

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

## Products for Hydrogen Applications

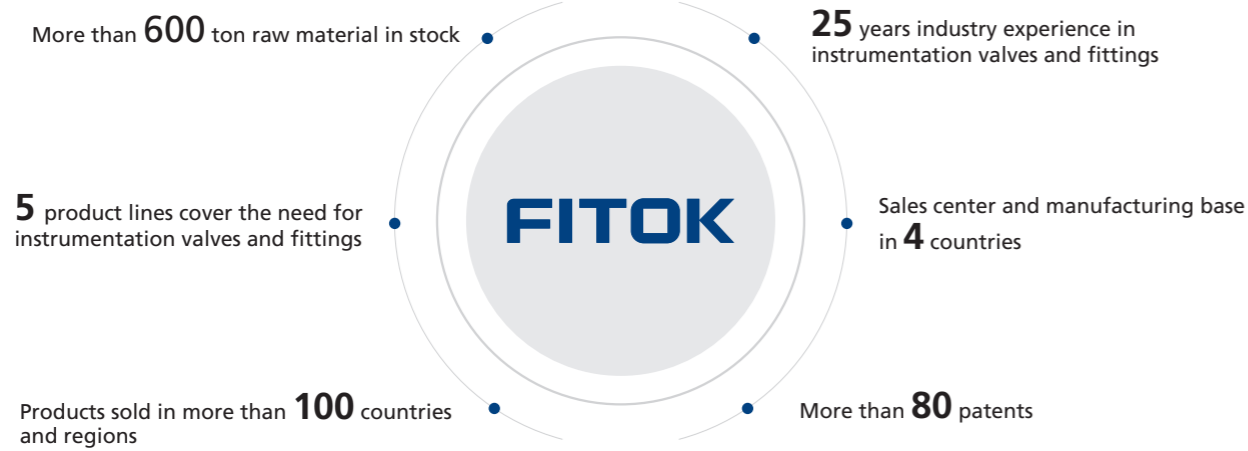
Specialized products and professional services  
Meeting your needs in hydrogen applications

# About FITOK

Founded in 1998, FITOK Group has been a global leading supplier of valves and fittings, having our factories in Germany, USA and China (Wuhan, Shenzhen, Suzhou), and inventory and sales service centers in Germany, USA, China and UAE.

## Our Advantages:

1. Specialized in instrumentation valves and fittings: over 25 years of rich design and manufacturing experience, products sold in more than 100 countries and regions.
2. Superior R&D capabilities: 100+ professional engineers and 80+ patents.
3. Lean and reliable quality management: a variety of management system certifications and product certifications.
4. Fast and efficient product delivery: manufacturing bases and service centers globally for faster product delivery and timely response to customers' needs.



