	14.7	23.2	29.4	35.8	46.1	83.7	96.3	254.4
375	10.1	16.7	25.6	31.5	38.7	50.5	91.3	106.1	263.5	8.5	14.1	22.2	28.4	34.3	44.3	80.4	92.6	243.6

Table 2.11 – Maximum Critical Volume for Hastelloy Diaphragm (See Note - page 2.20)

Tp (°C)	VCmax (10^{-2} x cm^3) for Monel Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	10.0	16.5	25.4	31.2	38.3	50.1	90.5	105.1	260.8	8.4	13.9	22.0	27.9	34.0	43.9	79.7	91.8	241.3
75	9.4	15.6	23.8	29.2	35.9	47.0	85.0	98.8	244.0	7.9	13.2	20.8	26.2	32.0	41.5	75.3	86.9	227.2
125	8.8	14.5	22.2	27.1	33.4	43.8	79.1	92.1	226.2	7.4	12.4	19.5	24.5	29.9	38.8	70.6	81.6	212.0
175	8.3	13.7	20.9	25.4	31.4	41.2	74.4	86.7	212.0	7.0	11.7	18.4	23.1	28.2	36.7	66.8	77.3	199.7
225	7.9	13.1	19.9	24.2	29.8	39.2	70.9	82.7	201.7	6.7	11.2	17.6	22.0	27.0	35.1	63.9	74.0	190.7
275	7.7	12.7	19.3	23.4	28.9	38.0	68.7	80.2	195.2	6.5	10.9	17.1	21.3	26.2	34.1	62.1	72.0	185.0
325	7.6	12.5	19.0	23.1	28.5	37.6	67.9	79.2	192.7	6.4	10.8	16.9	21.1	25.9	33.7	61.4	71.2	182.8
375	7.5	12.4	18.8	22.7	28.2	37.2	67.7	78.2	190.0	6.3	10.6	16.7	21.0	25.4	33.0	60.5	70.8	180.5

Table 2.12 – Maximum Critical Volume for Monel Diaphragm (See Note - page 2.20)

Tp (°C)	VCmax (10^{-2} x cm^3) for Tantalum Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	8.5	13.9	21.3	25.9	32.0	42.0	75.8	88.3	216.4	7.1	11.9	18.7	23.5	28.7	37.3	67.9	78.5	203.5
75	7.1	11.7	17.8	21.5	26.6	35.0	63.8	74.0	179.4	6.0	10.1	15.8	19.7	24.2	31.6	56.6	66.8	170.9
125	5.6	9.2	13.9	16.8	20.8	27.4	49.6	58.0	139.4	4.8	8.0	12.5	15.5	19.1	25.1	45.8	53.3	134.5
175	4.3	7.2	10.7	12.9	16.0	21.2	38.3	44.9	107.1	3.7	6.3	9.7	12.0	14.8	19.6	35.8	41.8	104.2
225	3.4	5.6	8.4	10.0	12.4	16.5	29.3	35.0	83.1	2.9	4.9	7.6	9.3	11.6	15.3	28.0	32.8	81.3
275	2.8	4.6	6.8	8.1	10.1	13.4	24.3	28.5	67.6	2.4	4.0	6.2	7.6	9.4	12.5	22.9	26.9	66.3
325	2.5	4.1	6.1	7.3	9.1	12.1	21.8	25.6	60.8	2.1	3.6	5.6	6.9	8.5	11.3	20.6	24.2	59.6
375	2.2	3.8	5.7	7.0	8.3	11.2	19.7	22.4	58.7	1.9	3.1	4.8	6.0	7.9	10.7	18.6	22.8	55.8

Table 2.13 – Maximum Critical Volume for Tantalum Diaphragm (See Note - page 2.20)

Tp (°C)	VCmax (10^{-2} x cm^3) for Titanium Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	18.2	29.9	47.5	61.0	73.6	93.8	169.5	194.0	519.6	14.7	24.0	38.8	50.9	60.8	76.5	137.8	156.6	438.1
75	16.7	27.4	43.4	55.3	67.0	85.7	154.9	177.7	469.6	13.6	22.2	35.8	46.7	55.9	70.6	127.5	145.1	402.3
125	14.9	24.5	38.5	48.6	59.1	76.0	137.4	158.1	410.9	12.2	20.0	32.1	41.6	50.1	63.6	114.9	131.1	359.1
175	13.3	21.8	34.0	42.5	51.9	67.1	121.3	140.0	358.1	10.9	18.0	28.7	36.9	44.6	56.9	103.0	117.9	319.1
225	11.8	19.4	30.0	37.2	45.6	59.3	107.1	124.0	312.9	9.8	16.1	25.7	32.8	39.8	51.0	92.4	106.1	283.6
275	10.6	17.4	26.8	33.0	40.5	52.9	95.6	110.9	276.8	8.8	14.6	23.1	29.4	35.7	46.1	83.6	96.2	254.3
325	9.7	15.9	24.4	30.0	36.9	48.2	87.2	101.3	250.9	8.1	13.5	21.3	26.9	32.8	42.4	77.0	88.8	232.8
375	9.2	15.1	23.1	28.2	34.8	45.6	82.4	95.8	236.2	7.7	12.8	20.2	25.4	31.1	40.2	73.2	84.5	220.4

Table 2.14 – Maximum Critical Volume for Titanium Diaphragm (See Note - page 2.20)

Tp (°C)	VCmax (10^{-2} x cm^3) for 304L Stainless Steel Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	8.1	13.4	20.4	24.9	30.7	40.3	72.9	84.9	207.5	6.9	11.5	18.0	22.6	27.7	36.0	65.6	75.9	195.8
75	7.6	12.5	19.0	23.0	28.4	37.4	67.6	78.9	191.9	6.4	10.7	16.8	21.0	25.8	33.6	61.2	71.0	182.1
125	6.9	11.4	17.3	21.0	25.9	34.2	61.8	72.1	174.7	5.9	9.9	15.4	19.2	23.6	30.9	56.3	65.4	166.8
175	6.4	10.5	15.9	19.2	23.8	31.4	56.8	66.4	160.2	5.5	9.1	14.3	17.7	21.8	28.6	52.1	60.5	153.6
225	5.9	9.8	14.8	17.8	22.1	29.2	52.7	61.6	148.3	5.1	8.5	13.3	16.5	20.3	26.6	48.5	56.5	142.8
275	5.6	9.2	13.9	16.7	20.7	27.2	49.5	58.0	139.2	4.8	8.0	12.5	15.5	19.1	25.1	45.8	53.3	134.4
325	5.3	8.8	13.3	16.0	19.8	26.2	47.4	55.0	133.0	4.6	7.7	12.0	14.8	18.3	24.0	43.9	51.1	128.5
375	5.2	8.6	12.9	15.6	19.3	25.5	46.2	54.0	129.5	4.5	7.5	11.7	14.4	17.8	23.5	42.8	49.9	125.3

Table 2.15 – Maximum Critical Volume for 304L Stainless Steel Diaphragm (See Note - page 2.20)

Tp (ºC)	VCmax (10^{-2} x cm^3) for Duplex Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	16.9	27.7	43.8	55.8	67.5	86.3	156.0	179.0	473.2	13.7	22.5	36.1	47.1	56.4	71.2	128.5	146.2	405.3
75	15.9	26.1	41.2	52.2	63.3	81.2	146.8	168.7	442.2	13.0	21.3	34.2	44.4	53.4	67.5	121.9	138.9	382.7
125	14.8	24.4	38.2	48.2	58.6	75.4	136.3	156.8	407.0	12.2	20.0	32.0	41.4	49.8	63.2	114.3	130.4	356.6
175	13.9	22.8	35.6	44.6	54.4	70.2	126.9	146.4	376.3	11.4	18.8	30.0	38.7	46.6	59.2	107.3	122.8	333.4
225	13.1	21.5	33.4	41.7	50.9	65.9	119.1	137.5	350.8	10.8	17.8	28.3	36.4	43.9	56.1	101.6	116.3	313.7
275	12.4	20.4	31.7	39.4	48.2	62.5	112.9	130.5	331.0	10.3	17.0	27.0	34.5	41.8	53.5	97.0	111.2	298.2
315	12.0	19.8	30.6	38.0	46.2	61.1	109.3	126.4	319.5	10.0	16.5	26.2	33.5	40.6	52.0	94.2	108.1	289.1

Table 2.16 – Maximum Critical Volume for Duplex Diaphragm (See Note - page 2.20)

Tp (ºC)	VCmax (10^{-2} x cm^3) for Super Duplex Diaphragm																	
	# 0.05mm									# 0.1mm								
	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8	Family 0	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7	Family 8
-25 to 35	18.7	30.7	48.9	62.9	75.8	96.4	174.2	199.3	535.5	15.1	24.7	39.9	52.3	62.5	78.5	141.4	160.5	449.9
75	17.8	29.2	46.3	59.3	71.7	91.4	165.2	189.2	504.5	14.4	23.6	38.0	49.8	59.5	74.9	135.0	153.5	427.9
125	16.8	27.5	43.5	55.3	67.0	85.7	155.0	177.8	469.6	13.6	22.3	35.9	46.8	56.1	70.8	127.7	145.4	402.7
175	15.9	26.0	41.0	51.9	63.0	80.8	146.1	167.8	439.6	12.9	21.2	34.0	44.2	53.1	67.2	121.4	138.3	380.8
225	15.1	24.8	38.9	49.1	59.7	76.8	138.8	159.6	415.3	12.4	20.3	32.5	42.1	50.6	64.3	116.1	132.4	362.8
275	14.5	23.9	37.4	47.0	57.2	73.7	133.3	153.5	397.1	11.9	19.6	31.3	40.5	48.8	62.0	112.1	128.0	349.1
300	14.3	23.5	36.8	46.3	56.3	72.6	131.3	151.2	390.5	11.8	19.4	30.9	39.9	48.1	61.2	110.6	125.6	344.1

Table 2.17 – Maximum Critical Volume for Super Duplex Diaphragm (See Note - page 2.20)

Note - Tables 2.10 to 2.17

The tables 2.10 to 2.17 are Theoretical. For the VcMax values in diaphragm with 0.075 mm of thickness, interpolate the listed values. All the thickness and listed materials are not available. In case of doubt it consults our representatives.

See below the Table 2.18 of Minimum Critical Volume.

VCmin (10^{-2} x cm^3)												
% VCmin / Transmitter Range	120%	110%	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	7.02	6.44	5.85	5.27	4.68	4.10	3.51	2.93	2.34	1.76	1.17	0.59
3	7.02	6.44	5.85	5.27	4.68	4.10	3.51	2.93	2.34	1.76	1.17	0.59
4	6.34	5.81	5.28	4.75	4.22	3.70	3.17	2.64	2.11	1.58	1.06	0.53
5	2.75	2.52	2.29	2.06	1.83	1.60	1.37	1.15	0.92	0.69	0.46	0.23
6	3.46	3.17	2.88	2.59	2.30	2.02	1.73	1.44	1.15	0.86	0.58	0.29

Table 2.18 – Minimum Critical Volume

Error Guide Trend for Transmitter Assembled with Remote Seal

There are factors that influence the remote seal response, like process temperature, ambient temperature, seal diameter and capillary length.

To better understand the influence of these parameters, a Total Probable Error behavior guide for the transmitter and the remote seal assembly was devised.

This guide is valid only for the assembly of the Remote Seal SR301T and the Smar pressure transmitter LD30X with the following conditions:

- Stainless Steel # 0.05mm diaphragm;
- Filling Fluid DC200;
- Stability for 12 months;
- Static pressure variation up to 10 bar (only for LD30XD);
- Reference Temperature of 25°C;
- Thermal simmetry for two seals assembly;
- Transmitter Calibration with Rangeability 1:1 for cases 1,2,3.

  Therefore, the transmitter calibrations are the following:

  Range 2 : 0 to 50 Kpa;
  Range 3 : 0 to 250 Kpa;
  Range 4 : 0 to 2500 Kpa;
  Range 5 : 0 to 25000 Kpa;
  Range 6 : 0 to 40000 Kpa.

- Transmitter Calibration with Rangeability 10:1 for cases 4,5,6.

  Therefore, the transmitter calibrations are the following:

  Range 2 : 0 to 5 Kpa;
  Range 3 : 0 to 25 Kpa;
  Range 4 : 0 to 250 Kpa;
  Range 5 : 0 to 2500 Kpa;
  Range 6 : 0 to 4000 Kpa.

The Guide is divided in six cases that must be chosen according to the process temperature and ambient temperature. Through these six cases it is possible to observe some factors that influence measuring:

- Ambient and Process Temperature: This is the most important factor and can turn the remote seal use unfeasible. Note that by comparing the six tables (cases 1, 2 and 3; cases 4, 5 and 6), as the temperatures increase, the errors also increase. Cases 3 and 6, where temperatures are higher, present more specifications where the remote seal is not applicable (N.A.).

- Capillary Length: In cases with high temperatures (cases 2 and 3; cases 5 and 6), the shorter the capillary length, the smaller the seal response time and the better the assembly Total Probable Error (TPE).

- Remote Seal Diameter: In cases with high temperatures (cases 2 and 3; cases 5 and 6), the bigger the seal diameter, the better the the assembly Total Probable Error (TPE).

For cases 1 to 6, are:

- N.A.: Nonapplicable by outdatet mechanical limits;
- Error %: TPE lesser or equal to Error % of the calibrated span;
- Δtp: Variation of Temperature in the process;
- Δta: Variation of Temperature in the capillary and pressure transmitter;
- Obs.: For median capillary lengths, use the higher listed value.

Case 1 – TPE % of the Span with Calibration in Rangeability (1:1)

Process Temperature: 40 ºC ± 0 ºC -> Δtp = + 15ºC
Ambient Temperature: 25 ºC ± 0 ºC -> Δta = 0ºC

Capillary	Range	LD30XM (2 to 6)						LD30XD (2 to 4)					
		1 Seal SR301T						2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	2	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	3	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	2	1.15	0.25%	0.25%	0.25%	0.25%	0.25%	2.20	0.25%	0.25%	0.25%	0.25%	0.25%
	3	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	2	2.20	0.25%	0.25%	0.25%	0.25%	0.25%	4.30	0.25%	0.25%	0.25%	0.25%	0.25%
	3	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	2	3.60	0.25%	0.25%	0.25%	0.25%	0.25%	7.10	0.25%	0.25%	0.25%	0.25%	0.25%
	3	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	1.50	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	2	5.70	0.25%	0.25%	0.25%	0.25%	0.25%	11.27	0.25%	0.25%	0.25%	0.25%	0.25%
	3	1.22	0.25%	0.25%	0.25%	0.25%	0.25%	2.35	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	2	7.10	0.25%	0.25%	0.25%	0.25%	0.25%	14.10	0.25%	0.25%	0.25%	0.25%	0.25%
	3	1.50	0.25%	0.25%	0.25%	0.25%	0.25%	2.90	0.25%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.19 – TPE (Case 1)

Case 2 – TPE % of the Span with Calibration in Rangeability (1:1)

Process Temperature: 100 ºC ± 0 ºC -> Δtp = + 75ºC
Ambient Temperature: 40 ºC ± 0 ºC -> Δta = + 15ºC

Capillary	Range	LD30XM (2 to 6)						LD30XD (2 to 4)					
		1 Seal SR301T						2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	2	< 1	3.50%	1.00%	1.00%	0.25%	0.25%	< 1	2.00%	0.50%	0.50%	0.25%	0.25%
	3	< 1	1.00%	0.25%	0.25%	0.25%	0.25%	< 1	0.50%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	2	< 1	5.00%	1.50%	1.00%	0.50%	0.25%	1.70	3.00%	1.00%	0.50%	0.25%	0.25%
	3	< 1	1.00%	0.25%	0.25%	0.25%	0.25%	< 1	1.00%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	2	1.70	7.00%	1.50%	1.50%	0.50%	0.25%	3.28	4.00%	1.00%	1.00%	0.25%	0.25%
	3	< 1	1.50%	0.50%	0.50%	0.25%	0.25%	< 1	1.00%	0.25%	0.25%	0.25%	0.25%
	4	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	< 1	0.25%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	2	2.75	N.A.	1.50%	1.50%	0.50%	0.25%	5.40	N.A.	1.50%	1.00%	0.50%	0.25%
	3	< 1	N.A.	0.50%	0.50%	0.25%	0.25%	1.16	N.A.	0.25%	0.25%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	2	4.35	N.A.	3.00%	2.50%	1.00%	0.25%	8.57	N.A.	2.00%	1.50%	0.50%	0.50%
	3	< 1	N.A.	1.00%	0.50%	0.25%	0.25%	1.80	N.A.	0.50%	0.50%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	2	5.40	N.A.	3.50%	2.50%	1.00%	0.50%	10.68	N.A.	2.00%	1.50%	0.50%	0.25%
	3	1.16	N.A.	1.00%	0.50%	0.25%	0.25%	2.22	N.A.	0.50%	0.50%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.20 – TPE (Case 2)

Case 3 – TPE % of the Span with Calibration in Rangeability (1:1)

Process Temperature: 170 ºC ± 0 ºC -> Δtp = + 145ºC
Ambient Temperature: 60 ºC ± 0 ºC -> Δta = + 35ºC

Capillary	Range	LD30XM (2 to 6) 1 Seal SR301T						LD30XD (2 to 4) 2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	2	< 1	N.A.	2.00%	2.00%	0.50%	0.50%	< 1	N.A.	1.50%	1.00%	0.50%	0.50%
	3	< 1	N.A.	0.50%	0.50%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	2	< 1	N.A.	2.50%	2.00%	0.50%	0.50%	1.29	N.A.	1.50%	1.50%	0.50%	0.25%
	3	< 1	N.A.	1.00%	0.50%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	2	1.30	N.A.	3.50%	3.00%	0.50%	0.50%	2.49	N.A.	2.00%	2.00%	0.50%	0.50%
	3	< 1	N.A.	1.00%	1.00%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	4	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	< 1	N.A.	0.25%	0.25%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	2	2.00	N.A.	N.A.	4.00%	1.00%	0.50%	4.08	N.A.	N.A.	2.00%	1.00%	0.50%
	3	< 1	N.A.	N.A.	1.00%	0.50%	0.25%	< 1	N.A.	N.A.	0.50%	0.25%	0.25%
	4	< 1	N.A.	N.A.	0.25%	0.25%	0.25%	< 1	N.A.	N.A.	0.25%	0.25%	0.25%
	5	< 1	N.A.	N.A.	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	2	3.28	N.A.	N.A.	N.A.	1.50%	0.50%	6.45	N.A.	N.A.	N.A.	1.00%	0.50%
	3	< 1	N.A.	N.A.	N.A.	0.50%	0.25%	1.37	N.A.	N.A.	N.A.	0.25%	0.25%
	4	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	< 1	N.A.	N.A.	N.A.	0.25%	0.25%
	5	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	2	4.08	N.A.	N.A.	N.A.	2.00%	0.50%	8.16	N.A.	N.A.	N.A.	1.00%	0.50%
	3	< 1	N.A.	N.A.	N.A.	0.50%	0.50%	1.70	N.A.	N.A.	N.A.	0.25%	0.25%
	4	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	< 1	N.A.	N.A.	N.A.	0.25%	0.25%
	5	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	N.A.	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.21 – TPE (Case 3)

Case 4 – TPE % of the Span with Calibration in Rangeability (10:1)

Process Temperature: 40 ºC ± 0 ºC -> Δtp = + 15ºC
Ambient Temperature: 25 ºC ± 0 ºC -> Δta = 0ºC

Capillary	Range	LD30XM (2 to 6)						LD30XD (2 to 4)					
		1 Seal SR301T						2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	**2**	**< 1**	2.50%	1.00%	1.00%	0.50%	0.50%	**< 1**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	**2**	**1.15**	2.50%	1.00%	1.00%	0.50%	0.50%	**2.20**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	**2**	**2.20**	2.50%	1.00%	1.00%	0.50%	0.50%	**4.30**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	**2**	**3.60**	2.50%	1.00%	1.00%	0.50%	0.50%	**7.10**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**< 1**	0.50%	0.25%	0.25%	0.25%	0.25%	**1.50**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	**2**	**5.70**	2.50%	1.00%	1.00%	0.50%	0.50%	**11.27**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**1.22**	0.50%	0.25%	0.25%	0.25%	0.25%	**2.35**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	**2**	**7.10**	2.50%	1.00%	1.00%	0.50%	0.50%	**14.10**	1.50%	0.50%	0.50%	0.50%	0.25%
	3	**1.50**	0.50%	0.25%	0.25%	0.25%	0.25%	**2.90**	0.50%	0.25%	0.25%	0.25%	0.25%
	4	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%
	5	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.
	6	**< 1**	0.25%	0.25%	0.25%	0.25%	0.25%	**- - -**	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.22 – TPE (Case 4)

Case 5 – TPE % of the Span with Calibration in Rangeability (10:1)

Process Temperature: 100 ºC ± 0 ºC -> Δtp = + 75ºC
Ambient Temperature: 40 ºC ± 0 ºC -> Δta = + 15ºC

Capillary	Range	LD30XM (2 to 6)						LD30XD (2 to 4)					
		1 Seal SR301T						2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	2	< 1	N.A.	N.A.	N.A.	3.00%	2.00%	< 1	N.A.	N.A.	N.A.	2.00%	1.50%
	3	< 1	N.A.	2.00%	1.50%	1.00%	0.50%	< 1	N.A.	1.50%	1.00%	0.50%	0.50%
	4	< 1	1.00%	0.50%	0.50%	0.25%	0.25%	< 1	0.50%	0.25%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	2	< 1	N.A.	N.A.	N.A.	3.50%	2.50%	1.70	N.A.	N.A.	N.A.	2.00%	1.50%
	3	< 1	N.A.	2.50%	2.00%	1.00%	0.50%	< 1	N.A.	1.50%	1.00%	0.50%	0.50%
	4	< 1	1.00%	0.50%	0.50%	0.25%	0.25%	< 1	1.00%	0.50%	0.25%	0.25%	0.25%
	5	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	2	1.70	N.A.	N.A.	N.A.	4.00%	2.50%	3.28	N.A.	N.A.	N.A.	2.50%	1.50%
	3	< 1	N.A.	3.00%	2.50%	1.00%	1.00%	< 1	N.A.	2.00%	1.50%	0.50%	0.50%
	4	< 1	1.50%	0.50%	0.50%	0.25%	0.25%	< 1	1.00%	0.50%	0.50%	0.25%	0.25%
	5	< 1	0.50%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	0.25%	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	2	2.75	N.A.	N.A.	N.A.	5.00%	3.00%	5.40	N.A.	N.A.	N.A.	N.A.	1.50%
	3	< 1	N.A.	4.00%	3.50%	1.00%	1.00%	1.16	N.A.	2.50%	2.00%	1.00%	0.50%
	4	< 1	N.A.	0.50%	0.50%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	2	4.35	N.A.	N.A.	N.A.	6.00%	3.00%	8.57	N.A.	N.A.	N.A.	N.A.	2.00%
	3	< 1	N.A.	6.00%	4.50%	1.50%	1.00%	1.80	N.A.	3.50%	2.50%	1.00%	0.50%
	4	< 1	N.A.	1.00%	0.50%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	2	5.40	N.A.	N.A.	N.A.	7.00%	3.50%	10.68	N.A.	N.A.	N.A.	N.A.	2.00%
	3	1.16	N.A.	7.00%	5.00%	1.50%	1.00%	2.22	N.A.	4.00%	3.00%	1.00%	0.50%
	4	< 1	N.A.	1.00%	1.00%	0.25%	0.25%	< 1	N.A.	0.50%	0.50%	0.25%	0.25%
	5	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.25%	0.25%	0.25%	0.25%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.23 – TPE (Case 5)

Case 6 – TPE % of the Span with Calibration in Rangeability (10:1)

Process Temperature: 170 ºC ± 0 ºC -> Δtp = + 145ºC
Ambient Temperature: 60 ºC ± 0 ºC -> Δta = + 35ºC

Capillary	Range	LD30XM (2 to 6) 1 Seal SR301T						LD30XD (2 to 4) 2 Seals SR301T(equal)					
		Tr (s)	1"	1.1/2"	2"	3"	4"	Tr (s)	1"	1.1/2"	2"	3"	4"
0.5 m	2	< 1	N.A.	N.A.	N.A.	N.A.	4.00%	< 1	N.A.	N.A.	N.A.	4.00%	2.50%
	3	< 1	N.A.	4.00%	3.00%	1.50%	1.00%	< 1	N.A.	2.50%	2.00%	1.00%	1.00%
	4	< 1	N.A.	1.00%	1.00%	0.50%	0.50%	< 1	N.A.	1.00%	1.00%	0.50%	0.50%
	5	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
1.5 m	2	< 1	N.A.	N.A.	N.A.	N.A.	4.50%	1.29	N.A.	N.A.	N.A.	4.50%	2.50%
	3	< 1	N.A.	5.00%	4.00%	1.50%	1.00%	< 1	N.A.	3.00%	2.50%	1.00%	1.00%
	4	< 1	N.A.	1.00%	1.00%	1.00%	0.50%	< 1	N.A.	1.00%	1.00%	0.50%	0.50%
	5	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
3 m	2	1.30	N.A.	N.A.	N.A.	N.A.	5.00%	2.49	N.A.	N.A.	N.A.	5.00%	3.00%
	3	< 1	N.A.	7.00%	5.50%	2.00%	1.00%	< 1	N.A.	4.00%	3.00%	1.50%	1.00%
	4	< 1	N.A.	1.00%	1.00%	1.00%	0.50%	< 1	N.A.	1.00%	1.00%	0.50%	0.50%
	5	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	0.50%	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
5 m	2	2.00	N.A.	N.A.	N.A.	N.A.	5.50%	4.08	N.A.	N.A.	N.A.	6.00%	3.00%
	3	< 1	N.A.	N.A.	7.00%	2.50%	1.50%	< 1	N.A.	N.A.	5.00%	1.50%	1.00%
	4	< 1	N.A.	N.A.	1.00%	1.00%	0.50%	< 1	N.A.	N.A.	1.00%	0.50%	0.50%
	5	< 1	N.A.	N.A.	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	0.50%	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
8 m	2	3.28	N.A.	N.A.	N.A.	N.A.	6.00%	6.45	N.A.	N.A.	N.A.	8.00%	3.50%
	3	< 1	N.A.	N.A.	N.A.	3.00%	1.50%	1.37	N.A.	N.A.	N.A.	2.00%	1.00%
	4	< 1	N.A.	N.A.	N.A.	1.00%	0.50%	< 1	N.A.	N.A.	N.A.	0.50%	0.50%
	5	< 1	N.A.	N.A.	N.A.	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	N.A.	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
10 m	2	4.08	N.A.	N.A.	N.A.	N.A.	7.00%	8.16	N.A.	N.A.	N.A.	N.A.	4.00%
	3	< 1	N.A.	N.A.	N.A.	3.50%	1.50%	1.70	N.A.	N.A.	N.A.	2.00%	1.00%
	4	< 1	N.A.	N.A.	N.A.	1.00%	0.50%	< 1	N.A.	N.A.	N.A.	0.50%	0.50%
	5	< 1	N.A.	N.A.	N.A.	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.
	6	< 1	N.A.	N.A.	N.A.	0.50%	0.50%	- - -	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.24 – TPE (Case 6)

Chapter 3

OPERATION

Operation of the Remote Seal Sensor

In the remote seal transmitter, the remote insulator diaphragm plus transmission capillary set is connected to the transmitter chamber.

The internal spaces of the capillary pipe diaphragm and the sensor chamber are filled with the application proper fluid, according to the pressure and the of the process operation temperature.

The process pressure displaces the insulator diaphragm of the seal causing the filling fluid to transmit through the capillary the pressure to the sensor, generating a difference of capacitance between the sensor diaphragm and each plate on the capacitive cell. This differential capacitance is electrically converted into a signal of 4 to 20 mA transmitted by the two-wire system.

Operation Start Up

To start operating the remote seal transmitter see the Transmitter Operation and Maintenance Instructions Manual.

The transmitter is supplied in compliance with the data list and calibrated according to the range requested by the client.

Should you need to change the range (see the Transmitter Operation Manual) make new calculations and adjust the transmitter in accordance with these calculations.

The output signal adjustment on zero, in accordance with the "Test and Output Signal Adjustment" item is available on any transmitter, except to the absolute pressure transmitter.

Calibration

Output Signal Test and Setting

While testing and adjusting the transmitter, the ambient temperature should not change.

It is possible to test and to adjust the output signal without disassembling the remote seal for a pressure value (Px) known, if this remains constant.

Adjust the corresponding pressure at the beginning of the range for value (Pi), and similarly adjust the pressure on the end of the range (Ps). See Figures 3.1 or to 3.2 according to the type of curve (ascendant or descendant).

To determine the "Ix" current value when the current curve in terms of the ascendant (Figure 3.1) or descendant pressure (Figure 3.2), use the equation 3.1 below.

$$Ix = 4 + 16 \cdot \frac{Px - Pi}{Ps - Pi} \quad (3.1)$$

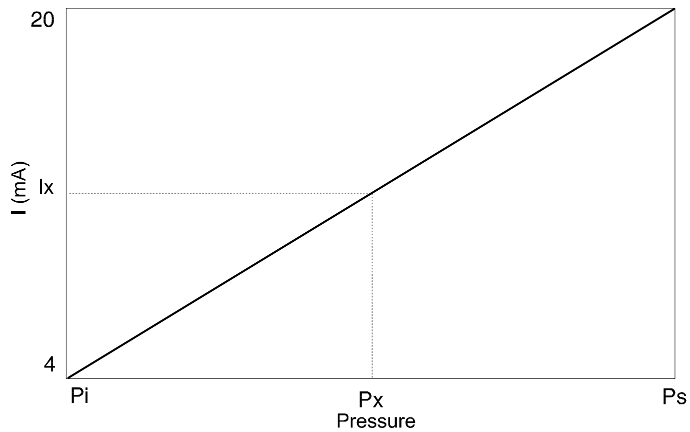


Figure 3.1 – Ascendant Curve of the Ix Output Signal in Terms of the Pressure

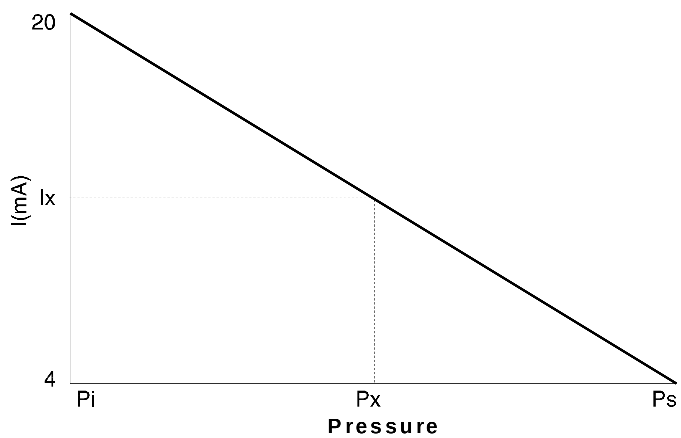


Figure 3. 2 - Descendant Curve of the Ix Output Signal in Terms of the Pressure (Reverse Mode)

If the seal needs a final adjustment, bring it to a laboratory and do the following:

- Put the pressure generator with adapter to the leaking test, in the side (H) of the seal and keep the low side (L) in the same height as the high side, leaving it opens to the atmosphere. If the beginning of the range is below the atmospheric pressure, simulate the depression setting an equivalent pressure value in the low side of the seal (this requires special equipments for vacuum calibration). In this case the high side will be submitted to the atmospheric pressure.

