

## PRODUCTS FOR SOUR OILFIELD APPLICATIONS (NACE MR0175/ISO 15156 - 2009) AND SOUR PETROLEUM REFINING OPERATIONS (NACE MR0103 - 2010)

PIP #: ASH-PI-60

Applicable to:  
Pressure Gauges,  
Diaphragm Seals,  
Switches, Transducers  
And Thermowells

### Introduction

Many metals and alloys are susceptible to corrosion and stress corrosion cracking when used in environments containing hydrogen sulfide (H<sub>2</sub>S). To prevent equipment failures and increase safety in “sour” applications, NACE International (formerly the National Association of Corrosion Engineers) issues several standards regarding materials selection for applications exposed to hydrogen sulfide. Using materials selected in accordance with NACE standards MR0175/ISO 15156 and/or MR0103 reduces the likelihood of failure due to stress corrosion cracking in sour environments.

### The Standards

**MR0175/ISO 15156 – 2009:** *“Materials for Use in H<sub>2</sub>S Containing Environments in Oil and Gas Production”*

This document has been adopted as a worldwide standard by NACE, ANSI, and ISO. This comprehensive standard is divided into three sections, separately addressing general requirements, ferrous alloys, and corrosion resistant alloys as used in sour oil and gas field applications.

**MR0103 – 2010:** *“Materials Resistant to Sulfide Corrosion Cracking in Corrosive Petroleum Refining Environments”*

This document addresses the selection of materials in oil and gas refineries. Refinery environments are typically less severe than production environments, due to lower chloride concentrations and higher pH levels. As a result, MR0103 tends to be less stringent than MR0175/ISO 15156.

### Scope of the Standards

MR0175/ISO 15156 and MR0103 only consider cracking mechanisms due to exposure to H<sub>2</sub>S and do not address general or localized corrosion. Additionally, the standards restrict the usage of many alloys by limiting the temperature, pH, and/or composition at which these alloys may be used. It is the responsibility of the customer to select an appropriate instrument based on these factors.

## Products Compliant with NACE Standards

A summary of NACE compliant products is listed in the table on page 3.

## Pressure Gauges

All gauges with Monel wetted parts are compliant with MR0175/ISO 15156 and MR0103.

The following Ashcroft gauge types with 316L stainless steel wetted parts are compliant with the standards: **1009** (4½" and 6" only), **1109, 1259, 1279, 1377, 1379, 2462, T5500, T6500, 1010, 1017, 1020, 1127, 1128, and 1220**. Gauges with stainless steel wetted components are limited to a maximum temperature of 158°F (70°C)

## Diaphragm Seals

Type **100 & 200** Series, and **702/740** diaphragm seals with 304L, 316L, or Carpenter 20 Cb-3 wetted components are compliant with MR0175 / ISO 15156 and MR0103. However, Ashcroft does not recommend the use of these materials in excess of 140°F (60°C). Above this temperature, the diaphragm, which is quite thin, may experience localized corrosion in the presence of chlorides.

Type **100 & 200** Series, and **702/740** diaphragm seals with Monel<sup>®</sup>, Hastelloy<sup>®</sup> C-22, or Hastelloy<sup>®</sup> C-276 wetted parts comply with both standards without restriction.

Type **310, 400/500, and 510/511** seals with Monel<sup>®</sup> wetted parts, and Type **510/511** seals with all Hastelloy<sup>®</sup> C-276 construction are compliant with both standards without restriction.

Instruments attached to diaphragm seals should have stainless steel or Monel<sup>®</sup> wetted components to prevent corrosion in the event of a diaphragm failure.

## Laboratory Testing

An independent laboratory was commissioned to assess the suitability of Ashcroft stainless steel bourdon tube gauges in sour environments. The gauges were pressurized to 80% of scale at a temperature of 158°F (70°C) with a sour media as specified in MR0175/ISO 15156, table E.1, Level V. The media consisted of an aqueous solution of H<sub>2</sub>S at a partial pressure of 100 psi (0.7 mPa), CO<sub>2</sub> at a partial pressure of 200 psi (1.4 MPa), and a chloride concentration of 91 g/L (in the form of sodium chloride). The media was replenished weekly. After 30 days of exposure, there was no evidence of stress corrosion cracking or other damage. After exposure to the test media, the gauges were tested for cycle life by pressure cycling from 20% to 80% of scale at a rate of 0.3 to 0.6 Hertz (ASME B40.1 paragraph A-2.8). The performance of the exposed gauges was equivalent to baseline tests.

## Certification

All products listed are compliant with the NACE standards. If a certificate of compliance with MR0175 / ISO 15156 or MR0103 is required, order option CD5.

**Precautions**

Gauges and diaphragm seals shall be used in accordance with ASME B40.100 and all Ashcroft recommendations. All restrictions on temperature, pH, and chemistry imposed by MR0175 / ISO 15156 must be observed. It is the responsibility of the customer to determine the appropriate materials of construction based on their process variables and operational requirements.

**ASHCROFT INC. NACE COMPLIANT PRODUCTS**

Instrument	Specification	
	Oilfields (Production) MR0175/ISO 15156-2009	Refineries MR0103-2010
<b>Pressure Gauges</b>		
Pressure Gauges of any type with Monel® wetted parts	Compliant	Compliant
Types <b>1009</b> (4 1/2" and 6" only), <b>1109, 1259, 1279, 1377, 1379, 2464, T5500, T6500, 1010, 1017, 1020, 1127, 1128,</b> and <b>1220</b> with 316L wetted components	Compliant	Compliant
Pressure Gauges of any type with Monel® wetted parts	Compliant	Compliant
Type <b>5503</b> Differential Pressure Gauge with Hastelloy® C-276 diaphragm and housing and Teflon® gaskets	Compliant	Compliant
<b>Diaphragm Seals</b>		
Type <b>100 &amp; 200</b> Series, and <b>702/740</b> with 304L, 316L, or Carpenter 20 Cb-3® wetted (140°F/60°C max.)	Compliant	Compliant
Types <b>400 &amp; 500</b> Series with 316L wetted parts (140°F/60°C max.)	Compliant	Compliant
Types <b>100 &amp; 200</b> Series, and <b>702/740</b> with Monel®, Hastelloy® C-22 or C-276 wetted parts	Compliant	Compliant
Types <b>400 &amp; 500</b> Series with Hastelloy® C-22 or C-276 wetted parts	Compliant	Compliant
Type <b>100 &amp; 200</b> Series, and <b>702/740</b> with Tantalum wetted	Compliant	Not Compliant
Type <b>311/312</b> with all 316L wetted parts (140°F / 60°C)	Compliant	Compliant
Type <b>310/315, 400/500, 510/511</b> with all Monel®	Compliant	Compliant
Type 510/511 with all Hastelloy® C-276 construction	Compliant	Compliant
<b>Switches</b>		
Type <b>B400, B700, G, L, and P</b> series with all welded Monel® construction (Specify XMA option)	Compliant	Compliant
<b>Transducers</b>		
Type <b>A2, A2X, and A4</b> with 316L sensor (140°F/60°C)	Compliant	Compliant
<b>Thermowells</b>		
316 (specify XMA option), Monel®, or Hastelloy® C-276	Compliant	Compliant