# Selecting the correct process seal for Rosemount GWR products

Rosemount Guided Wave Radar, GWR, probes are available with a variety of process seal connections to meet pressure and temperature demands and other process conditions of level applications. This document outlines the structural differences between the process seals, the pressure and temperature limits, and guidelines for selection of the correct process seal.

## Overview of process seal options

The Rosemount 3300 and 5300 Guided Wave Radar Transmitters are designed to be used in a wide variety of level applications. To meet the installation and application demands, four types of process seals are available and are chosen as part of the model number sequence:

S - Standard temperature and pressure process seal
H - High Temperature and High Pressure
P - High Pressure
C - Cryogenic Temperatures

Most application conditions can be met with the standard temperature and pressure process seal (S). However, some more extreme temperature or pressure conditions will require the use of a seal designed for those conditions.

In the design of any process seal, one critical factor is to allow passage of the microwave signal thru the seal area with minimal signal degradation. Materials frequently used are PTFE and ceramic alloys. PTFE has excellent chemical compatibility and microwave properties; however it has limitations in terms of pressure and temperature capability. Ceramic alloys have very good mechanical capabilities but higher dielectric constant which results in more signal degradation compared to PTFE. Thus a balance must be created between the chosen material for microwave function and the mechanical function of creating a robust pressure and temperature seal.

## Seal Construction - Standard Process Seal

The Standard temperature and pressure process seal is constructed of a combination of PTFE, Ultem® plastics, and 316 SST. It is available with a choice of o-rings for process compatibility. O-rings materials include Viton®, Ethylene Propylene, Kalrez® 6375 and Buna-N.

Optional wetted materials in place of 316 SST are Alloy 400 and Alloy 276.

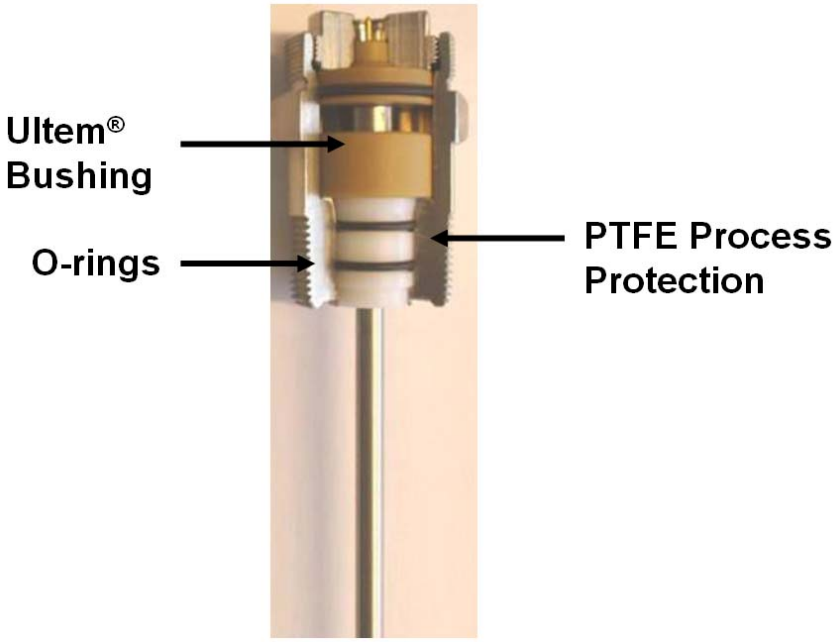


**Figure 1. Standard Temperature and Pressure Process Seal.**

## Seal Construction - Extreme Pressure and Temperature Seals

The High Temperature/High Pressure, High Pressure and Cryogenic process seals are designed to prevent leakage and perform reliably when exposed to extreme process conditions. Materials and design are selected to avoid stress fractures commonly induced by changes in temperature and pressure conditions.

The primary pressure seal portion is the same on all three seals. The use of ceramic provides the temperature and pressure seal and serves as the primary microwave transport material. The use of ceramic is restricted to areas where the pressure and temperature sealing is necessary. Figure 2 below describes the general design of the process seal.

