Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "**Caution**," "**Warning**" or "**Danger**." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)^{*1} and other safety regulations^{*2}.

* 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.

ISO 4413: Hydraulic fluid power – General rules relating to systems.

IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots -Safety.

- JIS B 8370: General rules for pneumatic equipment.
- JIS B 8361: General rules for hydraulic equipment.
- JIS B 9960-1: Safety of machinery Electrical equipment of machines. (Part 1: General requirements)
- JIS B 8433-1993: Manipulating industrial robots Safety.

etc. * 2) Labor Safety and Sanitation Law, etc.

Caution: Operator error could result in injury or equipment damage.

<u>.</u>

Warning: Operator error could result in serious injury or loss of life.

Danger : In extreme conditions, there is a possibility of serious injury or loss of life.

Warning

I.

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

- 1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
- 2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
- 3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.
- 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.
 - 1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
 - 2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
 - 3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
 - 4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Safety Instructions

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary. If anything is unclear, contact your nearest sales branch.

Limited Warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited Warranty and Disclaimer" and "Compliance Requirements". Read and accept them before using the product.

Limited Warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.^{*3}

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

- For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
- 3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.
 - * 3) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

Chemical Resistance of the Fluoropolymer FEP Material

Chemicals in this table are inactive against FEP material Note 1), however physical properties may be effected by temperature or pressure change.

Please make sure that operating conditions do not cause problems since the use of FEP tubing under chemical environment is unsecured.

2-nitro-2-methyl propanol Chloroform 2-nitrobutanol Pentabasic benzamide N-butylamine N-octadecanol N-butyl acetate O-cresol Di-isobutyl adipate Acetophenone Acetone Alniline Abietic acid Sulfuric chloride Isooctane Liquid ammonia Ethyl alcohol Ethyl ether Ethylene glycol Ethylenediamine Zinc chloride Aluminum chloride Ammonium chloride Calcium chloride Sulfuric chloride Iron chloride (III) Benzoyl chloride Magnesium chloride Hydrochloric acid Chlorine (absolute) Aqua regia Ozone Hydrogen peroxide Natrium peroxide Gasoline Permanganate Formic acid **Xylene** Chromic acid Chlorosulfonic acid

Paraffinum liquidum Allyl acetate Ethyl acetate Potassium Butyl acetate Sodium hypochlorite Carbon tetrachloride Dioxane Cyclohexanone Cyclohexane Dimethyl ether Dimethylsulfoxide Dimethylformamide Bromine Deionized water Nitric acid Mercurv Ammonium hydroxide Potassium hydroxide Sodium hydroxide Cetane Soap, detergent Dibutyl sebacate Diethyl carbonate Tetrachloroethylene Tetrahydrofuran Tetrabromoethane Triethanolamine Trichloroethylene Trichloroacetic acid Toluene Naphtha Naphthalene Naphthol I ead Carbon dioxide Nitrogen dioxide Nitrobenzene

Nitromethane Perchloroethylene Perphloroxylene Unsymmetrical dimethylhydrazine Hvdrazine Pinene Piperidine Glacial acetic acid (Acetic acid) Pvridine Phenol Phthalic acid Dybutyl phthalate Dimethyl phthalate Hydrofluoric acid Naphthalene fluoride Nitrobenzene fluoride Furan Hexachlorethane Hexane Ethyl hexanoate Phenylcarbinol Benzaldehyde Benzonitrile Borax Boric acid Formic aldehyde (Formalin) Acrylic anhydride Acetic anhydride Methacrylic acid Allyl methacrylate Vinyl methacrylate Methyl alcohol Methyl ethyl ketone Methylene chloride Sulphuric acid Phosphoric acid Iron phosphate (III) Tri-n-butyl phosphate Tricresyl phosphate

Note 1) "Inactive in chemistry terminology" means - not to cause any chemical reaction.

Reference cited: Teflon®, the fluoropolymer handbook, Manual for the chemical applications of Teflon®. Du Pond-Mitsui Fluorochemicals Co., Ltd.

Teflon® is a registered trademark for the fluoropolymer produced by E.I du Pond de Nemours & Company (Inc.) and Du Pond-Mitsui Fluorochemicals Co., Ltd.

▲ Precautions

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions, pages 13 to 16 for Fittings and Tubing Precautions and pages 314, 315, 351 and 352 for Fluoropolymer Fittings Precautions.

Soft Fluoropolymer Tubing Metric Size Series TD



Flexibility: Improved by approx. 20% * SMC comparison (Fluoropolymer tubing, Series TL/TIL)

Applications: Food, semiconductor, medical, automobile and machine tools fields

Compatible with the Food Sanitation Law

- Compatible with the test conforming to the Food Sanitation Law based on the 370th notice given by the Ministry of Health and Welfare in 1959.
- Compatible with the §177-1550 dissolution test approved by FDA (Food and Drug Administration).

