

The top half of the page features a background image of water ripples in shades of blue. Overlaid on this is a grid of thin, light blue lines that curve and warp across the water's surface, creating a sense of depth and movement.

FITOK

Products for Hydrogen Applications

**Specialized products and professional services
Meeting your needs in hydrogen applications**

About FITOK

Founded in 1998, FITOK Group has been a leading global supplier of instrumentation valves, fittings, and integrated systems, locating our factories in Germany, the USA, and China, with inventory and sales service centers in Germany, the USA, China, and the UAE.

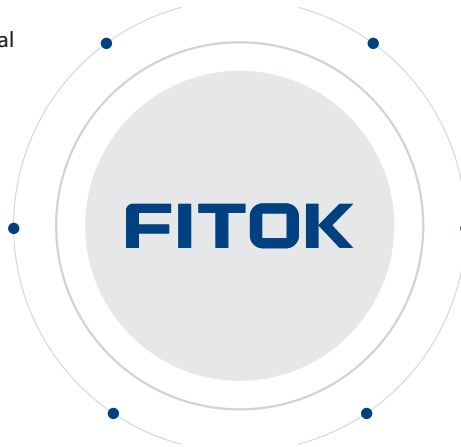
Our Advantages:

1. Specialized in instrumentation valves and fittings: decades of rich design and manufacturing experience, products sold in more than 100 countries and regions.
2. Superior R&D capabilities: 150+ professional engineers and 100+ patents.
3. Lean and reliable quality management: a variety of management system certifications and product certifications.
4. Fast and efficient product delivery: global manufacturing bases and service centers for faster product delivery and timely response to customers' needs.

More than **600** tons raw material in stock

5 product lines to cover various applications

Customers in more than **100** countries worldwide



Excellence since **1998** in development and manufacturing of valves and fittings

