Swagelok Singapore

# Swagelok Tech Bits

ISSUE 2

## In This Issue

# Corrosion: Type & Ways to Manage It (Part 2)

- by Rajasegaran A/L Munion

Are you facing corrosion problems in your plant and equipment? Are you second guessing on what to do with it? Don't fret! We are giving you more types of corrosion and how to handle them.

## Localized Crevice Corrosion in Chloride-Containing Media

In a typical fluid system, crevices exist between tubing and tube supports or tube clamps, between adjacent tubing runs, and underneath dirt and deposits that may have accumulated on surfaces. Crevices are virtually impossible to avoid in tubing installations, and tight crevices pose the greatest danger for corrosion to occur.

## How It Forms

Like pitting corrosion, crevice corrosion starts with the breakdown of the passive oxide layer that protects the metal. This breakdown leads to the formation of small pits. The pits grow larger and deeper until they cover the whole crevice. In some places, tubing can be perforated. Crevice corrosion occurs at far lower temperatures than pitting corrosion.

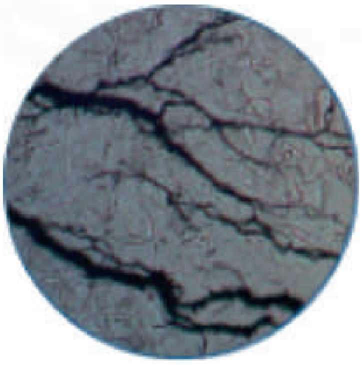
## Material Matters

When seawater diffuses into a crevice, some Fe++ ions dissolve and cannot rapidly diffuse out of a tight crevice. In saltwater, negatively charged chloride ions (C1-) are attracted by these positively charged Fe++ ions and begin to diffuse into the crevice. As the chloride concentration increases, the crevice solution becomes more corrosive, causing more iron to dissolve, which in turn attracts more chloride ions to diffuse into the crevice. Ultimately, the crevice solution turns into an acidic solution with high chloride concentration, which is very corrosive.

## Potential Solutions

- 6-Moly Alloys
- Alloy 2507
- Alloy 825
- Alloy 625
- Alloy C-276
- Alloy 400

# Stress Corrosion Cracking in Chloride-Containing Media

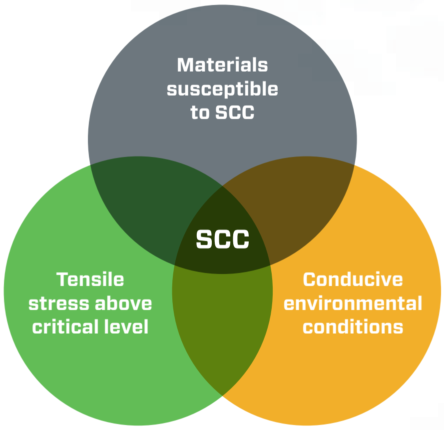


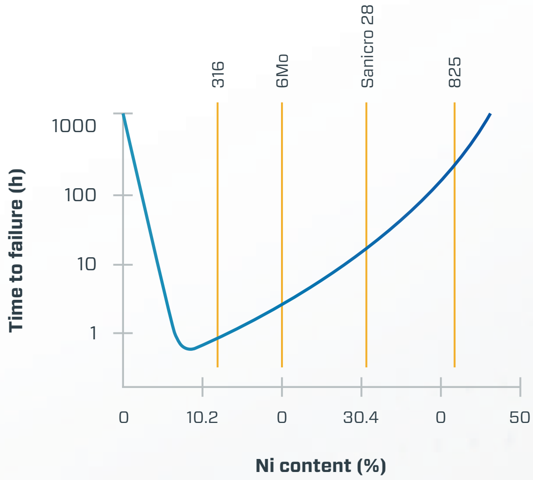
Stress corrosion cracking (SCC) is dangerous because it can destroy a component at stress levels below the yield strength of an alloy. In the presence of chloride ions, austenitic stainless steels are susceptible to SCC. The ions interact with the material at the tip of a crack where tensile stresses are highest, making it easier for the crack to grow. While in progress, SCC can be difficult to detect, and final failure can occur suddenly.

