



# *CONNECTION BULLETIN*

## *Vogt Valves*

Sour Service Valve Applications

FCD VVABR1017-00 – 02/05 (Replaces CB-17)



*Experience In Motion*



**CLASS 800 AND CLASS 1500**

## Sour Service Valve Applications

### WHAT IS A “SOUR ENVIRONMENT”?

Fluids, notably petroleum crudes and gases, containing water (H<sub>2</sub>O) as a liquid and hydrogen sulfide (H<sub>2</sub>S) are considered to be “sour environments.” Piping and components transporting these fluids are considered to be in sour service.

### WHAT’S NEW?

The “Sour Environment” problem has existed for decades but became a major concern in the 1970’s with the increased production of H<sub>2</sub>S bearing hydrocarbon crudes and gases which caused a noticeable increase in failures of materials.

### WHAT’S THE PROBLEM?

Valves operating in a sour environment have prematurely failed as a result of a corrosion process known as **sulfide stress cracking (SSC)**. SSC is a **hydrogen embrittlement** phenomenon that occurs in high strength steels and in the heat-affected zones (HAZ) of steel weldments. It occurs as an unexpected brittle failure in materials when subjected to stresses that are even less than their yield strength.

### WHAT MATERIALS ARE AFFECTED?

Most alloys and particularly ferrous metals, whether hardened by heat treatment or cold work to hardnesses above Rc-22, are susceptible to SSC. Heat-affected zones (HAZ) in welds with hardnesses above Rc-22 are also susceptible.

## The Connection For Sour Service Valve Applications

### WHAT’S NACE?

National Association of Corrosion Engineers. This highly respected organization has recognized the problem and issued Standard MR-01-03 and Revisions, “MATERIALS RESISTANT TO SULFIDE STRESS CRACKING IN CORROSIVE PETROLEUM REFINING ENVIRONMENTS.”

# Sour Service Valve Applications

## WHAT'S MR-01-03 ABOUT?

MR-01-03 is a material standard—not a design standard. It is an aid in the selection of materials for those “Sour Environment” applications with conditions present that could result in SSC. The standard discusses the sour environment and presents guidelines in the H<sub>2</sub>S concentration and pressure relationships where SSC can occur in sour gas and sour multiphase systems. The standard has an excellent listing of ferrous and non-ferrous materials that are resistant to SSC. Copies of MR-01-03, including revisions, can be obtained by contacting: NACE INTERNATIONAL, 1440 Southcreek Drive, Houston, Texas 77084-4906, (281) 228-6200.

## ANY OTHER CONSIDERATIONS?

Yes. In addition to H<sub>2</sub>S, carbon dioxide (CO<sub>2</sub>) and water containing chlorides may also be present in crude oils and gases. This environment can lead to **degradation** of exposed material by **weight loss corrosion** (pitting, crevice and general corrosion) and other forms of **environmental embrittlement**.

MR-01-03 covers only **materials** resistant to SSC but other considerations must be recognized and properly dealt with to assure efficient and safe control of hazardous media.

## DOES FLOWSERVE VOGT VALVES MEET THE CHALLENGE?

Yes. We offer a number of valve series that are manufactured under a **controlled manufacturing** system that assures all materials, welds, and fabrication processes meet MR-01-03 and can be certified on request.

All Vogt forged steel valve bodies and bonnets meet NACE MR-01-03. However, we exert extreme care to control the manufacturing process for valve trim parts, bolting, and pressure boundary welds to maintain appropriate chemistry and mechanical properties for resistance to SSC.

## WHAT'S THE BEST BOLTING?

Flowserve Vogt ASTM A105 NACE valves use ASTM A193 Gr. B7M or B8M CL1 material for exposed and non-exposed bonnet bolt applications. For temperatures to -50°F, Vogt ASTM A350, Gr. LF2 valves use ASTM A320, Gr. L7M or B8M CL1 bonnet bolts for exposed and non-exposed bolt applications.

NACE MR-01-03 addresses bolting requirements in two categories:

1. **Exposed Bolting:** Bolting that is exposed directly to the sour environment in service or that will be buried, insulated or equipped with flange protectors or otherwise denied direct exposure to the open atmosphere.
2. **Non-Exposed Bolting:** Bolting that is exposed to the open atmosphere rather than the sour environment.

## WHAT'S THE “BEST” TRIM?

No single trim is “best” for all sour environment applications, particularly when H<sub>2</sub>S, CO<sub>2</sub>, and water containing chlorides are present.

Flowserve Vogt makes maximum use of 13% Cr., 316 stainless steel and Monel trim packages which offer superior corrosion resistance when matched to the sour environment and considering CO<sub>2</sub> and water containing chlorides.

After your careful analysis of the “Sour Environment” conditions, the selection of trim materials may be made from the following “trim suggestions” chart.

# Sour Service Valve Applications

## TRIM SUGGESTIONS FOR APPLICATIONS WITHIN THE SSC REGION

Service	Also Present	Temperature Range	Flowserve Suggested Trim
Oil/Gas	H <sub>2</sub> S and H <sub>2</sub> O	-20°F to 800°F	316 or 13% Cr.
Oil/Gas	H <sub>2</sub> S, H <sub>2</sub> O, CO <sub>2</sub>	-20°F to 800°F	316, 13% Cr. or <i>Monel</i> *
Oil/Gas	H <sub>2</sub> S, H <sub>2</sub> O and Chlorides	-20°F to 800°F	<i>Monel</i> * or 13% Cr.
Oil/Gas	H <sub>2</sub> S, H <sub>2</sub> O, CO <sub>2</sub> and Chlorides	-20°F to 800°F	<i>Monel</i> * or 13% Cr.