- Always maintain the two seals on the same height.

- Compensate the hydrostatic pressure of the capillary filling fluid in accordance with the seal assembling. See the calculation of the Pf pressure according to the "Influence of Filling Fluids on the Capillaries" item.

Range Beginning Change

This change is possible only for the transmitters installed on field when there is an input signal that corresponds to the range start with due accuracy. Otherwise, disassemble the transmitter, remove it to the laboratory and make the change in accordance with the "Span Change" item.

Make the adjustments in accordance with the transmitter operation manual.

Span Change on Differential and Flow Pressure Transmitters

In general, this work can be done only at the laboratory and with the two seals on the same height.

- Apply on the (H) side the pressure you want to calibrate.
- Make the adjustments according to the transmitter operation manual.

Level Transmitter Span Change

Proceed as for differential and flow transmitters. The span is given in Table 3.1.

OUTPUT	ZERO	SPAN
Ascendant	Pi = Hi . δp	Ps = Hs . δp
Descendant	Pi = Hs . δp	Ps = Hi . δp

Table 3.1 – Ascendant and Descendant Curves Span

Where:

Hs = Maximum level measured

Hi = Minimum level measured

δp = Density of the process fluid

Capillaries Filling Fluid Effect

The effect of the hydrostatic pressure of the capillary filling fluid must be compensated during measuring (see item Calibration).

The hydrostatic pressure is given by:

$$Pf = Hv \cdot \delta e \tag{3.2}$$

Where:

Pf = Hydrostatic Pressure

Hv = Level Difference between the two seals

δe = Density of the Filling Fluid (see Table 2.6)

The Hv distance between the two seals is limited by the capillary length and the maximum H1 difference allowed between the transmitter and the seal. See the “Mounting of Transmitter with Remote Seal“ – Chapter 1.

Chapter 4

MAINTENANCE

Before working with transmitter verifies the characteristics of the fill fluid in the piping and observes all safety standards.

Remote Seal Cleaning

The interval between the cleaning of the seals depends on the service conditions and the chemical and physical characteristics of the materials. This period of time depends on the concentration of dirt incrustations in the seal and in the tap that connects the seal to the main piping or tank.

When it is necessary to clean the seal and this piping, be careful not to damage it, because it is very delicate. If there are incrustations it can cause damages when disassembling the diaphragm, such as hardened bitumen between the diaphragm and the flange of the tank. To prevent this, this incrustation must be eliminated through the heating of this section of the piping or by using solvent before disassembling. Use a paintbrush to remove it.

Disassembling and Packing the Remote Seal Transmitter

Instructions:

a) Disable the transmitter;
b) Switch off the power supply;
c) Remove the counterflange seal;
d) Clean the seal carefully because the diaphragm is very delicate;
e) Set the protection cover over the diaphragm and fix it with adhesive tape;
f) Release the transmitter;
g) Roll the capillary without twisting it, leaving a 150mm or greater radius;
h) Do not loose the sealed bolts;
i) The transmitter package must protect it from mechanical shocks and must be like the original (See Figure 4.1) when returning materials.

Figure 4.1- Remote Seal Package

Component Replacement

The seal, the capillary and the cell form an only set in which is sealed the fill fluid. For eventual replacements the set must be considered.

Return of Materials

If it becomes necessary to return the transmitter and/or configurator to Smar, simply contact our office, informing the defective instrument's serial number, and return it to our factory. In order to speed up analysis and solution of the problem, the defective item should be returned with the Service Request Form (SRF – Appendix A) properly filled with a description of the failure observed and with as much details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

Remote Seal Spare Parts

SPARE PARTS: LD300S / SR301S (SANITARY)							
CONNECTIONS			RINGS			TANK ADAPTOR	TRI-CLAMP
			BUNA N	VITON	TEFLON		
1"	WITH EXTENSION	DN-25	400-0460	400-0461	400-0462	400-0496	N.D.
1.1/2"	WITHOUT EXTENSION	TC	400-0470	400-0471	400-0472	400-0500	400-0491
		TC [HP]					400-0492
		SMS	400-0467	400-0468	400-0469	400-0499	N.D.
		DN40	400-0464	400-0465	400-0466	400-0498	N.D.
	WITH EXTENSION	DN40	201-0125	201-130	400-0463	400-0497	N.D.
2"	WITHOUT EXTENSION	TC	400-0482	400-0483	400-0484	201-0150	201-0155
		TC [HP]					400-0493
		SMS	400-0473	400-0474	400-0475	201-0145	N.D.
		RJT	400-0476	400-0477	400-0478	201-0140	N.D.
		IDF	400-0479	400-0480	400-0481	201-0135	N.D.
		DN50	400-0876	400-0877	400-0878	400-0872	N.D.
	WITH EXTENSION	TC	201-0125	201-0130	400-0463	400-0262	201-0155
		TC [HP]					400-0493
		SMS				400-0261	N.D.
		RJT				400-0260	N.D.
		IDF				400-0259	N.D.
		DN50				400-0873	N.D.
3"	WITHOUT EXTENSION	TC	400-0488	400-0489	400-0490	400-0501	400-0494
		TC [HP]					400-0495
		DN80	400-0879	400-0880	400-0881	400-0874	N.D.
	WITH EXTENSION	TC	400-0485	400-0486	400-0487	400-0326	400-0494
		TC [HP]					400-0495
		SMS				400-0329	N.D.
		RJT				400-0328	N.D.
		IDF				400-0327	N.D.
		DN80				400-0875	N.D.

Table 4.1 – Spare Parts LD300S / SR301S

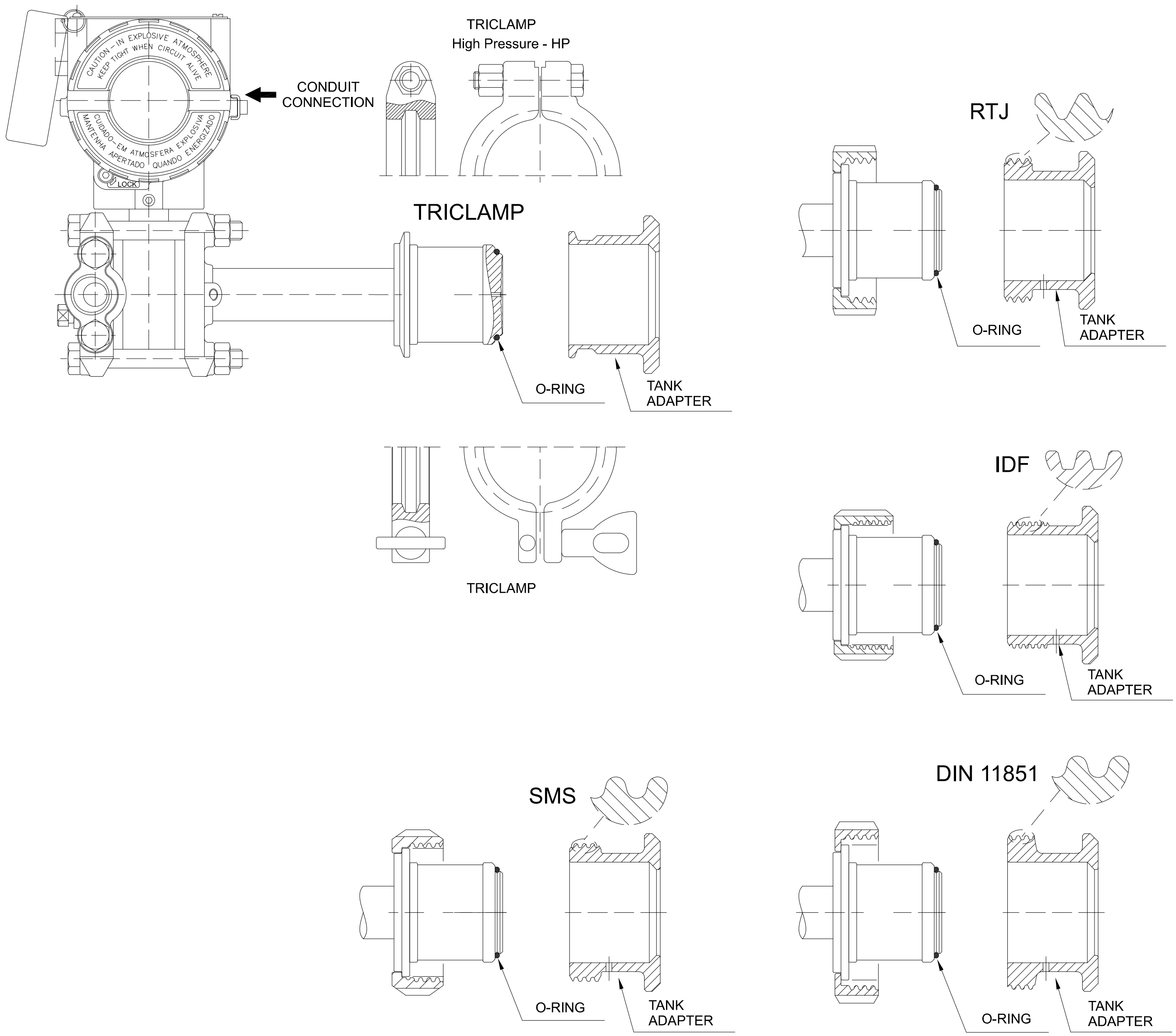


Figure 4.2 – Exploded View of LD300S with Extension

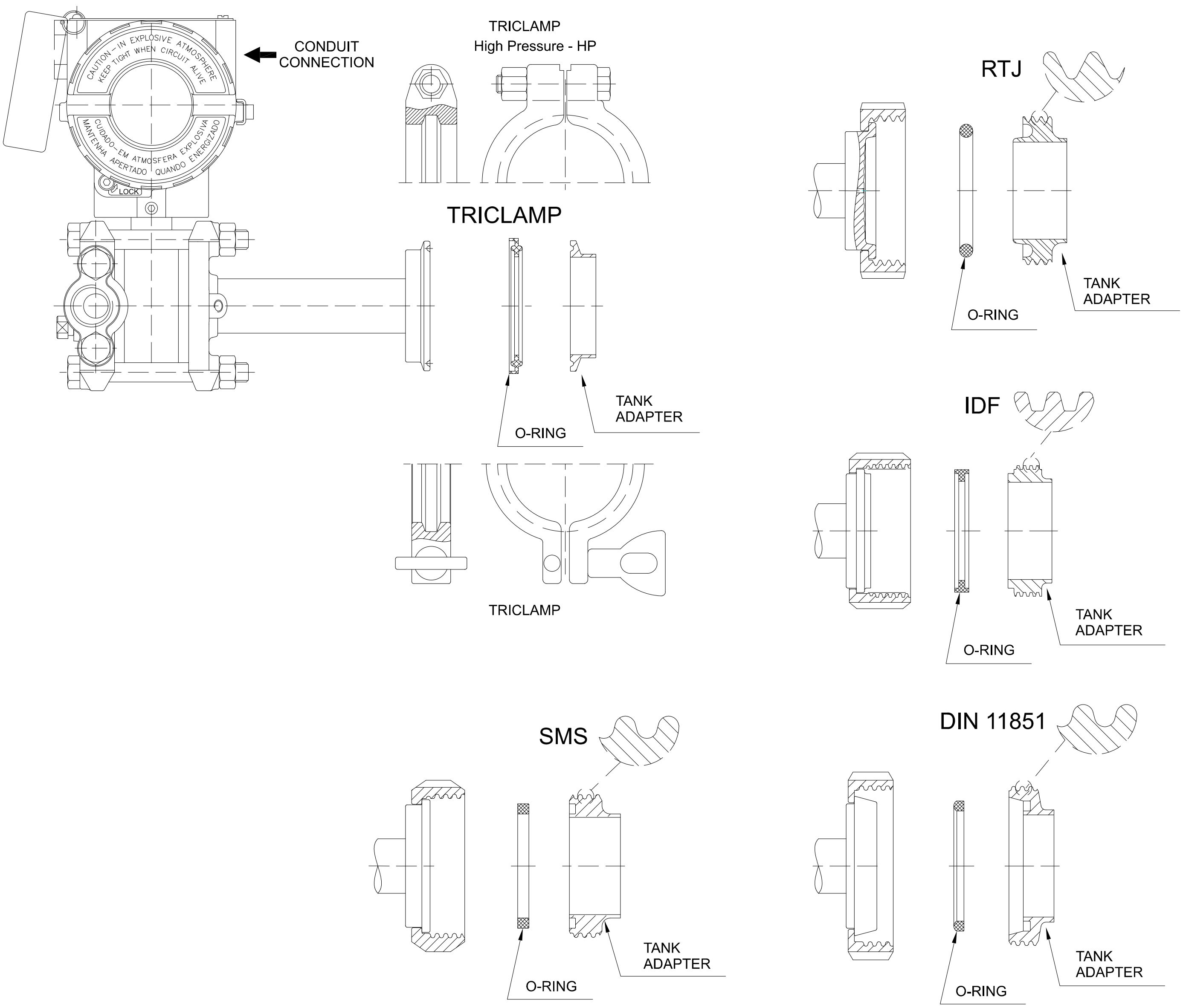


Figure 4.3 – Exploded View of LD300S without Extension

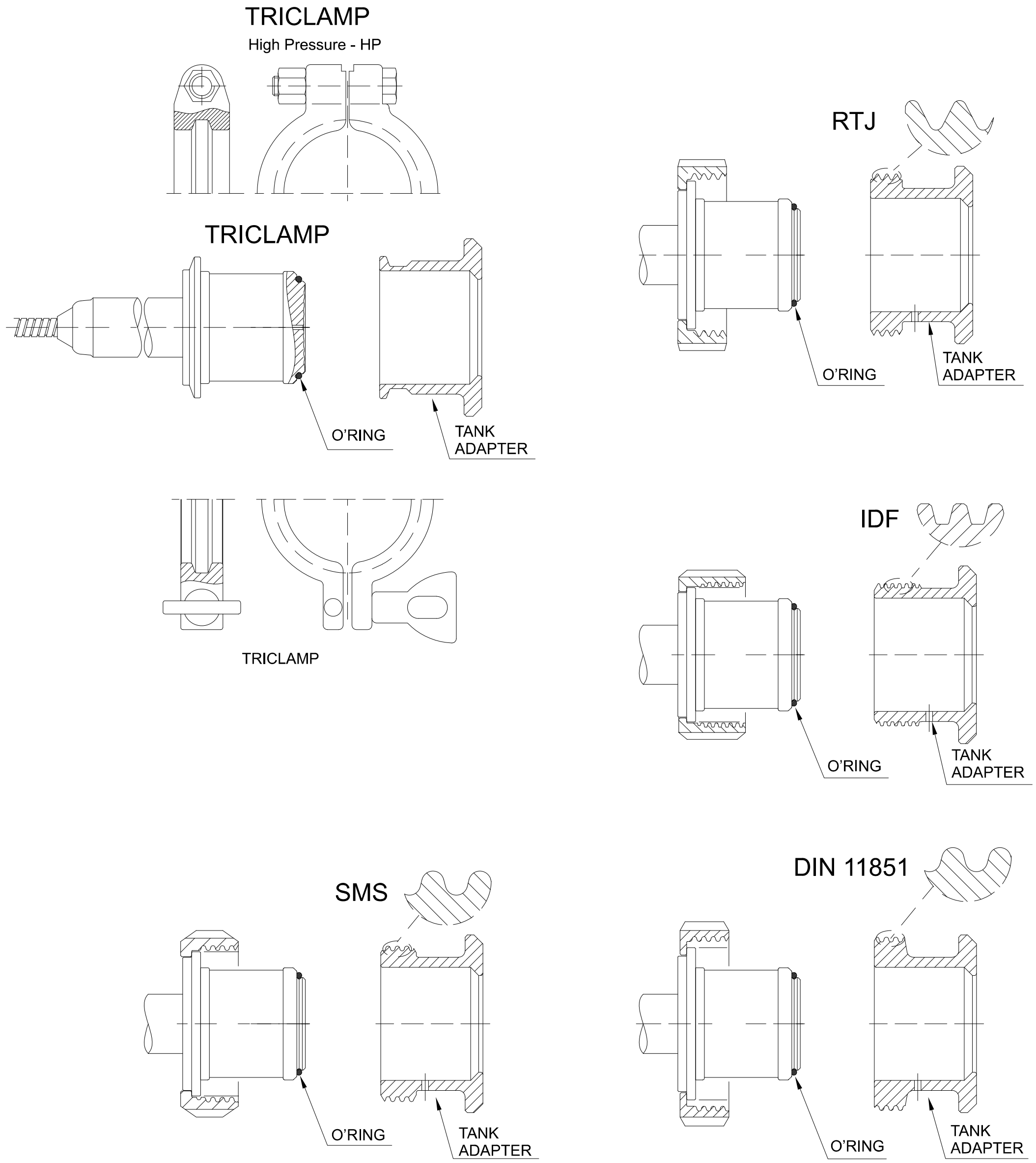


Figure 4.4 – Exploded View of SR301S with Extension

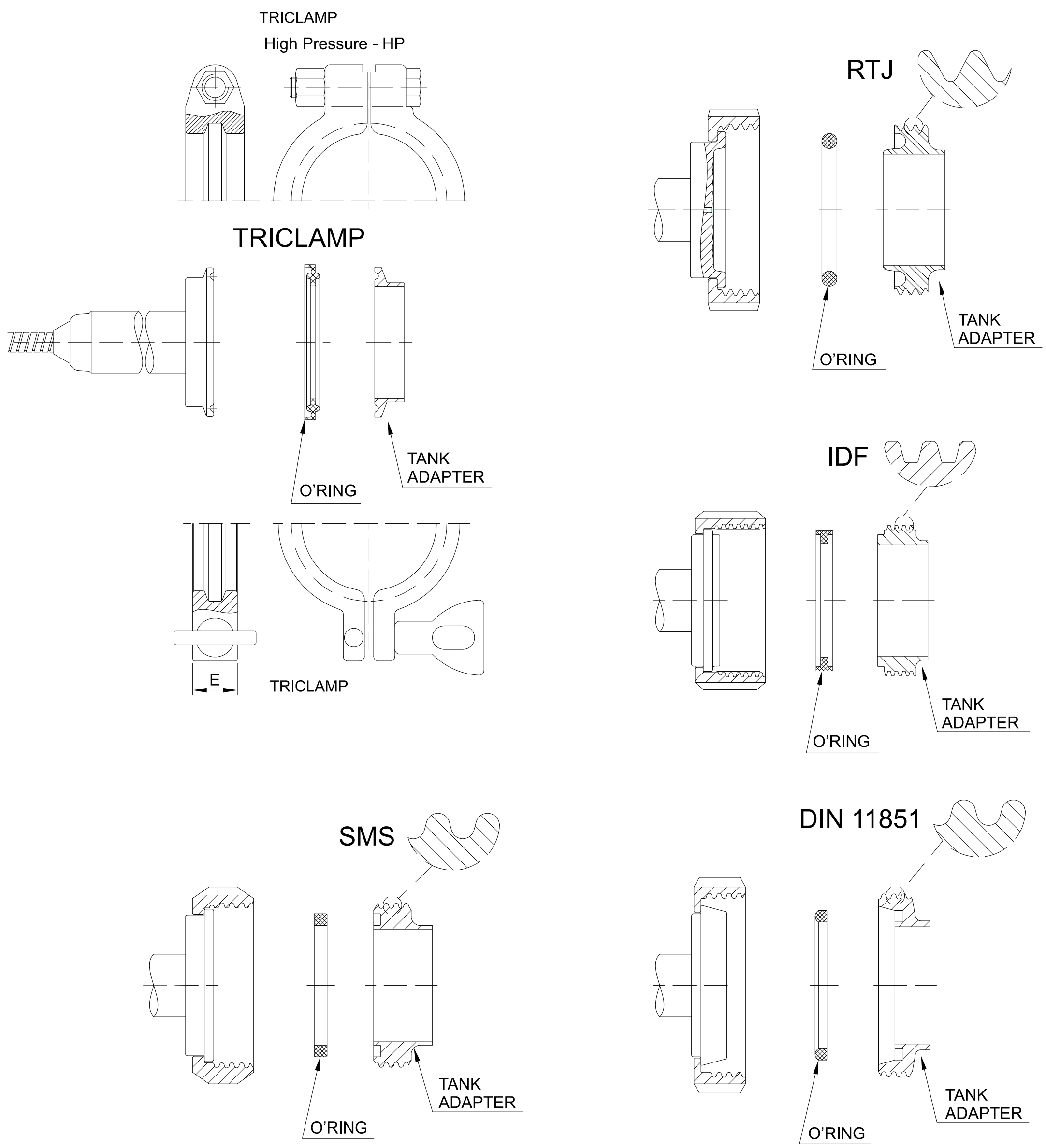


Figure 4.5 – Exploded View of SR301S without Extension

SPARE PARTS: LD300L / SR301T / SR301P						
ØN	GROUP	NORM	GASKET			DRAIN VALVE
			TEFLON	COPPER	GRAFOIL	STAINLESS STEEL 316L
1"	ALL	ANSI-B16.5	400-0425	400-0426	400-0427	400-0792
1.1/2"	ALL		400-0428	400-0429	400-0430	
2"	ALL		400-0431	400-0432	400-0433	
3"	ALL		400-0434	400-0435	400-0436	
4"	ALL		400-0437	400-0438	400-0439	
DN25	ALL	EN 1092-1/2501	400-0440	400-0441	400-0442	
DN40	ALL		400-0443	400-0444	400-0445	
DN50	ALL		400-0446	400-0447	400-0448	
DN80	ALL		400-0449	400-0450	400-0451	
DN100	ALL		400-0452	400-0453	400-0454	

Table 4.2 – LD300L / SR301T / SR301P Spare Parts

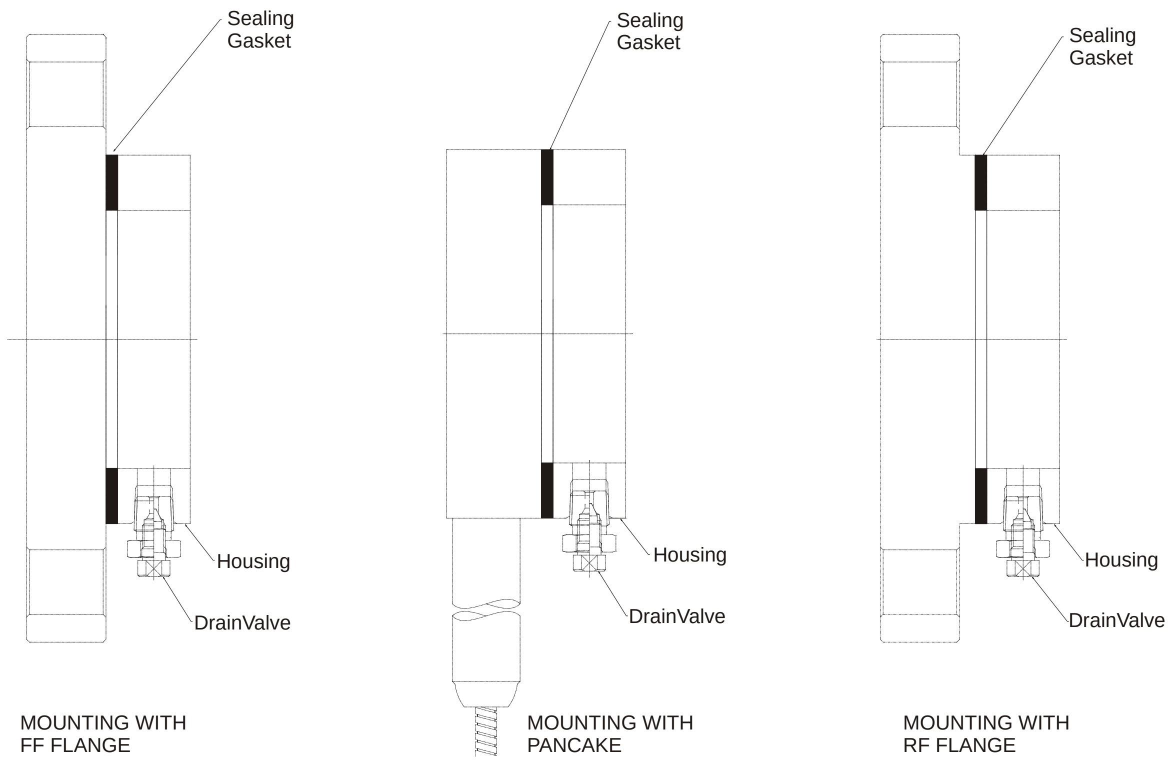


Figure 4.6 – Exploded View - Mounting with Gasket and Drain Valve

RTJ SPARE PARTS: LD300L (without Extension) / SR301T / SR301E					
ØN	**GROUP**	**NORM**	**RING**	**METALLIC RING**	**DRAIN VALVE**
				STAINLESS STEEL 316L	**STAINLESS STEEL 316L**
1"	**150**	**ANSI B 16.20 RTJ**	**R15**	400-0887	400-0792
	300		**R16**	400-0888	
	600		**R16**	400-0888	
	1500		**R16**	400-0888	
	2500		**R18**	400-0889	
1.1/2"	**150**		**R19**	400-0890	
	300		**R20**	400-0891	
	600		**R20**	400-0891	
	1500		**R20**	400-0891	
	2500		**R23**	400-0893	
2"	**150**		**R22**	400-0892	
	300		**R23**	400-0893	
	600		**R23**	400-0893	
	1500		**R24**	400-0894	
	2500		**R26**	400-0895	
3"	**150**		**R29**	400-0896	
	300		**R31**	400-0897	
	600		**R31**	400-0897	
4"	**150**		**R36**	400-0900	
	300		**R37**	400-0901	
	600		**R37**	400-0901	

Table 4.3 – LD300L (without) / SR301T / SR301E Spare Parts

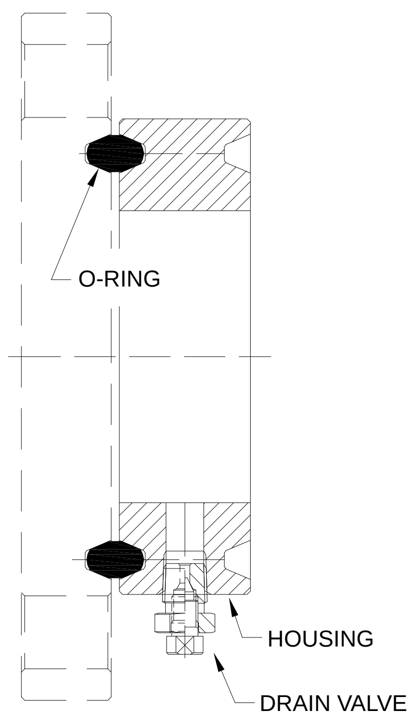


Figure 4.7 – Exploded View of LD300L (without extension) SR301T / SR301E

SR301R SPARE PARTS				
NPT THREAD	**SEALING GASKET**			**DRAIN VALVE**
	TEFLON	**COPPER**	**GRAFOIL**	**STAINLESS STEEL 316L**
1/4”	201-0120	400-0458	400-0459	400-0792
3/8”				
1/2”				
3/4”				
1”				
1.1/2”				

Table 4.4 – SR301R Spare Parts

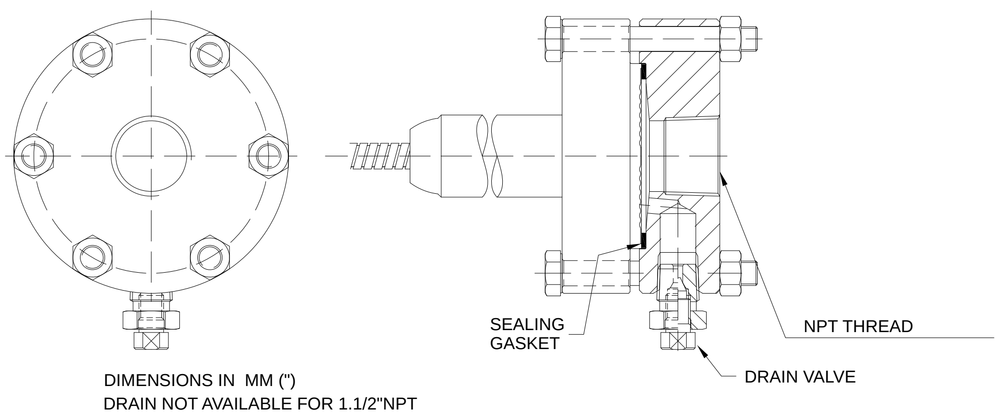


Figure 4.8 – SR301R Exploded View

INSULATOR KIT SPARE PARTS: LD300L / SR301T / SR301E				
ØN	GROUP	NORM	MODELS WITHOUT EXTENSION	MODELS WITH EXTENSION
			LD300L / SR301T	LD300L / SR301E
1”	150	ANSI B 16.5	400-0861-11X01	400-0861-11X11
	300		400-0861-12X01	400-0861-12X11
	600		400-0861-13X01	400-0861-13X11
1.1/2”	150		400-0861-21X01	400-0861-21X11
	300		400-0861-22X01	400-0861-22X11
	600		400-0861-23X01	400-0861-23X11
2”	150		400-0861-31X01	400-0861-31X11
	300		400-0861-32X01	400-0861-32X11
	600		400-0861-33X01	400-0861-33X11
3”	150		400-0861-41X01	400-0861-41X11
	300		400-0861-42X01	400-0861-42X11
	600		400-0861-43X01	400-0861-43X11
4”	150		400-0861-51X01	400-0861-51X11
	300		400-0861-52X01	400-0861-52X11
	600		400-0861-53X01	400-0861-53X11
DN25	PN10/40	DIN EN1092-1	400-0861-64X01	400-0861-64X11
DN40	PN10/40		400-0861-74X01	400-0861-74X11
DN50	PN10/40		400-0861-84X01	400-0861-84X11
DN80	PN10/40		400-0861-94X01	400-0861-94X11
DN100	PN16		400-0861-A8X01	400-0861-A8X11
	PN40		400-0861-A4X01	400-0861-A4X11
40A	20K	JIS B 2202	400-0861-B6X01	400-0861-B6X11
50A	10K		400-0861-C5X01	400-0861-C5X11
	40K		400-0861-C7X01	400-0861-C7X11
80A	10K		400-0861-D5X01	400-0861-D5X11
	20K		400-0861-D6X01	400-0861-D6X11
100A	10K		400-0861-E5X01	400-0861-E5X11

OBS.: X – Option for Flange Face Type. Where: 0 – RF Flange Face (RF Face Flange) / 1 – FF Flange Face (Flat Face).
This Kit is composed by: Nonconductive Sealing Gasket, Isolating Bolt Bush, Nonconductive Washer and Compression Washer.