**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

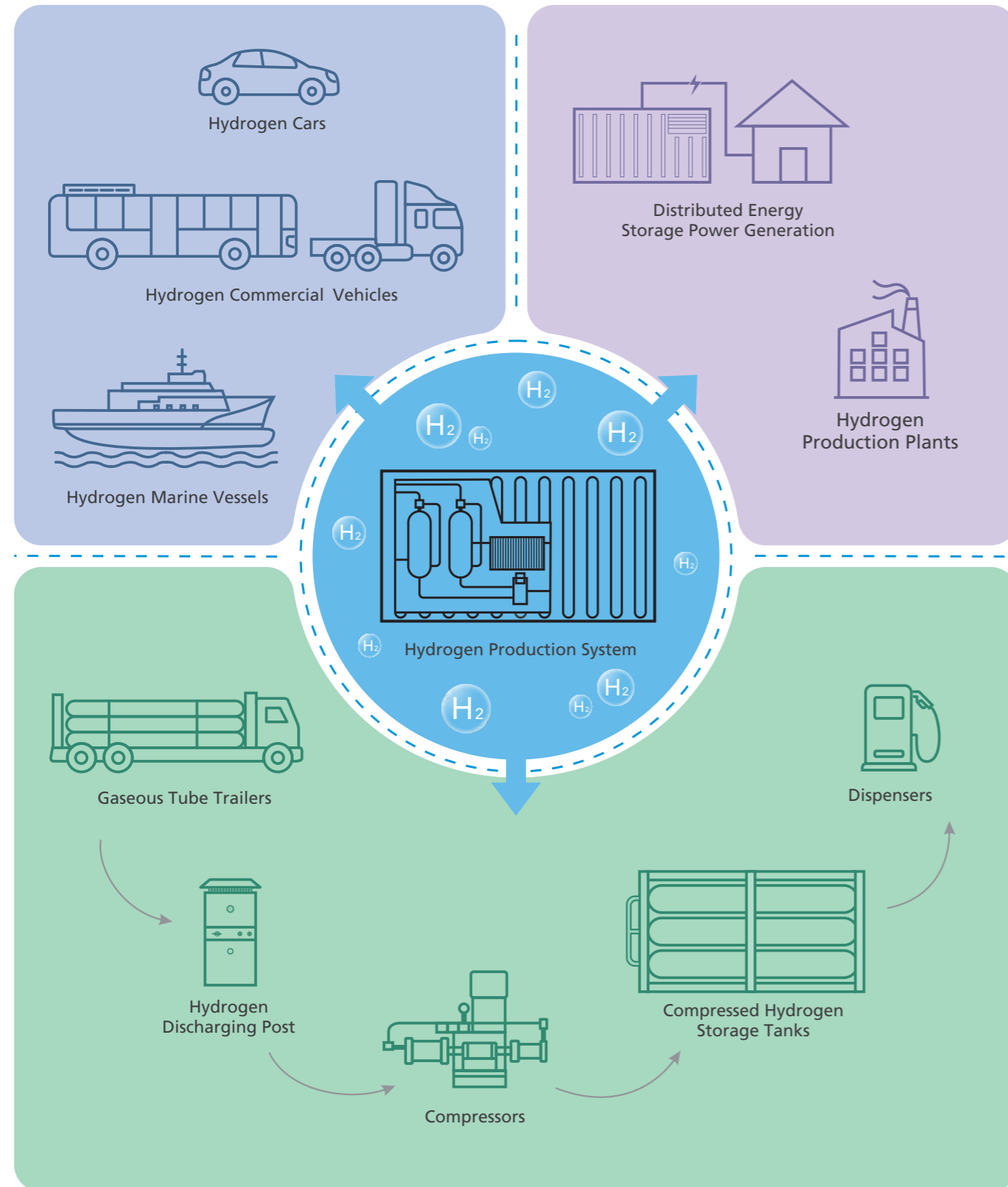


**FITOK Incorporated**  
Manufacturing to Order  
- Shenzhen, China



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

## Typical Hydrogen Applications



## Our Services in Hydrogen Applications



# Products for Hydrogen Applications

## Features

### ★ Raw Materials

Experiments have proven that stainless steels with nickel content greater than 12% and nickel equivalent not less than 28.5% have excellent resistance to hydrogen embrittlement. FITOK has specially customized 316/316L SS for wetted components for hydrogen applications in accordance with industry standards, which has good resistance to hydrogen embrittlement under high pressure and can meet the requirements of various international standards.

#### Chromium (Cr):

To improve corrosion resistance, chromium can form a dense, stable protective film of chromium trioxide, leaving the steel in a passivated state.

#### Nickel (Ni):

To form and stabilize austenite so that stainless steel obtains a complete austenitic structure. Stainless steel with increased nickel content improves the strength and low temperature and welding mechanical properties, as well as the resistance to high temperature oxidation and hydrogen embrittlement.

Grade	ASTM 316 SS	FITOK Customized 316/316L SS	
Element (%)	Cr	16-18	17-18
	Ni	10-14	12-14
	Mo	2.0-3.0	2.6-3.0
Ni <sub>eq</sub> (%)	>22.4	≥28.5	