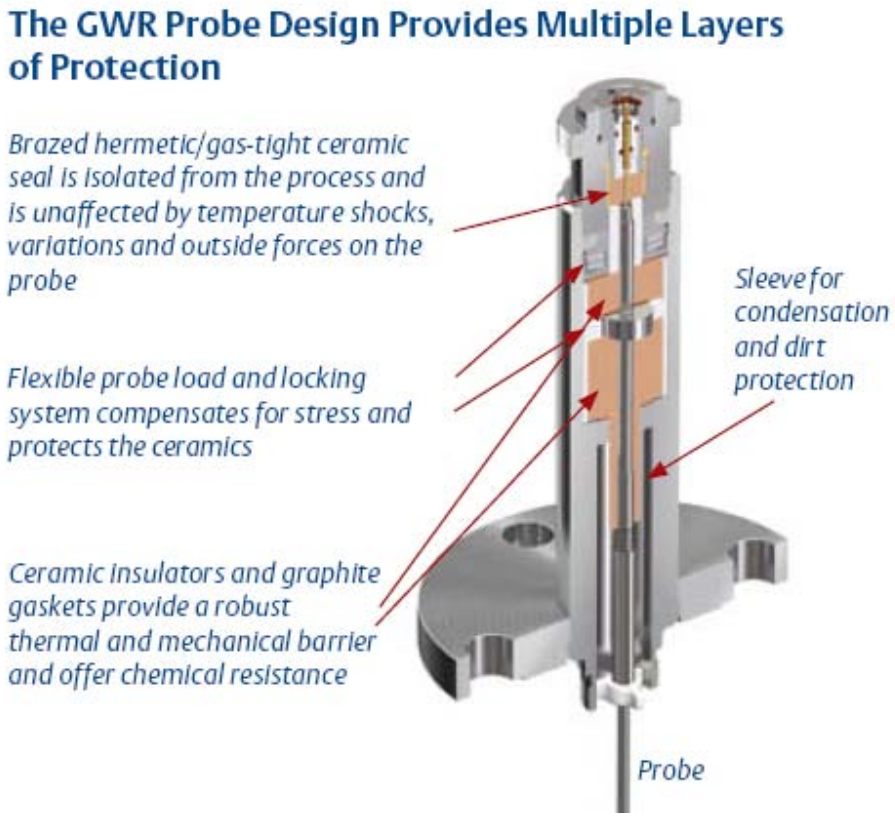


**Figure 2. Extreme pressure and temperature seal design.**

The three versions differ in the area that has direct contact with the process. Below is a description of the different versions.

## High Pressure/High Temperature Process Seal

In the High Temperature/High Pressure (H) seal for applications up to 750 °F (400 °C) the wetted parts include a body and probe in 316 SST, Ceramic ($Al_2O_3$), an Inconel spring, and graphite.

The body and probe are also available in Alloy 276 instead of SST.

The ceramic sleeve below the primary pressure seal works as a drip-off sleeve and prevents liquid droplets from blocking the microwave signal transmission. The ceramic seal allows good transmission of microwave signals while also meeting the high temperature requirements

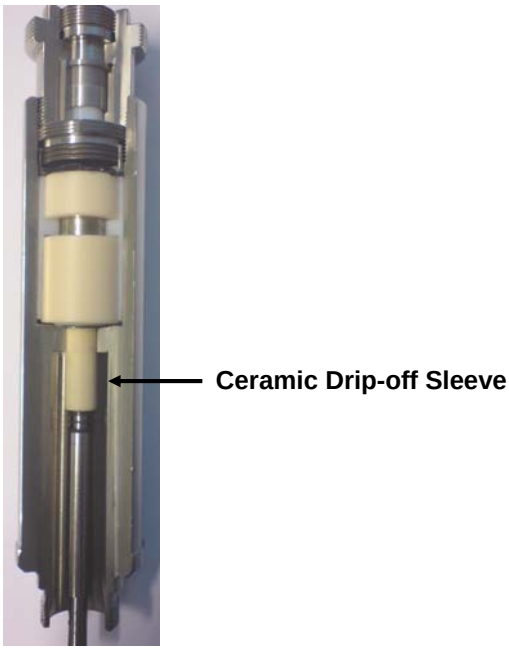


**Figure 3. High Pressure and High Temperature Seal Design.**

## High Pressure Process Seals

In the High Pressure Seal (P) seal for applications up to 392 °F (200 °C) the wetted parts include a body and probe in 316 SST, Ceramic ($Al_2O_3$), an Inconel spring, graphite, and PTFE. The body and probe are also available in Alloy 276 instead of 316 SST.

There are two slightly different versions. The *single lead version* has a large PTFE filled cavity. The *coaxial version* has a smaller PTFE drip-off sleeve similar to the ceramic drip-off sleeve in the High temperature/high pressure version (H).