Table 4.5 – LD300L / SR301T / SR301E Insulator Kit Spare Parts

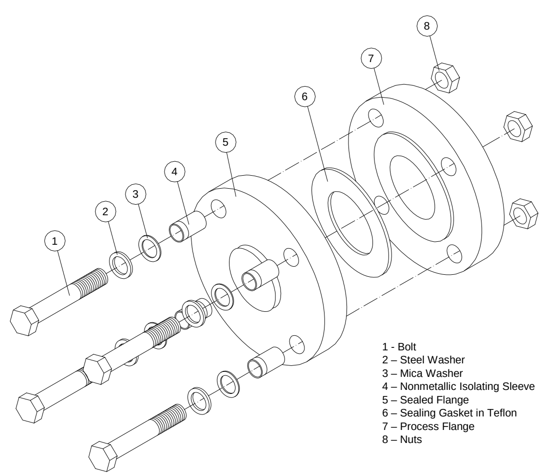


Figure 4.9 – Electric Insulator Kit

INSULATOR KIT SPARE PARTS: SR301P / SR301Q				
ØN	GROUP	NORM	MODEL WITHOUT EXTENSION	MODEL WITH EXTENSION
			SR301P	SR301Q
1.1/2"	ALL	ANSI B 16.5	400-1068-101	400-1068-111
2"	ALL		400-1068-201	400-1068-211
3"	ALL		400-1068-301	400-1068-311
4"	ALL		400-1068-401	400-1068-411
DN40	ALL	DIN EN1092-1	400-1068-501	400-1068-511
DN50	ALL		400-1068-601	400-1068-611
DN80	ALL		400-1068-701	400-1068-711
DN100	ALL		400-1068-801	400-1068-811
40A	20K	JIS B 2201	400-1068-901	400-1068-911
50A	10K		400-1068-A01	400-1068-A11
	40K		400-1068-A01	400-1068-A11
80A	10K		400-1068-B01	400-1068-B11
	20K		400-1068-B01	400-1068-B11
100A	10K		400-1068-C01	400-1068-C11

OBS.: This kit is composed by two nonconductive sealing gaskets.

Table 4.6 – Insulator Kit Spare Parts SR301P / SR301Q

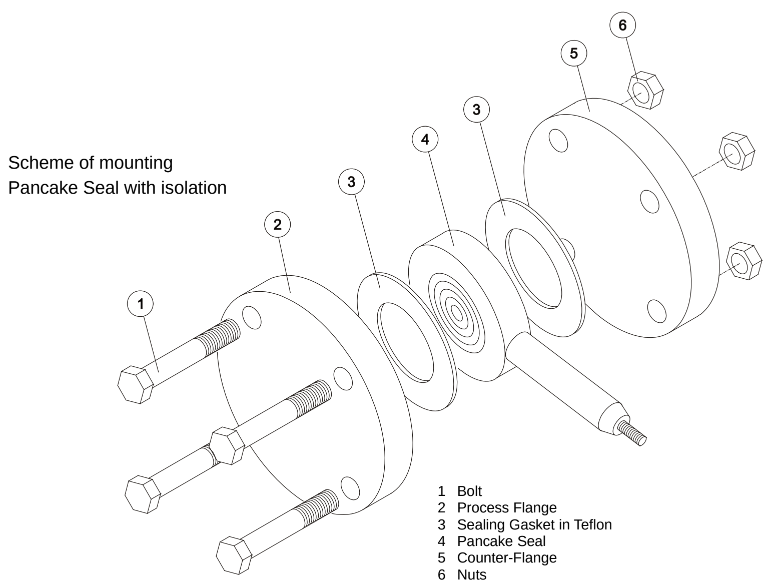


Figure 4.10 – SR301P and SR301Q Electric Insulator Kit

Chapter 5

EXAMPLES

NOTE
For the examples on this Chapter, consider the calibrated seal at temperature of 25°C.

Example 1

Considering a Two-Seal Transmitter.

A – TRANSMITTER DATA	RESPONSE
1. Type of Transmitter (Absolute, Gauge, Differential)	Differential
2. Range Superior Value / (V.sup.) (mmH2O @ 4 ºC)	2400
3. Range Inferior Value / (V. inf.) (mmH2O @ 4 ºC)	-1000
4. Transmitter Calibration (mmH2O @ 4 ºC)	3400
5. Transmitter Range (2,3,4,5)	2
6. Diaphragm Material/Fill Oil	316 SST/Sillicone
7. Maximum Ambient Temperature T Max. (ºC)	60
8. Minimum Ambient Temperature T Min. (ºC)	-15
9. Static Pressure Variation (Bar)	3
10. Pressure Transmitter Error to T Max. (Calibration percent)	0.175
11. Pressure Transmitter Error to T Min. (Calibration percent)	0.195
12. Transmitter Accuracy (Transmitter Calibration percent)	0.075
13. Stability/Time (Transmitter Calibration percent / months)	0.225 / 60
14. Transmitter Response Time (seconds)	0.1

Table 5.1 – Transmitter Data (Example 1)

B – SEAL/LEVEL DATA	RESPONSE
1. Type of Connection (One Seal, Two Seals, One Level, Level/Seal)	Two Seals
2. Capillary Filling Fluid (Table 2.4)	Dc 200
3. Geometric Symmetry (Symmetric, Assymetric)	Assymetric
4. Thermic Symmetry (Symmetric, Assymetric)	Assymetric
5. Diaphragm Material (Steel, Hasteloy, Monel, Titanium, Tantalum and other)	Steel
6. Diaphragm Thickness	0.05 mm
B.1 – H Side	
1. H Side Model (SR301T, SR301E, SR301R, SR301S, SR301P, SR301Q, LD30XL, LD30XS)	SR301E
2. Side H Diameter Seal (N Inch, DN (mm))	3 Pol.
3. H Side Diaphragm Family (Table 2.5)	7
4. Diaphragm Reservoir Volume – Vrdf (cm3) (Table 2.6)	105.6E-2
5. H Side Capillary Length (meters)	2.5
6. H Side Extension Length (meters)	0.10
B.2 – L Side	
1. L Side Model (SR301T, SR301E, SR301R, SR301S, SR301P, SR301Q, LD30XL, LD30XS)	SR301E
2. Side L Diameter Seal (N Inch, DN (mm))	3 Pol.
3. L Side Diaphragm Family (Table 2.5)	7
4. Diaphragm Reservoir Volume – Vrdf (cm3) (Table 2.6)	105.6E-2
5. L Side Capillary Length (meters, N.A. - Non Applicable)	4.5
6. L Side Extension Length (meters)	0.10

Table 5.2 – Level/Seal Data (Example 1)

C – ASSEMBLY SCHEME

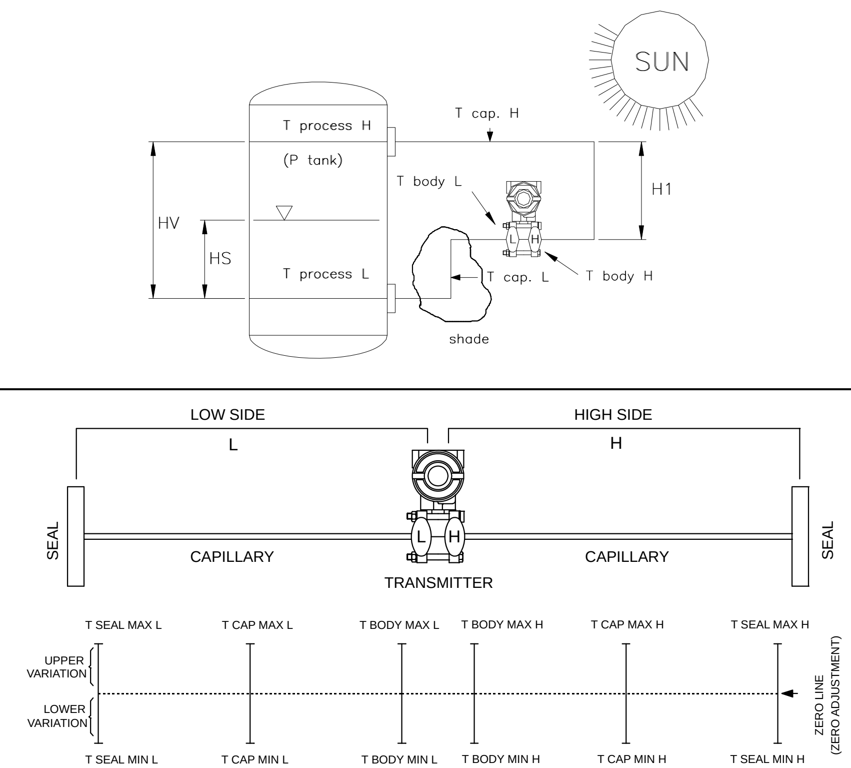


Table 5.3 – Assembly Scheme (Example 1)

D – PROCESS DATA	RESPONSE
D.1 – H Side	
1. T seal max H – Maximum Temperature in the H Side Seal (°C)	70
2. T seal min H – Minimum Temperature in the H Side Seal (°C)	60
3. T cap max H – Maximum Temperature in the H Side Capillary (°C)	60
4. T cap min H – Minimum Temperature in the H Side Capillary (°C)	-15
5. T body max H – Maximum Temperature in the H Side Body (°C)	60
6. T body min H – Minimum Temperature in the H Side Body (°C)	-15
D.2 – L Side	
1. T seal max L – Maximum Temperature in the Side Seal (°C)	120
2. T seal min L – Minimum Temperature in the L Side Seal (°C)	80
3. T cap max L – Maximum Temperature in the L Side Capillary (°C)	35
4. T cap min L – Minimum Temperature in the L Side Capillary (°C)	-5
5. T body max L – Maximum Temperature in the L Side Body (°C)	60
6. T body min L – Minimum Temperature in the L Side Body (°C)	-15
D.3 – Pressure	
1. Maximum Process Pressure (bar abs.)	5
2. Minimum Process Pressure (bar abs.)	2

Table 5.4 – Process Data (Example 1)

E – USER EXPECTANCY	RESPONSE
1. Global Error Requested by User (% Transmitter Calibration)	0.5%
2. Response Time Requested by the Mesh Control (seconds)	10

Table 5.5 – User Expectancy (Example 1)

Error Calculation by Temperature

Have:

1° – "Upper Variation of Temperature"

Seal H Side

$$\Delta T_{seal} = (70 - 25) = 45\,^{\circ}C$$
$$\Delta T_{cap} = (60 - 25) = 35^{\circ}C$$
$$\Delta T_{body} = (60 - 25) = 35\,^{\circ}C$$

Using the formulas on Chapter 2, item 2 we have:

$$\Delta V_{rdf} = 0.0508\, cm^3$$
$$\Delta V_{ext} = 0.0049\, cm^3$$
$$\Delta V_{cap} = 0.0843\, cm^3$$
$$\Delta V_{body} = 0.0432\, cm^3$$
$$V_{total} = \Delta V_{total} = 0.1823\, cm^3$$

Entering this value in Figure 2.6, we have:

$$Error = Error\,(Graphic).\,Fm$$

$$E_H = +25.9080\; mmH_2O$$

NOTE
If the diaphragm is equal to 0.1mm, enter with this value V_{total} on Figure 2.8 E_H = + 71.8080 mmH_2O.

Seal L Side

$$\Delta T_{seal} = (120 - 25) = 95\,^{\circ}C$$
$$\Delta T_{cap} = (35 - 25) = 10^{\circ}C$$
$$\Delta T_{body} = (60 - 25) = 35\,^{\circ}C$$

Using the formulas on Chapter 2, item 2 have:

$$\Delta V_{rdf} = 0.1073\, cm^3$$
$$\Delta V_{ext} = 0.0104\, cm^3$$
$$\Delta V_{cap} = 0.0433\, cm^3$$
$$\Delta V_{body} = 0.0432\, cm^3$$
$$V_{total} = \Delta V_{total} = 0.2042\, cm^3$$

Enter this value on Figure 2.6, have:

$$Error = Error\,(Graphic).\,Fm$$

$$E_L = +28.9000\ mmH_2O$$

NOTE
If the diaphragm is equal to 0.1mm enter this value V_{total} on Figure 2.8, E_L = + 80.2060 mmH_2O.

2º – "Temperature Lower Variation"

Seal H Side

$$\Delta T_{seal} = (60 - 25) = 35\ ^oC$$
$$\Delta T_{cap} = (-15 - 25) = -40^oC$$
$$\Delta T_{body} = (-15 - 25) = -40\ ^oC$$

Using the formulas on Chapter 2, item 2 we have:

$$\Delta V_{rdf} = 0.0395\ cm^3$$
$$\Delta V_{ext} = 0.0038\ cm^3$$
$$\Delta V_{cap} = -0.0963\ cm^3$$
$$\Delta V_{body} = -0.0494\ cm^3$$
$$V_{total} = \Delta V_{total} = -0.1024\ cm^3$$

Enter this value in the Figure 2.6, we have:

$$Error = Error\ (Graphic).\ Fm$$

$$E_H = -14.4160\ mmH_2O$$

Enter this value in the Figure 2.8 it is not possible to find the Value for negative Error because there is a contraction in the diaphragm.

ATTENTION

The logarithmic graphs do not indicate negative errors. To resolve this problem and considering that the error is symmetrical, the V_{total} must be calculated, inverting the signals of the seal volume variation, of the extension and capillary and to add the negative signal to error:
From Equations 2.8 and 2.9:

$$V_{Total} = \Delta V_{rdf} + \Delta V_{ext} + \Delta V_{cap} + \Delta V_{body}$$

$$V_{total} = (-0.0395) + (-0.0038) + (+0.0963) + (+0.0494) = 0.1024\ cm^3$$

To enter this value in the Figure 2.6, obtain the Symmetric Error $E_H = +14.4160\ mmH_2O$

Inverting the signal: $E_H = -14.4160\ mmH_2O$

If the lamina equal 0.1mm enter with this value V_{total} in the Figure 2.8
$E_H = +39.8820\ mmH_2O$.

Inverting the signal: $E_H = -39.8820\ mmH_2O$

Seal L Side

$$\Delta T_{seal} = (80 - 25) = 55\ ^{o}C$$
$$\Delta T_{cap} = (-5 - 25) = -30^{o}C$$
$$\Delta T_{body} = (-15 - 25) = -40\ ^{o}C$$

Using the formulas from Chapter 2, item 2:

$$\Delta V_{rdf} = 0.0620\ cm^{3}$$
$$\Delta V_{ext} = 0.0060\ cm^{3}$$
$$\Delta V_{cap} = -0.1300\ cm^{3}$$
$$\Delta V_{body} = -0.0494\ cm^{3}$$
$$V_{total} = \Delta V_{total} = -0.1113\ cm^{3}$$

Enter this value on Figure 2.6, have:

$$Error = Error\ (Graphic).\ Fm$$

$$E_{L} = -15.7080\ mmH_{2}O$$

Entering this value on Figure 2.8 it is not possible to find the Value for negative Error because there is a contraction in the diaphragm.

ATTENTION
The logarithmic graphs do not show negative errors. To solve this problem and considering that the error is symmetrical, the V_{total} must be calculated, by inverting the seal volume, the extension and the capillary variation signals and by adding the negative signal to the error, namely From Equations 2.8 and 2.9: $V_{Total} = \Delta V_{rdf} + \Delta V_{ext} + \Delta V_{cap} + \Delta V_{body}$ $V_{total} = (-0.062) + (-0.0060) + (+0.1300) + (+0.0494) = 0.1113 cm^{3}$ By entering this value on Figure 2.6, one has the Symmetric Error $E_{L} = +15.7080\ mmH_{2}O$ Inverting the signal: $E_{L} = -15.7080\ mmH_{2}O$ If the diaphragm is equal to 0.1mm, enter with this value V_{total} on Figure 2.8 $E_{L} = +43.3840\ mmH_{2}O$ Inverting the signal: $E_{L} = -43.3840\ mmH_{2}O$

Calculation of Seal/Level Error

To calculate the Seals Error, verify the cases of symmetry. In this case, there is a Geometric Asymmetry and a Thermal Asymmetry, and therefore the Equation 2.13 on Chapter 2 must be used.

$$Es = \sqrt{(E_{H})^{2} + (E_{L})^{2}}$$

1° – "Upper Temperature Variation"

$$Es1 = \sqrt{(25.9080)^{2} + (28.9000)^{2}}$$

$$Es1 = 38.8128 \text{ mmH}_2\text{O}$$

2º – "Lower Temperature Variation"

$$Es2 = \sqrt{(-14.4160)^2 + (-15.7080)^2}$$

$$Es2 = 21.3205 \text{ mmH}_2\text{O}$$

Calculation of the Transmitter Accuracy with Seal/Level

NOTE
The transmitter accuracy is not significantly altered by the addition of seal/level. However, the measuring error resulting from the combination suffers significant increase due to physical and geometric parameters, in terms of temperature variation.

$$Accuracy = \frac{0.075}{100} \cdot 3400 = 2.55 \text{ mmH}_2\text{O}$$ *(See Transmitter's Manual)*

Calculation of the Global Error of Transmitter Assembling with Seals/Level

From Equation 2.14 the global error of the remote seal must be calculated:

$$E_{TpT\,\max} = \frac{0.175}{100} \cdot 3400 = 5.9500 \; mmH_2O$$

$$E_{TpT\,\min} = \frac{0.195}{100} \cdot 3400 = 6.6300 \; mmH_2O$$

$$E_{globalpTMax} = \sqrt{E_S{}^2 + E_T{}^2} = \sqrt{38.8128^2 + 5.9500^2}$$

$$E_{globalpTMax} = 39.2662 \, mmH_2O$$

$$E_{globalpTMax} = 1.155\%$$ **of the calibrated Span**

$$E_{globalpTMin} = \sqrt{E_S{}^2 + E_T{}^2} = \sqrt{21.3205^2 + 6.6300^2}$$

$$E_{globalpTMin} = 22.3276 \, mmH_2O$$

$$E_{globalpTMin} = 0.657\%$$ **of the calibrated Span**

The larger global error is:

$$E_{global} = 39.2662 \, mmH_2O$$

$$E_{global} = 1.155\%$$ **of the calibrated Span**

Calculation of the Response Time

The response time is obtained through the Equation 2.14: $TR_S = TR_{listed} \cdot L$

Considering that the transmitter is range 2 type, the filling fluid is DC200/20.

However, the temperature to be used is closer to the Maximum value, because the temperature will not necessarily be kept on the maximum. So:

Maximum Temperature on the H Side Capillary = 60°C.

Maximum Temperature on the L Side Capillary, 35°C, from the Table 2.9:

$$TR_{listed} H = 0.455 \ \ s/m$$
$$TR_{listed} L = 0.698 \ \ s/m$$

Thus:

$$TR\,H = 0.455 \times 2.5 = 1.1375 \ \ s$$
$$TR\,L = 0.698 \times 4.5 = 3.1410 \ \ s$$

NOTE
Note that the response time between the sides is longer than 0.5 second and therefore this type of assembling is not recommended. It is advisable to reduce this difference.

$$TR_S = TR\,H + TR\,L = 4.2785\,\mathrm{sec}$$

This response time refers only to the remote seal. To calculate the response time of the remote seal and transmitter set, add the time of both:

$$TR = TR_S + TR_T = 4.2785 + 0.1 = 4.3785\,\mathrm{sec}$$

Checking the Capillary Length

To evaluate the maximum length of the capillary, three conditions on Chapter 2 must be met.

1º - Check if the dilated or contracted volume related to the initial volume of the seal diaphragm is in the Lower and Upper Limits (VCmin and VCmax) according to Equation 2.12.

$$VC_{\min} \leq V_{total} \leq VC_{\max}$$

Maximum Limit of the Transmitter: URL = 50Kpa = 5098.58 mmH_2O.

Thus, the process pressure conditioned to the transmitter URL will be:

$$\%VC_{\min} = \frac{MVP}{URL} \times 100$$

MVP=2400 mmH_2O (MVP: The larger value between the $|V.\sup|$ and $|V.\inf|$)

$$\%VC_{\min} = \frac{2400}{5098.58} \times 100 = 47.1\,\%$$

Table 2.18 shows the VC_{mim} value. Considering that the assembling was performed with a range 2 transmitter, the value relative to $\%VC_{\min}$ is obtained by the linear interpolation between 50% and 40%, whereby:

$$VC_{\min} = 2.76 \cdot (10^{-2} x \ cm^3)$$

VC_{max} is obtained on Table 2.10. Considering the # 0.05 mm Inox Steel diaphragm material, the family 7 diaphragm and the process ºC temperature, one has:

Maximum Temperature in the H Side Seal, 70°C.

Maximum Temperature in the L Side Seal, 120°C, on table 2.10, means:

$$VC_{\max} H = 93.7 \cdot (10^{-2} x \ cm^3)$$
$$VC_{\max} L = 85.9 \cdot (10^{-2} x \ cm^3)$$

From the calculation:

$V_{total} H1c = 0.1823 \ cm^3$ (*"Upper Temperature Variation"*)
$V_{total} L1c = 0.2042 \ cm^3$ (*"Upper Temperature Variation"*)

$\left|V_{total} H2c\right| = \left|-0.1024\right| = 0.1024 \ cm^3$ (*"Lower Temperature Variation"*)
$\left|V_{total} L2c\right| = \left|-0.1113\right| = 0.1113 \ cm^3$ (*"Lower Temperature Variation"*)

All the values are in their lower and upper limits according to equation 2.12, which makes the first condition acceptable.

2º - Check if the response time is compatible with the process variables, and if there is enough time for the pressure transmitted guarantees the application control limits.

Requested Client Time = 10 s
Calculated Time = 4.3785 s

Therefore, as a conclusion, the lengths satisfy the second condition.

3º - Check if the global assembling error is within client expectations.

Have:

Global Error Expected by User: 0.5% of the calibrated span
Global Assembling Error: 1.155% of the calibrated span

Thus, the Percent Error is greater than expected, so one concludes that the lengths do not meet the third condition.

Conclusion about the Capillary Length

As the third condition is not favorable, the remote seal assembled do not meet the application and user expectations.
It is worth remembering that the last condition do not depend only on the capillary length, hence it is possible to improve it and to make the application feasible using Table 2.2 of the Chapter 2.

Example 2

Combining Geometric Symmetry with Thermal Symmetry to minimize the Error.

A – TRANSMITTER DATA	RESPONSE
1. Type of Transmitter (Absolute, Gauge, Differential)	Differential
2. Range Superior Value (V.sup.) (mmH2O @ 4 ºC)	2400
3. Range Inferior Value (V. inf.) (mmH2O @ 4 ºC)	-1000
4. Transmitter Calibration (Span) (mmH2O @ 4 ºC)	3400
5. Transmitter Range (2,3,4,5)	2
6. Diaphragm Material/Fill Oil	316 SST/Sillicone
7. Maximum Ambient Temperature T Max. (ºC)	30
8. Minimum Ambient Temperature T Min. (ºC)	-5
9. Static Pressure Variation (Bar)	3
10. Pressure Transmitter Error to T Max. (Calibration percent)	0.078
11. Pressure Transmitter Error to T Min. (Calibration percent)	0.154
12. Transmitter Accuracy (Transmitter Calibration percent)	0.075
13. Stability/Time (Transmitter Calibration percent / months)	0.225 / 60
14. Transmitter Response Time (seconds)	0.1

Table 5.6 – Transmitter Data (Example2)

B – SEAL/LEVEL DATA	RESPONSE
1. Type of Connection (One Seal, Two Seals, One Level, Level/Seal)	Two Seals
2. Capillary Filling Fluid (Table 2.4)	Dc 200
3. Geometric Symmetry (Symmetric, Assymetric)	Symmetric
4. Thermic Symmetry (Symmetric, Assymetric)	Symmetric
5. Diaphragm Material (Steel, Hasteloy, Monel, Titanium, Tantalum and other)	Steel
6. Diaphragm Thickness	0.05 mm
B.1 – H Side	
1. H Side Model (SR301T, SR301E, SR301R, SR301S, SR301P, SR301Q, LD30XL, LD30XS)	SR301E
2. Side H Diameter Seal (N Inch, DN (mm))	3 Inch
3. H Side Diaphragm Family (Table 2.5)	7
4. Diaphragm Reservoir Volume – Vrdf (cm3) (Table 2.6)	105.6E-2
5. H Side Capillary Length (meters)	4.5
6. H Side Extension Length (meters)	0.10
B.2 – L Side	
1. L Side Model (SR301T, SR301E, SR301R, SR301S, SR301P, SR301Q, LD30XL, LD30XS)	SR301E
2. Side L Diameter Seal (N Inch, DN (mm))	3 Inch
3. L Side Diaphragm Family (Table 2.5)	7
4. Diaphragm Reservoir Volume – Vrdf (cm3) (Table 2.6)	105.6E-2
5. L Side Capillary Length (meters, N.A. – non applicable)	4.5
6. L Side Extension Length (meters)	0.10

Table 5.7 – Level/Seal Data (Example 2)

C – ASSEMBLY SCHEME

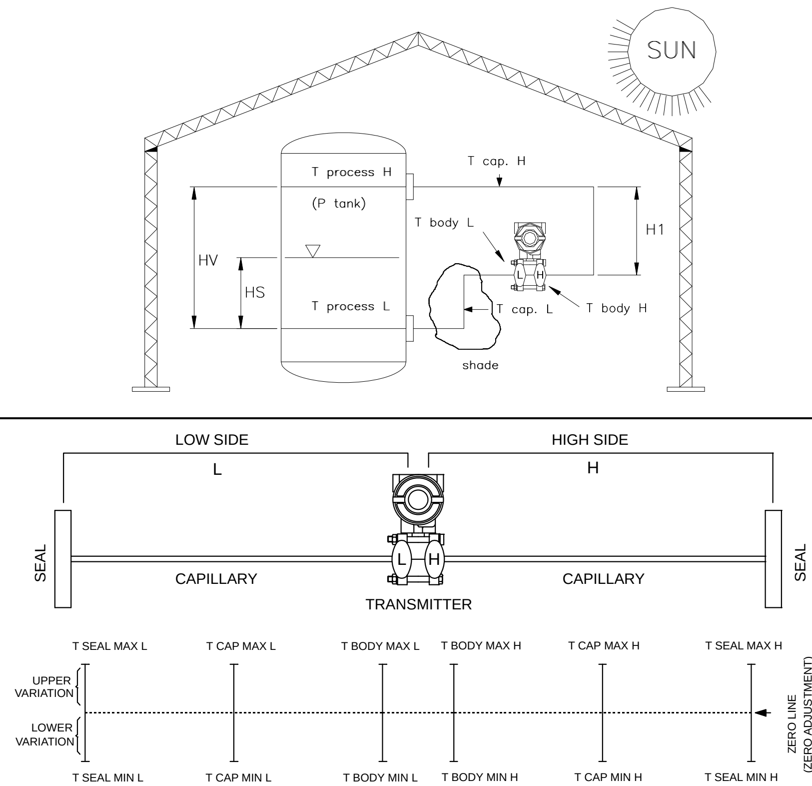


Table 5.8 – Assembly Scheme (Example 2)

D – PROCESS DATA	RESPONSE
D.1 – H Side	
1. T seal max H – Maximum Temperature in the H Side Seal (°C)	90
2. T seal min H – Minimum Temperature in the H Side Seal (°C)	80
3. T cap max H – Maximum Temperature in the H Side Capillary (°C)	30
4. T cap min H – Minimum Temperature in the H Side Capillary (°C)	-5
5. T body max H – Maximum Temperature in the H Side Body (°C)	30
6. T body min H – Minimum Temperature in the H Side Body (°C)	-5
D.2 – L Side	
1. T seal max L – Maximum Temperature in the L Side Seal (°C)	90
2. T seal min L – Minimum Temperature in the L Side Seal (°C)	80
3. T cap max L – Maximum Temperature in the L Side Capillary (°C)	30
4. T cap min L – Minimum Temperature in the L Side Capillary (°C)	-5
5. T body max L – Maximum Temperature in the L Side Body (°C)	30
6. T body min L – Minimum Temperature in the L Side Body (°C)	-5
D.3 – Pressure	
1. Maximum Process Pressure (bar abs.)	5
2. Minimum Process Pressure (bar abs.)	2

Table 5.9 – Process Data (Example 2)

E – USER EXPECTANCY	RESPONSE
1. Global Error Requested by User (% Transmitter Calibration)	0.5%
2. Response Time Requested by the Mesh Control (seconds)	10

Table 5.10 – User Expectancy (Example 2)

Error Calculation by Temperature

Have:

1º – "Upper Variation of Temperature"

Seal L and H Side

$$\Delta T_{seal} = (90 - 25) = 65\,^{o}C$$
$$\Delta T_{cap} = (30 - 25) = 5^{o}C$$
$$\Delta T_{body} = (30 - 25) = 5\,^{o}C$$
$$E_H = E_L = +15.2864\ mmH_2O$$

2º – "Temperature Lower Variation"

Seal L and H Side

$$\Delta T_{seal} = (80 - 25) = 55\,^{o}C$$
$$\Delta T_{cap} = (-5 - 25) = -30^{o}C$$
$$\Delta T_{body} = (-5 - 25) = -30\,^{o}C$$
$$E_H = E_L = -13.9468\ mmH_2O$$

Calculation of Seal/Level Error

To calculate the Seals Error, verify the cases of symmetry. In this case, there is a Geometric Asymmetry and a Thermal Symmetry, and therefore the Equation 2.12 on Chapter 2 must be used.

$$Es = \sqrt{(E_H)^2 + (E_L)^2} \times \left(\frac{1}{\sqrt{6}}\right)$$

1º – "Upper Temperature Variation"

$$Es1 = \sqrt{(15.2864)^2 + (15.2864)^2} \times \left(\frac{1}{\sqrt{6}}\right)$$

$Es1 = 8.8260$ mmH_2O

2º – "Lower Temperature Variation"

$$Es2 = \sqrt{(-13.9468)^2 + (-13.9468)^2} \times \left(\frac{1}{\sqrt{6}}\right)$$

$Es2 = 8.0520$ mmH_2O

Calculation of the Transmitter Accuracy with Seal/Level

NOTE
The transmitter accuracy is not significantly altered by the addition of seal/level. However, the measuring error resulting from the combination suffers significant increase due to physical and geometric parameters, in terms of temperature variation.

$Accuracy = \frac{0.075}{100} \cdot 3400 = 2.55\ mmH_2O$ *(See Transmitter's Manual)*

Calculation of the Global Error of Transmitter Assembling with Seals/Level

From Equation 2.14 the global error of the remote seal must be calculated:

$$E_{TpT\max} = \frac{0.078}{100} \cdot 3400 = 2.6520\ mmH_2O$$

$$E_{TpT\min} = \frac{0.154}{100} \cdot 3400 = 5.2360\ mmH_2O$$

$$E_{globalpTMax} = \sqrt{E_S{}^2 + E_T{}^2} = \sqrt{8.8260^2 + 2.6520^2}$$

$$E_{globalpTMax} = 9.216\, mmH_2O$$

$E_{globalpTMax} = 0.271\%$ **of the calibrated Span**

$$E_{globalpTMin} = \sqrt{E_S{}^2 + E_T{}^2} = \sqrt{8.0520^2 + 5.2360^2}$$

$$E_{globalpTMin} = 9.605\, mmH_2O$$

$E_{globalpTMin} = 0.283\%$ **of the calibrated Span**

The larger global error is:

$$E_{global} = 9.605\, mmH_2O$$

$E_{global} = 0.283\%$ **of the calibrated Span**

Calculation of the Response Time

The response time is obtained through the Equation 2.14: $TR_S = TR_{listed} \cdot L$

Considering that the transmitter is range 2 type, the filling fluid is DC200/20.

