

Title: Selecting Conductivity Sensors
Part 2: Chemical Compatibility

Signet standard conductivity sensors are manufactured using the following materials:

- 316 stainless steel
- PTFE insulator
- EPR O-rings
- 3/4" polypropylene, stainless steel or PEEK process connectors. (sensor dependent)

While most water and waste water applications can use the standard material, applications using acids or caustics may require alternative materials. Through the "Special Products" program, Signet can provide conductivity sensors manufactured from materials other than stainless steel. These optional materials include:

- Monel
- Hastelloy-C
- Titanium

Let's look at a common application:

A customer wants to monitor 5% Hydrochloric acid at 95°F (35°C) and 25 psi (1.7 bars). How do we determine which Signet conductivity sensor to recommend?

1. Verify conductivity level of the fluid:

The conductivity level of 5% HCl is 250,000 microseimens. The only sensor that can measure fluid in this range is p/n 3-2823-1 (198 844 010). It features a 20.0 cell constant, with a stainless steel sensor and process connector. This sensor has a maximum conductivity measurement range of 400,000 microseimens.

2. Verify pressure requirements:

The pressure rating of the 3-2823-1 is 100 psi (6.9 bars), well beyond the pressure range of the customers application.

3. Chemical compatibility:

This step is the most important and yet the most forgotten and overlooked step. The reference guide "Chemical Resistance Guide for Metals and Alloys" from Compass Publications provides the following information for HCl:

Stainless steel and HCl:

- 3-100% concentration of HCl is not recommended at any temperature.

Monel and HCl:

- 5% HCl at 150°F (65.5°C) will cause the material to erode < 0.020" (<0.50 mm) per year.

Hastelloy-C and HCl:

- Any HCl concentration up to 40% and at temperatures up to 140°F (60°C) will cause the sensor material to erode < 0.002" (< 0.05 mm) per year.

Titanium and HCl:

- 5 – 10% concentration of HCl at any temperature up to 160°F (71.1°C) will cause the sensor material to erode < 0.020" (< .50 mm) per year.

Facts:

- Figure 1 shows that the average thickness of the metal components is approximately .35"/.889 mm thick.
- From the chemical compatibility data we can conclude that stainless steel cannot be used at all.
- Monel and Titanium will be eroded by 0.020"/0.50 mm per year. At this rate the sensor would only last about 18 months in this application.
- Hastelloy-C will erode at a much slower rate (0.002 in/0.05 mm) per year.



Figure 1: Average tube wall thickness 0.035"/0.889 mm

Conclusion:

Hastelloy-C is the most suitable material for this application.

Field Experience:

This photograph shows a standard 3-2823-1 sensor, with stainless steel body, before and after exposure to 5% HCl for a period of one year.

- The lower sensor is new.
- The upper sensor shows the steel body completely eroded, exposing the plastic interior of the sensor.