## How It Forms

For SCC to occur, three conditions must be met simultaneously:

- The metal must be susceptible to SCC
- Environmental (fluid or temperature) conditions conducive to SCC must exist
- The tensile stress (applied + residual) must be above critical level




## Potential Solutions

- 6-Moly Alloys
- Alloy 2507
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# Gas Seal 101

– by Alfred Low

## What are Gas Seals?

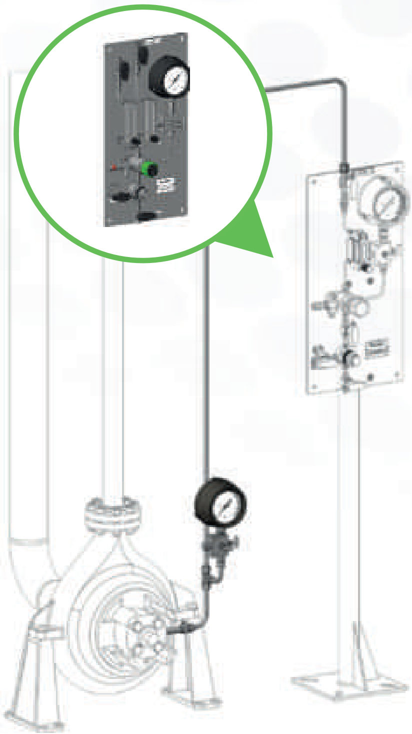
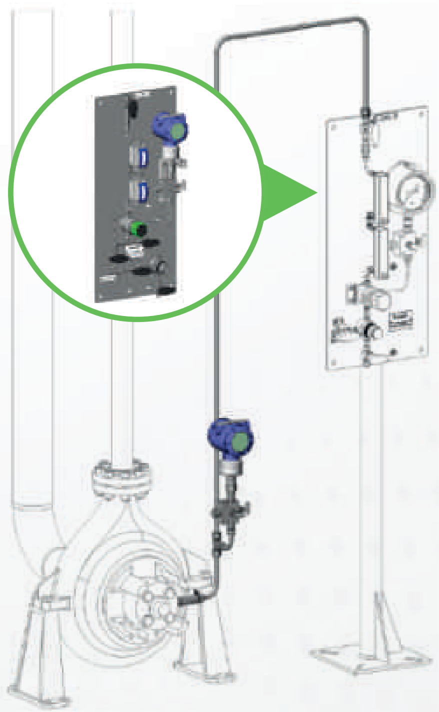
- Gas seals run in a clean, controlled fluid environment and are designed to remain non-contacting and non-wearing for the expected operating conditions. Seal faces operate on a barrier fluid film which is typically nitrogen.
- Used on light hydrocarbons or liquids with a high vapor pressure
- Typically used on Volatile Organic Compound (VOCs) where leakage control is important

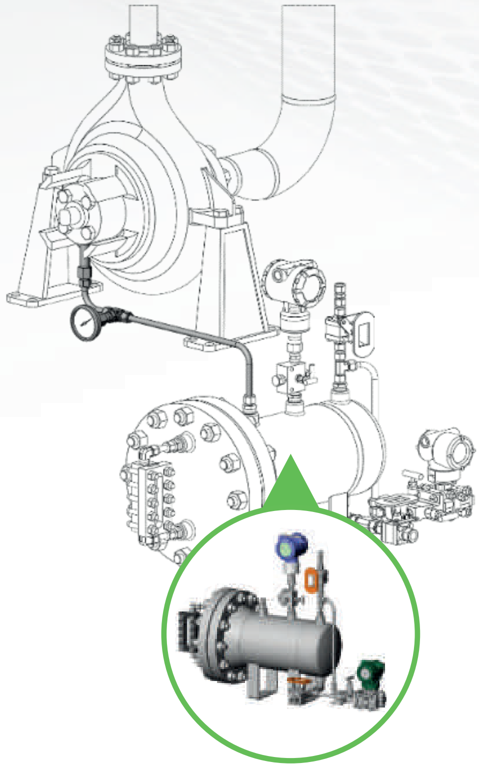
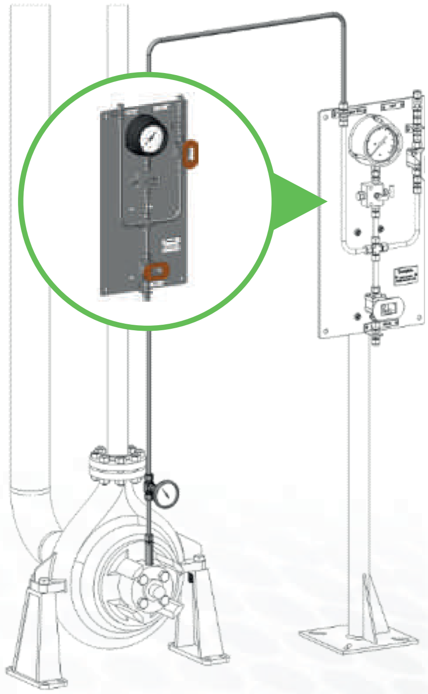
## Advantages of Gas Seals