However, the temperature to be used is closer to the Maximum value, because the temperature will not necessarily be kept on the maximum. So:

Maximum Temperature on the H Side Capillary, 30 ºC.

Maximum Temperature on the L Side Capillary, 30°C, from the Table 2.9:

$$TR_{listed}H = TR_{listed}L = 0.698\ s/m$$

Thus:

$$TR\,H = TR\,L = 0.698 \times 4.5 = 3.1410\ s$$

NOTE
Note that the response time between the sides is smaller than 0.5 second and therefore this type of assembling is recommended.

$$TR_S = TR\,H + TR\,L = 6.2820\,\text{sec}$$

This response time refers only to the remote seal. To calculate the response time of the remote seal and transmitter set, add the time of both:

$$TR = TR_S + TR_T = 6.2820 + 0.1000 = 6.3820\,\text{sec}$$

Checking the Capillary Length

To evaluate the maximum length of the capillary, three conditions on Chapter 2 must be met.

1º - Check if the dilated or contracted volume related to the initial volume of the seal diaphragm is in the Lower and Upper Limits (VCmin and VCmax) according to Equation 2.12.

$$VC_{\min} \le V_{total} \le VC_{\max}$$

Maximum Limit of the Transmitter: URL = 50Kpa = 5098.58 mmH_2O

Thus, the process pressure conditioned to the transmitter URL will be:

$$\%VC_{\min} = \frac{MVP}{URL} \times 100$$

MVP=2400 mmH_2O (MVP: The larger value between the $|V.\sup|$ and $|V.\inf|$)

$$\%VC_{\min} = \frac{2400}{5098.58} \times 100 = 47.1\%$$

Table 2.18 shows the VC_{mim} value. Considering that the assembling was performed with a range 2 transmitter, the value relative to $\%VC_{\min}$ is obtained by the linear interpolation between 50% and 40%, whereby:

$$VC_{\min} = 2.76 \cdot (10^{-2}\,x\ cm^3)$$

VC_{max} is obtained on Table 2.10. Considering the # 0.05 mm Steel diaphragm material, the family 7 diaphragm and the process ºC temperature, one has:

Maximum Temperature in the H Side Seal, 90 ºC.

Maximum Temperature in the L Side Seal, 90°C, on table 2.10, means:

$$VC_{max}H = VC_{max}L = 85.9 \cdot (10^{-2} x \ cm^3)$$

From the calculation:

$$V_{total}H1c = V_{total}L1c = 0.108\ cm^3$$ (*"Upper Temperature Variation"*)

$$V_{total}H2c = |V_{total}L2c| = |-0.099| = 0.099\ cm^3$$ (*"Lower Temperature Variation"*)

All the values are in their lower and upper limits according to equation 2.12, which makes the first condition acceptable.

2º - Check if the response time is compatible with the process variables, and if there is enough time for the pressure transmitted guarantees the application control limits.

Requested Client Time = 10 s
Calculated Time = 6.3820 s

Therefore, as a conclusion, the lengths satisfy the second condition.

3º - Check if the global assembling error is within client expectations.

Have:

Global Error Expected by User: 0.5% of the calibrated span
Global Assembling Error: 0.283% of the calibrated span

Thus, the Percent Error is smaller than expected, so one concludes that the assembling meets the third condition.

Conclusion about the Capillary Length

As all the condition is favorable, the remote seal assembled do meet the application and user expectations.

Chapter 6

TYPE OF SEAL AND ORDERING CODE

"T" Type Flanged Remote Seal - SR301T

Description

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

Bolts and nuts are not supplied with the seal.

For Dimensions Models and Pressure Limits see respectively the pages 6.24 (for integral flange), 6.25, 6.26 (for slip-on flange) and 6.29 for Dimensions and page 6.17 for Pressure Limits.

MODEL SR301T	"T" TYPE FLANGED REMOTE SEAL

CODE		Process Connection, Range and Standard	CODE		Process Connection, Range and Standard
1	**1**	1" 150 # ANSI B-16.5 **(11)**	**6**	**9**	DN 25 PN250 DIN 2501 **(11)**
1	**2**	1" 300 # ANSI B-16.5 **(11)**	**7**	**B**	DN 40 PN10/40 DIN EN1092-1 **(11)**
1	**3**	1" 600 # ANSI B-16.5 **(11)**	**7**	**D**	DN 40 PN63/100 DIN EN1092-1 **(11)**
1	**4**	1" 1500 # ANSI B-16.5 **(4) (11)**	**7**	**8**	DN 40 PN160 DIN 2501 **(11)**
1	**5**	1" 2500 # ANSI B-16.5 **(11)**	**7**	**9**	DN 40 PN250 DIN 2501 **(11)**
2	**1**	1 1/2" 150 # ANSI B-16.5 **(11)**	**8**	**B**	DN 50 PN10/40 DIN EN1092-1 **(3)**
2	**2**	1 1/2" 300 # ANSI B-16.5 **(11)**	**8**	**6**	DN 50 PN63 DIN EN1092-1 **(11)**
2	**3**	1 1/2" 600 # ANSI B-16.5 **(11)**	**8**	**7**	DN 50 PN100 DIN EN1092-1 **(11)**
2	**4**	1 1/2" 1500 # ANSI B-16.5 **(4) (11)**	**8**	**8**	DN 50 PN160 DIN 2501 **(11)**
2	**5**	1 1/2" 2500 # ANSI B-16.5 **(11)**	**8**	**9**	DN 50 PN250 DIN 2501 **(11)**
3	**1**	2" 150 # ANSI B-16.5	**9**	**B**	DN 80 PN10/40 DIN EN1092-1 **(3)**
3	**2**	2" 300 # ANSI B-16.5	**9**	**6**	DN 80 PN63 DIN EN1092-1 **(11)**
3	**3**	2" 600 # ANSI B-16.5	**9**	**7**	DN 80 PN100 DIN EN1092-1 **(11)**
3	**4**	2" 1500 # ANSI B-16.5 **(4) (11)**	**9**	**8**	DN 80 PN160 DIN 2501 **(11)**
3	**5**	2" 2500 # ANSI B-16.5 **(11)**	**A**	**A**	DN 100 PN10/16 DIN EN1092-1
4	**1**	3" 150 # ANSI B-16.5	**A**	**C**	DN 100 PN25/40 DIN EN1092-1
4	**2**	3" 300 # ANSI B-16.5	**C**	**G**	JIS 40A 20K **(11)**
4	**3**	3" 600 # ANSI B-16.5	**D**	**F**	JIS 50A 10K **(11)**
5	**1**	4" 150 # ANSI B-16.5	**D**	**H**	JIS 50A 40K **(11)**
5	**2**	4" 300 # ANSI B-16.5	**E**	**F**	JIS 80A 10K **(11)**
5	**3**	4" 600 # ANSI B-16.5	**E**	**G**	JIS 80A 20K **(11)**
6	**B**	DN 25 PN10/40 DIN EN1092-1 **(11)**	**F**	**F**	JIS 100A 10K **(11)**
6	**D**	DN 25 PN63/100 DIN EN1092-1 **(11)**			
6	**8**	DN 25 PN160 DIN 2501 **(11)**			

CODE	Capillary Length	CODE	Capillary Length
1	500 mm	**8**	6000 mm
2	1000 mm	**9**	8000 mm
3	1500 mm	**B**	9000 mm
4	2000 mm	**A**	10000 mm
5	3000 mm		
6	4000 mm		
7	5000 mm		

CODE	Diaphragm Material	CODE	Diaphragm Material
I	316L Stainless Steel	**B**	Tantalum with Teflon Lining
H	Hastelloy C276	**G**	316L Stainless Steel Gold Plated
M	Monel 400	**L**	316L Stainless Steel with Halar Lining **(10)**
T	Tantalum	**C**	Hastelloy with Teflon Lining
U	Titanium	**D**	304L SST
A	316L Stainless Steel with Teflon Lining		

CODE	Fill Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10 **(1)**
T	Syltherm 800
N	Neobee M20
G	Glycerin + Water **(7)**
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbon 4.2

CODE	Lower Housing	CODE	Lower Housing
0	Without Lower Housing **(2)**	**4**	Duplex (UNS 31803) **(7)**
1	316 Stainless Steel	**5**	304L Stainless Steel **(7)**
2	Hastelloy C276	**M**	Monel
3	Super Duplex (UNS 32750) **(7)**		

CODE	Gasket Material
0	Without Gasket
T	Teflon (Ptfe)
G	Grafoil (Flexible Grafoil)
C	Copper
	316L Stainless

CODE	Optional Items*
ZZ	Special Options – Specify

SR301T – 4 2 3 – H S – 1 T / * ← **TYPICAL MODEL NUMBER**

* Leave it blank if there are not optional items.

OPTIONAL ITEMS	
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel With PVC Lining A3 - 316 Stainless Steel With PVC Lining
Material / Flange Type	F0 - 316L Stainless Steel (Integral Flange) F1 - C276 Hastelloy (Integral Flange) F2 - 304L Stainless Steel (Integral Flange) **(7)** F3 - Super Duplex (UNS 32750) (Integral Flange) **(7)** F4 - Duplex (UNS 31803) (Integral Flange) **(7)** F5 - Coated Carbon Steel (Slip-on Flange) F6 - 304 Stainless Steel (Slip-on Flange) F7 - 316 Stainless Steel (Slip-on Flange)
Lower Housing Connection	G0 - With Flush Connection of ¼" NPT (If Supplied with Housing) G1 - With Two Flush Connections of ¼" NPT at 180° G2 - With Two Flush Connections of ¼" NPT at 90° G3 - With Two Connections of ½" – 14 NPT at 180° (With Lid) G4 - Without Flush Connection
Face (8)	H0 - Raised Face (ANSI, DIN, JIS) H1 - Flat Face (ANSI, DIN) H2 - Flat Face With Sealing Channel – RTJ (ANSI B 16.20) **(5)** H3 - Tongue Type Face (DIN) **(7)** H4 - Groove Type Face (DIN) **(7)** H5 - Small Tongue (ANSI) **(7)** H6 - Small Groove (ANSI) **(7)** H7 - Large Tongue (ANSI) **(7)** H8 - Large Groove (ANSI) **(7)**
Insulator Kit (6)	K0 - Without Kit K1 - With Kit
Special Procedures	P1 - Degrease Cleaning (Oxygen or Chlorine Service) **(9)** P5 - Mounting according NACE Standard
Diaphragm Thickness	N0 - Default **(12)** N1 - 0.1mm **(7)**

Note – SR301T:

(1) Fluorolube Filling Fluid is not available with Monel Diaphragm.
(2) Supplied Without Gasket.
(3) The Smar Standardized PN10/40 (With Dimension PN40), however, the DIN Standard Divides It in PN10/16 and PN25/40.
(4) Also fits the #900 class.
(5) Only the gasket code available I (Stainless 316).
(6) The Insulator Kit is applicable with Raised Face (H0) and Flat Face (H1), with Gasket T (Teflon) material and limited only for the models ANSI until #600, DIN until P40 and JIS until 40K; for models with extension the gasket T (Teflon) have special format.
(7) Item by inquiry.
(8) Finishing of the flange faces sealing regions.
a - Standard: ANSI B 16.5 / MSS-SP6:
Raised or Flat Face with grooved lining: 3.2 to 6.3 µm Ra (125 to 250 µ" AA);
Face Small or Large Tongue and Small or Large Groove with smooth finishing not exceeding: 3.2 µm Rt (125 µ" AA);
b - Standard RTJ ANSI B 16.20 / MSS-SP6:
Smooth finishing not exceeding: 1,6 µm Rt (63 µ" AA);
c - Standard DIN EN-1092-1:
Grooved Finishing "B1" (PN 10 to PN40): 3.2 to 12.5 µm Ra (125 to 500 µ" AA);
Smooth Finishing "B2" (PN 63 to PN100), "C" (Tongue) and "D" (Groove): 0.8 to 3.2 µm Ra (32 to 125 µ" AA).
d - Standard Din 2501 (DIN 2526):
Smooth Finishing "E" (PN 160 to PN250): Rz = 16 (3.2 µm Ra (125 µ" AA)).
e - Standard Jis B2201:
Groove Finishing: 3.2 to 6.3 µm Ra (125 to 250 µ" AA).
Whereby: Ra (average ruggedness) and Rt (total ruggedness).
(9) Degrease cleaning not available for carbon steel flanges.
(10) Applicable only for:
- Diaphragm Thickness of 0.05mm.
- Diameters/Capillary Length:
2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models.
- Faces: RF and FF.
- Temperature Limits:
+10 to 100°C;
+101 to 150°C (by inquiry).
- Not applicable for diaphragm thickness: N1 – 0.10mm.
- Not applicable for use with housing.
- Performance with Halar see page 6.22.
(11) Not available for slip-on flange.
(12) Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.

Flanged Remote Seal with Extension - SR301E

Description

The **SR301E** is a flanged seal with welded diaphragm. The diaphragm is extended from the seal flange and welded to the extension. Differently from Model SR301T, it is not supplied with housing, because the diaphragm coincides with the internal wall of the tank.

Bolts and nuts are not supplied with the seal.

For Dimensions Models and Pressure Limits see respectively the pages 6.24 (for integral flange), 6.25 and 6.26 (for slip-on flange) for Dimensions and page 6.17 for Pressure Limits.

MODEL SR301E	FLANGED REMOTE SEAL WITH EXTENSION

CODE		Process Connection, Range and Standard (3)
2	1	1.1/2" 150 # ANSI B-16.5 **(9)**
2	2	1.1/2" 300 # ANSI B-16.5 **(9)**
2	3	1.1/2" 600 # ANSI B-16.5 **(9)**
3	1	2" 150 # ANSI B-16.5
3	2	2" 300 # ANSI B-16.5
3	3	2" 600 # ANSI B-16.5
4	1	3" 150 # ANSI B-16.5
4	2	3" 300 # ANSI B-16.5
4	3	3" 600 # ANSI B-16.5
5	1	4" 150 # ANSI B-16.5
5	2	4" 300 # ANSI B-16.5
5	3	4" 600 # ANSI B-16.5
7	B	DN 40 PN10/40 DIN EN1092-1 **(9)**
8	B	DN 50 PN10/40 DIN EN1092-1 **(2)**
9	C	DN 80 PN10/40 DIN EN1092-1 **(2)**
A	A	DN 100 PN10/16 DIN EN1092-1
A	C	DN 100 PN25/40 DIN EN1092-1

CODE	Capillary Length
1	500 mm
2	1000 mm
3	1500 mm
4	2000 mm
5	3000 mm
6	4000 mm
7	5000 mm
8	6000 mm
9	8000 mm
B	9000 mm
A	10000 mm
C	11000 mm

CODE	Diaphragm Material
I	316L Stainless Steel
H	Hastelloy C276
M	Monel 400
T	Tantalum
U	Titanium
A	316L Stainless Steel with Teflon Lining
B	Tantalum with Teflon Lining
G	316L Gold Plated Stainless Steel
L	316L Stainless Steel with Halar Lining **(8)**
C	Hastelloy with Teflon Lining

CODE	Filling Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10 **(1)**
T	Syltherm 800
N	Neobee M20
G	Glycerin + Water **(5)**
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbom 4.2

CODE	Extension Length (2)
1	50 mm (2")
2	100 mm (4")
3	150 mm (6")
4	200 mm (8")

CODE	Optional Items*
ZZ	Special Options – Specify

SR301E – 4 2 3 – H S – 1 / *

* Leave it blank when there are not optional items.

OPTIONAL ITEMS		
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel With PVC Lining A3 - 316 Stainless Steel With PVC Lining	
Material / Flange Type	F0 - 316L Stainless Steel (Integral Flange) F1 - C276 Hastelloy (Integral Flange) F2 - 304L Stainless Steel (Integral Flange) **(5)** F3 - Super Duplex (UNS 32750) (Integral Flange) **(5)** F4 - Duplex (UNS 31803) (Integral Flange) **(5)** F5 - Coated Carbon Steel (Slip-on Flange) F6 - 304 Stainless Steel (Slip-on Flange) F7 - 316 Stainless Steel (Slip-on Flange)	
Face (6)	H0 - Raised Face (ANSI, DIN, JIS) H1 - Flat Face (ANSI, DIN) H2 - Flat Face With Sealing Channel – RTJ (ANSI B 16.20) H3 - Tongue Type Face (DIN) **(5)** H4 - Groove Type Face (DIN) **(5)** H5 - Small Tongue (ANSI) **(5)** H6 - Small Groove (ANSI) **(5)** H7 - Large Tongue (ANSI) **(5)** H8 - Large Groove (ANSI) **(5)**	
Extension Material	J0 - 316 Stainless Steel J1 - C276 Hastelloy J2 - 304l Stainless Steel **(5)**	J3 - Super Duplex (UNS 32750) **(5)** J4 - Duplex (UNS 31803) **(5)**
Insulator Kit (4)	K0 - Without Kit K1 - With Kit	
Special Procedures	P1 - Degrease Cleaning (Oxygen or Chlorine Service) **(7)** P5 - Mounting according NACE Standard	
Diaphragm Thickness	N0 - Default **(10)**	N1 - 0.1mm **(5)**

Note – SR301E:
(1) Fluorolube Filling Fluid Is Not Available With Monel Diaphragm. **(2)** The Smar Standardized PN10/40 (With Dimension PN40), however, the DIN Standard Divides It in PN10/16 and PN25/40. **(3)** Flanges ANSI # (1500 and 2500), DIN PN (63, 100, 160 and 250) and JIS. Supply by inquiry. **(4)** The Insulator Kit is applicable with Raised Face (H0) and Flat Face (H1), with Gasket T (Teflon) material and limited only for the models ANSI until #600, DIN until P40 and JIS until 40K; for models with extension the gasket T (Teflon) have special format. **(5)** Item by inquiry. **(6)** Finishing of the flange faces sealing regions. a - Standard: ANSI B 16.5 / MSS-SP6: Raised or Flat Face with grooved lining: 3.2 to 6.3 µm Ra (125 to 250 µ" AA); Face Small or Large Tongue and Small or Large Groove with smooth finishing not exceeding: 3.2 µm Rt (125 µ" AA); b - Standard RTJ ANSI B 16.20 / MSS-SP6: Smooth finishing not exceeding: 1,6 µm Rt (63 µ" AA); c - Standard DIN EN-1092-1: Grooved Finishing "B1" (PN 10 to PN40): 3.2 to 12.5 µm Ra (125 to 500 µ" AA); Smooth Finishing "B2" (PN 63 to PN100), "C" (Tongue) and "D" (Groove): 0.8 to 3.2 µm Ra (32 to 125 µ" AA). d - Standard Din 2501 (DIN 2526): Smooth Finishing "E" (PN 160 to PN250): Rz = 16 (3.2 µm Ra (125 µ" AA)). e - Standard Jis B2201: Groove Finishing: 3.2 to 6.3 µm Ra (125 to 250 µ" AA). Whereby: Ra (average ruggedness) and Rt (total ruggedness). **(7)** Degrease cleaning not available for carbon steel flanges. **(8)** Applicable only for: - Diaphragm Thickness of 0.05mm. - Diameters/Capillary Length: 2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry). 3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models. 4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models. - Faces: RF and FF. - Temperature Limits: +10 to 100°C; +101 to 150°C (by inquiry). - Not applicable for diaphragm thickness: N1 – 0.10mm. - Performance with Halar see page 6.22. **(9)** Not available for slip-on flange. **(10)** Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.

Threaded Remote Seal – SR301R

Description

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

This model is supplied with bolts and nuts in Stainless Steel 316.

For Dimension Models and Pressure Limits see respectively the page 6.27 for Dimensions and page 6.17 for Pressure Limits.

MODEL SR301R	THREADED REMOTE SEAL

CODE	Process Connection
1	1/4 NPT
2	3/8 NPT
3	½ NPT
4	3/4 NPT
5	1 NPT
6	1 ½ NPT
7	1/2" BSP
8	1" BSP

CODE	Pressure Limit (3)
1	2500 psi **(5)**

CODE	Capillary Length
1	500 mm
2	1000 mm
3	1500 mm
4	2000 mm
5	3000 mm
6	4000 mm
7	5000 mm
8	6000 mm
9	8000 mm
B	9000 mm
A	10000 mm

CODE	Diaphragm Material
I	316L Stainless Steel
H	Hastelloy C276
M	Monel 400
T	Tantalum
U	Titanium
A	316L Stainless Steel with Teflon Lining
B	Tantalum with Teflon Lining
G	316L Gold Plated Stainless Steel
C	Hastelloy with Teflon Lining

CODE	Filling Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10 **(1)**
T	Syltherm 800
N	Neobee M20
G	Glycerin + Water **(5)**
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbom 4.2

CODE	Lower Housing
I	316L Stainless Steel
H	Hastelloy C276
S	Super Duplex (UNS 32750) **(5)**
D	Duplex (UNS 31803) **(5)**
A	304L Stainless Steel **(5)**
M	Monel

CODE	Gasket Material (4)
T	Teflon (Ptfe)
G	Grafoil (Flexible Grafoil)

CODE	Flush Connection
0	Without Flush Connection
1	With Flush Connection **(2)**

CODE	Optional Items*
ZZ	Special Options – Specify

SR301R – 4 1 3 – H A I T 0 / *

* Leave it blank when there are not optional items.

OPTIONAL ITEMS	
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel With PVC Lining A3 - 316 Stainless Steel With PVC Lining
Flange Material	F0 - 316 Stainless Steel F1 - C276 Hastelloy F2 - 304L Stainless Steel F3 - Super Duplex (UNS 32750) **(5)** F4 - Duplex (UNS 31803) **(5)**
Lower Housing Connection	G0 - With Flush Connection of ¼" NPT (If Supplied with Housing) G1 - With Two Flush Connections of ¼" NPT at 180° G2 - With Two Flush Connections of ¼" NPT at 90° G3 - With Two Connections of ½" – 14 NPT at 180° (With Lid) G4 - Without Flush Connection
Special Procedures	P1 - Degrease Cleaning (Oxygen or Chlorine Service) **(6)**
Diaphragm Thickness	N0 – Default **(7)** N1 - 0.1mm **(5)**

Note – SR301R:

(1) Fluorolube Filling Fluid Is Not Available With Monel Diaphragm.
(2) Flush connection not available for process connection 1½" NPT.
(3) See Table 4 – For Pressure Limits and Temperature.
(4) See Table 7 – Gasket Application Guide for Pressure and Temperature Limits.
(5) Item by inquiry.
(6) Degrease cleaning not available for carbon steel flanges.
(7) Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.

Sanitary Remote Seal – SR301S

Description

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

For Dimension Models and Pressure Limits see respectively the pages 6.34, 6.35 and 6.36 for Dimensions and pages 6.17 and 6.18 for Pressure Limits.

MODEL SR301S	SANITARY REMOTE SEAL 'S'				
CODE		**Process Connection (1)**			
T	**1**	Tri-Clamp DN50 – without extension	**V**	**1**	Threaded DN50– DIN 11851 – with extension **(2) (4)**
A	**1**	Tri-Clamp DN50 – with extension	**W**	**1**	Threaded DN80–DIN 11851 – without extension **(2)**
A	**2**	Tri-Clamp DN50 HP – with extension	**X**	**1**	Threaded DN80 – DIN 11851 – with extension **(2) (4)**
F	**1**	Tri-Clamp – 1.1/2" - without extension**(4)**	**S**	**1**	Threaded SMS – 1.1/2" - without extension **(2)**
F	**2**	Tri-Clamp – 1.1/2" HP - without extension**(4) (5)**	**E**	**1**	Threaded SMS – 2" - without extension **(2) (4)**
D	**1**	Tri-Clamp – 2" - without extension **(4)**	**7**	**1**	Threaded SMS – 2" - with extension **(2) (4)**
D	**2**	Tri-Clamp – 2" HP - without extension **(4) (5)**	**M**	**1**	Threaded SMS – 3" - with extension **(2) (4)**
6	**1**	Tri-Clamp – 2" - with extension**(4)**	**1**	**1**	Threaded SMS – 3" - without extension **(2)(4)**
6	**2**	Tri-Clamp – 2" HP - with extension **(4) (5)**	**C**	**1**	Threaded RJT – 2" - without extension **(2)**
G	**1**	Tri-Clamp – 3" - without extension **(4)**	**5**	**1**	Threaded RJT – 2" - with extension **(2) (4)**
G	**2**	Tri-Clamp – 3" HP - without extension **(4) (5)**	**L**	**1**	Threaded RJT – 3" - with extension **(2) (4)**
I	**1**	Tri-Clamp – 3" - with extension **(4)**	**2**	**1**	Threaded RJT – 3" - without extension **(2)** Threaded
I	**2**	Tri-Clamp – 3" HP - with extension **(4) (5)**	**B**	**1**	IDF – 2" - without extension **(2) (4)**
8	**1**	Threaded DN25–DIN 11851–with extension **(2) (4)**	**4**	**1**	Threaded IDF – 2" - with extension **(2) (4)**
H	**1**	Threaded DN40–IN 11851– without extension **(2)**	**K**	**1**	Threaded IDF – 3" - with extension **(2) (4)**
9	**1**	Threaded DN40– DIN 11851 – with extension **(2) (4)**	**3**	**1**	Threaded IDF – 3" - without extension **(2) (4)**
U	**1**	Threaded DN50–DIN 11851 – without extension **(2)**			

CODE	Capillary Length		
1	500 mm	**7**	5000 mm
2	1000 mm	**8**	6000 mm
3	1500 mm	**9**	8000 mm
4	2000 mm	**B**	9000 mm
5	3000 mm	**A**	10000 mm
6	4000 mm		

CODE	Diaphragm Material
H	Hastelloy C276
I	316L SST

CODE	Fill Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10
T	Syltherm 800
N	Neobee M20 **(4)**
G	Glycerin + Water **(6)**
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbom 4.2

CODE	Wet O-ring
0	Without O-ring
T	Teflon **(4)**
B	Buna N **(4)**
V	Viton **(4)**

CODE	Tank Adapter
0	Without Tank Adapter
3	With Tank Adapter in 316L SST **(3)**

CODE	Tri Clamp
0	Without Tri-Clamp
2	With Tri-Clamp in 304 SST

CODE	Optional Items*
ZZ	Special Options – Specify

SR301S – 4 | 1 | 3 – I | A – T | 1 | 0 / *

* Leave it blank when there are not optional items.

OPTIONAL ITEMS	
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel with PVC Lining A3 - 316 Stainless Steel with PVC Lining
Special Procedures	P1 - Degrease Cleaning (Oxygen or Chlorine Service) **(7)** P3 - Polishing of the wet parts according to 3A Certification **(4) (6)**
Diaphragm Thickness	N0 - Default N1 - 0.1mm **(6)**

Note – SR301S:

(1) Extension Material in 316 Stainless Steel and wet part with diaphragm material.
(2) Not available for Tri-clamp in 304 stainless steel.
(3) Not available for without O-Ring option.
(4) Compliant with 3A-7403 standard for food and other applications where sanitary connections are required:
- Neobee M2O Filling Fluid
- Wet Face lining: 0.8 µm Ra (32 µ" AA)
- Wet O-Ring: Viton

(5) HP – High Pressure.
(6) Item by inquiry.
(7) Degrease cleaning is not available for Carbon Steel Flanges.

Pancake Remote Seal - SR301P

Description

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

Bolts, nuts and blind flange are not supplied with the seal.

The pressure limits are established by pressure class of the blind flange.

For Dimensions Models and Pressure Limits see respectively the pages 6.28 and 6.29 for Dimensions and page 6.17 for Pressure Limits.

MODEL SR301P	PANCAKE REMOTE SEAL		
	CODE	**Process Connection, Pressure Class / Standard**	

CODE	Process Connection, Pressure Class / Standard		
1	1 1/2"	150...2500 #	ANSI B-16.5
2	2"	150...2500 #	ANSI B-16.5
3	3"	150...2500 #	ANSI B-16.5
4	4"	150...2500 #	ANSI B-16.5
5	DN 40	PN10...100	DIN EN1092-1 **(1)**
6	DN 50	PN10...100	DIN EN1092-1 **(1)**
7	DN 80	PN10...100	DIN EN1092-1 **(1)**
8	DN 100	PN10...100	DIN EN1092-1 **(1)**
9	40A	20K	JIS B 22 01
A	50A	10K	JIS B 22 01
B	50A	40K	JIS B 22 01
C	80A	10K	JIS B 22 01
D	80A	20K	JIS B 22 01
E	100A	10K	JIS B 22 01

CODE	Capillary Length	CODE	Capillary Length
1	500 mm	**8**	6000 mm
2	1000 mm	**9**	8000 mm
3	1500 mm	**B**	9000 mm
4	2000 mm	**A**	10000 mm
5	3000 mm		
6	4000 mm		
7	5000 mm		

CODE	Diaphragm Material	CODE	Diaphragm Material
I	316L Stainless Steel	**A**	316L Stainless Steel with Teflon Lining
H	Hastelloy C276	**B**	Tantalum with Teflon Lining
M	Monel 400	**G**	316L Stainless Steel Gold Plated
T	Tantalum	**L**	316L Stainless Steel with Halar Lining **(7)**
U	Titanium	**C**	Hastelloy with Teflon Lining

CODE	Fill Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10 **(2)**
T	Syltherm 800
N	Neobee M20
G	Glycerin + Water
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbon 4.2

CODE	Lower Housing
0	Without Lower Housing **(3)**
1	316 Stainless Steel
2	Hastelloy C276
3	Super Duplex (UNS 32750) **(4)**
4	Duplex (UNS 31803) **(4)**
5	304L Stainless Steel **(4)**

CODE	Gasket Material
0	Without Gasket
T	Teflon (Ptfe)
G	Grafoil (Flexible Grafoil)
C	Copper

CODE	Optional Items*
ZZ	Special Options – Specify

SR301P - 2 3 - I S - 1 0 / *

* Leave it blank when there are not optional items.

OPTIONAL ITEMS	
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel with PVC Lining A3 - 316 Stainless Steel with PVC Lining
Flange Material	F0 - 316L Stainless Steel F1 - C276Hastelloy F2 - 304L Stainless Steel **(4)** F3 - Super Duplex (UNS 32750) **(4)** F4 - Duplex (UNS 31803) **(4)**
Lower Housing Connection	G0 - With Flush Connection of ¼" NPT (If Supplied with Housing) G1 - With Two Flush Connections of ¼" NPT at 180° G2 - With Two Flush Connections of ¼" NPT at 90° G3 - With Two Connections of ½" – 14 NPT at 180° (With Lid)
Face (6)	H0 - Face (ANSI, DIN, JIS) **(5)**
Insulator Kit	K0 - Without Kit K1 - With Kit
Special Procedure	P1 - Degrease Cleaning (Oxygen or Chlorine Service)
Diaphragm Thickness	N0 – Default **(8)** N1 - 0.1 mm

Note – SR301P:

(1) Meets Din 2501 PN 10...PN250 Standard, however with grooved lining and if mounted with counter-flange by solicited pressure class.
(2) Fluorolube filling fluid is not available with Monel diaphragm.
(3) Supplied without gasket.
(4) Item by inquiry.
(5) This face does not cause interference when mounted with counter-flanges with Flat Face (FF) or Raised Face (RF).