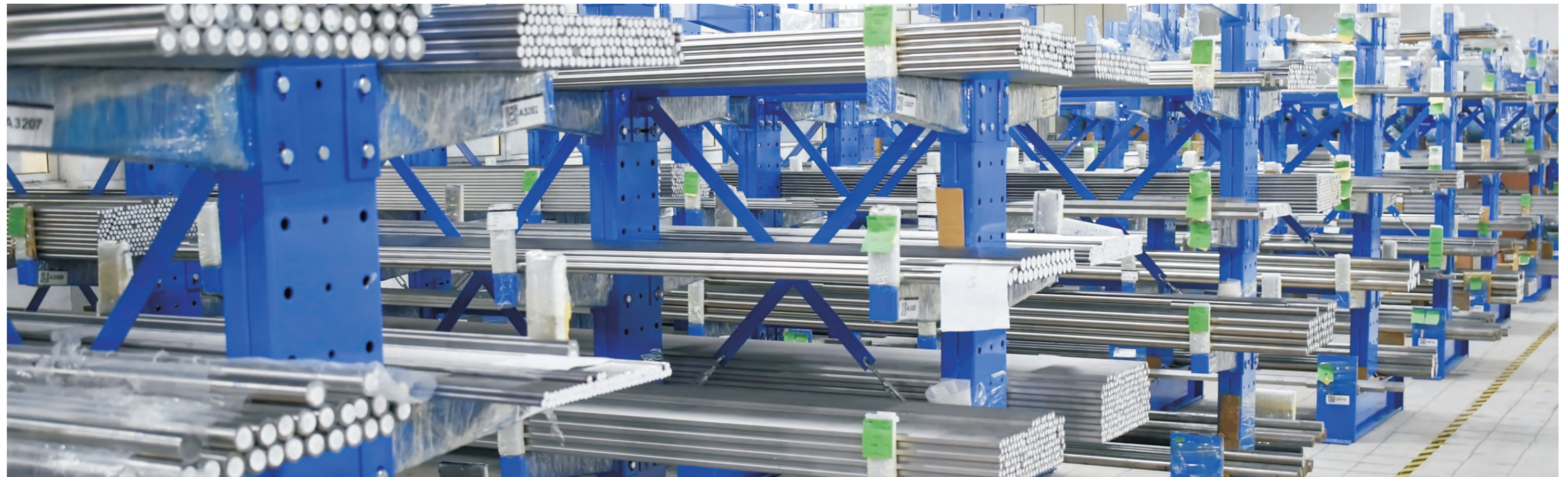
### ★ O-ring

Special working conditions for O-rings used in hydrogen applications

**Low temperature:** Hydrogen needs to be cooled (-40 °C) before it is filled into the hydrogen-powered vehicles to prevent the risk of tank rupture due to exothermic expansion, and O-rings may lose elasticity and sealing performance at too low operating temperatures.

**Pressure cycle:** From the filling of hydrogen to the pressure relief, the non-metallic O-rings of valves and fittings will undergo repeated pressure changes under 0 MPa to the maximum working pressure, and the small molecules of hydrogen will leak into the inside of O-rings under violent pressure changes.

FITOK provides low-temperature O-rings compatible with hydrogen applications to products suffixed with -HG and -EC79, which maintain consistent high reliability under extremely harsh working conditions.

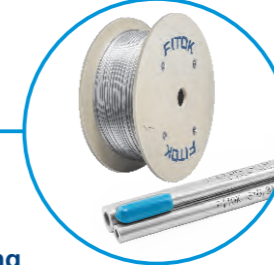


## Common Products

- ◆ Products with -EC79 suffix are designed, manufactured and tested in accordance with EC79 standards and have obtained EC79 certification
- ◆ Products with -HG suffix are designed, manufactured and tested meeting EC79 standards
- ◆ Standard products for general hydrogen applications



**Excess Flow Valves**  
(EV Series)



**Tubing**  
(TMP Series / TCT Series / T15A Series / T20D Series)

From 35 MPa on-road vehicles to 100 MPa hydrogen compressors, available in a variety of ODs, wall thicknesses and different connection types.



**Needle Valves**  
(10N Series / 15N Series / 20N Series)

Maximum working pressure 138 MPa. Specially treated surface of the stem tip and hydrogen-compatible packing provide better sealing, structure design provides long service life.



**Tube Fittings**  
(6D Series / 20D Series)

Maximum working pressure 138 MPa. Quick and easy installation, high reliability in a variety of harsh working conditions. EC79 Certified.

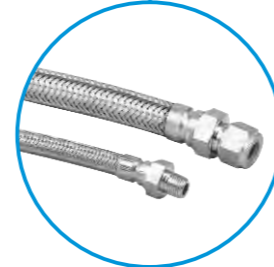


**Check Valves**  
(CH Series)

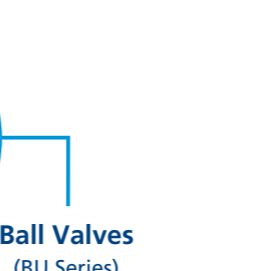
**Line Pressure Regulators**  
(HPL Series)



**Metal Hoses**  
(MH and MM Series)



**Filters**  
(FT Series)



**Ball Valves**  
(BU Series)

Ball valves designed for the harsh working conditions of hydrogen-powered vehicles. Non-metallic materials compatible with hydrogen for reliable performance. Applicable to 35 MPa hydrogen-powered vehicles.