4 major manufacturing bases located globally

More than **100** patents





FITOK, Inc.
Manufacturing &
Global Sales Center
- Texas, USA



FITOK GmbH
Manufacturing to Order
-Offenbach, Germany



FITOK Middle East
Regional Sales & Service Center
- Dubai, UAE



FITOK (Wuhan) Incorporated
Manufacturing to Stock
- Wuhan, China

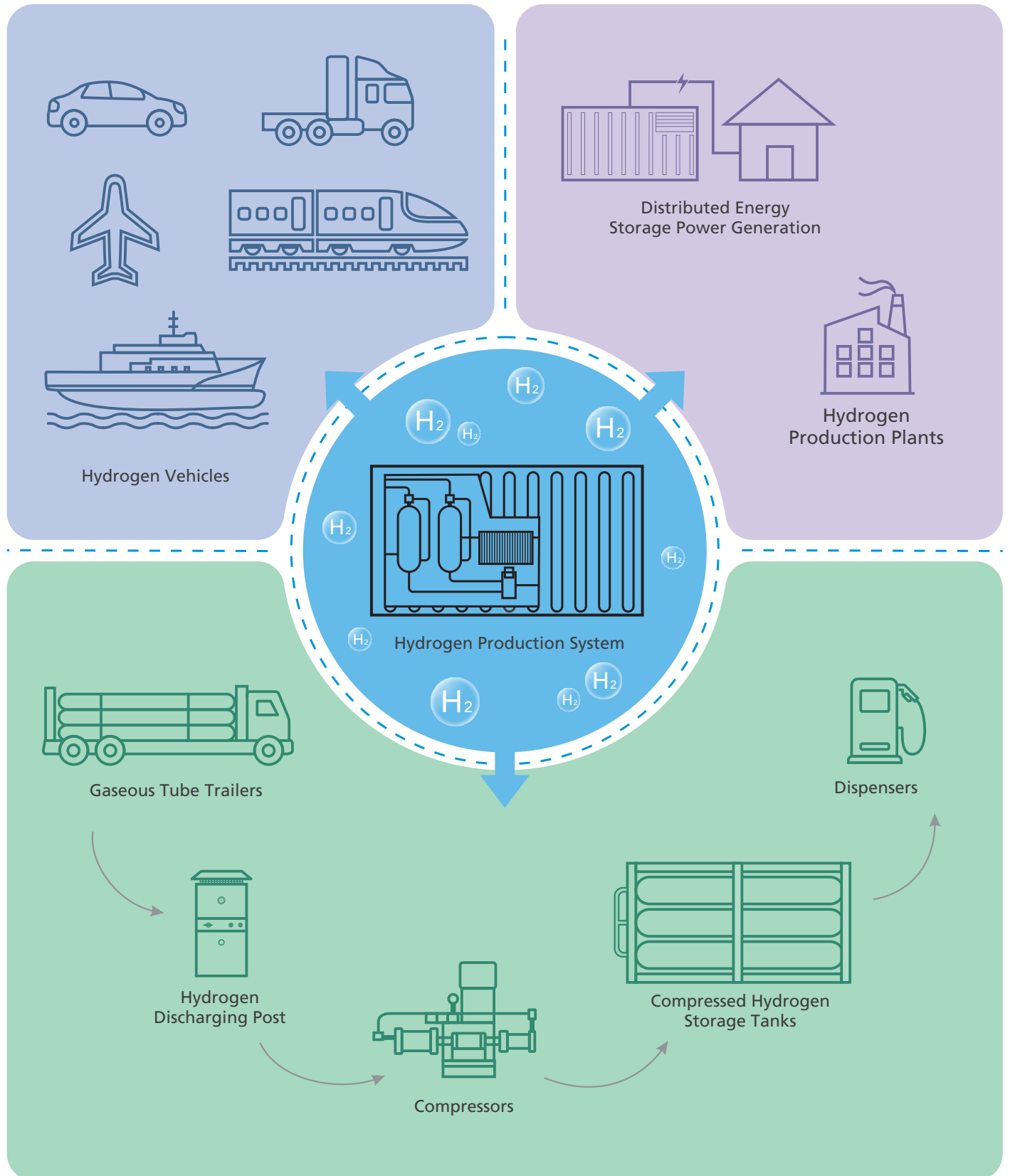


FITOK Incorporated
Manufacturing to Order
- Shenzhen, China



**FITOK (Suzhou)
Metal Products Co., Ltd**
Manufacturing - Tubing
- Suzhou, China

Typical Hydrogen Applications



Product Portfolio

- ◆ -HG: Suitable for harsh hydrogen working environments. Products are designed, manufactured, tested, and packaged in accordance with EC79 and HGV3.1 standards.
- ◆ -EC79: Suitable for harsh hydrogen working environments. Products are designed, manufactured, tested, marked, and packaged in accordance with the EC79 standard, featuring the specific EC79 markings.
- ◆ -HGV: Suitable for harsh hydrogen working environments. Products are designed, manufactured, tested, marked, and packaged in accordance with ANSI HGV 3.1-2015 standards, featuring the specific HGV3.1 markings.
- ◆ Products with standard part numbers are suitable for general hydrogen applications.

Tube Fittings



Ball Valves



Needle Valves



Check Valves



Filters



Metal Hoses



Quick-Connects



Pressure Regulators



Tubing



Products Highlights

EC79 Approved

Components in a hydrogen-powered vehicle must have an application-specific safety approval, for which the European Union issued regulation EC79/2009. It is one of the most recognized standards in the industry. The brief information of the test is as follows:

Test Nominal Pressure	35 & 70 MPa (350 & 700 bar)
Test Temperature Range	-40 ~ 248 °F (-40 ~ 120 °C)
Hydrogen Compatibility Test	No material failure
Corrosion Resistance Test	144 hours Salt Spray Test
Endurance Test	25 times assemble and disassemble
Hydraulic Pressure Cycle Test	150,000 times
Internal and External Leakage Test	≤10 Ncm ³ /h