(6) Finishing of the flange faces sealing regions.
a - Standard ANSI B 16.5 / MSS-SP6:
Face with grooved lining: 3.2 to 6.3 µm Ra (125 to 250 µ" AA);
b - Standard DIN EN-1092-1:
Grooved Finishing (PN 10 to PN100): 3.2 to 12.5 µm Ra (125 to 500 µ" AA);
c - Standard JIS B2201:
Groove Finishing: 3.2 to 6.3 µm Ra (125 to 250 µ" AA).
Whereby: Ra (average ruggedness) and Rt (total ruggedness).
(7) Applicable only for:
- Diaphragm Thickness of 0.05mm.
- Diameters/Capillary Length:
  2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
  3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
  4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models.
- Faces: RF and FF.
- Temperature Limits:
  +10 to 100°C;
  +101 to 150°C (by inquiry).
- Not applicable for diaphragm thickness: N1 – 0.10mm.
- Not applicable for use with housing.
- Performance with Halar see page 6.22.

(8) Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.

Pancake Remote Seal with Extension - SR301Q

Description

The **SR301Q** is a seal with welded diaphragm, whose assembly requests blind flanges. The diaphragm is extended from the seal flange and welded to the extension. Differently from Model SR301P, it is not supplied with housing, because the diaphragm coincides with the internal wall of the tank.

Bolts, nuts, gaskets and blind flange are not supplied with the seal.

The pressure limits are established by pressure class of the blind flange.

For Dimensions Models and Pressure Limits see respectively the page 6.28 for Dimensions and page 6.17 for Pressure Limits.

MODEL SR301Q	PANCAKE REMOTE SEAL WITH EXTENSION			
	CODE	Process Connection, Pressure Class / Standard		
	1	1 1/2"	150 ... 600 #	ANSI B-16.5
	2	2"	150 ... 600 #	ANSI B-16.5
	3	3"	150 ... 600 #	ANSI B-16.5
	4	4"	150 ... 600 #	ANSI B-16.5
	5	DN 40	PN10 ...40	DIN EN1092-1 (1)
	6	DN 50	PN10 ...40	DIN EN1092-1 (1)
	7	DN 80	PN10 ...40	DIN EN1092-1 (1)
	8	DN 100	PN10 ...40	DIN EN1092-1 (1)

CODE	Capillary Length
1	500 mm
2	1000 mm
3	1500 mm
4	2000 mm
5	3000 mm
6	4000 mm
7	5000 mm
8	6000 mm
9	8000 mm
B	9000 mm
A	10000 mm

CODE	Diaphragm Material
I	316L Stainless Steel
H	Hastelloy C276
M	Monel 400
T	Tantalum
U	Titanium
A	316L Stainless Steel with Teflon Lining
B	Tantalum with Teflon Lining
G	316L Stainless Steel Gold Plated
L	316L Stainless Steel with Halar Lining **(6)**
C	Hastelloy with Teflon Lining

CODE	Fill Fluid
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10 **(2)**
T	Syltherm 800
N	Neobee M20
G	Glycerin + Water
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbom 4.2

CODE	Extension Length
1	50 mm (2")
2	100 mm (4")
3	150 mm (6")
4	200 mm (8")

CODE	Optional Items*
ZZ	Special Options – Specify

SR301Q – 2 | 3 – I | S – 1 / *

* Leave it blank when there are not optional items.

OPTIONAL ITEMS	
Shield Material	A0 - 304 Stainless Steel A1 - 316 Stainless Steel A2 - 304 Stainless Steel With PVC Lining A3 - 316 Stainless Steel With PVC Lining
Flange Material	F0 - 316L Stainless Steel F1 - C276 Hastelloy F2 - 304L Stainless Steel (3) F3 - Super Duplex (UNS 32750) (3) F4 - Duplex (UNS 31803) (3)
Face (5)	H0 - Face (ANSI, DIN, JIS) **(4)**
Extension Material	J0 - 316 Stainless Steel J1 - C276Hastelloy J2 - 304L Stainless Steel (3) J3 - Super Duplex (UNS 32750) (3) J4 - Duplex (UNS 31803) (3)
Insulator Kit	K0 - Without Kit K1 - With Kit
Special Procedure	P1 - Degrease Cleaning (Oxygen or Chlorine Service)
Diaphragm Thickness	N0 – Default **(7)** N1 - 0.1 mm

Note – SR301Q:

(1) Meets Din 2501 PN 10...PN40 Standard, however with grooved lining and if mounted with counter-flange by solicited pressure class.
(2) Fluorolube filling fluid is not available with Monel diaphragm.
(3) Item by inquiry.
(4) This face does not cause interference when mounted with counter-flanges with Flat Face (FF) or Raised Face (RF).

(5) Finishing of the flange faces sealing regions:
- a - Standard ANSI B 16.5 / MSS-SP6:
  Face with grooved lining: 3.2 to 6.3 µm Ra (125 to 250 µ" AA);
- b - Standard DIN EN-1092-1:
  Grooved Finishing (PN 10 to PN100): 3.2 to 12.5 µm Ra (125 to 500 µ" AA);
- c - Standard JIS B2201:
  Groove Finishing: 3.2 to 6.3 µm Ra (125 to 250 µ" AA).
  Whereby: Ra (average ruggedness) and Rt (total ruggedness).

(6) Applicable only for:
- Diaphragm Thickness of 0.05mm.
- Diameters/Capillary Length:
  2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
  3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
  4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models.
- Faces: RF and FF.
- Temperature Limits:
  +10 to 100°C;
  +101 to 150°C (by inquiry).
- Not applicable for diaphragm thickness: N1 – 0.10mm.
- Performance with Halar see page 6.22.

(7) Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.

Level Transmitter – LD300L

Description

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

For LD300L dimensions see pages 6.30 (for integral flange) and 6.31 (for slip-on flange). For Pressure Limits see the Tables of the page 6.17.

MODEL	LEVEL TRANSMITTERS
LD301	HART[R]
LD302	FOUNDATION FIELDBUS[TM]
LD303	PROFIBUS PA

COD	Range Limits Min.	Range Limits Max.	Min. Span	Unit	Range limits Min.	Range limits Max.	Min. Span	Unit
L2	-50	50	1.25	kPa	-200	200	5	inH_2O
L3	-250	250	2.08	kPa	-36	36	0.3	psi
L4	-2500	2500	20.83	kPa	-360	360	3	psi
L5	-25000	25000	208.3	kPa	-3625	3625	30.2	psi

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The upper range value must be limited to the flange rating.

Diaphragm material and Fill Fluid (Low Side)

COD	Material	Fill Fluid
1	316LSST	Silicone Oil **(2)**
2	316LSST	Inert Fluorolube Oil **(3) (25)**
3	HastelloyC276	Silicone Oil **(1) (2)**
4	HastelloyC276	Inert Fluorolube Oil **(1) (3) (25)**
5	Monel400	Silicone Oil **(1) (2)**
7	Tantalum	Silicone Oil **(2)**
8	Tantalum	Inert Fluorolube Oil **(3) (25)**
9	316LSST	Fomblim Oil
A	Monel400	Fomblim Oil **(1)**
D	316LSST	Inert Krytox Oil **(25)**
E	HastelloyC276	Inert Krytox Oil **(1) (25)**
G	Tantalum	Inert Krytox Oil **(25)**
K	Monel400	Inert Krytox Oil **(1) (25)**
M	Monel400 Gold Plated	Silicone Oil **(1) (2)**
P	Monel400 Gold Plated	Inert Krytox Oil **(1) (25)**
Q	316L SST	Inert Haloc 4.2 Oil **(25)**
R	Hastelloy C276	Inert Haloc 4.2 Oil **(1) (25)**
S	Tantalum	Inert Haloc 4.2Oil **(25)**

Flange, Adapter and Drain/Vent Valves material (Low Side)

COD.	Description
C	Plated CS (Drain/Vent in Stainless Steel) **(22)**
H	Hastelloy C276 (CW – 12MW, ASTM – A494) **(1)**
I	316 SST – CF8M (ASTM – A351)
M	Monel 400 **(1)**
N	316 SST – CF8M (ASTM – A351) (Drain/Vent in Hastelloy C276) **(1)**
P	316 SST – CF8M (ASTM – A351) Flange with PVDF (Kynar) insert **(3) (4) (5)**
A	304L SST

Wetted O'Ring Material (Low Side)

COD.	Description
0	Without O'Rings
B	Buna N
E	Ethylene - Propylene
K	Kalrez
T	Teflon
V	Viton

Note: O'rings are not available on the sides with remote seals.

Drain/Vent Position (Low Side)

COD.	Description
0	Without Drain/Vent
A	Drain/Vent (Opposite to Process Connection)
D	Bottom
U	Top

Note: For better Drain/Vent operation, vent valves are strongly recommended.
Drain/Vent valve are not available on the sides with remote seals.

Local Indicator

COD.	Description
0	Without Indicator
1	With Digital indicator

Process Connection (Low Side)

COD.	Description
0	1/4 - 18 NPT (Without Adapter)
1	1/2 - 14 NPT (With Adapter)
3	Remote Seal (With Plug) **(7)**
5	1/2 - 14 NPT Axial with PVDF Insert **(3) (4) (6)**
9	Remote Seal (Low Volume Flange) **(3) (7)**
T	1/2 14 BSP (With Adapter)
W	Without Connection (Absolute Reference)

Electrical Connection

COD.	Description
0	1/2 – 14 NPT **(29)**
1	3/4 – 14 NPT (with 316 SST adapter for ½ - 14 NPT) **(26)**
2	3/4 – 14 BSP (with 316 SST adapter for ½ - 14 NPT) **(9)**
3	1/2 – 14BSP (with 316 SST adapter for ½ - 14 NPT) **(9)**
A	M20 x 1.5 **(30)**
B	PG 13.5 DIN **(30)**
Z	User's specification

Zero and Span Adjust

COD.	Description
1	With Zero and Span Adjustment

Process Connection

COD.	Description
U	1" 150 # (ANSI B16.5) **(31)**
V	1" 300 # (ANSI B16.5) **(31)**
W	1" 600 # (ANSI B16.5) **(31)**
O	1.1/2" 150 # (ANSI B16.5)
P	1.1/2" 300 # (ANSI B16.5)
Q	1.1/2" 600 # (ANSI B16.5)
9	2" 150 # (ANSI B16.5)
A	2" 300 # (ANSI B16.5)
B	2" 600 # (ANSI B16.5)
1	3" 150 # (ANSI B16.5)
2	3" 300 # (ANSI B16.5)
C	3" 600 # (ANSI B16.5)
3	4" 150 # (ANSI B16.5)
4	4" 300 # (ANSI B16.5)
D	4" 600 # (ANSI B16.5)
5	DN 25 PN 10/40 **(31)**
R	DN 40 PN 10/40
E	DN 50 PN 10/40
6	DN 80 PN 10/40
7	DN 100 PN 10/16
8	DN 100 PN 25/40
S	JIS 40A 20K **(21)**
F	JIS 50A 10K **(21)**
T	JIS 50A 40K **(21)**
G	JIS 80A 10k **(21)**
L	JIS 80A 20K **(21)**
H	JIS 100A 10K **(21)**
Z	User's specification

Material and Flange Type (Level Tap)

COD.	Description
2	316L SST (Integral Flange)
Z	User's specification
3	Hastelloy C276 (Integral Flange)
4	304 SST (Slip-on Flange)
5	316 SST (Slip-on Flange)
6	Coated Carbon Steel (Slip-on Flange)

Extension Length

COD	Description
0	0 mm (0")
1	50 mm (2")
2	100 mm (4")
3	150 mm (6")
4	200 mm (8")
Z	User's specification

Note: Extension Material 316L SST

Diaphragm (Level Tap)

COD.	Description
1	316 SST
2	Hastelloy C276
3	Monel 400
4	Tantalum **(10)**
5	Titanium **(10)**
6	316L SST with Teflon Lining (For 2"and 3")
7	316L SST Gold plated
B	Tantalum with Teflon Lining
L	316L Stainless Steel with Halar Lining **(20)**
C	Hastelloy with Teflon Lining
A	304L SST

Fill Fluid (Level Tap)

COD.	Description
1	DC 200 Silicone Oil
3	DC 704 Silicone Oil
2	MO – 10 Fluorolube Oil **(8)**
4	Krytox Oil
N	Neobee M20 Propylene Glycol Oil
G	Glycerin + Water **(11)**
B	Fomblim 06/06
H	Halocarbon 4.2
T	Syltherm 800 Oil

Lower Housing Material

COD.	Description
0	Without Lower Housing **(12)**
1	Stainless Steel 316
2	Hastelloy C276
3	Super Duplex (UNS 32750) **(11)**
4	Duplex (UNS 31803) **(11)**
5	Stainless Steel 304L **(11)**
M	Monel

Gasket Material

COD.	Description
0	Without gasket
T	Teflon (Ptfe)
G	Grafoil (Flexible lead)
C	Copper
L	Stainless 316 L

COD.	Continues Next Page

LD301	L2	1	I	B	U	1	0	0	1	1	2	2	1	1	1	T	*

⬅ TYPICAL MODEL NUMBER

* Leave it blank when there are not optional items.

MODEL	LEVEL TRANSMITTERS (CONTINUOUS)

COD.	Flanges Bolts and Nuts Material	COD.	
A0	Plated Carbon Steel (Default) **(22)**	A5	Hastelloy C276
A1	316 SST		
A2	Carbon Steel (ASTM A193 B7M) **(1) (22)**		

COD.	Flange thread for fixing accessories (adapters, manifolds, mounting brackets, etc)	COD.	
D0	7/16" UNF (Default)	D2	M12 X 1.75
D1	M10 X 1.5 Thread		

COD.	Flange Facing Finish (18)	COD.	
Q0	Raised Face – RF (Default)	Q3	Tongue Face **(11)**
Q1	Flat Face – FF	Q4	Grooved Face **(11)**
Q2	Ring Joint Face – RTJ (Only available for ANSI standard flange) (17)		

COD.	Output Signal	COD.		COD.	
G0	4 – 20 mA (Default)	G1	0 – 20 mA (4 wire) **(13)**	G3	NAMUR NE43 Extended 4-20 mA (Burnout 3.55 and 22.8 mA)

COD.	Housing Material (27) (28)	COD.		COD.	
H0	Aluminum (Default) (IP/Type)	H2	Aluminum for Saline Atmosphere **(23)** (IPW/TypeX)	H4	Aluminum Copper Free **(23)** (IPW/TypeX)
H1	316 SST – CF8M (ASTM – A351) (IP/Type)	H3	316 SST for Saline Atmosphere **(23)** (IPW/TypeX)		

COD.	Tag Plate	COD.	
J0	With tag, when specified (Default)	J2	According to user's notes
J1	Blank		

COD.	PID Configuration	COD.	
M0	With PID (Default)	M1	Without PID

COD.	LCD1 Indication	COD.	
Y0	LCD1: Percentage (Default)	Y3	LCD1: Temperature (Engineering Unit)
Y1	LCD1: Current – I (mA)	YU	LCD1: According to user notes **(14)**
Y2	LCD1: Pressure (Engineering Unit)		

COD.	LCD2 Indication	COD.	
Y0	LCD2: Percentage (Default)	Y6	LCD2: Temperature (Engineering Unit)
Y4	LCD2: Current – I (mA)	YU	LCD2: According to user notes **(14)**
Y5	LCD2: Pressure (Engineering Unit)		

COD.	Identification Plate	COD.	
I1	FM: XP, IS, NI, DI,	I6	Without Certification
I2	NEMKO: Ex-d, Ex-ia	I7	EXAM (DMT): Group I, M1 Ex-ia
I3	CSA: XP, IS, NI, DI	I8	0 to 20 mA **(13)**
I4	EXAM (DMT): Ex-ia; Nemko: Ex-d	IM	BDSR – GOST: Ex-d, Ex-ia
I5	CEPEL: Ex-d, Ex-ia		

COD.	Painting	COD.	
P0	Gray Munsell N6,5 Polyesters	P8	Without Painting
P3	Black Polyester	P9	Safety Blue Epoxy – Electrostatic Painting
P4	White Epoxy	PC	Safety Polyesters – Electrostatic Painting
P5	Yellow Polyester		

LD301-L2I-BU10-01-12211	A0	D0	F0	G0	H0	J0	M0	Y0	Y0	I6	P0	*

← TYPICAL MODEL NUMBER

* Leave it blank when there are not optional items.

OPTIONAL ITEMS			
Burn-out	BD - Down Scale (Accordance to NAMUR NE43 specification)	BU - Up Scale (Accordance to NAMUR NE43 specification)	
Special Procedures	C1 - Degrease Cleaning (Oxygen or Chlorine Service) **(15)**	C2 - For Vacuum Application	C5 – Mounting according NACE Standard
Special Features	ZZ - User's Specification		
Lower Housing Connection	U0 - With Flush Connection of ¼" NPT (If Supplied with Housing) U1 - With Two Flush Connections of ¼" NPT at 180°	U2 - With Two Flush Connections of ¼" NPT at 90° U3 - With Two Connections of ½" – 14 NPT at 180° (With Lid)	U4 – Without Flush Connection
Insulator Kit (16)	K0 - Without Kit K1 - With Kit		
Diaphragm Thickness	N0 – Default **(24)**	N1 - 0.1mm **(11)**	

Note – LD300L:

(1) Meets NACE MR – 01 – 75/ISO 15156 recommendations.
(2) Silicone oil not recommended for Oxygen (O2) or Chlorine Service.
(3) Not applicable for vacuum service.
(4) Drain/Vent is not applicable.
(5) O-ring material must be of Viton or Kalrez.
(6) Maximum pressure 24 bar.
(7) For remote seal is only available flange in 316 stainless steel– CF8M (ASTM A351) (thread M12).
(8) Fluorolube fills fluid not available with Monel diaphragm.
(9) Options not certified for Explosive Atmosphere.
(10) Not recommended with extension.
(11) Item by inquiry.
(12) Supplied without Gasket.
(13) Without certification for Explosion proof certification or Intrinsically safe.
(14) Limited values to 4 1/2 digits; limited unit to 5 characters.
(15) Degreaser's cleaning is not available for carbon steel flanges
(16) The insulator kit is applicable with Raised Face (HO) and Smooth Face (H1) with Gasket material.
T(Teflon) and only for the following models:
- ANSI until #600 , DIN until P40 and JIS until 40K;
- For models with extension the Gasket T (Teflon) it has special share.

(17) Gasket for housing, available only in Stainless 316.
(18) Finishing flange faces:
ANSI B 16.5 / MSS-SP6:
- Raised or Smoth Face with gooved lining: 3.2 to 6.3 µm Ra (125 a 250 µ" AA);
- Small or Large Tongue Face and Small or Large Groove with smooth finishing not exceeding: 3.2 µm Rt (125 µ" AA);

RTJ ANSI B 16.20 / MSS-SP6:
- Smooth finishing not exceeding: 1.6 µm Rt (63 µ" AA);

DIN EN-1092-1:
- Grooved finishing "B1" (PN 10 a PN40): 3.2 a 12.5 µm Ra (125 a 500 µ" AA);
- Smooth finishing "B2" (PN 63 a PN100), "C" (Tongue) e "D" (Groove): 0.8 a 3.2 µm Ra (32 a 125 µ" AA).

DIN 2501 (DIN 2526):
- Smooth finishing "E" (PN 160 a PN250): Rz = 16 (3.2 µm Ra (125 µ" AA).

JIS B2201:
- Grooved finishing 3.2 a 6.3 µm Ra (125 a 250 µ" AA).

(19) Temperature application range: -40 to 150°C.
(20) Applicable only for:
- Diaphragm Thickness of 0.05mm.
- Diameters/Capillary Length:
  - 2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
  - 3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
  - 4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models.
- Faces: RF and FF.
- Temperature Limits:
  - +10 to 100°C;
  - +101 to 150°C (by inquiry).
- Not applicable for diaphragm thickness: N1 – 0.10mm.
- Not applicable for use with housing.
- Performance with Halar see page 6.22.

(21) Not available for slip-on flange.
(22) Not applicable for saline atmosphere.
(23) IPW / TypeX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
(24) Diaphragms of Titanium and Monel available only in 0.1 mm, and diaphragms of Tantalum only in 0.075 mm.
(25) The inert fluid guarantees safety for Oxygen (O_2) service.
(26) Certified for use in Explosive Atmosphere (CEPEL and CSA).
(27) IPX8 tested in 10 meters of water column for 24 hours.
(28) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
LD30X	IP66/68/W	IP66/68/W	Type 4X/6P	Type 4X	IP67

(29) Certified for use in Explosive Atmosphere (CEPEL, FM, CSA, NEPSI, NEMKO and EXAM).
(30) Certified for use in Explosive Atmosphere (CEPEL, NEPSI, NEMKO and EXAM).
(31) Not available for integral flange.

Sanitary Differential Pressure Transmitter – LD300S

Description

The **LD300S** is a transmitter for food applications and others, where sanitary connections are necessary.

The process connections can be Threaded or Tri-Clamp, allowing a fast and easy connection and disconnection of the process. The standard of lining of the wet surface is 32 Ra, highly polished, so that the seal is free of the breach not allowing the lodging of the food or bacterium that can infect the process.

The Smar's sanitary equipments (LD300S and SR301S) are supplied according to 3A standard, the sanitary pattern more accepted in the food industry, beverage and pharmaceutical.

For Dimensions of the LD300S see the pages 6.32, 6.33 and 6.36. For Pressure Limits see the Tables of the pages 6.17 and 6.18.

The figures 6.1 and 6.2 below show the LD300S Transmitter with Threaded and Tri-Clamp connection respectively.

Figure 6.1 – LD300S with Threaded Connection

Figure 6.2 – LD300S with Tri – Clamp Connection

MODEL	SANITARY TRANSMITTERS
LD301	HART[R]
LD302	FOUNDATION FIELDBUS[TM]
LD303	PROFIBUS PA

CODE	Range Limits Min.	Max.	Min. Span	Unit	Range Limits Min.	Max.	Min. Span	Unit
S2	-50	50	1.25	kPa	-200	200	5	inH_2O
S3	-250	250	2.08	kPa	-36	36	0.3	psi
S4	-2500	2500	20.83	kPa	-360	360	3	psi
S5	-25000	25000	208.30	kPa	-3625	3625	30.2	psi

Note: The range can be extended up to 0.75 LRL and 1.2 URL with small degradation of accuracy. The upper range value must be limited to the connection.

Diaphragm Material and Fill Fluid (Low Side)

CODE		
1	316L SST	Silicone Oil **(2)**
2	316L SST	Inert Fluorolube Oil **(3) (19)**
3	Hastelloy C276	Silicone Oil **(1) (2)**
4	Hastelloy C276	Inert Fluorolube Oil **(1) (3) (19)**
5	Monel 400	Silicone Oil **(1) (2)**
7	Tantalum	Silicone Oil **(2)**
8	Tantalum	Inert Fluorolube Oil **(3) (19)**
9	316L SST	Fomblim Oil
A	Monel 400	Fomblim Oil **(1)**
D	316L SST	Inert Krytox Oil **(19)**
E	Hastelloy C276	Inert Krytox Oil **(1) (19)**
G	Tantalum	Inert Krytox Oil **(19)**
K	Monel 400	Inert Krytox Oil **(1) (19)**
M	Monel 400 Gold Plated	Silicone Oil **(1) (2)**
P	Monel 400 Gold Plated	Inert Krytox Oil **(1) (19)**
Q	316L SST	Inert Haloc 4.2 Oil **(19)**
R	Hastelloy C276	Inert Haloc 4.2 Oil **(1) (19)**
S	Tantalum	Inert Haloc 4.2 Oil **(19)**

Flange(s), Adapter (s) and Drain Valve(s) Material (Low Side)

CODE	Description
C	Plated CS (Drain in Stainless Steel) **(17)**
H	Hastelloy C276 (CW-12MW, ASTM - A494) **(1)**
I	316 SST - CF8M (ASTM - A351)
M	Monel 400 **(1)**
N	316 SST – CF8M (ASTM – A351) (Drain in Hastelloy C276) **(1)**
P	316 SST – CF8M (ASTM – A351) Flange with PVDF (Kynar) insert **(3) (4) (5)**

Wetted O-Ring Material (Low Side)

CODE	Description
0	Without O-Ring
B	Buna N
E	Ethylene - Propylene
K	Kalrez
T	Teflon
V	Viton

Note: O-Rings are not available on the sides with remote seal.

Drain Position (Low Side)

CODE	Description
0	Without Drain
A	Drain (Opposite to process connection)
D	Bottom
U	Top

Note: For better drain operation, drain valves are strongly recommended. Drain valve are not available on the sides with remote seal.

Local Indicator

CODE	Description
0	Without Indicator
1	With Digital Indicator

Process Connection (Low Side)

CODE	Description
0	1/4 - 18 NPT (Without Adapter)
1	1/2 - 14 NPT (With Adapter)
3	Remote Seal (With Plug – Vacuum Assembly) **(7)**
5	1/2 - 14 NPT Axial with PVDF insert **(3) (4) (6)**
9	Remote Seal (Low Volume Flange) **(3) (7)**
T	1/2-14 BSP (With Adapter)

Electrical Connection

CODE	Description
0	1/2 - 14 NPT **(23)**
1	3/4 - 14 NPT (With 316 SST adapter for 1/2 - 14 NPT) **(20)**
2	3/4 - 14 BSP (With 316 SST adapter for 1/2 - 14 NPT) **(9)**
3	1/2 - 14 BSP (With 316 SST adapter for 1/2 - 14 NPT) **(9)**
A	M20 X 1.5 **(24)**
B	PG 13.5 DIN **(24)**
Z	User's Specification

Zero and Span Adjust

CODE	Description
1	With Local Adjustment

Process Connection

CODE	Description
8	Threaded DN25 DIN 11851 – with extension/316L SST **(10) (11)**
9	Threaded DN40 DIN 11851 - with extension/316L SST **(10) (11)**
H	Threaded DN40 DIN 11851 – without extension/316L SST **(10)**
V	Threaded DN50 DIN 11851 - with extension/316L SST **(10) (11)**
U	Threaded DN50 DIN 11851 - without extension/316L SST **(10)**
X	Threaded DN80 DIN 11851 - with extension/316L SST **(10) (11)**
W	Threaded DN80 DIN 11851 - without extension/316L SST **(10)**
4	Threaded IDF 2" - with extension/316L SST **(10) (11)**
B	Threaded IDF 2" – without extension/316L SST **(10) (11)**
K	Threaded IDF 3" - with extension/316L SST **(10) (11)**
3	Threaded IDF 3" - without extension/316L SST **(10) (11)**
5	Threaded RJT 2" - with extension/316L SST **(10) (11)**
C	Threaded RJT 2" - without extension/316L SST **(10)**
L	Threaded RJT 3" - with extension/316L SST **(10) (11)**
2	Threaded RTJ 3" - without extension/316L SST **(10)**
S	Threaded SMS 1 1/2" – without extension/316L SST **(10) (11)**
7	Threaded SMS 2" - with extension/316L SST **(10) (11)**
E	Threaded SMS 2" – without extension/316L SST **(10) (11)**
M	Threaded SMS 3" - with extension/316L SST **(10) (11)**
1	Threaded SMS 3" - without extension/316L SST **(10) (11)**
F	Tri-Clamp 1 1/2" – without extension/316L SST **(11)**
Q	Tri-Clamp 1 1/2" HP (High Pressure) - without extension/316L SST **(8) (11)**
6	Tri-Clamp 2" - with extension/316L SST **(11)**
D	Tri-Clamp 2" – without extension/316L SST **(11)**
N	Tri-Clamp 2" HP (High Pressure) - with extension/316L SST **(8) (11)**
P	Tri-Clamp 2" HP (High Pressure) – without extension/316L SST **(8) (11)**
I	Tri-Clamp 3" - with extension/316L SST **(11)**
G	Tri-Clamp 3" – without extension/316L SST **(11)**
J	Tri-Clamp 3" HP (High Pressure) - with extension/316L SST **(8) (11)**
R	Tri-Clamp 3" HP (High Pressure) – without extension/316L SST **(8) (11)**
Z	User's specification

Diaphragm Material

CODE	Description
H	Hastelloy C276
I	316L SST

Fill Fluid

CODE	Description
S	DC 200 – silicone oil
D	DC 704 – silicone oil
F	Fluorolube MO-10
T	Syltherm 800
N	Neobee M20 **(11)**
G	Glycerin + Water **(12)**
B	Fomblim 06/06
K	Krytox 1506
H	Halocarbom 4.2

Wet O-ring

CODE	Description
0	Without O-ring
T	Teflon **(11)**
B	Buna-N **(11)**
V	Viton **(11)**

Tank Adapter

CODE	Description
0	Without Tank Adapter
1	With Tank Adapter in 316 SST

Tri-Clamp

CODE	Description
0	Without Tri-Clamp
2	With Tri-Clamp in 304 SST

CODE	Continues next page

LD301	S2	1	I	B	U	1	0	0	1	A	2	I	S	T	1	*

⬅ TYPICAL MODEL NUMBER

* Leave it blank when there are not optional items.

MODEL	SANITARY TRANSMITTERS (CONTINUOUS)		
CODE	**Flange Bolts and Nuts Material**		
A0	Plated Carbon Steel (Default) **(17)**	A5	Hastelloy C276
A1	316 SST		
A2	Carbon Steel (ASTM A193 B7M) **(1) (17)**		

CODE	Flange Thread for fixing accessories (adapters, manifolds, mounting brackets, etc)		
D0	7/16" UNF (Default)	D2	M12 X 1.75
D1	M10 X 1.5 Thread		

CODE	Output Signal		
G0	4 – 20 mA (Default)	G3	NAMUR NE43 Extended 4-20 mA (Burnout 3.55 and 22.8 mA)
G1	0 – 20 mA (4 wire) **(13)**		

CODE	Housing Material (21) (22)				
H0	Aluminum (Default) (IP/Type)	H2	Aluminum for Saline Atmosphere **(18)** (IPW/TypeX)	H4	Aluminum Copper Free **(18)** (IPW/TypeX)
H1	316 SST – CF8M (ASTM – A351) (IP/Type)	H3	316 SST for Saline Atmosphere **(18)** (IPW/TypeX)		

CODE	TAG Plate
J0	With tag, when specified (Default)
J1	Blank
J2	According to user's notes

CODE	PID Configuration
M0	With PID (Default)
M1	Without PID

CODE	LCD1 Indication		
Y0	LCD1: Percentage (Default)	Y3	LCD1: Temperature (Engineering Unit)
Y1	LCD1: Current - I (mA)	YU	LCD1: User's Specification **(14)**
Y2	LCD1: Pressure (Engineering Unit)		

CODE	LCD2 Indication		
Y0	LCD2: Percentage (Default)	Y6	LCD2: Temperature (Engineering Unit)
Y4	LCD2: Current - I (mA)	YU	LCD2: User's Specification **(14)**
Y5	LCD2: Pressure (Engineering Unit)		

CODE	Identification Plate		
I1	FM: XP, IS, NI, DI	I6	Without Certification
I2	NEMKO: Ex-d, Ex-ia	I7	EXAM (DMT): Class I, M1 Ex-ia
I3	CSA: XP, IS, NI, DI	I8	0 to 20 mA: LD301 **(13)**
I4	EXAM (DMT): Ex-ia; Nemko: Ex-d		
I5	CEPEL: Ex-d, Ex-ia		

CODE	Painting		
P0	Gray Munsell N 6,5 Polyester	P8	Without Painting
P3	Black Polyester	P9	Safety Blue Epoxy – Electrostatic Painting
P4	White Epoxy	PC	Safety Polyester - Electrostatic Painting
P5	Yellow Polyester		

LD301	A0	D0	G0	H0	J0	M0	Y0	Y0	I6	P0	*

⬅ TYPICAL MODEL NUMBER

* Leave it blank when there are not optional items.