How to measure the minimum bending radius



Bend the tube into the U-form at a temperature of 20° C. Fix one end and close loop gradually. Measure 2R when the deformed ratio of the tube diameter at bending reaches 5%.

Maximum Operating Pressure



Model/Spe							
Size		Metric size					
	Model		TD0425	TD0604	TD0806	TD1075	TD1209
Tubing O.D. (mm)		4	6	8	10	12	
Tubing I.D. (m	ım)		2.5	4	6	7.5	9
Dell		10 m			•		
Roll		20 m			•		
Color		Translucent (material color)					
Fluid Note 1)		Air, Water, Inert gas					
Applicable fittings Note 2)		Insert fitting Miniature fittings M, MS series (Hose nipple type) Fluoropolymer fitting LQ1 series					
20°CMax. operating100°Cpressure (MPa)200°C260°C		20°C	1.6	1.4	0.9	0.9	0.9
		100°C	0.9	0.7	0.5	0.5	0.5
		200°C	0.45	0.35	0.25	0.25	0.25
		260°C	0.23	0.2	0.15	0.15	0.15
Min. bending	Recomme	nded radius	15	25	45	55	75
radius (mm) Note 3)	us (mm) Note 3) Refraction value		8	16	31	35	41
Max operating temperature (fixed usage)		260°C					

Modified PTFE (Polytetrafluoroethylene resin)

Note 1) When using a liquid fluid, the surge pressure must be under the maximum operating pressure. If the surge pressure exceeds the maximum operating pressure, it will result in damage to fittings and tubes. Furthermore, abnormal temperature rise caused by adiabatic compression may result in the tube bursting.

Note 2) Do not use this product in a manner in which the tube is not fixed.

Material

Observe the lesser value of the maximum operating pressure between the tube and fitting. A material change over a long duration or due to high-temperature may cause leakage. Perform periodic maintenance and replace with a new product immediately when abnormalities are detected. (Refer to Maintenance in the Series TD/TID Precautions on page 396.)

Note 3) The minimum bending radius is the representative value measured as shown in the left figure. • Use a tube above the recommended minimum bending radius.

• The tube may be bent if used under the recommended minimum bending radius. Therefore, refer to the refraction value and make sure that the tube is not bent or flattened.

• Please note that the refraction value is not warranted because of the value when 2R is measured by the method in the left figure if the tube is bent or flattened, etc.

How to Order



Cut the fluoropolymer tube into 15 g and clean it with pure water. After letting the 15 m² of 25% methyl alcohol elute for 24 hours at the room temperature, dilute the elute with ultrapure water. In accordance with the dissolution method, carry out the quantitative study of fluorine ions.

Metal ion elution Note 4)

Kind Al Fe Ni Na Ca						(ng/cm-
	Kind	AI	Fe	Ni	Na	Ca
Amount of elution 0.1 or less 0.1 or less 0.1 or less 0.1 0.1 or less	Amount of elution	0.1 or less	0.1 or less	0.1 or less	0.1	0.1 or less

Clean the inside of fluoropolymer tube with ultrapure water. Weight out about 20 g of ultrapure hydrofluoric acid (48%) and pull in the tube, and then cover both sides of the tube for a week at the room temperature. Dilute the elute with ultrapure water. In accordance with the dissolution method, carry out the quantitative study of AI, Fe, Ni, Na and Ca.

Note 4) The values in the table are not warranted, but the measured values.

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Тп

Soft Fluoropolymer Tubing **Inch Size** Series TID



Flexibility: Improved by approx. 20% * SMC comparison (Fluoropolymer tubing, Series TL/TIL)

Applications: Food, semiconductor, medical, automobile and machine tools fields

Compatible with the Food Sanitation Law

- · Compatible with the test conforming to the Food Sanitation Law based on the 370th notice given by the Ministry of Health and Welfare in 1959.
- Compatible with the §177-1550 dissolution test approved by FDA (Food and Drug Administration).