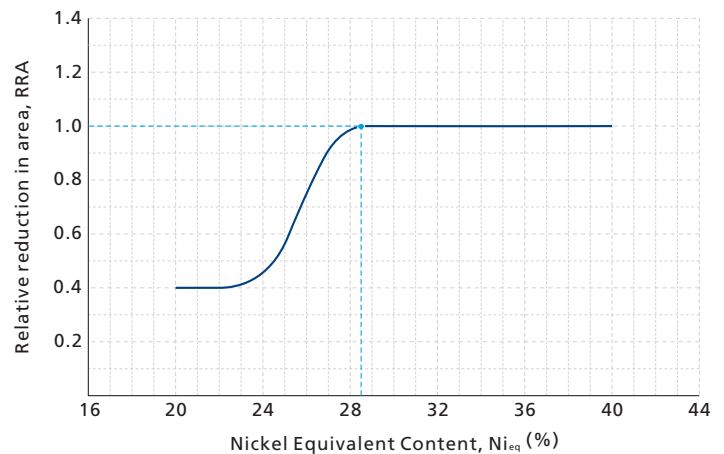
Hydrogen Compatible Material

★ Tailor-Made 316/316L Stainless Steel

Tailor-Made 316/316L stainless steel with nickel equivalent not less than 28.5% have excellent resistance to hydrogen embrittlement.

Material Grade	Composition %			Ni _{eq} %
	Ni	Cr	Mo	
ASTM A479 316 SS	10-14	16-18	2-3	>22.4
FITOK Tailor-Made 316/316L SS	12-14	17-18	2.6-3	≥28.5

Hirayama's equation: $Ni_{eq} = 12.6C + 0.35Si + 1.05Mn + Ni + 0.65Cr + 0.98Mo$



RRA is a quantitative description of hydrogen embrittlement

★ XM-19 Stainless Steel

XM-19 is a high strength austenitic stainless steel with excellent mechanical properties and resistance to hydrogen embrittlement. FITOK utilizes XM-19 for components requiring high mechanical strength, such as stems of medium pressure ball valves and lower stems of medium pressure needle valves.

★ Low-Temperature FKM and EPDM

FKM and EPDM O-rings conform to EC79 standard, offering excellent performance in terms of hydrogen compatibility and low temperature (-40 °C).

Working Pressure

Materials with higher mechanical properties offer higher working pressures across the same sizes. Most products are rated for working pressures up to 6,500 psig (450 bar).

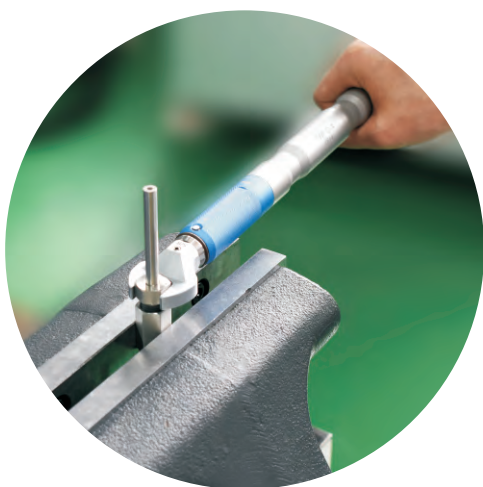
Stringent Test and Leak Rate Standards

FITOK leak rate standard is significantly more stringent than those required by HGV 3.1 and EC79. Proportional sampling helium leak tests are conducted on valves, filters, quick-connects, and metal hoses. Each valve, filter, quick-connect, and metal hose is bubble tested using a helium-nitrogen gas mixture prior to shipment.

Products	Leak Rate Standard		
	FITOK	EC-79	HGV 3.1
Valves and Other Products	$\leq 1 \times 10^{-6}$ Ncm ³ /s	≤ 10 Ncm ³ /h	≤ 10 Ncm ³ /h
	11.6 days/Ncm ³	6 minutes/Ncm ³	6 minutes/Ncm ³
Tube Fittings	$\leq 1 \times 10^{-9}$ Ncm ³ /s	≤ 10 Ncm ³ /h	≤ 10 Ncm ³ /h
	32 years/Ncm ³	6 minutes/Ncm ³	6 minutes/Ncm ³

Assembly

FITOK double ferrule fittings with the suffix "-HG", "-EC79", or "-HGV3.1" in part number can be assembled by torque or by turns. Assembly-by-torque can significantly enhance efficiency and quality, making it perfect for mass production.