OPTIONAL ITEMS		
Burn-out	BD - Down Scale (Accordance to NAMUR NE43 specification) BU - Up Scale (Accordance to NAMUR NE43 specification)	
Special Procedures	C1 - Degrease Cleaning (Oxygen or Chlorine Service) **(15)** C2 - For Vacuum Application	C4 - Polishing of the wet parts according to 3A Certification **(11) (12)** C5 – Mounting according NACE Standard
Special Features	ZZ - User's Specification	
Diaphragm Thickness	N0 - Default N1 - 0.1mm **(12)**	

Note – LD300S:

(1) Meets NACE MR-01-75/ISO 15156 recommendations.
(2) Silicone oil not recommended for Oxygen (O2) or Chlorine Service.
(3) Not applicable for vacuum service.
(4) Drain not applicable.
(5) O-Ring material must be of Viton or Kalrez.
(6) Maximum pressure 24 bar.
(7) For remote seal is only available flange in 316 Stainless Steel - CF8M (ASTM A351) (thread M12).
(8) HP – High Pressure.
(9) Options not certified for Explosive Atmosphere.
(10) Not available for Tri-clamp.
(11) Compliant with 3A-7403 standard for food and other applications where sanitary connections are required:
- Neobee M2O Fill Fluid
- Finishing wet Face: 0,8 µm Ra (32 µ" AA)
- Wet O-Ring: Viton, Buna-N and Teflon

(12) Item by inquiry.
(13) Without certification for explosion proof or intrinsically safe.
(14) Limited values to 4 1/2 digits; limited unit to 5 characters.
(15) Degrease cleaning is not available for Carbon Steel Flanges.
(16) Temperature application range: -40 to 140 °C and Tables 5 and 6 – pages 6.17 and 6.18.
(17) Not applicable for saline atmosphere.
(18) IPW / TypeX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
(19) The inert fluid guarantees safety for Oxygen (O_2) service.
(20) Certificate for use in Explosive Atmosphere (CEPEL and CSA).
(21) IPX8 tested in 10 meters of water column for 24 hours.
(22) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
LD30X	IP66/68/W	IP66/68/W	Type 4X/6P	Type 4X	IP67

(23) Certified for use in Explosive Atmosphere (CEPEL, FM, CSA, NEPSI, NEMKO and EXAM).
(24) Certified for use in Explosive Atmosphere (CEPEL, NEPSI, NEMKO and EXAM).

Technical Data

The calibration maximum limit of the remote seal or level transmitter should be the smallest value between the connection pressure limit (Tables 1 to 6) and the upper range limit of the transmitter (URL). See transmitter's manual.

Pressure Limit (Bar) - ANSI (ASME B 16.5 – 2003) – Table 1

Class \ Temperature ºC (ºF)	- 29 to 38 (20 to 100)	50 (122)	100 (212)	150 (302)	200 (392)	250 (482)	300 (572)	325 (617)	350 (662)
150	15.9	15.3	13.3	12.0	11.2	10.5	10.0	9.3	8.4
300	41.4	40.0	34.8	31.4	29.2	27.5	26.1	25.5	25.1
600	82.7	80.0	69.6	62.8	58.3	54.9	52.1	51.0	50.1
900	124.1	120.1	104.4	94.2	87.5	82.4	78.2	76.4	75.2
1500	206.8	200.1	173.9	157.0	145.8	137.3	130.3	127.4	125.4
2500	344.7	333.5	289.9	261.6	243.0	228.9	217.2	212.3	208.9

Pressure Limit (Bar) - DIN (EN1092-1 / DIN 2501) – Table 2

PN \ Temperature ºC (ºF)	-10 to 50 (14 to 122)	50 (122)	100 (212)	150 (302)	200 (392)	250 (482)	300 (572)	350 (662)
10	7.6	7.4	6.3	5.7	5.3	4.9	4.6	4.4
16	12.3	11.8	10.2	9.2	8.5	7.9	7.4	7.1
25	19.2	18.5	16.0	14.5	13.3	12.4	11.7	11.1
40	30.6	29.6	25.5	23.1	21.2	19.8	18.7	17.8
63	48.3	46.6	40.2	36.4	33.5	31.1	29.5	28.1
100	76.6	74.0	63.9	57.8	53.1	49.4	46.8	44.5

Pressure Limit (Kgf/cm^2) - JIS B 2201 – Table 3

PN \ Temperature ºC (ºF)	120 (248)	220 (428)	300 (572)	350 (662)
10 K	14.0	12.0	10.0	----
20 K	34.0	31.0	29.0	26.0
40 K	68.0	62.0	57.0	52.0

Pressure Limit (Bar) - SR301 R – Table 4

Model \ Temperature ºC (ºF)	25 (77)
2500 psi	172

Note – Tables 1, 2, 3 and 4:

- The Tables 1,2 and 3 are based on the Norm and are subject to modifications. For more details consult the corresponding Norms;
- The DIN EN1092-1 norm does not assist pressure limits for PN 160 and 250;
- It is necessary verify the application limits of the sealing gasket, because the limits can do unviable the tables above;
- The temperature limits of the fill fluid limit this tables. See Table 2.5, Section2;
- Tables 1, 2 and 4 for 316L e 304L. Stainless Steel.

Pressure Limit Tri-Clamp (TC) (Bar) – Table 5

DN	Normal Pressure		High Pressure (HP)	
	20°C (68ºF)	120°C (248ºF)	20°C (68ºF)	120°C (248ºF)
1.1/2"	34	20	100	60
2" / DN50	28	17	70	42
3"	22	13	70	42

Pressure Limit for Thread (Bar) – NP – Table 6				
DN	RJT	IDF	SMS	DIN
	120°C (248ºF)	120°C (248ºF)	120°C (248ºF)	140°C (284ºF)
DN25	10	16	40	40
1.1/2" / DN40	10	16	40	40
2" / DN50	10	16	25	25
3" / DN80	10	10	25	25

Note – Tables 5 and 6:

This Tables are based on the Norm and are subject to modifications. For more details consult the Norm:

- Tri-Clamp (TC) - BS 4825 : Part 3; ISO 2852;
- RJT - BS 4825 : Part 5 ;
- IDF - BS 4825 : Part 4; ISO 2853;
- SMS – 1145;
- DIN - 11851(Standard OD).

Application Guide of Sealing Gasket – Table 7 (3, 4 and 7)								
Gasket Material		Factor (P.T) (Bar x ºC) (5)	Ambient	Minimum Temperature º C (°F) (8)	Maximum Temperature º C (°F) (8)	Maximum Pressure (Bar absolute) (6)	Ph	Hardness (HB)
No Metallic	**Teflon (PTFE)**	2700	—	-210 (-346)	260 (500)	83	0 to 14	—
	Flexible Graphite	12000	Neutral	-240 (-400)	3000 (5432)	20 **(1)**	0 to 14	—
			Oxidant	-240 (-400)	450 (842)			
			Vapour	-240 (-400)	650 (1202)			
Metallic	**Copper**	Above 25000	—	—	260 (500)	**(2)**	—	80
	316L Stainless Steel		—	—	815 (1499)	**(2)**	—	160

Note – Table 7:

(1) Value for gasket without metallic reinforcement.
(2) According to pressure class referring to Norm (ANSI, DIN and JIS).
(3) This table does not gasket specification, only indicative guide for application.
(4) The corrosion analysis is very important for sealing gasket application.
(5) Factor (P.T) = Pressure (Bar abs.) x Temperature (ºC).
(6) Maximum Pressure - Use Continuous.
(7) For projects of gasket other factors must be considered as the gasket and screw squeezing.
(8) For maximum and minimum temperatures verify the Limits for Seal/Level filling fluids.

O'Ring Application Guide – Table 8				
Ring Material	Resistance to Temperature in Continuous Service		Application – Recommended Use and Specification	
	Minimum Temperature º C (ºF)	Maximum Temperature º C (ºF)	Recommended	Not Recommended
Teflon® (PTFE)	-23 (-10)	232 (450)	General Applications, Excellent resistance to acids, bases, water and amines	To avoid solvents and aromatic fuels.
Viton	-29 (-20)	205 (400)	Products of Petroleum, Silicone Fluids, Diester Fluids.	Amines, Cetone, Hot Water/Vapor Brake Fluids.
Buna N	-35 (-31)	135 (275)	General Applications, Products of Petroleum, Silicone Fluids, Fluids to Ethylene Glycol	Acids, Brake Fluids, Ozone, Cetones.

O'Ring Materials Guide – Table 9			
Ambient	**Teflon® (PTFE)**	**Viton**	**Buna N**
Acetic Acid, 30%	S.I.	++	+++
Acetone	-	-	-
Air, below 93 ºC (200° F)	++++	++++	++++
Ammonia Gas, Cold	++++	-	++++
Ammonia Gas, Hot	+++	-	-
Ammonia, Liquid	++	-	+++
Carbon Dioxide, Dry	++++	+++	++++
Carbon Dioxide, Wet	++++	+++	++++
Carbon Monoxide	++++	++++	++++
Caustic Soda	++++	-	+++
Chloro Dioxide	++	+++	-
Citric Acid	++++	++++	++++
Corn Oil	++++	++++	++++
Cottonseed Oil	++++	++++	++++
Diesel Oil	++++	++++	++++
Ethyl Alcohol (Ethanol)	++++	++	++++
Glycol Ethylene	++++	++++	++++
Fish Oil	S.I.	++++	++++
Gasoline	+++	++++	++++
Glucose	++++	++++	++++
Hydrogen	S.I.	++++	++++
Kerosene	+++	++++	++++
Methane	+++	++++	++++
Milk	++++	++++	++++
Mineral Oil	++++	++++	++++
Olive Oil	++++	++++	++++
Oxygen, Gas (Hot)	-	++	-
Oxygen, Liquid	-	-	-
Ozone	++++	++++	-
Propane	++++	++++	++++
Propylene Glycol	++++	++++	++++
Sodium Bicarbonate	++++	++++	++++
Vapour < 149 ºC (300 ºF)	+++	+++	-
Vapour > 149 ºC (300 ºF)	++	-	-
Vegetable Oils	++++	++++	++++
Vinegar	S.I.	+++	+++
Water	++++	++++	++++
(++++) Recommended; (+++) Satisfactory; (++) Transitory; (-) Not Recommended; (S. I.) Without Information			

Diaphragm Hydrogen Migration

The hydrogen in H2 form does not have penetration danger in the diaphragm. However if the hydrogen separates forming ions of hydrogen (H+), the penetration can happen, therefore the spaces between the molecules of the diaphragm material can be larger than the size of the ion.

Inside of the diaphragm, this ion in contact with filling fluid (silicone oils) can be return the H2 form and to be arrested (inflating the diaphragm), causing damages the measurement.

Steps to Facilitate the Migration

- In High Temperatures or High Pressures, the H_2 molecules are excited, generating its break, favoring the migration of the ion (H+);

- Processes of spontaneous generation of electric current for potential difference between flanges;

- Corrosion of the pipe material due to the process fluid, liberating ion (H+); and

- Vapour to the High Temperature can generate corrosion of the diaphragm metal and to liberate ions (H+).

Form to Inhibit the Hydrogen Migration

- Kit of electric insulator, inhibit the galvanic current between flanges; and

- Stainless Steel diaphragms gold plated can aid in the hydrogen migration due to the size of the molecular space to be smaller than the ion space.

Gold Plated Stainless Steel Diaphragm

Resistance to Diaphragm Hydrogen Migration

Diaphragm Material	**AISI 316 Gold Plated**	**AISI 316**	**Hastelloy C**
Hydrogen Penetration	+++	++	+
(+++) Excellent Performance, (++) Good Performance, (+) Low Performance.			

Smar Insulator Kit

The Insulator Kit Smar prevents the generation of galvanic current between metals when in contact. The difference of potential between the metals generates this current that flows from the metal with higher potential to the other. This process in the presence of aqueous solution with salts, acids or bases can start the corrosion process, where the corroded metal is always the one with bigger potential (anode).

In the processes, when it is impossible to isolate the two potencialized metals, occurs the generation of galvanic current. This current will form free ions of hydrogen (H+) in one of the solutions, with tendency to start the corrosion and the migration of the Hydrogen to the diaphragm of the Remote Seal or of the Level Transmitter.

The figure 6.3 shows the following parts that constitute the Smar Insulator Kit: Teflon Gasket (**6**), Nonmetallic Insulating Sleeve (**4**), Mica Washers (**3**) and Steel Washers (**2**).

Smar Insulator Kit Mounting

Mounting step by step:

1 – Insert all the Nonmetallic Insulating Sleeve (**4**); in the holes of the Sealed Flange (**5**);
2 – Put the Teflon Gasket (6) between the Flanges (**5** e **7**);
3 – Insert the Steel Washers (**2**) and the Mica Washers (**3**) in the bolts (**1**)
4 – Join the Flanges positioning its holes (**5** and **7**);
5 – Introduce the bolts in the holes of the flanges (**5** and **7**) and tighten the flanges with the nuts (**8**)
6 – Measure the resistance between the Sealed Flange (**5**) and the Flange of Process (**7**) that should be tending to the infinite to check the efficiency of the Insulator Kit.

NOTE
If the studs are used instead of the bolts, obey the same mounting sequence for the items 2, 3 and 4. This Insulator Kit can be applied with raised and flat face flanges. The Gasket must be made of Teflon when the Smar Insulator Kit is indicated.

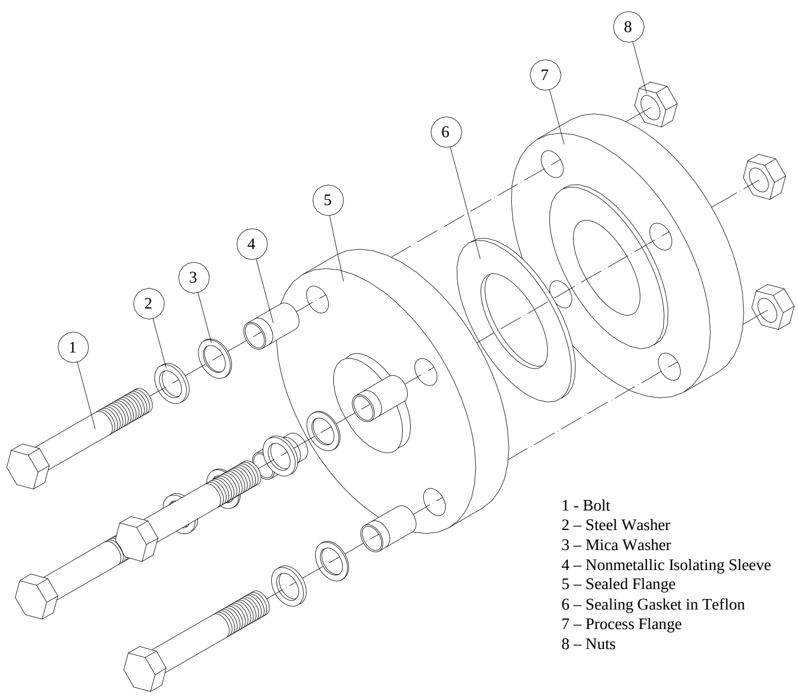


Figure 6.3 – Insulator Kit Mounting

Besides Insulator Kit described previously, there is also the Insulator Kit for Pancake Remote Seals (SR301P) and Pancake with Extension (SR301Q).

The Figure 6.4 shows this kit which is composed by: Bolts (**1**), Process Flange (**2**), Sealing Gasket in Teflon (**3**), Pancake Seal (**4**), Counter-Flange (**5**) and Nuts (**6**). Note that the "support tube" of the SR301P and SR301Q should not have direct contact with the bolts, process flanges and counter-flange, avoiding metallic contact.

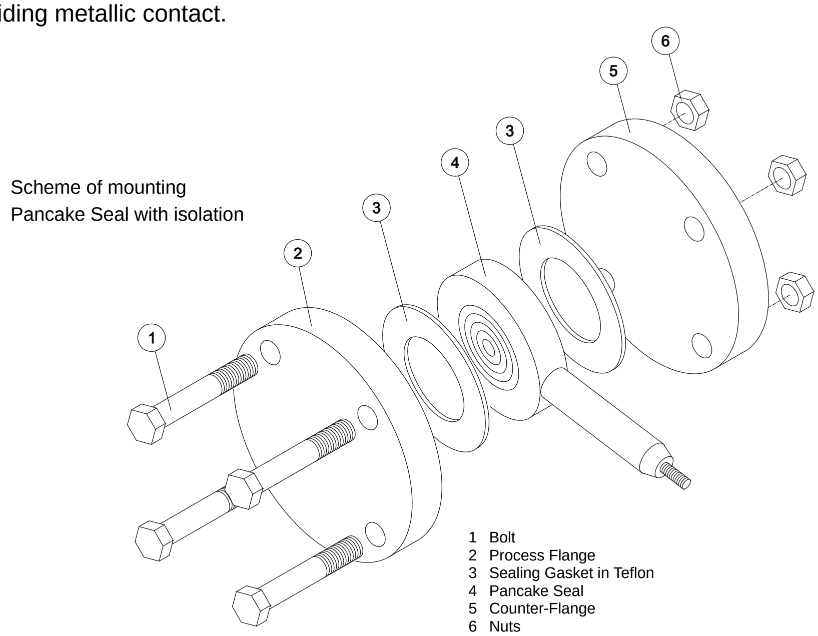


Figure 6.4 – SR301P and SR301Q Electric Insulator Kit

Application with Halar for Seals and Levels

Technical Specification

Halar® is chemically one of the most resistant fluoropolymer. It is a thermoplastic of the melting process manufactured by Solvay Solexis, Inc. For its chemical structure, a 1:1 alternating ethylene copolymer and chlorinetrifluoroethylene, Halar® ***(ECTFE)*** offers an only combination of useful properties.

The diaphragms in 316L Stainless Steel covered with Halar®, are ideal for applications in contact with aggressive liquids. They offer excellent resistance to the chemic and abrasion with a wide temperature range. Halar® does not contaminate liquids of high purity and it is not affected by most of corrosive chemists, usually found in the industries, including strong minerals, oxidant acids, alkalis, liquid oxygen and some organic solvents.

Halar® is trademark of *Solvay Solexis, Inc*.

Performance Specification

For the performance specification see the equation below:

[1% SPAN x (URL/SPAN)] - Included temperature error*****

Diameters/Capillary Length:

- 2" ANSI B 16.5, DN 50 DIN, JIS 50 A, for seals up to 3 meters of capillary and level models (by inquiry).
- 3" ANSI B 16.5, DN 80 DIN, JIS 80 A, for seals up to 5 meters of capillary and level models.
- 4" ANSI B 16.5, DN 100 DIN, JIS 100 A, for seals up to 8 meters of capillary and level models.

*****Temperature Limits:
+10 to 100°C;
+101 to 150°C (by inquiry).

TPE – Total Probable Error (Software)

Software to calculate the assembly error of the Pressure Transmitters with the possible connections to the process.

TPE was developed to a fast and effective aid of the products related the pressure measurement. The users are the Applications Engineer and Commercial Areas. The customer can request a report of performance estimate to Smar.

This product allows doing simulations of possible assemblies, verifying important data as the error estimates of the response time, of capillary length analysis and mechanical resistance of diaphragms with temperature variation. See an example in the Figure 6.5.

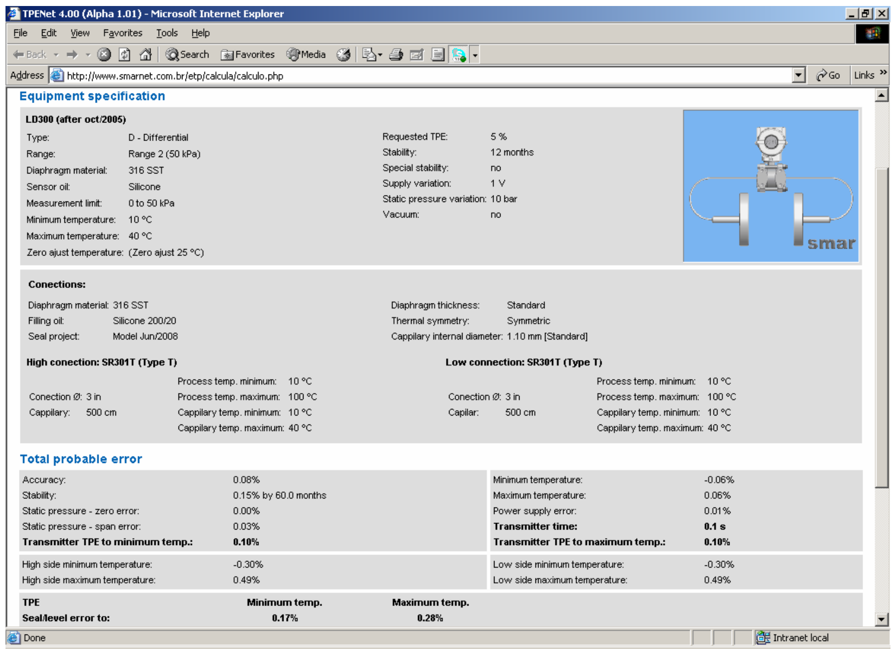
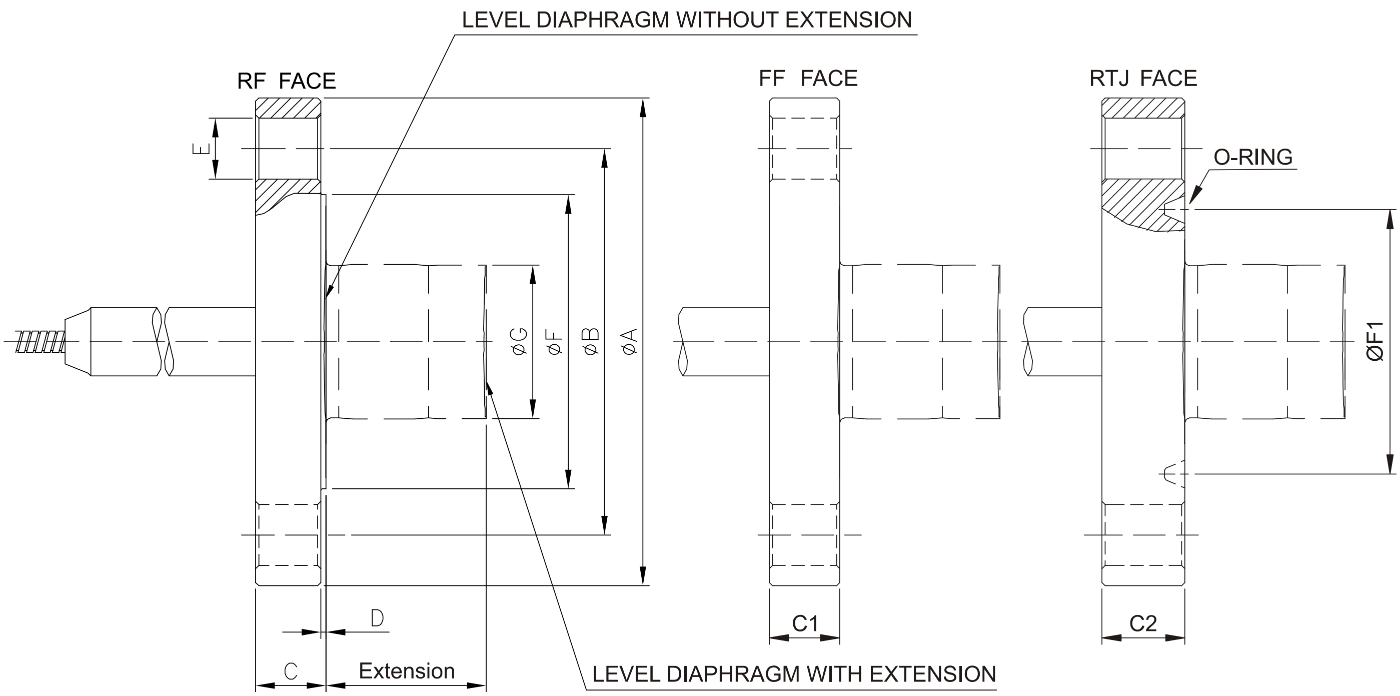


Figure 6.5 – TPE Software Screen

Dimensions

SR301T (RF/FF/RTJ) - "T" Type Flanged Remote Seal and SR301E (RF/FF/RTJ) - Flanged Remote Seal with Extension
(Integral Flange)



DIMENSIONS IN mm (in)
EXTENSION LENGTH: 0 , 50 , 100 , 150 OR 200
* FLANGES 1500 AND 2500 WITH EXTENSION HAVE SUPPLYING UNDER CONSULT

ANSI-B 16.5 DIMENSIONS

DN	CLASS	A	B	C	C1 (FF)	C2 (RTJ)	D	E	F	F1 (RTJ)	ANEL RTJ	G	# HOLES
1"	150	108 (4.25)	79.2 (3.12)	20 (0.78)	15 (0.59)	21 (0.83)	1.6 (0.06)	16 (0.63)	50.8 (2)	47.6 (1.87)	R15		4
	300	123.9 (4.88)	88.9 (3.50)	20 (0.78)	18 (0.71)	24.4 (0.96)	1.6 (0.06)	19 (0.75)	50.8 (2)	50.8 (2)	R16		4
	600	123.9 (4.88)	88.9 (3.50)	24.4 (0.96)	24.4 (0.96)	24.4 (0.96)	6.4 (0.25)	19 (0.75)	50.8 (2)	50.8 (2)	R16		4
	1500	149.3 (5.88)	101.6 (4)	35.4 (1.39)		35.4 (1.39)	6.4 (0.25)	25 (0.98)	50.8 (2)	50.8 (2)	R16		4
	2500	158 (6.22)	108 (4.25)	42 (1.65)		42 (1.65)	6.4 (0.25)	25 (0.98)	50.8 (2)	60.3 (2.37)	R18		4
1.1/2"	150	127 (5)	98.6 (3.88)	20 (0.78)	19 (0.75)	24.4 (0.96)	1.6 (0.06)	16 (0.63)	73.2 (2.88)	65.1 (2.56)	R19	40 (1.57)	4
	300	155.4 (6.12)	114.3 (4.5)	21 (0.83)	21 (0.83)	27.4 (1.07)	1.6 (0.06)	22 (0.87)	73.2 (2.88)	68.3 (2.68)	R20	40 (1.57)	4
	600	155.4 (6.12)	114.3 (4.5)	29.3 (1.15)	29.3 (1.15)	29.3 (1.15)	6.4 (0.25)	22 (0.87)	73.2 (2.88)	68.3 (2.68)	R20	40 (1.57)	4
	1500	177.8 (7)	124 (4.88)	38.6 (1.52)		38.6 (1.52)	6.4 (0.25)	28 (1.10)	73.2 (2.88)	68.3 (2.68)	R20	40* (1.57)	4
	2500	203.2 (8)	146 (5.75)	51.5 (2.03)		52.9 (2.08)	6.4 (0.25)	32 (1.26)	73.2 (2.88)	82.6 (3.25)	R23	40* (1.57)	4
2"	150	152.4 (6)	120.7 (4.75)	22 (0.87)	20 (0.78)	25.9 (1.02)	1.6 (0.06)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R22	48 (1.89)	4
	300	165.1 (6.5)	127 (5)	22.8 (0.9)	22.8 (0.9)	30.8 (1.21)	1.6 (0.06)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R23	48 (1.89)	8
	600	165.1 (6.5)	127 (5)	32.3 (1.27)	32.3 (1.27)	32.3 (1.27)	6.4 (0.25)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R23	48 (1.89)	8
	1500	215.9 (8.50)	165 (6.50)	45 (1.77)		46.5 (1.83)	6.4 (0.25)	25 (0.98)	91.9 (3.62)	95.3 (3.75)	R24	48* (1.89)	8
	2500	235 (9.25)	171.5 (6.75)	57.7 (2.27)		59.2 (2.33)	6.4 (0.25)	28 (1.10)	91.9 (3.62)	101.6 (4)	R26	48* (1.89)	8
3"	150	190.5 (7.5)	152.4 (6)	24.4 (0.96)	24.4 (0.96)	30.7 (1.21)	1.6 (0.06)	19 (0.75)	127 (5)	114.3 (4.5)	R29	73 (2.87)	4
	300	209.5 (8.25)	168.1 (6.62)	29 (1.14)	29 (1.14)	36.9 (1.45)	1.6 (0.06)	22 (0.87)	127 (5)	123.8 (4.87)	R31	73 (2.87)	8
	600	209.5 (8.25)	168.1 (6.62)	38.7 (1.52)	38.7 (1.52)	40.2 (1.58)	6.4 (0.25)	22 (0.87)	127 (5)	123.8 (4.87)	R31	73 (2.87)	8
4"	150	228.6 (9)	190.5 (7.5)	24.4 (0.96)	24.4 (0.96)	30.7 (1.21)	1.6 (0.06)	19 (0.75)	158 (6.22)	149.2 (5.87)	R36	96 (3.78)	8
	300	254 (10)	200 (7.87)	32.2 (1.27)	32.2 (1.27)	40.2 (1.58)	1.6 (0.06)	22 (0.87)	158 (6.22)	149.2 (5.87)	R37	96 (3.78)	8
	600	273 (10.75)	215.9 (8.5)	45 (1.77)	45 (1.77)	46.5 (1.83)	6.4 (0.25)	25 (1)	158 (6.22)	149.2 (5.87)	R37	96 (3.78)	8