- Since they are non-contacting seals, they do not wear and provide consistent performance
- Reduce power consumption at the seal faces which results to lower cost of operation
- Seal generates little heat and any gas leakage will absorb heat away through gas expansion

## Downside on Gas Seals

- When it works, it will work great, when it does not work, it can be disaster to the seal
- Quality of clean dry nitrogen is critical
- Gas seals offer little room for error. If there is a disruption in nitrogen supply, the gas seal will fail quickly and catastrophically.

| Plan | Description | Design |
| --- | --- | --- |
| Plan 72 | • Unpressurized buffer gas control system<br>• Dilutes the vapor leakage in the containment seal cavity and sweeps away to vent<br>• System includes a pressure transmitter upstream of the flowmeter to indicate the buffer gas supply pressure and to trigger an alarm if supply fails<br>• Flow switch monitors the consumption of the buffer gas and triggers an alarm in the event that the containment seal fails |  |
| Plan 74 | • Back to Back Seal<br>• Pressurized barrier gas, usually nitrogen (higher pressure than seal chamber)<br>• Panel removes moisture, regulates, filters gas<br>• If there is an inboard seal leak, N2 leaks into process |  |

| Plan | Description | Design |
|---|---|---|
| Plan 75 | • Unpressurized Dual Seal<br>• Liquid collection reservoir<br>• Orifice allows vapor to bleed to collection system<br>• Pressure measuring device detects excessive seal leakage |  |
| Plan 76 | • Containment Seal<br>• Divert gas seal leakage to flare or vapor recovery system<br>• Pressure measuring device detects excessive seal leakage |  |

**Source:** Swagelok Mechanical Seal Support Systems Training Material.

# Grab Sampling for Gas System

– by Sharon Sng

Closed loop systems provide a sample that is fresh, extracted and held under the same process conditions that existed at the time of the sample. The precision of your facility's chemical products relies on the ability to collect accurate samples. Grab sampling is one way for your plant to reduce costs iteratively through consistently accurate sample grabs—diminishing product waste. Here are some grab sample modules designated for gas sampling, it can be customised to your needs depending on whether you require a fastloop or purge feature.

## GSM-G-1(-N)
## Standard Gas Sampler without Purge

**Use:**
General use for gas sampling.

**Recommended for:**

- non-toxic gases and systems when the return is sent to flare

Front Back

## GSM-G-1(-P)
## Standard Gas Sampler with Purge

**Use:**
General use for gas sampling. Purge option clears sample gas before and/or after sample collection.

**Recommended for:**
- gases that are toxic or with condensable hydrocarbons.
- systems when the return is sent to flare

Front Back

## GSM-G-2(-N)
## Continuous Flow Gas Sampler without Purge

**Use:**
General use for gas sampling when continuous flow is required from inlet to outlet.

**Recommended for:**
- gases that are non-toxic
- samplers installed directly in the sample stream, on a fast loop, or where long sample transport lines are used

Front Back

## GSM-G-2(-P)
## Continuous Flow Gas Sampler with Purge

**Use:**
General use for gas sampling when continuous flow is required from inlet to outlet. Purge option clears sample fluid from the sample transport lines before and/or after sample collection.

**Recommended for:**
- gases that are toxic or with condensable hydrocarbons
- samplers installed directly in the sample stream, on a fast loop, or where long sample transport lines are used

Front Back