Specify the Right Solution for Vacuum Applications

KEY POINTS

- Specify a high temperature fill fluid (DC704)
- Specify All-Welded Vacuum Construction for vacuums below 6 psia (300 mmHgA)
- Mount transmitter at or below the lower tap (3 feet or 1 meter is rule of thumb)
- Use Instrument Toolkit® software to validate system in your application

OVERVIEW

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

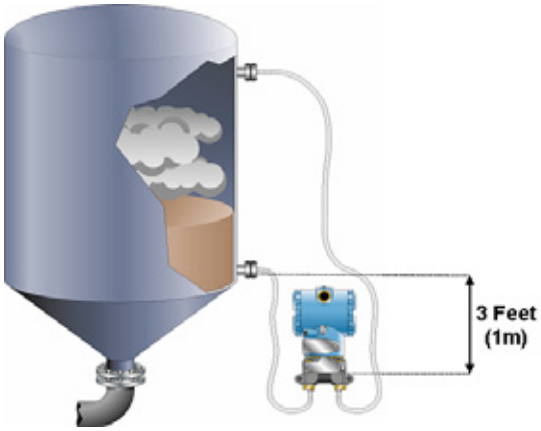
APPLICATION

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

- Mounting Position
- Fill Fluid Selection
- Seal System Construction

Mounting Position

Mounting the pressure transmitter at or below the bottom vessel tap is an important factor to ensure a stable measurement with vacuum applications. The static pressure limit for a differential pressure transmitter is 0.5 psia (25 mmHgA), which ensures the transmitter sensor module fill fluid typically (DC200) remains within the liquid phase of the vapor pressure curve.



If the vessel static limit is below 0.5 psia, mounting the transmitter below the bottom tap provides a capillary fill fluid head pressure on the module. A general rule of thumb is to always mount the transmitter approximately 3 feet (1 meter) below the bottom tap of the vessel. The actual head pressure can be calculated by multiplying the vertical distance between the bottom tap and transmitter by the specific gravity of the fill fluid. Finally, validate the system in your application using Instrument Toolkit Software to ensure the system will perform under your operating conditions.

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Fill Fluid Selection

When the process is under vacuum conditions, the fill fluid will vaporize under a lower temperature than when it is under normal atmospheric or greater pressure. Emerson Process Management offers over 16 different types of fill fluids for filled systems. Each fill fluid has a specific Vapor-Pressure curve. The Vapor-Pressure curve indicates the pressure and temperature relationship where the fluid is in a liquid or a vapor state. Proper seal operation requires the fill fluid to remain in a liquid state. For vacuum applications, specify fluids with a premium combination of vapor-pressure curve and high temperature limits like DC704 or DC705.

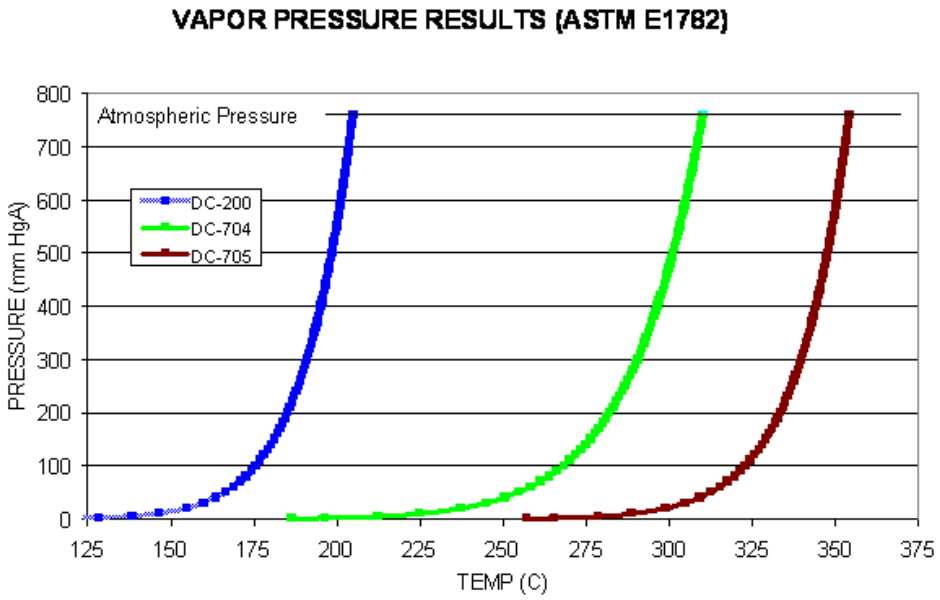


TABLE 1. Temperature Limits[1]