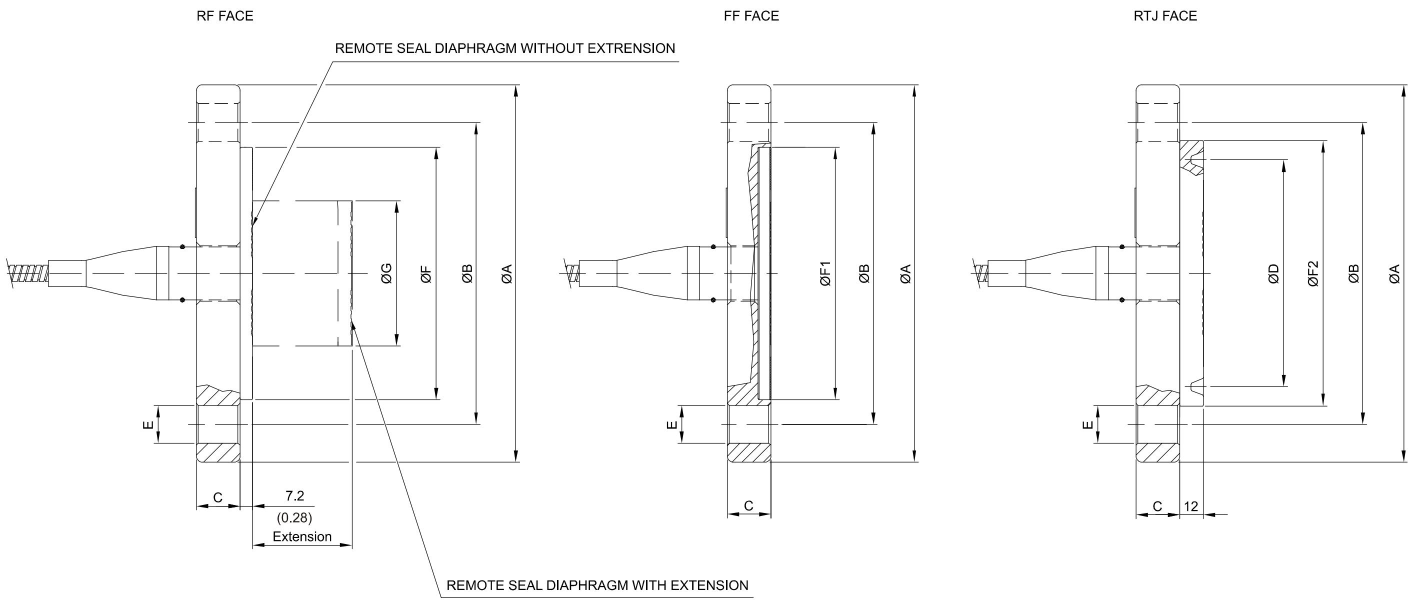
EN 1092-1 / DIN2501 DIMENSIONS

DN	PN	A	B	C	C1 (FF)		D	E	F		G	# HOLES
25	10/40	115 (4.53)	85 (3.35)	20 (0.78)	20 (0.78)		2 (0.08)	14 (0.55)	68 (2.67)			4
	63/100	140 (5.51)	100 (3.94)	24 (0.95)			2 (0.08)	18 (0.71)	68 (2.67)			4
	160	140 (5.51)	100 (3.94)	24 (0.95)			2 (0.08)	18 (0.71)	68 (2.67)			4
	250	150 (5.91)	105 (4.13)	28 (1.10)			2 (0.08)	22 (0.87)	68 (2.67)			4
40	10/40	150 (5.91)	110 (4.33)	20 (0.78)	20 (0.78)		3 (0.12)	18 (0.71)	88 (3.46)		40 (1.57)	4
	63/100	170 (6.69)	125 (4.92)	26 (1.02)			3 (0.12)	22 (0.87)	88 (3.46)		40 * (1.57)	4
	160	170 (6.69)	125 (4.92)	28 (1.10)			3 (0.12)	22 (0.87)	88 (3.46)		40 * (1.57)	4
	250	185 (7.28)	135 (5.31)	34 (1.34)			3 (0.12)	26 (1.02)	88 (3.46)		40 * (1.57)	4
50	10/40	165 (6.50)	125 (4.92)	20 (0.78)	22 (0.86)		3 (0.12)	18 (0.71)	102 (4.01)		48 (1.89)	4
	63	180 (7.09)	135 (5.31)	26 (1.02)			3 (0.12)	22 (0.87)	102 (4.01)		48 (1.89)	4
	100	195 (7.68)	145 (5.71)	28 (1.12)			3 (0.12)	26 (1.02)	102 (4.01)		48 (1.89)	4
	160	195 (7.68)	145 (5.71)	30 (1.18)			3 (0.12)	26 (1.02)	102 (4.01)		48 * (1.89)	4
	250	200 (7.87)	150 (5.91)	38 (1.50)			3 (0.12)	26 (1.02)	102 (4.01)		48 * (1.89)	8
80	10/40	200 (7.87)	160 (6.3)	24 (0.95)	24 (0.95)		3 (0.12)	18 (0.71)	138 (5.43)		73 (2.87)	8
	63	215 (8.46)	170 (6.69)	28 (1.12)			3 (0.12)	22 (0.87)	138 (5.43)		73 (2.87)	8
	100	230 (9.06)	180 (7.09)	32 (1.26)			3 (0.12)	26 (1.02)	138 (5.43)		73 * (2.87)	8
	160	230 (9.06)	180 (7.09)	36 (1.42)			3 (0.12)	26 (1.02)	138 (5.43)		73 * (2.87)	8
100	10/16	220 (8.67)	180 (7.08)	20 (0.78)			3 (0.12)	18 (0.71)	158 (6.22)		96 (3.78)	8
	25/40	235 (9.25)	190 (7.5)	24 (0.95)			3 (0.12)	22 (0.87)	162 (6.38)		96 (3.78)	8

JIS B 2202 DIMENSIONS

	CLASS	A	B	C		D	E	F		G	# HOLES
40A	20K	140 (5.5)	105 (4.13)	26 (1.02)		2 (0.08)	19 (0.75)	81 (3.2)		40 (1.57)	4
50A	10K	155 (6.1)	120 (4.72)	26 (1.02)		2 (0.08)	19 (0.75)	96 (3.78)		48 (1.89)	4
	40K	165 (6.5)	130 (5.12)	26 (1.02)		2 (0.08)	19 (0.75)	105 (4.13)		48 (1.89)	8
80A	10K	185 (7.28)	150 (5.9)	26 (1.02)		2 (0.08)	19 (0.75)	126 (4.96)		73 (2.87)	8
	20K	200 (7.87)	160 (6.3)	26 (1.02)		2 (0.08)	19 (0.75)	132 (5.2)		73 (2.87)	8
100A	10K	210 (8.27)	175 (6.89)	26 (1.02)		2 (0.08)	19 (0.75)	151 (5.95)		96 (3.78)	8

SR301T (RF/FF/RTJ) - "T" Type Flanged Remote Seal and SR301E (RF/FF/RTJ) - Flanged Remote Seal with Extension *(Slip-on Flange)*

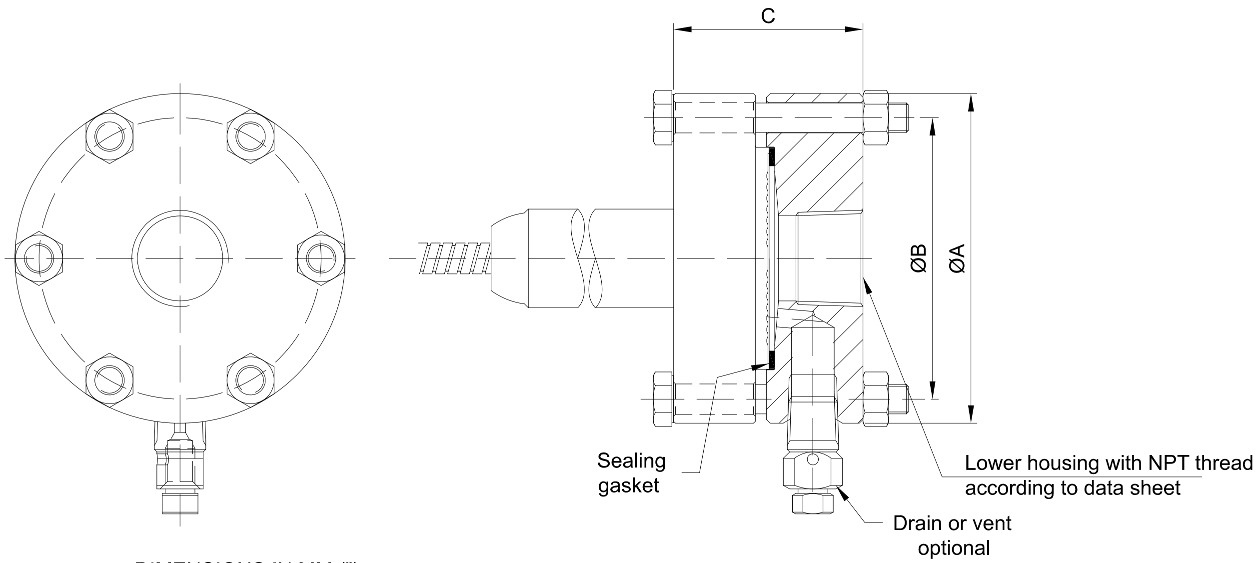


ANSI-B 16.5 DIMENSIONS											
DN	CLASS	A	B	C	D	E	F (RF)	F1 (FF)	F2 (RTJ)	G	# HOLES
1"	150	108 (4.25)	79.4 (3.16)	14.3 (0.56)	-	16 (0.63)	50.8 (2)	50.8 (2)	-	-	4
	300/600	124 (4.88)	8.9 (3.5)	17.5 (0.69)	-	19 (0.75)	50.8 (2)	50.8 (2)	-	-	4
1 1/2"	150	127 (5)	98.4 (3.87)	17.5 (0.69)	-	16 (0.63)	73 (2.87)	73 (2.87)	-	40 (1.57)	4
	300/600	156 (6.14)	114.3 (4.5)	22.2 (0.87)	-	22 (0.87)	73 (2.87)	73 (2.87)	-	40 (1.57)	4
2"	150	152.4 (6)	120.7 (4.75)	17.5 (0.69)	82.6 (3.25)	19 (0.75)	92 (3.62)	92 (3.62)	101.6 (4.00)	48 (1.89)	4
	300	165.1 (6.5)	127 (5)	20.7 (0.8)	82.6 (3.25)	19 (0.75)	92 (3.62)	92 (3.62)	107.9 (4.25)	48 (1.89)	8
	600	165.1 (6.5)	127 (5)	25.4 (1)	82.6 (3,25)	19 (0.75)	92 (3.62)	92 (3.62)	107.9 (4.25)	48 (1.89)	8
3"	150	190.5 (7.5)	152.4 (6)	22.3 (0.87)	114.3 (4.50)	19 (0.75)	127 (5)	127 (5)	133.4 (5.25)	73 (2.87)	4
	300	209.5 (8.25)	168.1 (6.62)	27 (1.06)	123.8 (4.87)	22 (0.87)	127 (5)	127 (5)	146.1 (5.75)	73 (2.87)	8
	600	209.5 (8.25)	168.1 (6.62)	31.8 (1.25)	123.8 (4.87)	22 (0.87)	127 (5)	127 (5)	146.1 (5.75)	73 (2.87)	8
4"	150	228.6 (9)	190.5 (7.5)	22.3 (0.87)	149.2 (5.87)	19 (0.75)	158 (6.22)	158 (6.22)	171.5 (6.75)	89 (3.5)	8
	300	254 (10)	200 (7.87)	30.2 (1.18)	149.2 (5.87)	22 (0.87)	158 (6.22)	158 (6.22)	174.6 (6.87)	89 (3.5)	8
	600	273 (10.75)	215.9 (8.5)	38.1 (1.5)	149.2 (5.87)	25 (1)	158 (6.22)	158 (6.22)	174.6 (6.87)	89 (3.5)	8

EN 1092-1 / DIN2501 DIMENSIONS - RF/ FF								
DN	PN	A	B	C	E	F	G	# HOLES
25	10/40	115 (4.53)	85 (3.35)	18 (0.71)	14 (0.55)	68 (2.68)	-	4
40	10/40	150 (5.91)	110 (4.33)	18 (0.71)	18 (0.71)	88 (3.46)	73 (2.87)	4
50	10/40	165 (6.50)	125 (4.92)	20 (0.78)	18 (0.71)	102 (4.01)	48 (1.89)	4
80	10/40	200 (7.87)	160 (6.30)	24 (0.95)	18 (0.71)	138 (5.43)	73 (2.87)	8
100	10/16	220 (8.67)	180 (7.08)	20 (0.78)	18 (0.71)	158 (6.22)	89 (3.5)	8
	25/40	235 (9.25)	190 (7.50)	24 (0.95)	22 (0.87)	162 (6.38)	89 (3.5)	8

NOTES:
- EXTENSIONS LENGTH IN mm(in): 0, 50 (1.96), 100 (3.93), 150 (5.9) or 200 (7.87)
- FOR 1" AND DN25 THE EXTENSION LENGTH IS 0 mm
- DIMENSIONS IN mm(in)

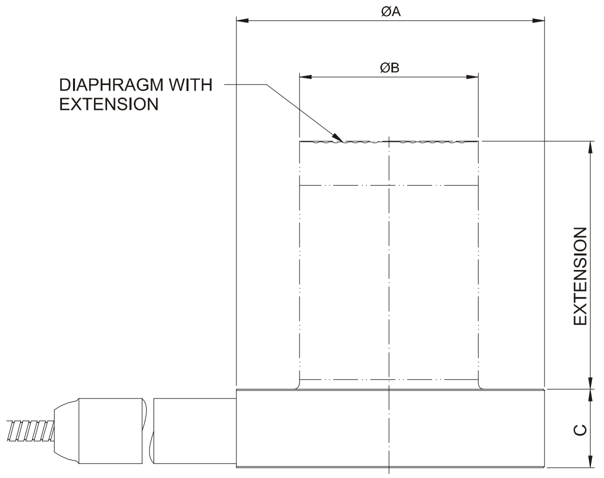
SR301R – Threaded Remote Seal

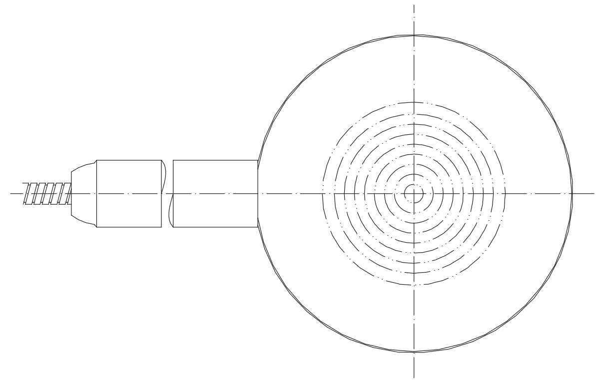


DIMENSIONS IN MM (")
DRAIN NOT AVAILABLE FOR 1.1/2"NPT

DIMENSIONS SR301R - TABLE 10				
LIMIT	A	B	C	# HOLES
2500PSI	89 (3.50)	76 (2.99)	51 (2.01)	6

SR301P – Pancake Remote Seal without Extension and SR301Q – Pancake Remote Seal with Extension





WITH EXTENSION

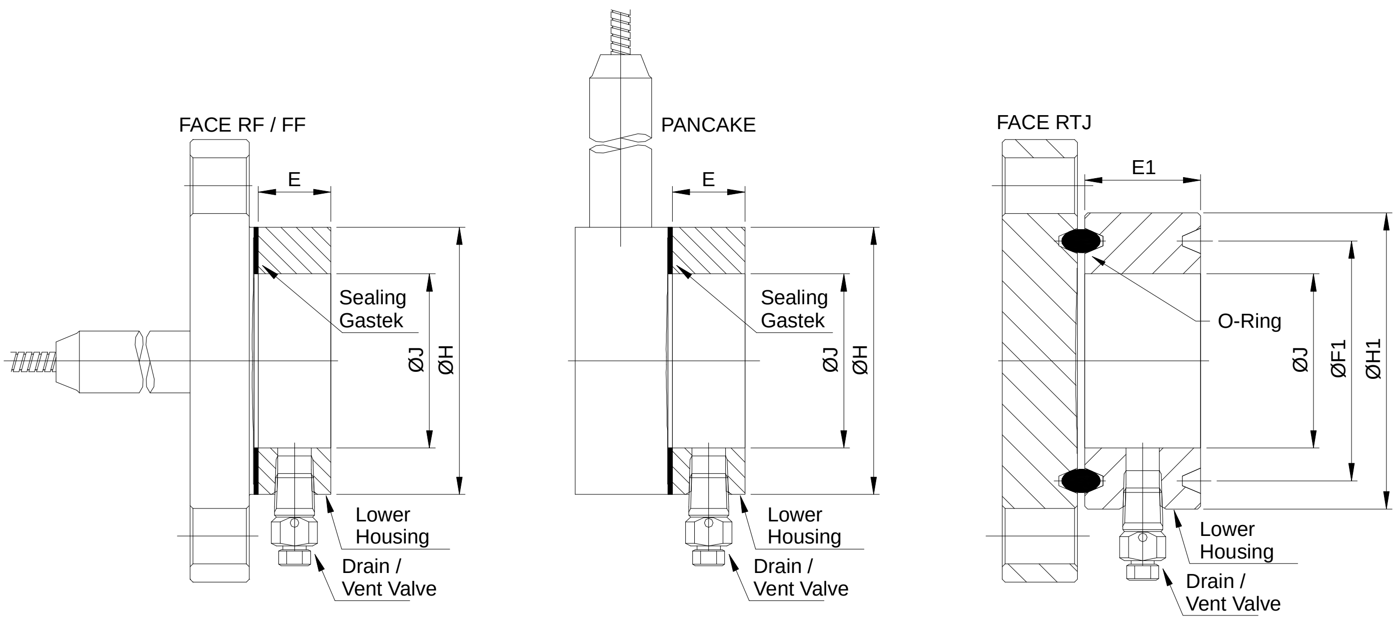
ANSI-B 16.5								
DN	CLASS	C		ØB		ØA		
1.1/2"	150...600	30	(1.18)	39.5	(1.55)	73.2	(2.88)	
2"	150...600	30	(1.18)	47.5	(1.87)	92	(3.62)	
3"	150...600	30	(1.18)	72.5	(2.85)	127	(5)	
4"	150...600	30	(1.18)	95.5	(3.76)	157.2	(6.19)	
EN 1092-1 / DIN2501								
DN	PN	C		ØB		ØA		
40	10...40	30	(1.18)	39.5	(1.55)	88	(3.46)	
50	10...40	30	(1.18)	47.5	(1.87)	101.6	(4)	
80	10...40	30	(1.18)	72.5	(2.85)	138	(5.43)	
100	10...40	30	(1.18)	95.5	(3.76)	162	(6.38)	

WITHOUT EXTENSION

ANSI-B16.5 DIMENSIONS					
DN	CLASS	C		ØA	
1.1/2"	150....2500	32	(1.26)	73.2	(2.88)
2"	150....2500	32	(1.26)	92	(3.62)
3"	150....2500	32	(1.26)	127	(5)
4"	150....2500	32	(1.26)	157.2	(6.19)
EN 1092-1 / DIN2501					
DN	PN	C		ØA	
40	10....100	32	(1.26)	88	(3.46)
50	10....100	32	(1.26)	101.6	(4)
80	10....100	32	(1.26)	138	(5.43)
100	10....100	32	(1.26)	162	(6.38)
JIS B 2202 DIMENSIONS					
	CLASS	C		ØA	
40A	20K	32	(1.26)	81	(3.19)
50A	10K	32	(1.26)	96	(3.78)
	40K	32	(1.26)	105	(4.13)
80A	10K	32	(1.26)	126	(4.96)
	20K	32	(1.26)	132	(5.19)
100A	10K	32	(1.26)	151	(5.94)

DIMENSIONS IN MM(")
EXTENSION LENGTH: 0, 50, 100, 150 OR 200
*FLANGES 1500 AND 2500 WITH EXTENSION HAVE SUPPLYING UNDER CONSULT

Lower Housing



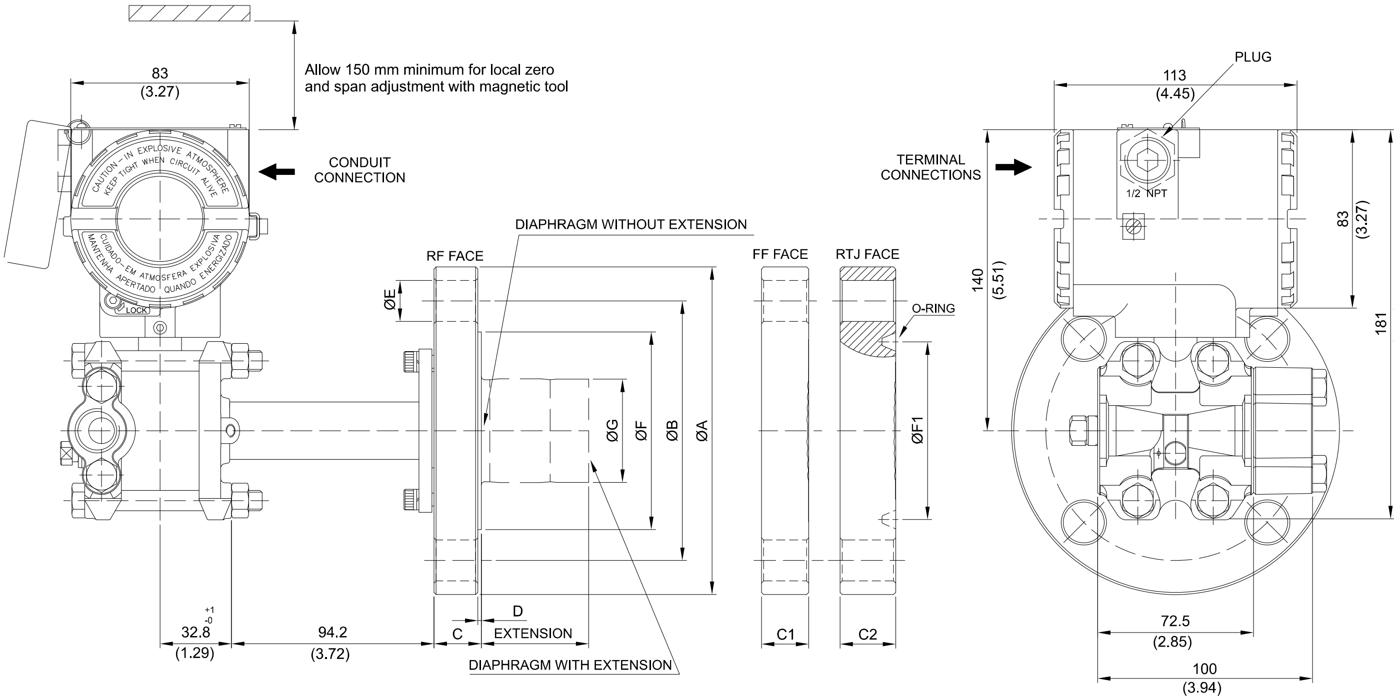
DIMENSIONS IN MM (")

ANSI-B 16.5 DIMENSIONS- FACE RF / FF					
DN	CLASS	H	J	E	
				1/4"NPT	1/2"NPT
1"	ALL	50,8 (2,00)	35 (1,38)	25	35
1.1/2"		73,2 (2,88)	48 (1,89)	25	35
2"		91,9 (3,62)	60 (2,36)	25	35
3"		127 (5,00)	89 (3,50)	25	35
4"		158 (6,22)	115 (4,53)	25	35
DIN EN1092-1/ DIN2501/2526 FORM D DIMENSIONS					
DN	PN	H	J		
25	ALL	68 (2,68)	35 (1,38)	25	35
40		88 (3,46)	48 (1,89)	25	35
50		102 (4,02)	60 (2,36)	25	35
80		138 (5,43)	89 (3,50)	25	35
100		158 (6,22)	115 (4,53)	25	35
JIS B 2202 DIMENSIONS					
DN	CLASS	H	J		
40A	20K	81 (3,19)	48 (1,89)	25	35
50A	10K	96 (3,78)	60 (1,36)	25	35
	40K	105 (4,13)	60 (1,36)	25	35
80A	10K	126 (4,96)	89 (3,50)	25	35
	20K	132 (5,20)	89 (3,50)	25	35
100A	10K	151 (5,94)	115 (4,53)	25	35

DIMENSIONS IN MM (")

ANSI-B 16.5 DIMENSIONS - FACE RTJ							
DN	CLASS	F1	O-RING	H1	J	E1	
						1/4"NPT	1/2"NPT
1"	150	47,6 (1,87)	R15	63,5 (2,50)	35 (1,38)	40	45
	300	50,8 (2,00)	R16	70 (2,75)	35 (1,38)	40	45
	600	50,8 (2,00)	R16	70 (2,75)	35 (1,38)	40	45
	1500	50,8 (2,00)	R16	71,5 (2,81)	35 (1,38)	40	45
	2500	60,3 (2,37)	R18	73 (2,88)	35 (1,38)	40	45
1.1/2"	150	65,1 (2,56)	R19	82,5 (3,25)	48 (1,89)	40	45
	300	68,3 (2,69)	R20	90,5 (3,56)	48 (1,89)	40	45
	600	68,3 (2,69)	R20	90,5 (3,56)	48 (1,89)	40	45
	1500	68,3 (2,69)	R20	92 (3,62)	48 (1,89)	40	45
	2500	82,6 (3,25)	R23	114 (4,50)	48 (1,89)	40	45
2"	150	82,6 (3,25)	R22	102 (4,00)	60 (2,36)	40	45
	300	82,6 (3,25)	R23	108 (4,25)	60 (2,36)	40	45
	600	82,6 (3,25)	R23	108 (4,25)	60 (2,36)	40	45
	1500	95,3 (3,75)	R24	124 (4,88)	60 (2,36)	40	45
	2500	101,6 (4,00)	R26	133 (5,25)	60 (2,36)	40	45
3"	150	114,3 (4,50)	R29	133 (5,25)	89 (3,50)	40	45
	300	123,8 (4,87)	R31	146 (5,75)	89 (3,50)	40	45
	600	123,8 (4,87)	R31	146 (5,75)	89 (3,50)	40	45
4"	150	149,2 (5,87)	R36	171 (6,75)	115 (4,53)	40	45
	300	149,2 (5,87)	R37	175 (6,88)	115 (4,53)	40	45
	600	149,2 (5,87)	R37	175 (6,88)	115 (4,53)	40	45

LD300L (RF/FF/RTJ) – Level Transmitter (Integral Flange)



NOTE
-EXTENSION LENGTH IN (mm): 0, 50, 100, 150 OR 200
-DIMENSIONS IN mm (in)

ANSI-B 16.5 DIMENSIONS

DN	CLASS	A	B	C (RF)	C1 (FF)	C2 (RTJ)	D (RF)	E	F (RF)	F1 (RTJ)	ANEL RTJ	G	# HOLES
1.1/2"	150	127 (5)	98.6 (3.88)	20 (0.78)	19 (0.75)	24.4 (0.96)	1.6 (0.06)	16 (0.63)	73.2 (2.88)	65.1 (2.56)	R19	40 (1.57)	4
	300	155.4 (6.12)	114.3 (4.5)	21 (0.83)	21 (0.83)	27.4 (1.07)	1.6 (0.06)	22 (0.87)	73.2 (2.88)	68.3 (2.68)	R20	40 (1.57)	4
	600	155.4 (6.12)	114.3 (4.5)	29.3 (1.15)	29.3 (1.15)	29.3 (1.15)	6.4 (0.25)	22 (0.87)	73.2 (2.88)	68.3 (2.68)	R20	40 (1.57)	4
2"	150	152.4 (6)	120.7 (4.75)	22 (0.87)	20 (0.78)	25.9 (1.02)	1.6 (0.06)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R22	48 (1.89)	4
	300	165.1 (6.5)	127 (5)	22.8 (0.9)	22.8 (0.89)	30.8 (1.21)	1.6 (0.06)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R23	48 (1.89)	8
	600	165.1 (6.5)	127 (5)	32.3 (1.27)	32.3 (1.27)	32.3 (1.27)	6.4 (0.25)	19 (0.75)	91.9 (3.62)	82.6 (3.25)	R23	48 (1.89)	8
3"	150	190.5 (7.5)	152.4 (6)	24.4 (0.96)	24.4 (0.96)	30.7 (1.21)	1.6 (0.06)	19 (0.75)	127 (5)	114.3 (4.50)	R29	73 (2.87)	4
	300	209.5 (8.25)	168.1 (6.62)	29 (1.14)	29 (1.14)	36.9 (1.45)	1.6 (0.06)	22 (0.87)	127 (5)	123.8 (4.87)	R31	73 (2.87)	8
	600	209.5 (8.25)	168.1 (6.62)	38.7 (1.52)	38.7 (1.52)	40.2 (1.58)	6.4 (0.25)	22 (0.87)	127 (5)	123.8 (4.87)	R31	73 (2.87)	8
4"	150	228.6 (9)	190.5 (7.5)	24.4 (0.96)	24.4 (0.96)	30.7 (1.21)	1.6 (0.06)	19 (0.75)	158 (6.22)	149.2 (5.87)	R36	96 (3.78)	8
	300	254 (10)	200 (7.87)	32.2 (1.27)	32.2 (1.27)	40.2 (1.58)	1.6 (0.06)	22 (0.87)	158 (6.22)	149.2 (5.87)	R37	96 (3.78)	8
	600	273 (10.75)	215.9 (8.5)	45 (1.77)	45 (1.77)	46.5 (1.83)	6.4 (0.25)	25 (1)	158 (6.22)	149.2 (5.87)	R37	96 (3.78)	8

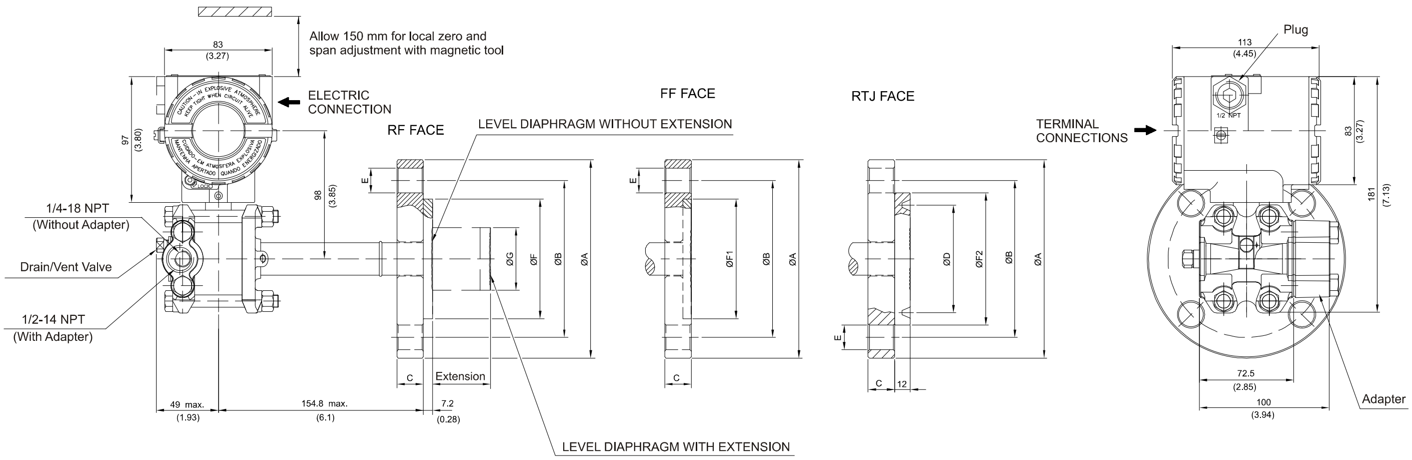
EN 1092-1 DIMENSIONS

DN	PN	A	B	C (RF)	C1 (FF)		D	E	F (RF)		G	# HOLES
DN40	10/40	150 (5.9)	110 (4.33)	20 (0.78)	20 (0.78)		3 (0.12)	18 (0.71)	88 (3.46)		40 (1.57)	4
DN50	10/40	165 (6.5)	125 (4.92)	20 (0.78)	22 (0.86)		3 (0.12)	18 (0.71)	102 (4.01)		48 (1.89)	4
DN80	10/40	200 (7.87)	160 (6.3)	24 (0.95)	24 (0.94)		3 (0.12)	18 (0.71)	138 (5.43)		73 (2.87)	8
DN100	10/16	220 (8.67)	180 (7.08)	20 (0.78)			3 (0.12)	18 (0.71)	158 (6.22)		96 (3.78)	8
	25/40	235 (9.25)	190 (7.5)	24 (0.95)			3 (0.12)	22 (0.87)	162 (6.38)		96 (3.78)	8