The PTFE process protection sleeve prevents highly viscous or dirty products from entering the seal area. The PTFE material fills the open space to eliminate plugging with minimal degradation of the microwave signal.

For this reason the High Pressure seal is the preferred seal in applications with a flange temperature less than 392 °F (200 °C) where sticky or dirty fluids may enter the recessed area, e.g. during times of overfill or in submerged probe interface applications.

The coaxial probe uses a smaller PTFE drip-off sleeve. Since the coaxial probe can only be used in clean applications and is intended for fluids with very low dielectric constants, this small PTFE part prevents condensation droplets from occurring in the most critical area which could cause signal degradation.

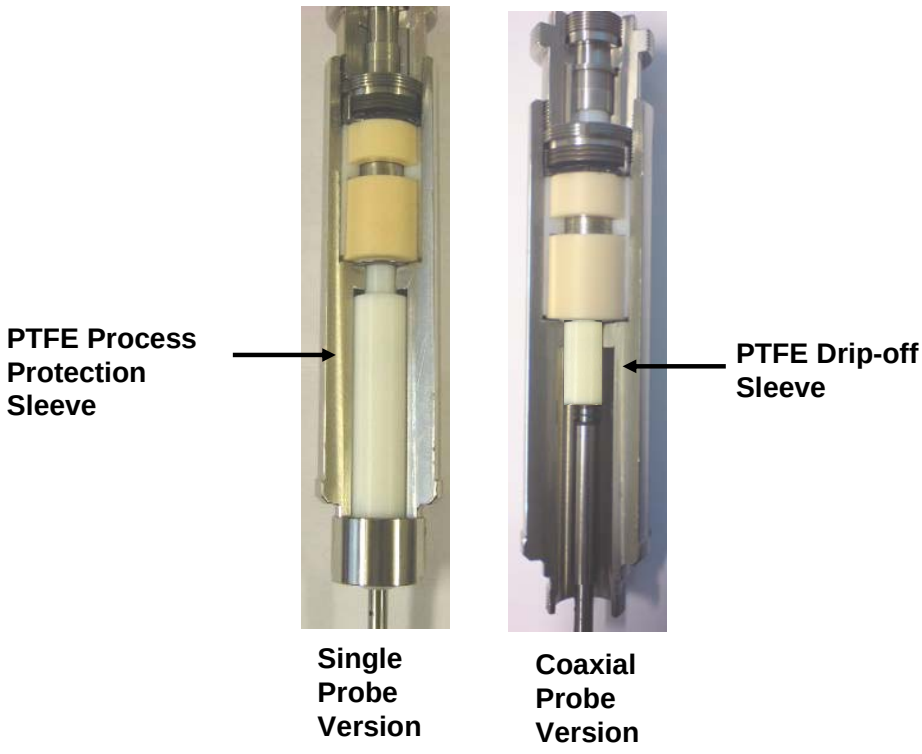


**Figure 4. High Pressure Seal Design.**

## Cryogenic Process Seals

The Cryogenic seal (C) is composed of 316 SST, Ceramic ($Al_2O_3$), graphite, and PTFE. This seal is constructed using special welding techniques suitable for cryogenic applications. Otherwise it is identical to the High Pressure process seal (P).

Note! The Cryogenic seal is not available in Alloy 276.

## Process Seal Wetted Materials

The table below summarizes the wetted materials in the various process seals.

| Wetted Materials | Standard (S) | High Pressure (P) | Cryogenic (C) | High Temperature/ High Pressure (H) |
|---|---|---|---|---|
| SST | Yes | Yes | Yes | Yes |
| Alloy 276 (optional) | Yes | Yes | No | Yes |
| Alloy 400 (Optional) | Yes | No* | No | No* |
| PTFE | Yes | Yes | Yes | No |
| Ceramic | No | Yes | Yes | Yes |
| O-rings (choice of 4) | Yes | No | No | No |
| Inconel spring | No | Yes | Yes | Yes |
| Graphite | No | Yes | Yes | Yes |

**Table 1. Summary of wetted materials associated with each process seal.**
* Under development, available 2010.

## Process Seal Selection Guidelines

The GWR process seals offer a wide range of pressure and temperature capabilities.

In general, the basic recommendation for process seal selection is to choose the lowest rated one that can meet the temperature and pressure needs. This approach achieves two things. It will ensure the greatest signal availability for the measurement since the smallest amount of PTFE or ceramic is used. It will also ensure that sticky heavier products that can occur at lower temperatures will not build up in recessed areas of the seals.