Assembly by Torque

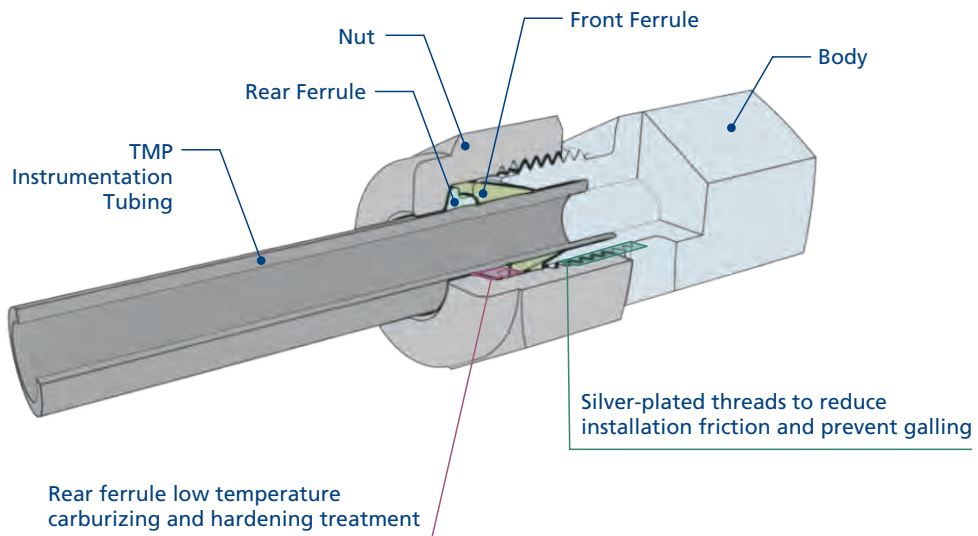


Tool Kit

Featured Products

Products for Hydrogen Applications up to 6,500 psig (450 bar)

★ 6D Series Tube Fittings



The design of double ferrule fittings offers excellent leak-tightness and anti-vibration properties, making them ideal for hydrogen applications. Installation is easy, with both by turns and by torque options available. Best match with FITOK TMP series tubing for hydrogen applications.

- ◆ Allowable working pressure ≥ 450 bar (6,500 psig)
- ◆ The slight axial movement of the front and rear ferrules along the outer wall of the tubing during installation reduces the requirement for dimensional accuracy in the tubing's length direction. This minimizes interference between adjacent fittings and enhances reliability
- ◆ A minimum of 25 assembly and disassembly cycles while maintaining reliable sealing performance
- ◆ 4 times safety factor
- ◆ EC79 compliant FKM O-ring for reliable performance
- ◆ Tube ends can be assembled by torque or turns
- ◆ Tube ends with a helium leak rate $\leq 1 \times 10^{-9}$ Ncm³/s

★ BU Series Ball Valves



BU Series Ball Valves feature low operating torque and high flow capacity, ideal for high flow hydrogen applications, and allow for bidirectional media flow.

- ◆ Spring-loaded seat offers a consistent and reliable sealing force
- ◆ EC-79 compliant FKM O-ring for reliable performance
- ◆ PEEK seat offers exceptional wear resistance and excellent hydrogen compatibility
- ◆ Panel mounting optional
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 6,500 psig (450 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Cv	Working Temperature °F (°C)
Tube Fittings	3/8"	0.28 (7.1)	4.0	-40~248 (-40~120)
	1/2"	0.41 (10.3)	7.2	
	10 mm	0.31 (7.9)	5.2	
Female SAE/MS	3/4-16	0.47 (12.0)	7.8	

★ NF Series Needle Valves



NF Series Needle Valves feature a two-piece stem design, with the lower stem moving linearly up and down. This minimizes packing abrasion and reduces friction between the seat and the tip, extending the service life in hydrogen applications.