JIS B 2202 DIMENSIONS

DN	CLASS	A	B	C		D	E	F (RF)		G	# HOLES
40A	20K	140 (5.5)	105 (4.13)	26 (1.02)		2 (0.08)	19 (0.75)	81 (3.2)		40 (1.57)	4
50A	10K	155 (6.1)	120 (4.72)	26 (1.02)		2 (0.08)	19 (0.75)	96 (3.78)		48 (1.89)	4
	40K	165 (6.5)	130 (5.12)	26 (1.02)		2 (0.08)	19 (0.75)	105 (4.13)		48 (1.89)	8
80A	10K	185 (7.28)	150 (5.9)	26 (1.02)		2 (0.08)	19 (0.75)	126 (4.96)		73 (2.87)	8
	20K	200 (7.87)	160 (6.3)	26 (1.02)		2 (0.08)	19 (0.75)	132 (5.2)		73 (2.87)	8
100A	10K	210 (8.27)	175 (6.89)	26 (1.02)		2 (0.08)	19 (0.75)	151 (5.95)		96 (3.78)	8

LD300L (RF/FF/RTJ) – Level Transmitter (Slip-on Flange)

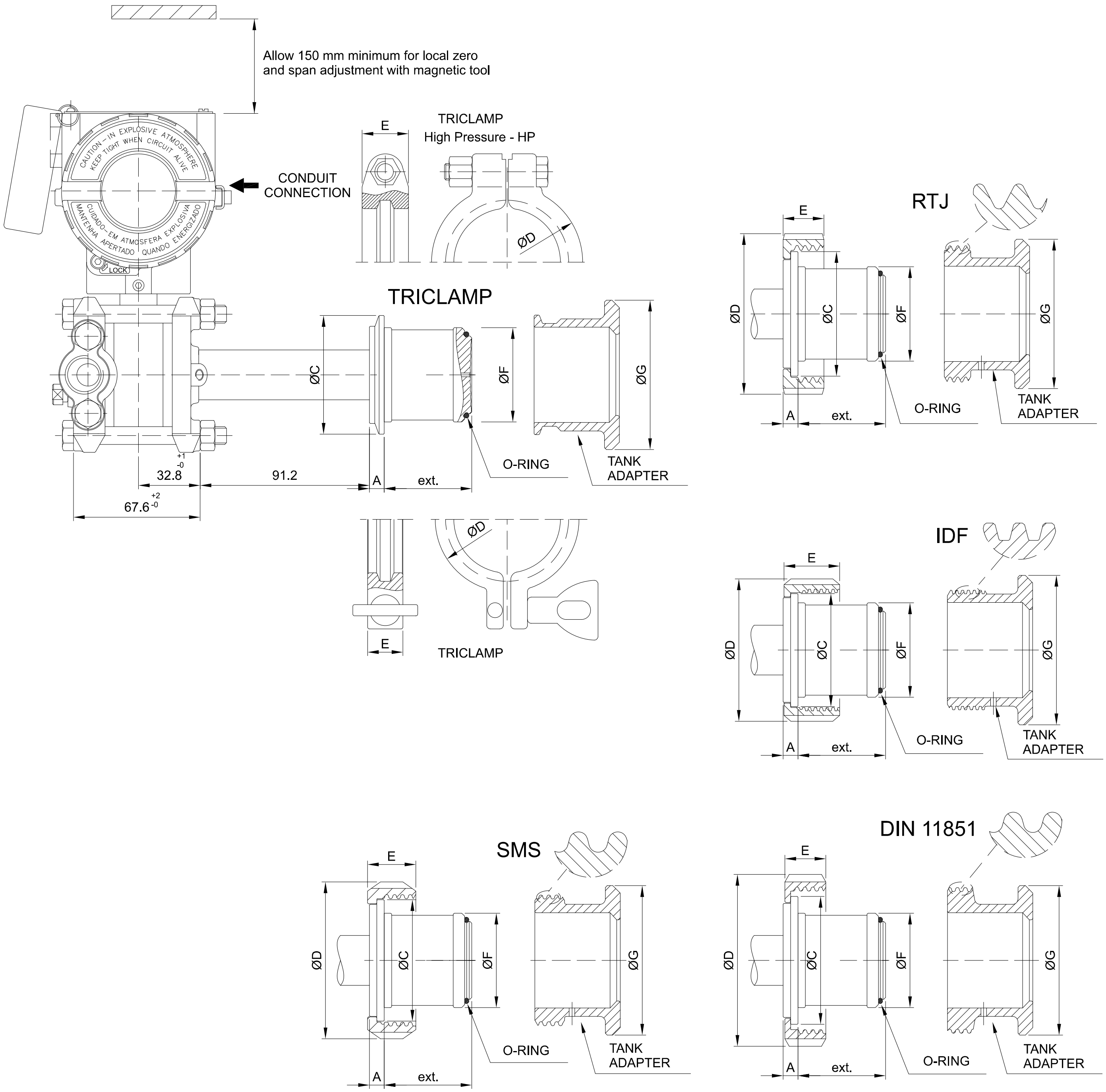


ANSI-B 16.5 DIMENSIONS											
DN	CLASS	A	B	C	D	E	F (RF)	F1 (FF)	F2 (RTJ)	G	# HOLES
1"	150	108 (4.25)	79.4 (3.16)	14.3 (0.56)	-	16 (0.63)	50.8 (2)	50.8 (2)	-	-	4
	300/600	124 (4.88)	88.9 (3.5)	17.5 (0.69)	-	19 (0.75)	50.8 (2)	50.8 (2)	-	-	4
1 1/2"	150	127 (5)	98.4 (3.87)	17.5 (0.69)	-	16 (0.63)	73 (2.87)	73 (2.87)	-	40 (1.57)	4
	300/600	156 (6.14)	114.3 (4.5)	22.2 (0.87)	-	22 (0.87)	73 (2.87)	73 (2.87)	-	40 (1.57)	4
2"	150	152.4 (6)	120.7 (4.75)	17.5 (0.69)	82.6 (3.25)	19 (0.75)	92 (3.62)	92 (3.62)	101.6 (4.00)	48 (1.89)	4
	300	165.1 (6.5)	127 (5)	20.7 (0.8)	82.6 (3.25)	19 (0.75)	92 (3.62)	92 (3.62)	107.9 (4.25)	48 (1.89)	8
	600	165.1 (6.5)	127 (5)	25.4 (1)	82.6 (3.25)	19 (0.75)	92 (3.62)	92 (3.62)	107.9 (4.25)	48 (1.89)	8
3"	150	190.5 (7.5)	152.4 (6)	22.3 (0.87)	114.3 (4.50)	19 (0.75)	127 (5)	127 (5)	133.4 (5.25)	73 (2.87)	4
	300	209.5 (8.25)	168.1 (6.62)	27 (1.06)	123.8 (4.87)	22 (0.87)	127 (5)	127 (5)	146.1 (5.75)	73 (2.87)	8
	600	209.5 (8.25)	168.1 (6.62)	31.8 (1.25)	123.8 (4.87)	22 (0.87)	127 (5)	127 (5)	146.1 (5.75)	73 (2.87)	8
4"	150	228.6 (9)	190.5 (7.5)	22.3 (0.87)	149.2 (5.87)	19 (0.75)	158 (6.22)	158 (6.22)	171.5 (6.75)	89 (3.5)	8
	300	254 (10)	200 (7.87)	30.2 (1.18)	149.2 (5.87)	22 (0.87)	158 (6.22)	158 (6.22)	174.6 (6.87)	89 (3.5)	8
	600	273 (10.75)	215.9 (8.5)	38.1 (1.5)	149.2 (5.87)	25 (1)	158 (6.22)	158 (6.22)	174.6 (6.87)	89 (3.5)	8

EN 1092-1 / DIN2501 DIMENSIONS - RF/ FF								
DN	PN	A	B	C	E	F	G	# HOLES
25	10/40	115 (4.53)	85 (3.35)	18 (0.71)	14 (0.55)	68 (2.68)	-	4
40	10/40	150 (5.91)	110 (4.33)	18 (0.71)	18 (0.71)	88 (3.46)	73 (2.87)	4
50	10/40	165 (6.50)	125 (4.92)	20 (0.78)	18 (0.71)	102 (4.01)	48 (1.89)	4
80	10/40	200 (7.87)	160 (6.30)	24 (0.95)	18 (0.71)	138 (5.43)	73 (2.87)	8
100	10/16	220 (8.67)	180 (7.08)	20 (0.78)	18 (0.71)	158 (6.22)	89 (3.5)	8
	25/40	235 (9.25)	190 (7.50)	24 (0.95)	22 (0.87)	162 (6.38)	89 (3.5)	8

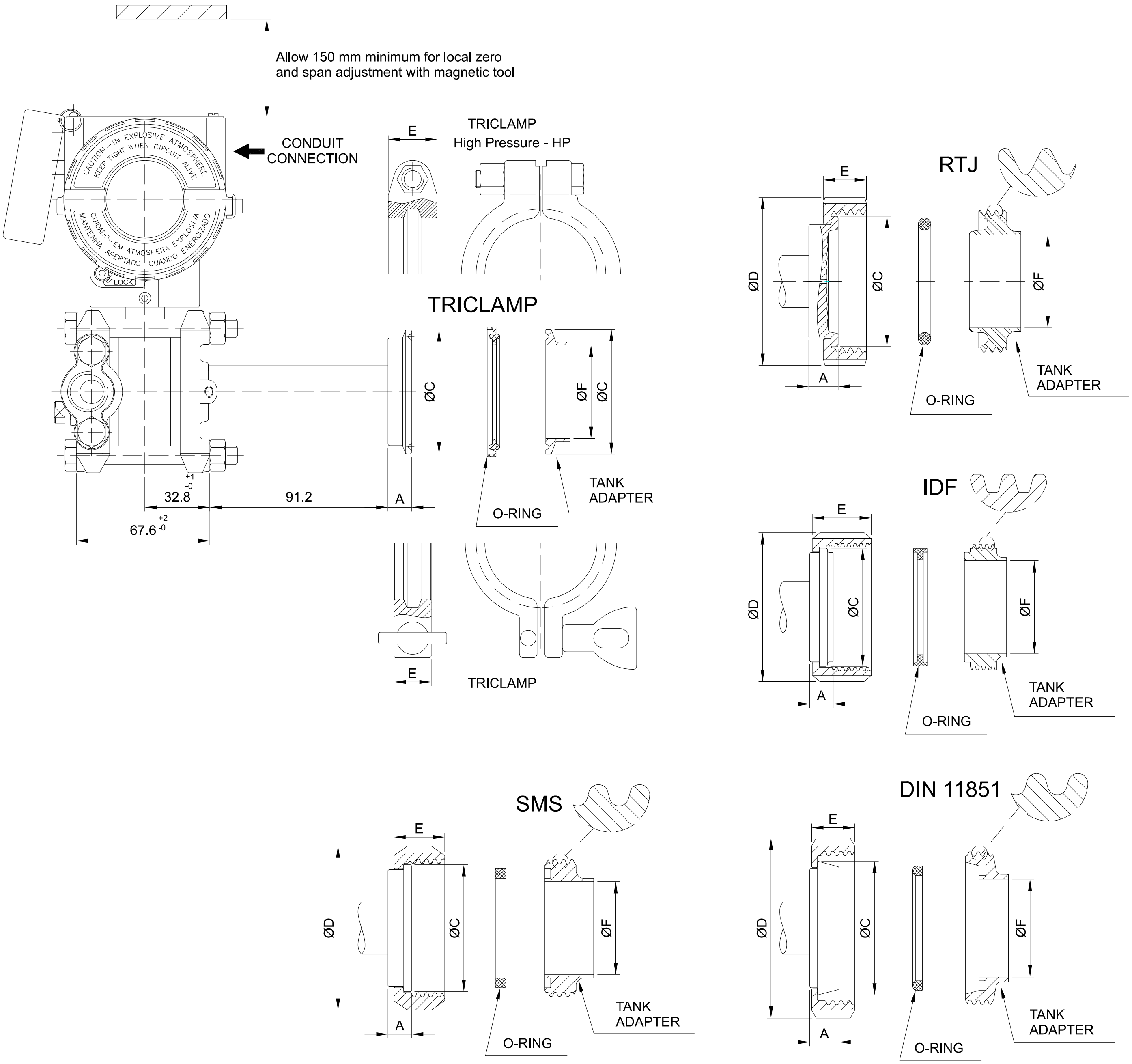
NOTES:
-EXTENSION LENGTH IN mm(in): 0, 50 (1.96), 100 (3.93), 150(5.9) or 200 (7.87)
-FOR 1" AND DN25 THE EXTENSION LENGTH IS 0 mm
-DIMENSIONS IN mm(in)

LD300S – Sanitary Transmitter with Extension



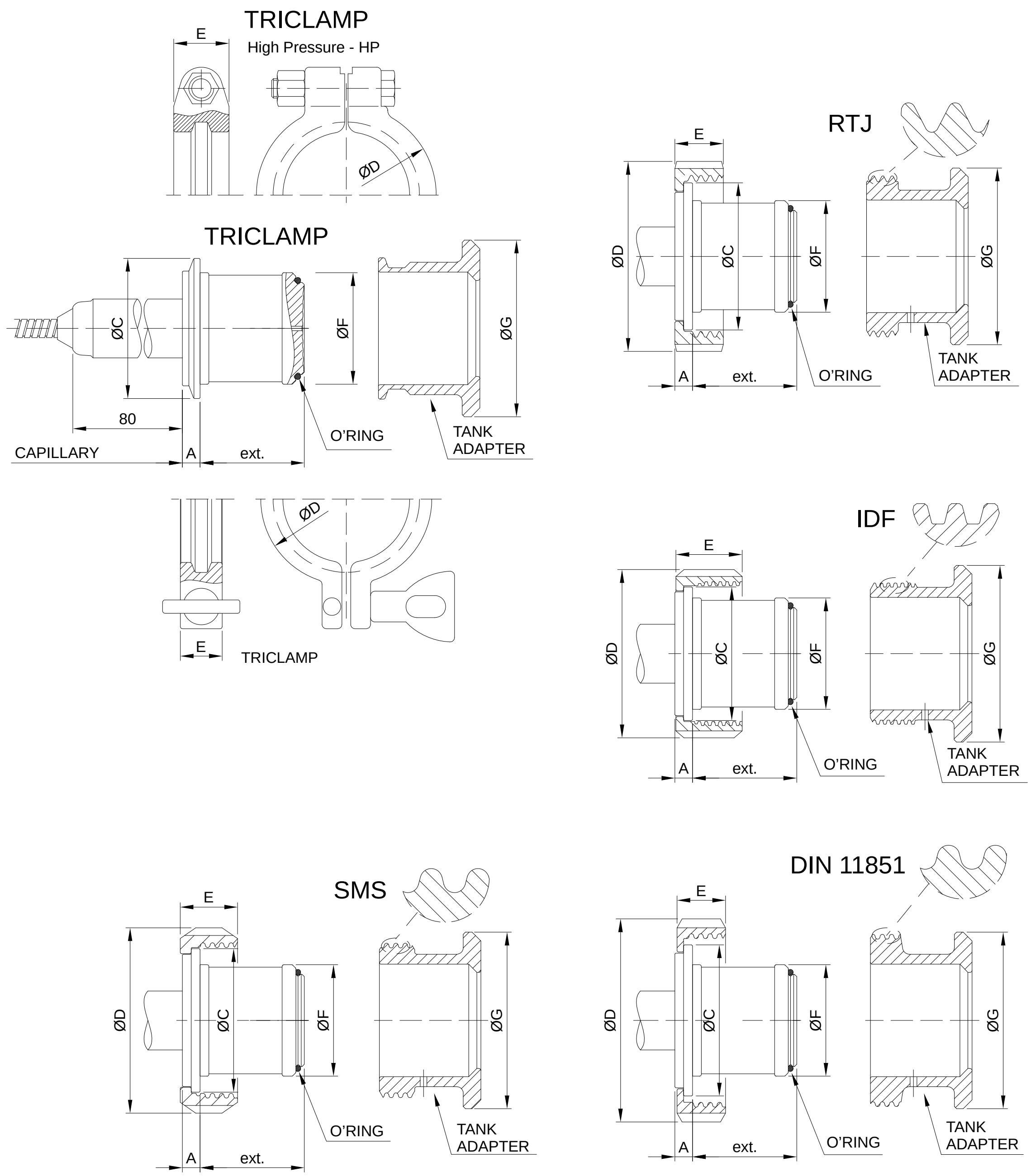
Dimensions see Table 11

LD300S – Sanitary Transmitter without Extension



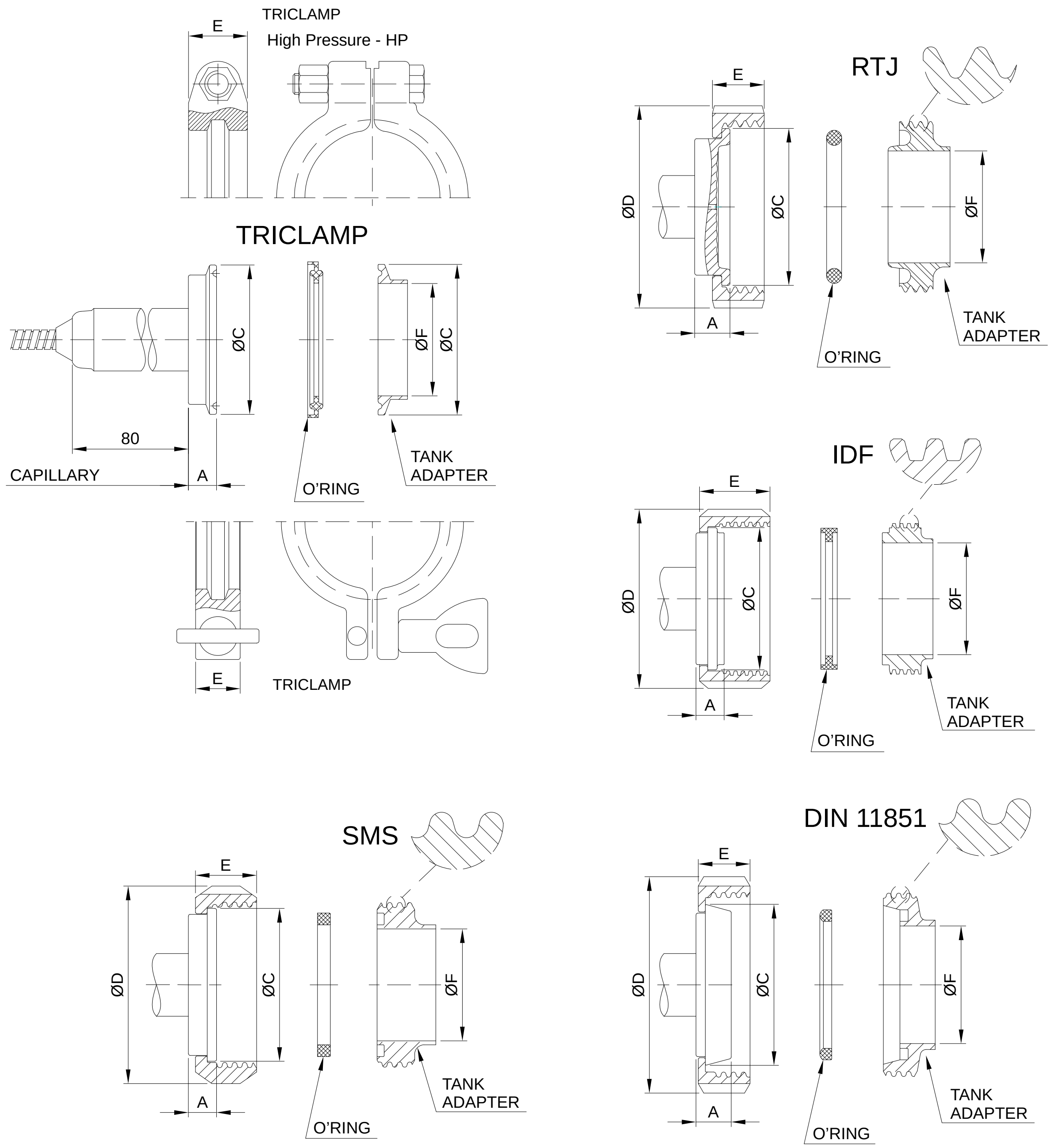
Dimensions see Table 11

SR301S – Sanitary Remote Seal with Extension



Dimensions see Table 11

SR301S – Sanitary Remote Seal without Extension



Dimensions see Table 11

Table 11: Dimensions relative to pages 6.32, 6.33, 6.34 and 6.35.

SR301S / LD300S							
CONNECTION WITHOUT EXTENSION	Dimensions in mm (")						
	A	ØC	ØD	E	ØF	ØG	EXT.
Tri-Clamp DN50 - without extension	8 (0.315)	63.5 (2.5)	76.5 (3.01)	18 (0.71)	47.5 (1.87)	---	---
Tri-Clamp - 1 1/2" - without extension	12 (0.47)	50 (1.96)	61 (2.4)	18 (0.71)	35 (1.38)	---	---
Tri-Clamp - 1 1/2" HP - without extension	12 (0.47)	50 (1.96)	66 (2.59)	25 (0.98)	35 (1.38)	---	---
Tri-Clamp - 2" - without extension	12 (0.47)	63.5 (2.5)	76.5 (3.01)	18 (0.71)	47.6 (1.87)	---	---
Tri-Clamp - 2" HP - without extension	12 (0.47)	63.5 (2.5)	81 (3.19)	25 (0.98)	47.6 (1.87)	---	---
Tri-Clamp - 3" - without extension	12 (0.47)	91 (3.58)	110 (4.33)	18 (0.71)	72 (2.83)	---	---
Tri-Clamp - 3" HP - without extension	12 (0.47)	91 (3.58)	115 (4.53)	25 (0.98)	72 (2.83)	---	---
Threaded DN40 - DIN 11851 - without extension	13 (0.51)	56 (2.2)	78 (3.07)	21 (0.83)	38 (1.5)	---	---
Threaded DN50 - DIN 11851 - without extension	15 (0.59)	68.5 (2.7)	92 (3.62)	22 (0.86)	50 (1.96)	---	---
Threaded DN80 - DIN 11851 - without extension	16 (0.63)	100 (3.94)	127 (5)	29 (1.14)	81 (3.19)	---	---
Threaded SMS - 1 1/2" - without extension	12 (0.47)	55 (2.16)	74 (2.91)	25 (0.98)	35 (1.38)	---	---
Threaded SMS - 2" - without extension	12 (0.47)	65 (2.56)	84 (3.3)	26 (1.02)	48.6 (1.91)	---	---
Threaded SMS - 3" - without extension	12 (0.47)	93 (3.66)	113 (4.45)	32 (1.26)	73 (2.87)	---	---
Threaded RJT - 2" - without extension	15 (0.59)	66.7 (2.63)	86 (3.38)	22 (0.86)	47.6 (1.87)	---	---
Threaded RJT - 3" - without extension	15 (0.59)	92 (3.62)	112 (4.41)	22.2 (0.87)	73 (2.87)	---	---
Threaded IDF - 2" - without extension	12 (0.47)	60.5 (2.38)	76 (2.99)	30 (1.18)	47.6 (1.87)	---	---
Threaded IDF - 3" - without extension	12 (0.47)	87.5 (3.44)	101.6 (4)	30 (1.18)	73 (2.87)	---	---

SR301S / LD300S							
CONNECTION WITH EXTENSION	Dimensions in mm (")						
	A	ØC	ØD	E	ØF	ØG	EXT.
Tri-Clamp DN50 - with extension	8 (0.315)	63.5 (2.5)	76.5 (3.01)	18 (0.71)	50.5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp DN50 HP - with extension	8 (0.315)	63.5 (2.5)	81 (3.19)	25 (0.98)	50.5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 2" - with extension	8 (0.315)	63.5 (2.5)	76.5 (3.01)	18 (0.71)	50.5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 2" HP - with extension	8 (0.315)	63.5 (2.5)	81 (3.19)	25 (0.98)	50.5 (1.99)	80 (3.15)	48 (1.89)
Tri-Clamp - 3" - with extension	8 (0.315)	91 (3.58)	110 (4.33)	18 (0.71)	72.5 (2.85)	100 (3.94)	50 (1.96)
Tri-Clamp - 3" HP - with extension	8 (0.315)	91 (3.58)	115 (4.53)	25 (0.98)	72.5 (2.85)	100 (3.94)	50 (1.96)
Threaded DN25 - DIN 11851 - with extension	6 (0.24)	47.5 (1.87)	63 (2.48)	21 (0.83)	43.2 (1.7)	80 (3.15)	26.3 (1.03)
Threaded DN40 - DIN 11851 - with extension	8 (0.315)	56 (2.2)	78 (3.07)	21 (0.83)	50.5 (1.99)	80 (3.15)	48 (1.89)
Threaded DN50 - DIN 11851 - with extension	8 (0.315)	68.5 (2.7)	92 (3.62)	22 (0.86)	50.5 (1.99)	80 (3.15)	48 (1.89)
Threaded DN80 - DIN 11851 - with extension	8 (0.315)	100 (3.94)	127 (5)	29 (1.14)	72.5 (2.85)	100 (3.94)	50 (1.96)
Threaded SMS - 2" - with extension	8 (0.315)	65 (2.56)	84 (3.3)	26 (1.02)	50.5 (1.99)	80 (3.15)	48 (1.89)
Threaded SMS - 3" - with extension	8 (0.315)	93 (3.66)	113 (4.45)	32 (1.26)	72.5 (2.85)	100 (3.94)	50 (1.96)
Threaded RJT - 2" - with extension	8 (0.315)	66.7 (2.63)	86 (3.38)	22 (0.86)	50.5 (1.99)	80 (3.15)	48 (1.89)
Threaded RJT - 3" - with extension	8 (0.315)	92 (3.62)	112 (4.41)	22.2 (0.87)	72.5 (2.85)	100 (3.94)	50 (1.96)
Threaded IDF - 2" - with extension	8 (0.315)	60.5 (2.38)	76.2 (3)	30 (1.18)	50.5 (1.99)	80 (3.15)	48 (1.89)
Threaded IDF - 3" - with extension	8 (0.315)	87.5 (3.44)	101.6 (4)	30 (1.18)	72.5 (2.85)	100 (3.94)	50 (1.96)

Appendix A

smar	**SRF – Service Request Form** **Remote Seals**	**Proposal No.:**
Company:	**Unit:**	**Invoice:**

COMMERCIAL CONTACT		**TECHNICAL CONTACT**	
Full Name:		**Full Name:**	
Function:		**Function:**	
Phone:	**Extension:**	**Phone:**	**Extension:**
Fax:		**Fax:**	
Email:		**Email:**	

EQUIPMENT DATA		
Model:	**Serial Number:**	**Sensor Number:**

PROCESS DATA							
Process Fluid:							
Calibration Range		**Ambient Temperature (ºC)**		**Process Temperature (ºC)**		**Process Pressure**	
Min:	**Max:**	**Min:**	**Max:**	**Min:**	**Max:**	**Min:**	**Max:**
Static Pressure				**Vacuum**			
Min:		**Max:**		**Min:**		**Max:**	
Normal Operation Time:				**Failure Date:**			

FAILURE DESCRIPTION
(Please, describe the observed behavior, if it is repetitive, how it reproduces, etc.)

OBSERVATIONS

USER INFORMATION

Company:

Contact: Title: Section:

Phone: Extension: E-mail:

Date: Signature:

For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on www.smar.com/contactus.asp.

SMAR WARRANTY CERTIFICATE

1. SMAR guarantees the equipment of its own manufacture for a period of 24 (twenty four) months, starting on the day the invoice is issued. The guarantee is effective regardless of the day the product was installed. Third-party equipment and software are not included in this Term of Guarantee and Smar does not offer any guarantee or declaration in the name of the manufacturer. Any guarantees related to these products are the supplier or licenser responsibility.

2. SMAR products are guaranteed against any defect originating from manufacturing, mounting, whether of a material or manpower nature, provided that the technical analysis reveals the existence of a quality failure liable to be classified under the meaning of the word, duly verified by the technical team within the warranty terms.

3. Exceptions are proven cases of inappropriate use, wrong handling or lack of basic maintenance compliant to the equipment manual provisions. SMAR does not guarantee any defect or damage caused by an uncontrolled situation, including but not limited to negligence, user imprudence or negligence, natural forces, wars or civil unrest, accidents, inadequate transportation or packaging due to the user's responsibility, defects caused by fire, theft or stray shipment, improper electric voltage or power source connection, electric surges, violations, modifications not described on the instructions manual, and/or if the serial number was altered or removed, substitution of parts, adjustments or repairs carried out by non-authorized personnel; inappropriate product use and/or application that cause corrosion, risks or deformation on the product, damages on parts or components, inadequate cleaning with incompatible chemical products, solvent and abrasive products incompatible with construction materials, chemical or electrolytic influences, parts and components susceptible to decay from regular use, use of equipment beyond operational limits (temperature, humidity, etc.) according to the instructions manual. In addition, this Warranty Certificate excludes expenses with transportation, freight, insurance, all of which are the customer's responsibility.

4. For warranty or non-warranty repair, please contact your representative.

   Further information about address and contacts can be found on www.smar.com/contactus.asp

5. In cases needing technical assistance at the customer's facilities during the warranty period, the hours effectively worked will not be billed, although SMAR shall be reimbursed from the service technician's transportation, meals and lodging expenses, as well dismounting/mounting costs, if any.

6. The repair and/or substitution of defective parts do not extend, under any circumstance, the original warranty term, unless this extension is granted and communicated in writing by SMAR.

7. No Collaborator, Representative or any third party has the right, on SMAR's behalf, to grant warranty or assume some responsibility for SMAR products. If any warranty would be granted or assumed without SMAR's written consent, it will be declared void beforehand.

8. Cases of Extended Warranty acquisition must be negotiated with and documented by SMAR.

9. If necessary to return the equipment or product for repair or analysis, contact us.
   See item 4.

10. In cases of repair or analysis, the customer must fill out the Revision Requisition Form (FSR) included in the instructions manual, which contains details on the failure observed on the field, the circumstances it occurred, in addition to information on the installation site and process conditions. Equipments and products excluded from the warranty clauses must be approved by the client prior to the service execution.

11. In cases of repairs, the client shall be responsible for the proper product packaging and SMAR will not cover any damage occurred in shipment.

12. In cases of repairs under warranty, recall or outside warranty, the client is responsible for the correct packaging and packing and SMAR shall not cover any damage caused during transportation. Service expenses or any costs related to installing and uninstalling the product are the client´s sole responsibility and SMAR does not assume any accountability before the buyer.

13. It is the customer's responsibility to clean and decontaminate products and accessories prior to shipping them for repair, and SMAR and its dealer reserve themselves the right to refuse the service in cases not compliant to those conditions. It is the customer's responsibility to tell SMAR and its dealer when the product was utilized in applications that contaminate the equipment with harmful products during its handling and repair. Any other damages, consequences, indemnity claims, expenses and other costs caused by the lack of decontamination will be attributed to the client. Kindly, fill out the Declaration of Decontamination prior to shipping products to SMAR or its dealers, which can be accessed at www.smar.com/doc/declarationofcontamination.pdf and include in the packaging.

14. This warranty certificate is valid only when accompanying the purchase invoice.