Other Products

**Pneumatic Ball Valves**

**Face Seal Fittings**

**Diaphragm Valves**

**Sampling Systems**

**Quick-Connects**

**FITOK**

EC79 Certified Products

**★ About EC79 Approval**

EC79 Approval means European Council (EC) Regulation No. 79/2009 on the type approval of hydrogen-powered motor vehicles, which specifies a series of tests to verify the reliability of hydrogen-powered vehicles' components, and its extensions such as UN/ECE-R134 and ANSI HGV have become important references to hydrogen-powered vehicles' standards in numerous countries.

**Durability Test**

Components are subjected to 25 times connection / disconnection cycles before performing the external leakage test.

**Corrosion Resistance Test**

Components are subjected to external leakage test after 144 hours of salt spray test according to ISO-9227 standard.

**External Leakage Test**

Components are subjected to gas leakage test at room temperature and 0.02 times rated working pressure, room temperature and rated working pressure, minimum temperature and 0.02 times and rated working pressure, maximum temperature and 0.02 times and 1.25 times rated working pressure, respectively. No bubble occurs within 3 minutes.

**Hydraulic Cycle Test**

Components are subjected to external leakage test after several hydraulic cycles from 2 MPa to 1.25 times rated working pressure.

**Ozone Compatibility Test**

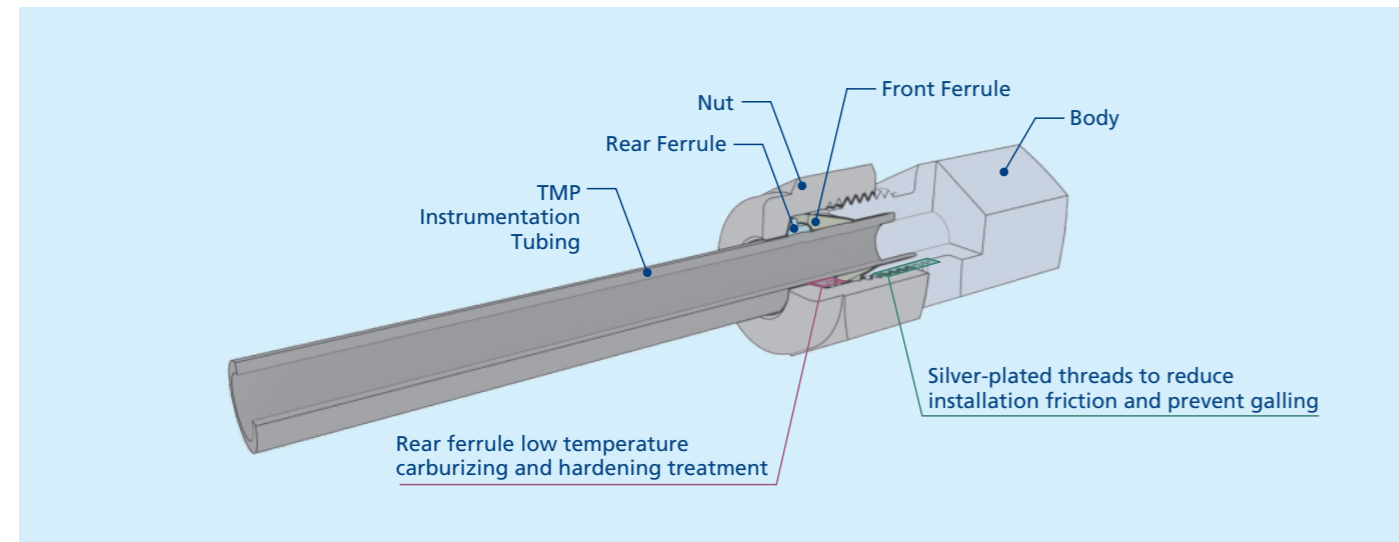
The tested products are stretched by 20% and then exposed to the air with an ozone concentration to 50 per billion for 120 hours. No visible cracks.

**Aging Test**

The tested products are continuously exposed to 2 MPa of oxygen at specified temperature for 96 hours, the physical properties performance shall meet the requirements with no visible cracks.

