

# NACE® MR0175/ISO 15156 Compliant Swagelok® Fittings

## Introduction

Swagelok® products made from 316/316L stainless steel, 6MO super austenitic stainless steel, alloy 2507 super duplex stainless steel, and nickel alloys 825, 625, C-276 and 400 are available for use in sour gas applications. The NACE® MR0175/ISO 15156 standard contains tables that describe metallurgical requirements and environmental limits for the use of materials in those applications. This document provides ordering requirements for products in compliance with NACE MR0175/ISO 15156.



# NACE MR0175/ISO 15156 Compliant Tube, Medium-Pressure FK, Pipe, and Weld Fittings

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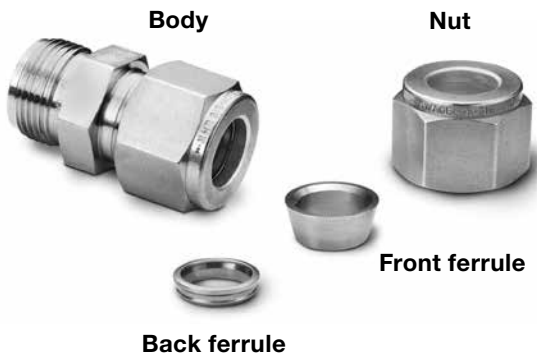
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### Compliance with NACE MR0175/ISO 15156

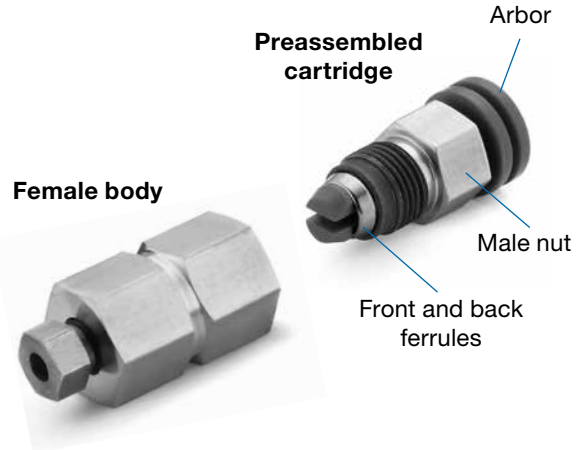
To function correctly, the nut and ferrules of Swagelok tube fittings and medium-pressure FK fittings must be made from cold-drawn bar stock. This material has the strength necessary to grip the tubing, which has a high surface hardness, and to maintain leak free performance at the pressures listed in *Tubing Data* catalog, MS-01-107, and Swagelok *Medium and High Pressure Fitting* catalogs, MS-02-474 and MS-02-472.

- Although the nuts and back ferrules are produced from cold-drawn bar stock, they are not wetted by the system fluid.
- Front ferrules are produced from cold-drawn bar stock, and the nose of the front ferrule comprises a wetted surface. However, the nose of the front ferrule is under compression and therefore is not subject to stress corrosion cracking or sour gas cracking as the NACE MR0175/ISO 15156 standard states that a tensile stress component is required to enable these cracking modes.

#### Swagelok tube fitting



#### Swagelok medium-pressure, FK fitting



### NACE MR0175/ISO 15156 compliance of tube fittings (all alloys) and FK Medium-Pressure fittings (alloys 316/316L, 2507, 625), external and internal exposure to sour gas

Body Material	Material Designator	External Exposure to Sour Gas		Internal Exposure to Sour Gas
		Tube <sup>①</sup> or FK Fitting <sup>②</sup>	Pipe or Weld Fittings	Tube, FK, Pipe, and Weld Fittings
316/316L	SS	Not Compliant	See tables on pages 4 to 7	See tables on pages 4 to 7
316L	316L	Not Compliant		
6MO (254, 6HN)	6MO	Table A.11 <sup>③</sup>		
Alloy 2507	2507	Not Compliant		
Alloy 625	625	Table A.14 <sup>③</sup>		
Alloy 825	825	Table A.14 <sup>③</sup>		
Alloy C-276	HC	Table A.14 <sup>③</sup>		
Alloy 400	M	Table A.13		

① Any tube fitting containing at least one Swagelok end connection, tube adapters, tube caps, tube plugs, and port connectors  
 ② Any medium-pressure FK fitting containing at least one FK end connection, FK tube adapters, FK caps, FK plugs, and FK port connectors.  
 ③ NACE MR0175 table listed is valid for external exposure to sour gas regardless of whether “SG2” ordering designator is selected.