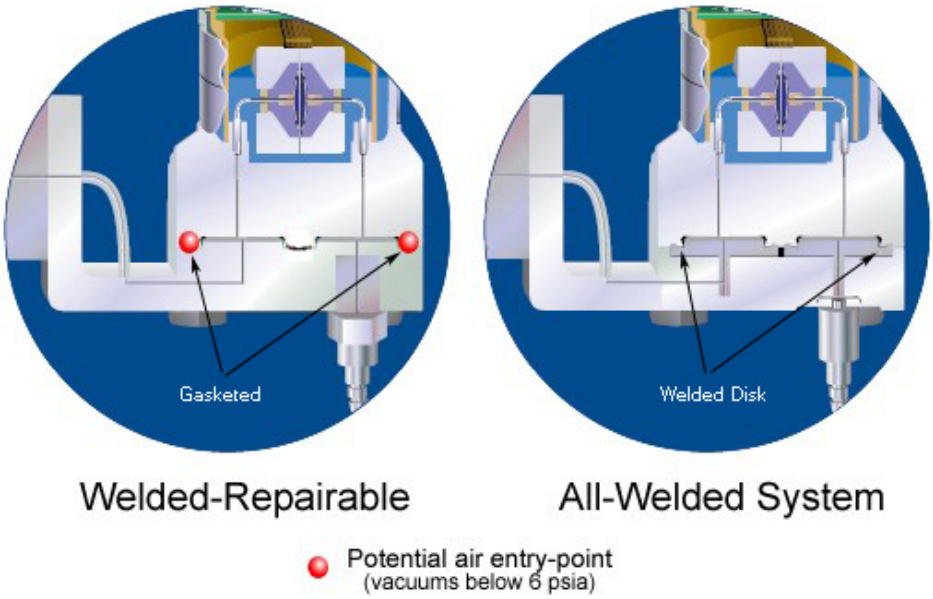
Fill Fluid	Maximum Temperature at Minimum Pressure	Maximum Temperature at ATM Pressure
D.C.® 200 Silicone	257°F (125°C) @ 25 mmHgA	–49°F (–45°C) to 400°F (205°C)
D.C. 704 Silicone[2]	See vapor pressure curve	32°F (0°C) to 600°F (315°C)
D.C. 705 Silicone[2]	See vapor pressure curve	68°F (20°C) to 662°F (350°C)

(1) Vapor pressure curve and operating limit details for published fill fluids can be found in the Rosemount 1199 Fill Fluid Specifications Technical Note, document 00840-2100-4016.

(2) Upper temperature limit is for capillary seal systems mounted away from the transmitter.

Seal System Construction

Emerson offers Rosemount 1199 seals with welded-repairable and All-Welded vacuum system construction methods. In vacuum applications, specify the All-Welded vacuum construction. Threaded or gasket connections allow the potential for vacuum pressure to draw air into the capillary system causing drift or complete system failure. No air in the system eliminates the need to re-zero and thus improves plant availability by preventing unscheduled downtime and instrument repair or replacement.



The all welded vacuum construction was designed specifically for high temperature and vacuum applications. In this construction, the sensor module gaskets are removed and a disk is welded over the sensor isolators. This eliminates the possibility of air being drawn into the seal system in deep vacuum conditions. This premium design is strongly suggested for vacuum pressures below 6 psia (310 mmHga).

Remote seal system construction model codes can be found in the Rosemount 1199 Diaphragm Seal System Product Data Sheet (00813-0100-4016, Tables 4, 5, and 50). Furthermore, Rosemount has improved the manufacturing processes for remote seals used for high temperature/high vacuum applications.

Fill Fluid Preparation

The fill fluids used in remote seal systems were developed for other applications, then adapted for use in seal systems. For example, DC704 was developed to be a heat transfer fluid in diffusion pumps for high vacuum chambers common in semiconductor manufacturing. When applied into a remote seal system, Rosemount has implemented the further preparation to purify the fluid and remove residual entrapped air or water to ensure a stable measurement performance under extreme vacuum conditions.

System Components Preconditioned

To ensure long term reliability, manufacturing process improvements were implemented to prepare the seal system for high temperature and vacuum conditions. System components are preconditioned at high temperatures and vacuum pressures to prepare them for the end use.

Stringent Manufacturing Processes

The equipment and procedures used to build remote seal systems for high temperature/high vacuum applications are continuously improved to deliver products for ever increasing application demands. Tight quality control measures like 100% helium leak checking of system welds ensures the reliability of every seal system. The process includes monitoring to detect any station leaks and to confirm the fill quality of the finished seal system.

Summary

Implementing the right combination of seal system construction, fill fluid, and mounting position can ensure long term stable measurement performance for high temperature and vacuum applications. If you have questions on a vacuum installation, contact your local Emerson Process Management representative for application assistance.

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