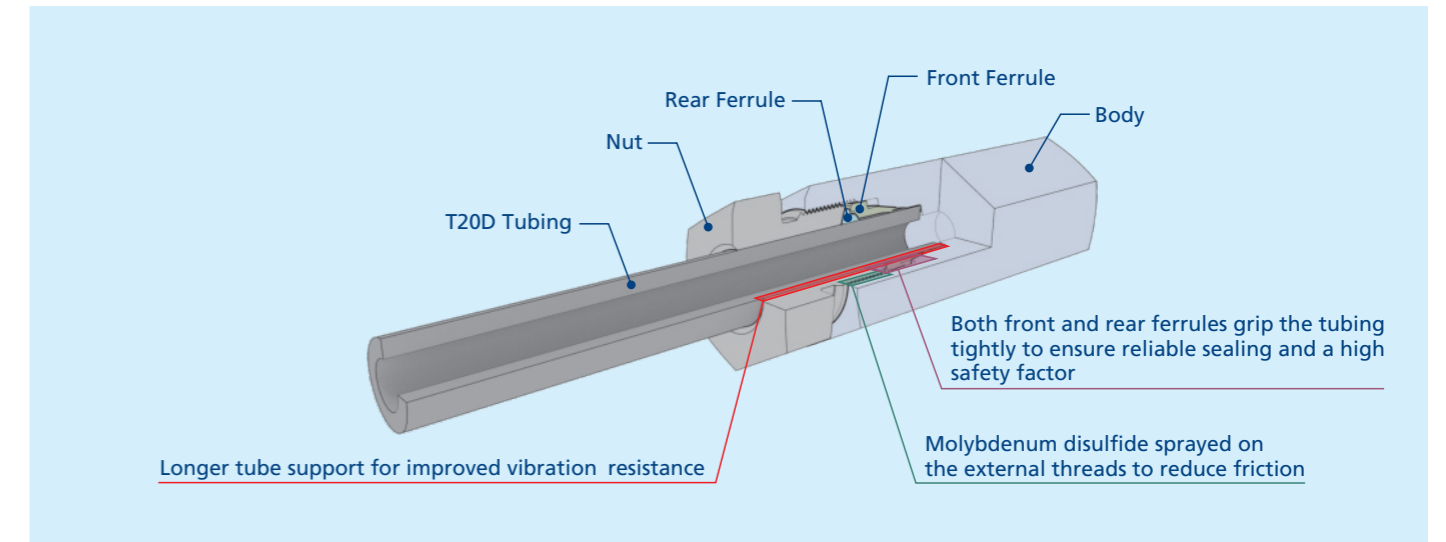
## ★ 6D Series Tube Fittings

FITOK 6D series tube fittings are used in a wide range of applications in thermal power, nuclear power, petrochemical, semiconductor and hydrogen applications due to their excellent product performance. For the highest level of performance, use with FITOK TMP series tubing.

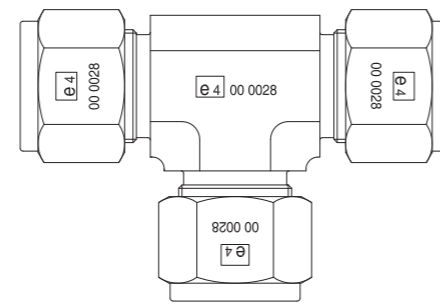
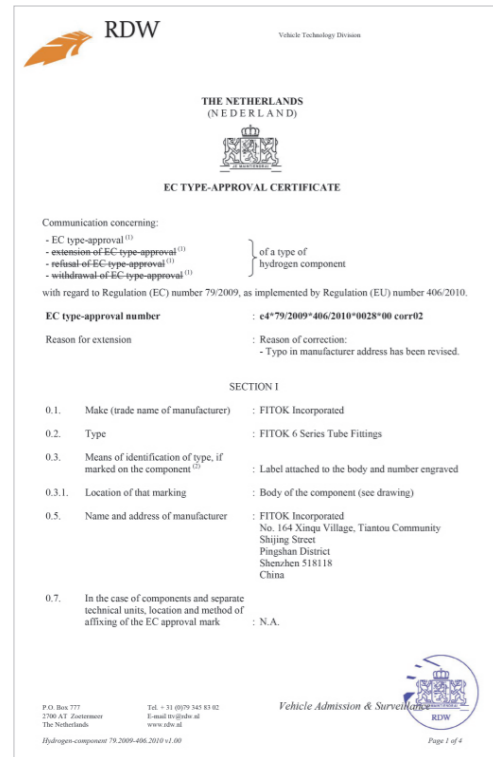


## ★ 20D Series Tube Fittings

FITOK double-ferrule tube fitting can be installed with a wrench only, just like conventional tube fittings. Best match with FITOK T20D series tubing for hydrogen applications.