## 316/316L Tube, Pipe, Weld, and Medium-Pressure FK Fittings

Configuration	Order Designator	Body Material		Body Marking		NACE MR0175 Table		
		Description	ASTM Specification	SS 316/316L Material Designator	316L Material Designator	Tube <sup>①</sup>	Pipe and Weld	FK
Body Straight	—	Alloy 316/316L (UNS S31600/S31603) Cold-drawn	A479	“316”	“6L” or “316L”	A.4	Not NACE Compliant	Not NACE Compliant
	-SG	Alloy 316/316L (UNS S31600/S31603) Solution-annealed	A479	“316” and “SG”	“6L” and “SG” or “316L” and “SG”	Not NACE Compliant	A.2	Not NACE Compliant
	-SG2				—	Not NACE Compliant	Not NACE Compliant	A.2 <sup>②</sup>
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 316/316L (UNS S31600/S31603) Cold-drawn	A479	“316”	“6L” or “316L”	A.4	Not NACE Compliant	Not NACE Compliant
		Alloy 316/316L (UNS S31600/S31603) Solution-annealed	A182					
	-SG	Alloy 316/316L (UNS S31600/S31603) Solution-annealed	A479/A182	“316” and “SG”	“6L” and “SG” or “316L” and “SG”	Not NACE Compliant	A.2	Not NACE Compliant
	-SG2				—	Not NACE Compliant	Not NACE Compliant	A.2 <sup>②</sup>

① Any tube fitting containing at least one Swagelok end connection, tube adapters, tube caps, tube plugs, and port connectors.

② FK end connection sizes 1/4 in., 3/8 in., 1/2 in., 6 mm, 10 mm, 12 mm, and 16 mm

## 6MO Tube, Pipe, and Weld Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table	
		Description	ASTM Specification		Tube <sup>①</sup>	Pipe and Weld
Body Straight	—	Alloy 6HN (UNS N08367) Cold-drawn	A479	“6HN”	A.11	Not NACE Compliant
	-SG2	Alloy 6HN (UNS N08367) Solution-annealed		“6HN” and “SG”	A.8 (type 3a and 3b)	A.8 (type 3a and 3b)
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 6HN (UNS N08367) Solution-annealed	A479/A182	“6HN”	A.11	Not NACE Compliant
	-SG2			“6HN” and “SG”	A.8 (type 3a and 3b)	A.8 (type 3a and 3b)

① Any tube fitting containing at least one Swagelok end connection, tube adapters, tube caps, tube plugs, and port connectors

## Alloy 2507 Tube, Pipe, Weld, and Medium-Pressure FK Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table	
		Description	ASTM Specification		Tube <sup>①</sup> , Pipe, and Weld	FK
Body Straight	—	Alloy 2507 Super Duplex SS (UNS S32750) Cold-drawn  Alloy 2507 Super Duplex SS (UNS S32750) Solution-annealed	A479	"2507"	Not NACE Compliant	Not NACE Compliant
	-SG2	Alloy 2507 Super Duplex SS (UNS S32750) Solution-annealed	A479	"2507" and "SG"	A.24	A.24
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 2507 Super Duplex SS (UNS S32750) Solution-annealed	A479/A182	"2507"	Not NACE Compliant	Not NACE Compliant
	-SG2	Alloy 2507 Super Duplex SS (UNS S32750) Solution-annealed	A479/A182	"2507" and "SG"	A.24	A.24

① Any tube fitting containing at least one Swagelok end connection, tube adapters, tube caps, tube plugs, and port connectors.

## Alloy 625 Tube, Pipe, Weld, and Medium-Pressure FK Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table
		Description	ASTM Specification		
Body Straight	—	Alloy 625 (UNS N06625) Cold-drawn Hardness 35 HRC max <sup>④</sup>  Alloy 625 (UNS N06625) Annealed (Grade 1)	B446 <sup>③</sup>	"625"	A.14 (type 4d)
	-SG2 <sup>①②</sup>	Alloy 625 (UNS N06625) Annealed (Grade 1)	B446	"625" and "SG"	A.13 (type 4a)
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 625 (UNS N06625) Annealed (Grade 1)	B564/B446	"625"	A.14 (type 4d)
		Alloy 625 (UNS N06625) Cold-drawn, Hardness 35 HRC max <sup>④</sup>	B446 <sup>③</sup>		
	-SG2 <sup>①②</sup>	Alloy 625 (UNS N06625) Annealed (Grade 1)	B564/B446	"625" and "SG"	A.13 (type 4a)

① SG2 designator is available for pipe fittings (any size), weld fittings (any size), and tube fittings (1/2 in. or 12 mm sizes only).

② SG2 designator is available for FK fittings with an FK end connection in combination with another FK, pipe or weld end connection (any size) or tube fitting end connection (1/2 in. or 12 mm sizes only).

③ B446, except elongation.

④ Hardness limit is 35 HRC max. per Swagelok material specification and NACE MR0103/ISO 17945.

## Alloy 825 Tube, Pipe, and Weld Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table
		Description	ASTM Specification		
Body Straight	—	Alloy 825 (UNS N08825) Cold-drawn, Hardness 35 HRC max <sup>②</sup>	B425 <sup>①</sup>	"825"	A.14 (type 4c)
	-SG2	Alloy 825 (UNS N08825) Annealed	B425	"825" and "SG"	A.13 (type 4a)
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 825 (UNS N08825) Annealed	B564/B425	"825"	A.14 (type 4c)
		Alloy 825 (UNS N08825) Cold-drawn, Hardness 35 HRC max <sup>②</sup>	B425 <sup>①</sup>		
	-SG2	Alloy 825 (UNS N08825) Annealed	B564/B446	"825" and "SG"	A.13 (type 4a)

① B425, except elongation

② Hardness limit is 35 HRC max. per Swagelok material specification and NACE MR0103/ISO 17945.