- ◆ One-piece forged body
- ◆ Stem tip features a specially treated surface that ensures excellent sealing performance
- ◆ Panel mounting optional
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 6,500 psig (450 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Cv	Working Temperature °F (°C)
Tube Fittings	1/4"	0.16 (4.0)	0.35	-40~248 (-40~120)
	3/8"	0.25 (6.4)	0.85	

★ CH Series Check Valves



CH Series Check Valves feature minimal cracking pressure and a floating seal ring design to protect the seal from contaminants and prevent reverse media flow.

- ◆ Optional cracking pressure ranges
- ◆ EC-79 compliant FKM O-ring for reliable performance
- ◆ Mountable in any direction
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 6,500 psig (450 bar) before shipment

Connection Type and Size		Cv	Working Temperature °F (°C)	Cracking Pressure Range, psig (bar)
Tube Fittings	1/4"	0.67	-40~248 (-40~120)	1~5 (0.06~0.34)
	1/4"	0.67		0~3 (0~0.21)
	3/8"	1.80		0~4 (0~0.28)
	3/8"	1.80		7~15 (0.49~1.1)
	1/2"	1.80		20~30 (1.4~2.1)

★ FT Series Filters



FT Series Filters feature a union bonnet design to prevent lock nut detachment, ideal for trapping fine particle contaminants in hydrogen pipelines.

- ◆ Easy to replace filter element without removing body from system
- ◆ 7 and 15 μ m element nominal pore sizes as standard
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each filter is tested for external leakage using a helium-nitrogen gas mixture at 6,500 psig (450 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Nominal Pore Size μ m	Effective Filter Element Area in. ² (mm ²)	Working Temperature °F (°C)	Max. Differential Pressure psig (bar)
Tube Fittings	1/4"	0.17 (4.4)	7	1.30 (830)	-40~248 (-40~120)	1,000 (69)
			15			
	3/8"	0.25 (6.4)	7	2.00 (1280)		
			15			
	1/2"	0.25 (6.4)	7	2.00 (1280)		
			15			

★ MH & MM Series Metal Hoses



MH & MM Series Metal Flexible Hoses are capable of changing pipeline direction and absorbing vibration. Welded fitting-to-hose construction ensures reliable seal, offering safe and reliable connection for hydrogen applications.

- ◆ Core tube made of 316L SS, fitting made of FITOK tailor-made 316/316L SS with $Ni_{eq} \% \geq 28.5$
- ◆ Overbraid material: 304 SS
- ◆ Welded fitting-to-hose construction provides a secure and reliable connection
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-7}$ std cm^3/s
- ◆ Each metal hose is tested for external leakage using a helium-nitrogen gas mixture at the maximum working pressure

MH Series						
Nominal Hose Size	Inside Diameter, in. (mm)	Min. Bend Radius		Temperature Range, °F (°C)	Working Pressure at 70 °F (20 °C), psig (bar)	Burst Pressure at 70 °F (20 °C), psig (bar)
		Static, in. (mm)	Dynamic, in. (mm)			
1/4	0.28 (7.1)	2.25 (57.2)	10.00 (254.0)	-40~248 (-40~120)	3,100 (213)	12,400 (854)
3/8	0.42 (10.6)	3.00 (76.2)	12.00 (305.0)		2,000 (137)	8,000 (551)
1/2	0.53 (13.5)	4.50 (114.0)	16.00 (406.0)		1,800 (124)	7,200 (496)