For this reason, we advise the use of the High Pressure instead of the High Temperature/High Pressure seal for applications with a flange temperature less than 392 °F (200 °C), since at those temperatures products may be more viscous and therefore benefit from a completely filled waveguide. Note that it is the flange temperature that is the relevant parameter used as the guideline for selection.*

In the case of applications below -76 °F (-60 °C), only the cryogenic probe should be used due to the special welding requirements.

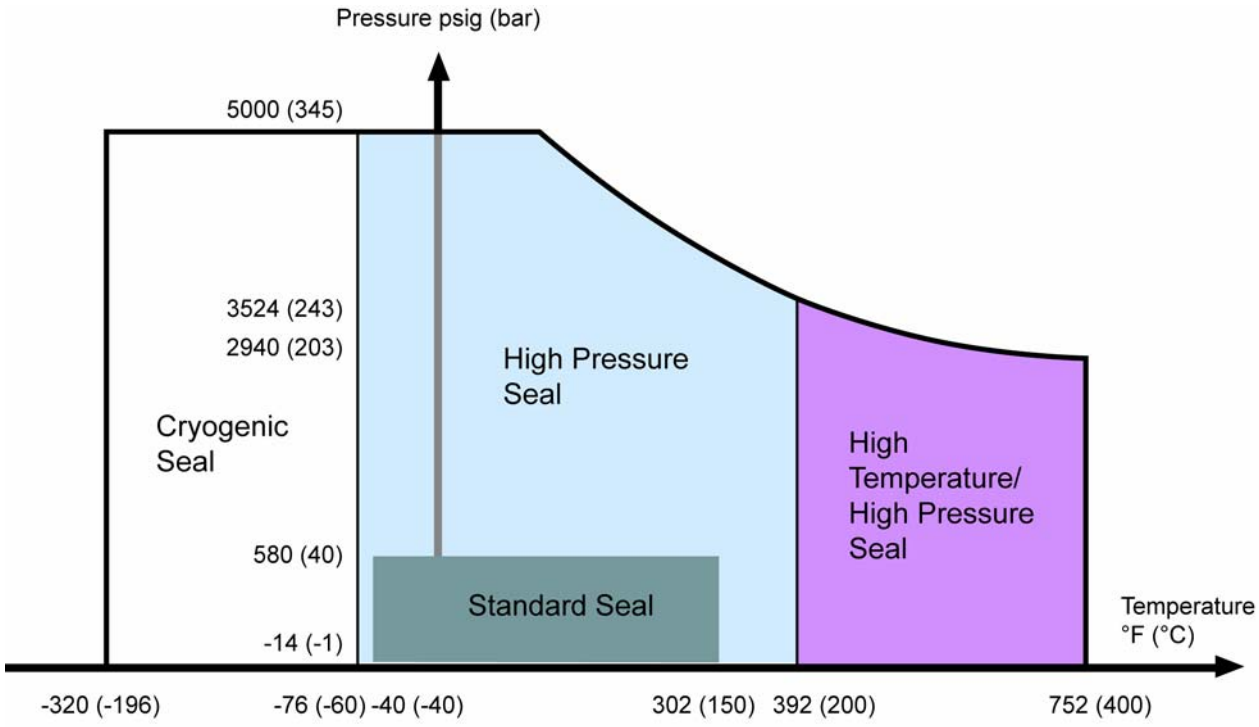


**Figure 5. Recommended choice of process seal type.**

* With the exception for coax probes where internal PTFE spacers in the probe have a temperature limit of 392 °F (200 °C).

## Application Selection Guidelines

Below is a general recommendation for selection of a suitable process seal depending on application. Note that exceptions may occur and each installation should be individually reviewed for proper selection.

| Standard (S) | High Pressure (P) | Cryogenic (C) | High Temperature/ High Pressure (H) |
|---|---|---|---|
| Accumulators, knock-out pots, separators, lube oil, feed tanks, settling tanks, desalters, scrubbers, Catalyst hoppers, towers (upper regions), amine, sumps, skim tanks. | Compressor systems, knock-out pots, scrubbers, debutanizer de-ethanizer, de-ethanizer tower bottoms, de-propanizer, cold HP separator, coalescers (water boot separator) absorber de-ethanizer tower de-propanizer OH accumulator, towers (lower regions), ammonia. | Liquid Gases | Steam systems measurements such as boilers, steam separators, feed water applications, hot lp separators. |

**Table 2. Typical Applications for different seal types.**



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