## Alloy C-276 Tube, Pipe, and Weld Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table
		Description	ASTM Specification		
Body Straight	—	Alloy C-276 (UNS N10276) Cold-drawn, Hardness 35 HRC max <sup>②</sup>	B574 <sup>①</sup>	"HC"	A.14 (type 4e)
	-SG2	Alloy C-276 (UNS N10276) Solution-annealed	B574	"HC" and "SG"	A.13 (type 4b)
Body Shaped (Elbow, Tee, and Cross)	—	Alloy C-276 (UNS N10276) Solution-annealed	B574/B564	"HC"	A.14 (type 4e)
		Alloy C-276 (UNS N10276) Cold-drawn, Hardness 35 HRC max <sup>②</sup>	B574 <sup>①</sup>		
	-SG2	Alloy C-276 (UNS N10276) Solution-annealed	B574/B564	"HC" and "SG"	A.13 (type 4b)

① B425, except elongation

② Hardness limit is 35 HRC max. per Swagelok material specification and NACE MR0103/ISO 17945.

## Alloy 400 Tube, Pipe, and Weld Fittings

Configuration	Order Designator	Body Material		Body Marking	NACE MR0175 Table
		Description	ASTM Specification		
Body Straight	—	Alloy 400 (UNS N04400) Cold-drawn, Hardness 35 HRC max <sup>①</sup>	B164	"M"	A.13
Body Shaped (Elbow, Tee, and Cross)	—	Alloy 400 (UNS N04400) Annealed, Hardness 35 HRC max <sup>①</sup>	B164/B564	"M"	A.13

① Hardness limit is 35 HRC max. per Swagelok material specification and NACE MR0103/ISO 17945.

## Environmental Limits per NACE MR0175 Compliant Alloys

Alloy	Material Designator	Condition of Alloy	NACE MR0175 Table	Application	Maximum Temperature C° (F°)	Maximum H <sub>2</sub> S Partial Pressure <sup>①</sup> kPa (psi)
316/316L (UNS S31600/S31603)	SS	Solution-annealed and Cold-drawn	A.4	Instrument tubing, control-line tubing, and associated fittings	no restrictions; see MR0175 for cautionary remarks	
		Solution-annealed	A.2	Any equipment or component	60 (140)	100 (14.5)
					60 (140)	1000 (145) <sup>②</sup>
90 (194)	1 (0.145) <sup>②</sup>					
6MO (254, 6HN) (UNS N08367)	6MO	Solution-annealed and Cold-drawn	A.11	Instrument tubing, control-line tubing, and compression fittings	no restrictions; see MR0175 for cautionary remarks	
		Solution-annealed	A.8	Any equipment or component	60 (140)	100 (14.5)
2507 (UNS 32507)	2507	Solution-annealed	A.24	Any equipment or component	232 (450)	20 (3)
625 (UNS N06625)	625	Annealed and Cold-drawn	A.14	Any equipment or component	232 (450)	200 (30)
		Solution-annealed or Annealed	A.13		218 (425)	2000 (300)
149 (300)	any					
825 (UNS N08825)	825	Annealed and Cold-drawn	A.14	Any equipment or component	232 (450)	200 (30)
					218 (425)	700 (100)
					204 (400)	1000 (150)
					177 (350)	1400 (200)
		132 (270)	any			
Solution-annealed or Annealed	A.13	no restrictions; see MR0175 for cautionary remarks				
C-276 (UNS N10276)	HC	Annealed and Cold-drawn	A.14	Any equipment or component	232 (450)	7000 (1000)
		Solution-annealed or annealed	A.13		204 (400)	any
					no restrictions; see MR0175 for cautionary remarks	
400 (UNS N04400)	M	Cold-worked condition permitted	A.13	Any equipment or component	no restrictions; see MR0175 for cautionary remarks	

① H<sub>2</sub>S partial pressure is the pressure contribution of hydrogen sulfide gas to the total pressure. (Example for partial pressure: air consists of 21% oxygen; if the total air pressure is 1.00 atm, then the partial pressure of oxygen is 0.21 atm).

② For chloride concentration ≤50 g/l and pH>=4.5

Note: Consult NACE MR0175/ISO 15156 for detailed information on the environmental limits of alloys.

Refer to the following product catalogs for additional information.

- *Gaugeable Tube Fittings and Adapters*, MS-01-140
- *Pipe Fittings*, MS-01-147
- *Medium- and High-Pressure Fittings, Tubing, Valves, and Accessories*, MS-02-472
- *Weld Fittings, Ultrahigh-Purity, Specially Cleaned, and Industrial*, MS-01-149
- *Gaugeable Alloy 2507 Super Duplex Tube Fittings*, MS-01-174
- *Alloy 2507 Super Duplex Weld Fittings*, MS-01-173

**Safe Product Selection**

**When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.**

**⚠ WARNING**

**Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.**

**Warranty Information**

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit [swagelok.com](http://swagelok.com) or contact your authorized Swagelok representative.

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