★ TMP Series Tubing



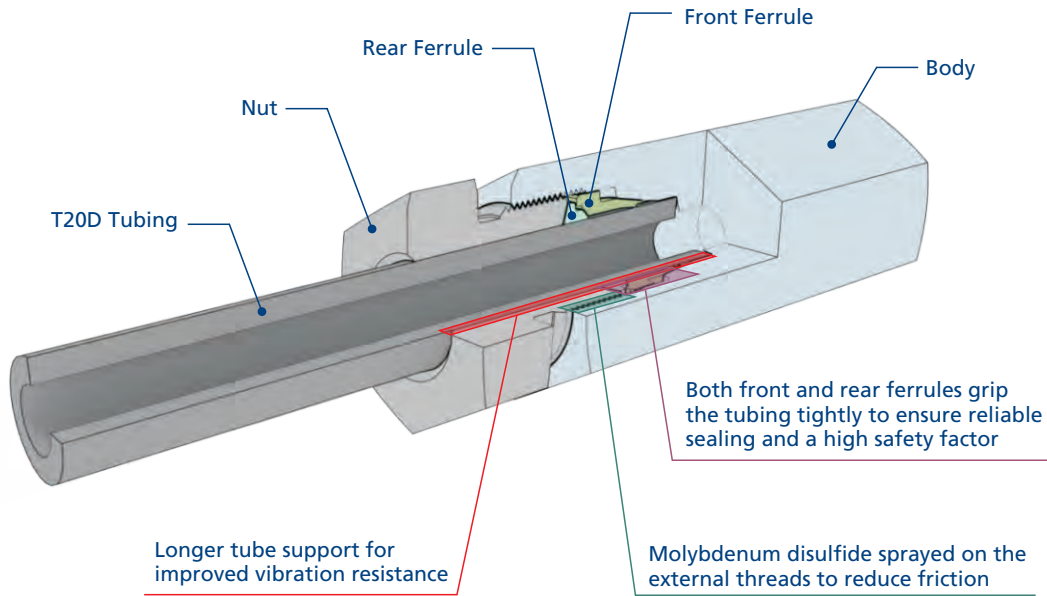
TMP Series Tubing is solution annealed, allowing for easy bending and ferrule connection, with a bright annealed internal surface and machine-finished external surface.

- ◆ FITOK Enhanced-316/316L stainless steel tubing features Ni, Cr, and Mo content near the upper limits of ASTM A269 and a Ni_{eq} of no less than 28.5%, providing better resistance to hydrogen embrittlement
- ◆ Complies with ASTM A269 and ASTM A213 standards, featuring tighter tolerances than required by the standards and a maximum hardness that is less than 90% of the upper limit specified
- ◆ Working temperature: -40 to 248 °F (-40 to 120 °C)
- ◆ Standard lengths: 10 ft, 20 ft, 1 m, 2 m, 3 m and 6 m
- ◆ Tube cutting, tube end processing, ferrule presetting, and pipeline system installation and testing services are available based on customer needs

Tube O.D. (D), in. (mm)	O.D. Tolerance, in. (mm)	Wall Thickness Tolerance, %	Yield Strength, ksi (MPa)	Tensile Strength, ksi (MPa)	Hardness
$3/32 (2.38) \leq D < 3/16 (4.76)$	+0.003 (0.08)/-0	+/-10	≥ 30 (205)	≥ 75 (515)	≤ 80 HRB
$3/16 (4.76) \leq D \leq 1 (25.4)$	+/-0.004 (0.10)				

Products for Hydrogen Applications up to 20,000 psig (1,379 bar)

★ 20D Series Tube Fittings



The design of double ferrule fittings offers excellent leak-tightness and anti-vibration properties, making them ideal for hydrogen applications. Installation is easy, with both by turns and by torque options available. Best match with FITOK T20D series tubing for hydrogen applications.

- ◆ The slight axial movement of the front and rear ferrules along the outer wall of the tubing during installation reduces the requirement for dimensional accuracy in the tubing's length direction. This minimizes interference between adjacent fittings and enhances reliability
- ◆ A minimum of 25 assembly and disassembly cycles while maintaining reliable sealing performance
- ◆ 3 times safety factor
- ◆ EC79 compliant FKM O-ring for reliable performance
- ◆ Tube ends can be assembled by torque or turns
- ◆ Tube ends with helium leak rate $\leq 1 \times 10^{-9}$ Ncm³/s

★ 20B Series Ball Valves



20B Series Ball Valves feature a coned-disc spring-loaded seat structure and O-ring made from specialized material, offering lasting sealing performance in hydrogen applications, ideal for harsh conditions such as low temperature and high pressure.