### EC79 Approval & Certificate

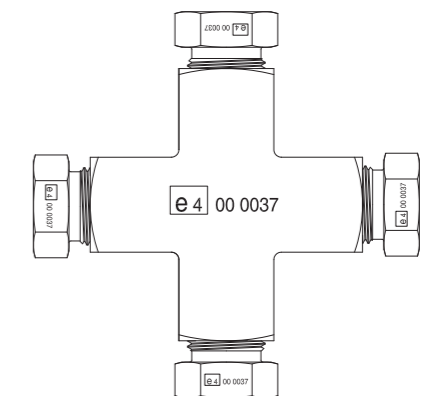
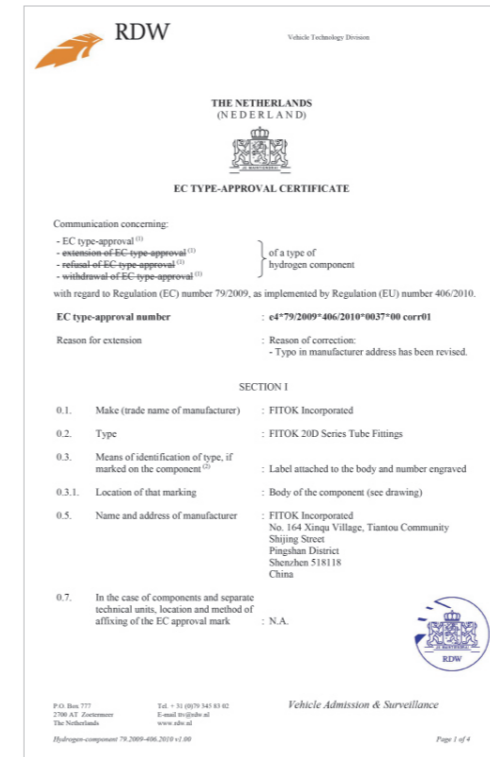


Marking on EC79 Certified Tube Fittings

- ◆ Excellent sealing performance in extreme environments
- ◆ Proven high reliability

6D Series Tube Fittings

### EC79 Approval & Certificate



Marking on EC79 Certified Tube Fittings

- ◆ Fixed installation turns for easy, fast and high consistency installation
- ◆ High reliability under extremely demanding conditions

20D Series Tube Fittings

# ■ Tubing for Hydrogen Applications

Ni > 12%, Ni<sub>eq</sub> ≥ 28.5%



**T20D Series Medium Pressure Tubing**



**TMP Series Instrumentation Tubing**



**TCT Series Instrumentation Tubing**

- ◆ Cold-drawn 1/8-hard seamless tubing
- ◆ Tighter O.D. tolerances and wall thickness range to reduce installation torque and number of turns
- ◆ Best match with FITOK 20D series tube fittings, or use with other popular medium and high pressure tube fittings
- ◆ Hardened to meet higher working pressure (138 MPa) requirements with smaller wall thickness and larger flow area

- ◆ Tighter O.D. tolerances and wall thickness range to reduce installation torque and number of turns
- ◆ Solution annealed with better flexibility, easy for bending and ferrule type connections
- ◆ Best match with FITOK 6D series tube fittings, or use with other popular tube fittings

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- ◆ Solution annealed with better flexibility, easy for bending and ferrule type connections
- ◆ Best match with FITOK 6D series tube fittings, or use with other popular tube fittings

**Material:**

316/316L: Ni ≥ 10%  
Enhanced-316/316L: Ni > 12%, Ni<sub>eq</sub> ≥ 28.5%

**Standard Length:**

T20D Series TMP Series	Supplied in fractional sizes up to 20 ft and metric sizes up to 6 m. No minimum order quantity. Customized lengths are available upon request (Tubing length ≤ 6 m)		
TCT Series	1/4" × 0.035" 184-235 m/coil	1/4" × 0.049" 152-194 m/coil	3/8" × 0.065" 85-109 m/coil
	1/2" × 0.065" 60-77 m/coil	1/2" × 0.083" 49-63 m/coil	-

**Specification:**

T20D Series Medium Pressure Tubing		TMP Series Instrumentation Tubing		TCT Series Instrumentation Tubing	
1/4" × 0.065"	3/8" × 0.083"	1/4" × 0.035"	1/4" × 0.049"	1/4" × 0.035"	1/4" × 0.049"
1/2" × 0.109"	-	5/16" × 0.049"	3/8" × 0.065"	3/8" × 0.065"	1/2" × 0.065"
3/4" × 0.165"	-	1/2" × 0.065"	1/2" × 0.083"	1/2" × 0.083"	-

※ TMP and TCT series tubing can reach a maximum working pressure of 83 MPa, please refer to the FITOK product catalog for working pressure of tubing in different specifications.