\* In multiphase systems, significant general corrosion may occur at temperatures above 300°F when CO<sub>2</sub>, H<sub>2</sub>S and chlorides are present.

For sour service valve applications outside the scope of NACE Standard MR-01-03 SSC region requirements, Flowserve suggests that our standard carbon steel valves containing 13% Cr., Type 316 stainless steel trim (F8M) or *Monel* (mm) trim be used.

TRIM SUFFIX DESIGNATIONS are used with series numbers to indicate the special characteristics of a valve for sour service applications.

Suffix for NACE Trim Designation	Special Characteristics
MBS ( <i>Monel</i> )	<i>Monel</i> Trim
	<i>Monel</i> /Flexible Graphite Spiral Wound Gasket
	Flexible Graphite Packing
	B7M Bonnet Bolting
	Full Rating
MB8 (316SS)	Solution Annealed 316 Trim
	316/Flexible Graphite Spiral Wound Gasket
	Flexible Graphite Packing
	B8MCL1 Bonnet Bolting
	Hard Faced Seats and Gate (or Disc)
Full Rating	
MB6 (13% Cr.)	Soft 13% Cr. Trim
	304/Flexible Graphite Spiral Wound Gasket
	Flexible Graphite Packing
	B7M Bonnet bolting
	Hard Faced Seats and Gate (or Disc)
Full Rating	

# Sour Service Valve Applications

## TYPICAL FLOWSERVE VOGT VALVES MEETING MATERIAL REQUIREMENTS OF NACE STANDARD MR-01-03

A number of outside screw and yoke (OS&Y) and inside screw (ISS) valves utilizing materials selected from NACE MR-01-03 are offered. These valves are carried in stock and are available with written certification to NACE Standard MR-01-03 when specified. For a more complete list of Vogt valves meeting NACE MR-01-03, see the Flowserve Vogt Valves VVACT0000 Catalog. *Order by size and number.*

Description	Pressure/Size Designation	Material		Series Number	
		Body/Bonnet	Trim	Threaded	Socket Weld
<b>Globe Valves Bolted Bonnet OS&amp;Y</b>	<b>Class 800</b> 1975 psi @ 100°F Sizes ½ - 2	A105	316M Trim* B8MCL1 Bolting	12141MB8	SW 12141MB8
<b>Gate Valves Bolted Bonnet OS&amp;Y</b>	<b>Class 800</b> 1975 psi @ 100°F Sizes ½ - 2 (to -50°F)	A350, Gr. LF2	316M Trim* B8MCL1 Bolting	32111MB8	SW 32111MB8
<b>Gate Valves Bolted Bonnet OS&amp;Y</b>	<b>Class 800</b> 1975 psi @100°F Sizes ¼ - 2	A105	316M Trim* B8MCL1 Bolting	12111MB8	SW 12111MB8
		A105	Monel Trim B7M Bolting	12111MBS	SW 12111MBS
		A105	Soft 13% Cr. Trim B7M Bolting	12111MB6	SW 12111MB6
<b>Gate Valves Welded Bonnet OS&amp;Y</b>	<b>Class 800</b> 1975 psi @ 100°F Sizes ¼ - 2	A105	Monel	2801MBS	SW 2801MBS
		A105	316*	2801MB8	SW 2801MB8
<b>Gate Valves Union Bonnet ISS</b>	<b>Class 800</b> 1975 psi @ 100°F Sizes ¼ - 2	A105	Monel	59851MBS	SW 59851MBS
<b>Gate Valves Bolted Bonnet OS&amp;Y</b>	<b>Class 1500</b> 3705 psi @ 100°F Sizes ½ -2 (to -50°F)	A350, Gr. LF2	316M Trim* B8MCL1 Bolting	35111MB8	SW 35111MB8
<b>Gate Valves Welded Bonnet OS&amp;Y</b>	<b>Class 1500</b> 3705 psi @ 100°F Sizes ½ - 2	A105	316M Trim* B8MCL1Bolting	15111MB8	SW 15111MB8
		A105	Monel Trim B7M Bolting	15111MBS	SW 15111MBS
		A105	Soft 13% Cr. Trim B7M Bolting	15111MB6	SW 15111MB6
<b>Gate Valves Welded Bonnet OS&amp;Y</b>	<b>Class 1500</b> 3705 psi @ 100°F Sizes ½ - 2	A105	Monel	15801MBS	SW 15801MBS
		A105	316M Trim* B8MCL1 Bolting	15801MBS	SW 15801MB8

**GLOBE** ★ Discs and integral seats are hard faced. The trim is solution annealed after machining to assure Rc-22 max. hardness.

**GATE** ★ Seats and wedge are hard faced and trim parts solution annealed after machining to assure Rc-22 max. hardness.

Most Flowserve Vogt valve designs can be furnished in accordance with NACE MR-01-03 including **special design requirements**.

**NOTE:** All forged steel fittings shown in our current catalogs meet the requirements of NACE MR-01-03 and are available for immediate shipment.



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***To find your local Flowserve representative:***

For more information about Flowserve Corporation, visit  
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