- ◆ Spring-loaded mechanism offers a consistent and reliable sealing force
- ◆ XM-19 stem for higher strength and enhanced resistance to hydrogen embrittlement
- ◆ Seat designed with Vespel improves flush resistance and withstands high temperatures
- ◆ EC-79 compliant EPDM O-ring for excellent low-temperature performance and implosion resistance
- ◆ Pneumatic actuator optional
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 2 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 10,150 psig (700 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Cv	Working Temperature °F (°C)	Max. Working Pressure at -40 °F (-40 °C), psig (bar)	Max. Working Pressure at 185 °F (85 °C), psig (bar)
Tube Fittings	1/4"	0.19 (4.8)	1.05	-40~185 (-40~85)	15,000 (1,034)	10,152 (700)
	3/8"					
	1/2"					

★ 20N Series Needle Valves



20N Series Needle Valves feature a two-piece stem design, with the lower stem moving linearly up and down. This minimizes packing abrasion and reduces friction between the seat and the tip, extending the service life in hydrogen applications.

- ◆ XM-19 stem for higher strength and enhanced resistance to hydrogen embrittlement
- ◆ Stem tip features a specially treated surface that ensures excellent sealing performance
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 10,150 psig (700 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Cv	Working Temperature °F (°C)
Tube Fittings	1/4"	0.19 (4.9)	0.65	-40~248 (-40~120)
	3/8"	0.25 (6.4)	0.95	
	1/2"	0.37 (9.5)	1.90	

★ 20CG Series Check Valves



20CG Series Check Valves are engineered to withstand high working pressure, ensure reliable unidirectional flow, and achieve leak-tight shutoff in hydrogen applications.

- ◆ PEEK seat offers exceptional wear resistance and excellent hydrogen compatibility
- ◆ Metal cone to PEEK seating design ensures reliable performance under high-pressure and high-flow conditions, making it particularly suitable for hydrogen fueling applications
- ◆ Mountable in any direction
- ◆ Proportional sampling helium leak tested to a leak rate of $\leq 1 \times 10^{-6}$ Ncm³/s
- ◆ Each valve is tested for internal and external leakage using a helium-nitrogen gas mixture at 10,150 psig (700 bar) before shipment

Connection Type and Size		Orifice in. (mm)	Cv	Working Temperature °F (°C)
Tube Fittings	1/4"	0.19 (4.9)	0.63	-40~248 (-40~120)
	3/8"	0.25 (6.4)	1.70	
	1/2"	0.33 (8.5)	3.40	
Medium Pressure Fittings	1/4"	0.13 (3.2)	0.28	
	3/8"	0.22 (5.5)	0.84	
	9/16"	0.36 (9.1)	2.30	

★ T20D Series Tubing



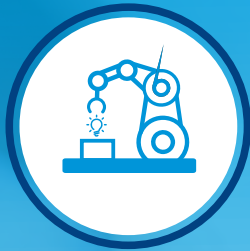
T20D Series cold-drawn 1/8-hard seamless tubing offer thinner wall thickness and larger flow area while maintaining working pressure. Assembly by torque or by turns and easy use with 20D series tube fittings.

- ◆ FITOK Enhanced-316/316L stainless steel tubing features Ni, Cr, and Mo content near the upper limits of ASTM A269 and a Ni_{eq} of no less than 28.5%, providing better resistance to hydrogen embrittlement
- ◆ Stricter dimensional tolerances than required by ASTM A269
- ◆ Working temperature: -40 to 248 °F (-40 to 120 °C)
- ◆ The best match for T20D series tubing is 20D series tube fittings
- ◆ Standard lengths: 10 ft, 20 ft, 1 m, 2 m, 3 m and 6 m
- ◆ Tube cutting, tube end processing, ferrule presetting, and pipeline system installation and testing services are available based on customer needs

Tube O.D.	O.D. Tolerance, in. (mm)	Wall Thickness Tolerance, %	Yield Strength, ksi (MPa)	Tensile Strength, ksi (MPa)	Hardness
1/4"	+/-0.005 (0.13)	+/-10	75-110 (517-758)	105-140 (724-965)	≤26 HRC
3/8"					
1/2"					
3/4"					
1"					

■ Customized Products and Services

From individual product supply to system integration, FITOK offers a complete range of solutions to meet the needs of a rapidly evolving application market.