How to measure the minimum bending radius



Bend the tube into the U-form at a temperature of 20°C. Fix one end and close loop gradually. Measure 2R when the deformed ratio of the tube diameter at bending reaches 5%

Maximum Operating Pressure



Model/Specifications

Size		Inch size					
Model		TID01	TID05	TID07	TID11	TID13	
Tubing O.D.		inch	1/8"	3/16"	1/4"	3/8"	1/2"
Tubing O.D.		mm	3.18	4.75	6.35	9.53	12.7
Tubing I.D.		inch	0.086"	0.124" (1/8")	0.156" (5/32")	0.25" (1/4")	0.374" (3/8")
		mm	2.18	3.15	3.95	6.33	9.5
Roll		8 m	\bullet				
		16 m					
Color		Translucent (material color)					
Fluid Note 1)		Air, Water, Inert gas					
Applicable fittings Note 2)			Fluoropolymer fitting LQ1 series				
		20°C	1.4	1.4	1.6	1.4	0.9
Max. operating		100°C	0.7	0.7	0.9	0.7	0.5
pressure (MP	a)	200°C	0.35	0.35	0.45	0.35	0.25
		260°C	0.2	0.2	0.23	0.2	0.15
Min. bending Recomme		nded radius	15	20	25	40	75
radius (mm) Note 3)	(mm) Note 3) Refraction value		9	10	15	23	42
Max. operating temperature (fixed usage)		260°C					
Material		Modified PTFE (Polytetrafluoroethylene resin)					

Note 1) When using a liquid fluid, the surge pressure must be under the maximum operating pressure. If the surge pressure exceeds the maximum operating pressure, it will result in damage to fittings and tubes. Furthermore, abnormal temperature rise caused by adiabatic compression may result in the tube bursting. Note 2) Do not use this product in a matter in which the modified PTFE tube is not fixed.

Observe the lesser value of the maximum operating pressure between the tube and fitting.

A material change over a long duration or due to high-temperature may cause leakage. Perform periodic maintenance and replace with a new product immediately when abnormalities are detected. (Refer to Maintenance in the Series TD/TID Precautions on page 396.)

Note 3) The minimum bending radius is the representative value measured as shown in the left figure. . Use a tube above the recommended minimum bending radius.

• The tube may be bent if used under the recommended minimum bending radius. Therefore, refer to the refraction value and make sure that the tube is not bent or flattened.

• Please note that the refraction value is not warranted because of the value when 2R is measured by the method in the left figure if the tube is bent or flattened, etc.

How to Order

Kind



(µg/g) Fluorine ion

Amount of elution	0.7
ut the fluoropolymer	tube into 15 g and clean it with pure water. After letting the 15 m
f 25% methyl alcohol	elute for 24 hours at the room temperature, dilute the elute with

С ultrapure water. In accordance with the dissolution method, carry out the quantitative study of fluorine ions.

Metal ion el	ution ^{IN}	ole 4)		(ng/cm ²	
Kind	AI	Fe	Ni	Na	Ca
Amount of elution	0.1 or less	0.1 or less	0.1 or less	0.1	0.1 or less

Clean the inside of fluoropolymer tube with ultrapure water. Weight out about 20 g of ultrapure hydrofluoric acid (48%) and pull in the tube, and then cover both sides of the tube for a week at the room temperature. Dilute the elute with ultrapure water. In accordance with the dissolution method, carry out the quantitative study of AI, Fe, Ni, Na and Ca.

Note 4) The values in the table are not warranted, but the measured values.



Applicable Fluid List Chemical resistance of Fluoropolymer modified PTFE material

Chemicals in the list below are chemically inert ^{Note)} to modified PTFE material. Possible physical effects may occur such as penetration and swelling due to temperature, pressure and chemical concentration.

To use modified PTFE tube in a chemical environment, tests should be performed with the same environment to ensure no problem occurs with operating environment.