Customized Product Development



System Design and Integration



Fast Product Delivery

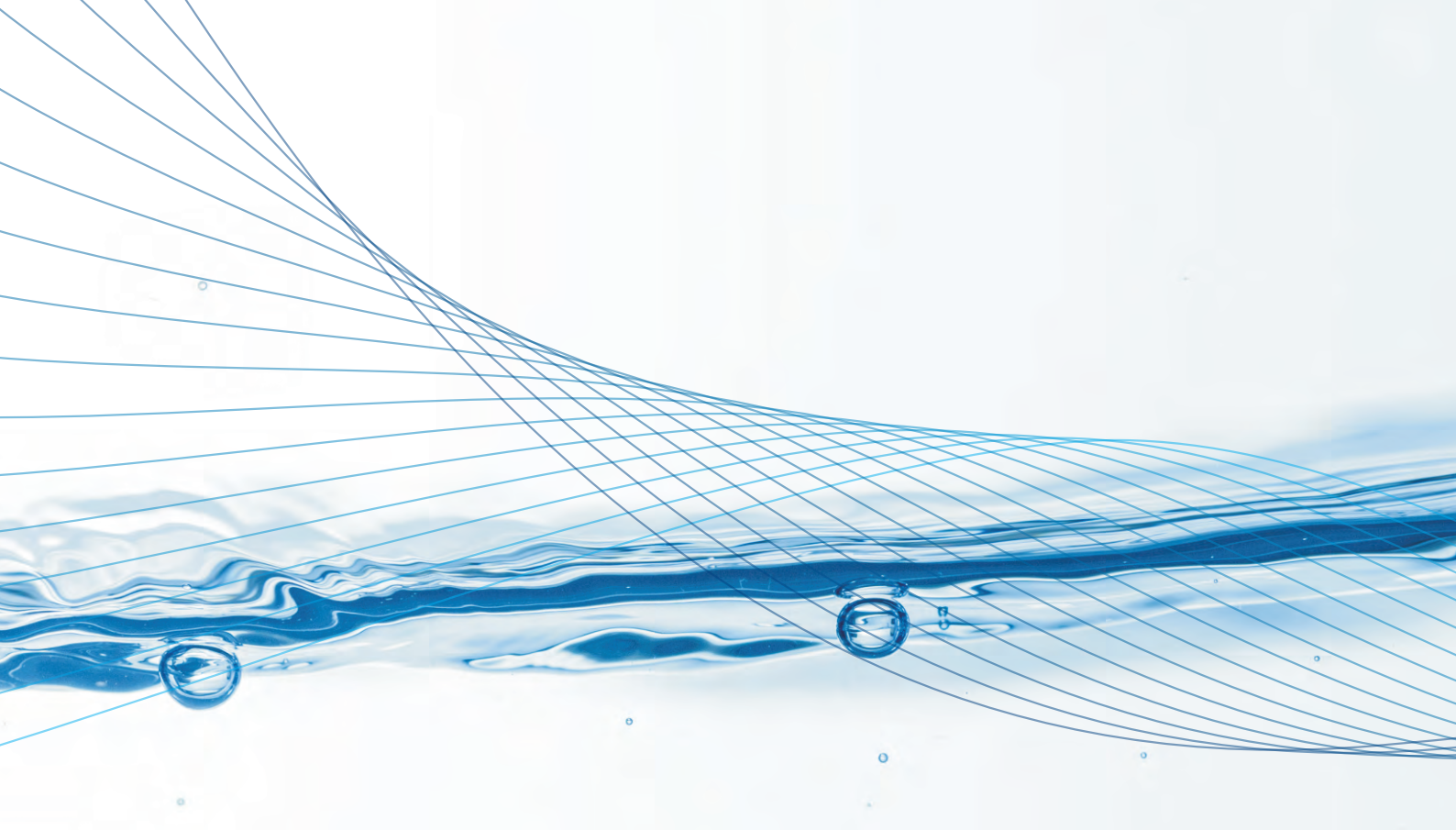


Product Technology and Selection



Installation Guidance and Training





A full listing of our global operations and sales network is available on our website.