1,1,1-Trichloroethane	Formic acid	Trichloroethylene	
1,1,2-Trichloroethane	Ethyl formate	Trichloroacetic acid	
1,2,3-Trichloropropane	Propyl formate	Toluene	
1,2-Dichlorobutane	Methyl formate	Naphtha	
2,4-Dichlorotoluene	Xylene	Carbon dioxide	
2-chloropropane	Glycol	Nitrogen dioxide	
2-nitro-2-methylpropane	Glycerine	Nitrobenzene	KK
2-nitrobutanol	Cresol	Nitromethane	
Pentabasic benzamide	Chromic acid	Carbon disulfide	
Hydrochlorofluorocarbon-22	Chloracetic acid	Piperidine	MS
N-octadecanol	Chlorosulfonic acid	Pyridine	INIO
N-butylamine	Chloroform	Pyrogallol	10
o-chlorotoluene	Paraffinum liquidum	Phenol	
Isobutyl adipate	Acetate	Butanol	MOR
Acetyl chloride	Amyl acetate	Phthalic acid	
Acetophenone	Ethyl acetate	Hydrofluoric acid	T
Acetone	Potassium	Furan	
Aniline	Butyl acetate	Ethyl propionate	
Sulfurous acid gas	Propyl acetate	Propyl propionate	
Allvl chloride	Methyl acetate	Methylpropionate	
Benzoic acid	Salicylic acid	Propylene chloride	
Ammonium	Sodium hypochlorite	Bromobenzene	
Sulfur	Diisobutyl ketone	Hexachlorethane	
Isoamyl alcohol	Diethylamine	Hexane	
Isooctane	Carbon tetrachloride	Hentane	
Ethanol	Dioxane	Benzyl alcohol	
Ethyl ether	Cycloberanone	Benzaldebyde	
Ethylene glycol	Cyclohexane	Benzine	
Ethylene chloride	Dichloroethylene	Benzovi chloride	
Ethylenediamine	Dichloropropylene	Benzonitrile	
Zinc chloride	Dibutyl phthalate	Pentachloroethane	
	Dimethyl ether	Boric acid	
Ammonium chloride	Dimethylsulfoxide	Sodium boric acid	
Calcium chloride	Dimethylformamide	Eormaldebyde	
Ferrous chloride	Hydrobromic acid	Acetic anbydride	
Mercuric chloride	Potassium dichromate	Methanol	
Stannous chloride	Bromine	Methyl ether	
Ferric chloride	Deionized water	Methyl ethyl ketone	
	Nitric acid	Methylene chloride	
Sodium chloride		Ethyl butyrate	
Magnesium chloride	Potassium hydroxide	Methyl butyrate	
Hydrochloric acid	Sodium bydroxide	Hydrogen sulfide	
Chlorine	Soan detergent	Sulphuric acid	
	Diethyl carbonate	Zinc sulfate	
	Sodium carbonate		
	Tetrachloroethane		
Derchlorate			
	Tetrabydrofuren	Dhoenhorio coid	
Natrium perovide			
Gasolino	Triothonolomino		
	Triothylomine		
Fotassium permanganate			

Note) "Chemically inert" means - not to cause any chemical reaction.



Series TD/TID Tubing/Precautions

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions, pages 13 to 16 for Fittings and Tubing Precautions and pages 314, 315, 351 and 352 for Fluoropolymer Fittings Precautions.

Selection

A Warning

1. Confirm the specifications.

Products represented in this catalog are designed only for use in compressed air systems (including vacuum). Do not operate at pressures or temperatures, etc., beyond the

range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

2. In case of using the product for medical care

This product is designed for use with compressed air system applications for medical care purposes. Do not use in contact with human bodily fluids, body tissues or transfer applications to a human living body.

ACaution

- 1. Do not use in locations where the connecting threads and tubing connection will slide or rotate. The connecting threads and tubing connection will come apart under these conditions.
- 2. Use tubing at or above the minimum bending radius. Using below the minimum bending radius can cause breakage or flattening of the tubing.
- 3. Never use the tubing for anything flammable, explosive or toxic such as gas, fuel gas, or cooling mediums etc.

Because the contents may penetrate outward.

4. Use the fittings applicable to the tubing size.

Mounting

▲Caution

- 1. Confirm model no., size, etc. before installing. Check tubing for damage, gouges, cracks, etc.
- 2. When tubing is connected, consider factors such as changes in the tubing length due to pressure, and allow sufficient leeway.
- 3. Do not apply unnecessary forces such as twisting, pulling, moment loads, etc. on fittings or tubing. This will cause damage to fittings and will crush, burst or release tubing.
- 4. Mount so that tubing is not damaged due to tangling and abrasion.

This can cause flattening, bursting or disconnection of tubing, etc.

Piping

1. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe. Not allowing chips of the piping thread or the seal material to go in.

Air Supply

🗥 Warning

1. Types of fluid

This product is designed for use with compressed air.

2. In case of excessive condensation

Excessive condensation in a compressed air system may cause pneumatic equipment to malfunction. Installation of an air dryer, water separator before filter is recommended.

3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic devices.

If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended. For compressed air quality, refer to SMC's "Air Cleaning Equipment" catalog.

Operating Environment

\land Warning

- 1. Do not use in locations having an explosive atmosphere.
- 2. Do not operate in locations where vibration or impact occurs.
- 3. In locations near heat sources, block off radiated heat.

Maintenance

ACaution

- 1. Reform periodic inspections to check the following problems and replace tubing, if necessary.
 - 1) Cracks, gouges, wearing, corrosion
 - 2) Air leakage
 - 3) Twists or crushing of tubing
 - 4) Hardening, deterioration, softening of tubing
- 2. Do not repair or patch the replaced tubing or fittings for reuse.
- 3. When using insert or miniature fittings over a long period, some leakage may occur due to age deterioration of the materials. If any leakage is detected, correct the problem by additional tightening.

If tightening becomes ineffective, replace the fittings with a new product immediately.