
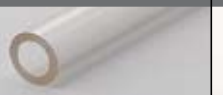





Rating comparison

Rating: + meets the stated property 1 not recommended
 ± meets the stated property to limited extent 10 excellent
 – does not meet the stated property

					
Properties	Tygon® LFL	Tygon® ST R-3603/R-3607	PharMed® Ismaprene	Tygon® MHSL 2001	Tygon® MHLL
FDA	+	+	+	+	+
US Pharmacopoeia Class VI	+	–	+	–	+
Transparency	+	+	–	+	–
Long Life	7	1	10	3	10
Gas Permeability					
CO ₂	8	7	5	5	5
O ₂	9	9	8	9	8
N ₂	10	9	8	6	8
Temperature, above 0°C	2	2	7	1	7
Temperature, below 0°C	3	4	8	7	8
Pressure	9	5	1	1	1
Absorption / Adsorption	6	6	9	10	9
Chemical Resistance,					
Acids (H ₂ SO ₄)					
10%	10	10	10	10	10
30%	10	10	10	10	10
95–98%	1	1	1	7	1
Bases (NaOH)					
10–15%	10	10	10	10	10
30–40%	4	4	10	10	10
Hydrocarbons					
(aliphatic)	1	1	1	1	1
Mineral Salts	10	10	10	10	10
Alcohols	1	1	10	10	10
Ketones (Acetone)	1	1	1	7	1

Maximum recommended operating pressure

WT* (mm)	i.d. (mm)	bar	bar	bar	bar	bar
1.6	0.8	8.7	8.7	3.7	N.A.	N.A.
1.6	1.6	4.8	4.8	2.1	3.1	N.A.
1.6	2.4	3.8	3.8	1.6	N.A.	N.A.
1.6	3.2	3.0	3.0	1.3	2.0	N.A.
1.6	4.8	2.2	2.2	0.9	1.5	N.A.
1.6	6.4	1.8	1.8	0.8	1.1	N.A.
1.6	8.0	1.5	1.5	0.6	0.9	N.A.
1.6	9.5	1.3	1.3	0.5	0.8	N.A.
1.6	11.1	1.2	1.2	0.5	N.A.	N.A.
1.6	12.7	1.1	1.1	0.5	N.A.	N.A.
1.6	15.9	1.0	1.0	0.4	N.A.	N.A.
2.4	4.8	3.0	3.0	1.3	N.A.	N.A.
2.4	6.4	2.4	2.4	1.0	N.A.	N.A.
2.4	8.0	2.0	2.0	0.8	N.A.	N.A.
2.4	9.5	1.8	1.8	0.8	N.A.	N.A.
2.4	11.1	1.5	1.5	0.6	N.A.	N.A.
2.4	12.7	1.3	1.3	0.6	N.A.	N.A.
2.4	15.9	1.2	1.2	0.5	N.A.	N.A.
3.2	6.4	3.0	3.0	1.3	N.A.	N.A.
3.2	9.6	2.2	2.2	0.9	N.A.	N.A.
3.2	12.7	1.8	1.8	0.8	1.1	N.A.
3.2	15.9	1.5	1.5	0.6	0.9	N.A.

*WT: Wall thickness

We recommend you to also observe the chart 'Tubing Properties' on the following pages. All information has been supplied to ISMATEC by the tubing manufacturers. It is for your guidance only. We recommend you to test the tubing before use.

					
Properties	Tygon® HC F-4040-A	Tygon® SI Silicone 3350 (Platinum)	Silicone Peroxid	Norprene® A-60-G	Viton® Fluran® HCA F-5500-A
FDA	–	+	+	–	–
US Pharmacopoeia Class VI	–	+	+	–	–
Transparency	±	±	±	–	–
Long Life	2	4	4	10	3
Gas Permeability CO ₂	9	1	1	5	10
O ₂	10	1	1	8	10
N ₂	10	1	1	8	10
Temperature, above 0°C	2	10	10	7	9
Temperature, below 0°C	1	10	10	8	4
Pressure	7	1	1	1	1
Absorption / Adsorption	6	1	1	9	7
Chemical Resistance,					
Acids (H ₂ SO ₄) 10%	10	10	10	10	10
30%	7	7	8	10	10
95–98%	1	1	1	1	10
Bases (NaOH) 10–15%	1	10	10	10	10
30–40%	1	10	10	10	10
Hydrocarbons (aliphatic)	7	1	1	1	7
Mineral Salts	10	7	7	10	10
Alcohols	7	7	10	10	1
Ketones (Acetone)	1	4	1	1	1

Maximum recommended operating pressure

WT* (mm)	i.d. (mm)	bar	bar	bar	bar	bar
1.6	0.8	10.9	1.9	1.9	3.7	3.7
1.6	1.6	6.1	1.0	1.0	2.1	2.1
1.6	2.4	4.8	0.8	0.8	1.6	1.6
1.6	3.2	3.8	0.6	0.6	1.3	1.3
1.6	4.8	2.7	0.5	0.5	0.9	0.9
1.6	6.4	2.2	0.4	0.4	0.8	0.8
1.6	8.0	1.8	0.3	0.3	0.6	0.6
1.6	9.5	1.6	0.3	0.3	0.5	0.5
1.6	11.1	1.5	0.3	0.3	0.5	0.5
1.6	12.7	1.4	0.2	0.2	0.5	0.5
1.6	15.9	1.2	0.2	0.2	0.4	0.4
2.4	4.8	3.8	0.6	0.6	1.3	1.3
2.4	6.4	3.0	0.5	0.5	1.0	1.0
2.4	8.0	2.5	0.4	0.4	0.8	0.8
2.4	9.5	2.2	0.4	0.4	0.8	0.8
2.4	11.1	1.8	0.3	0.3	0.6	0.6
2.4	12.7	1.7	0.3	0.3	0.6	0.6
2.4	15.9	1.5	0.3	0.3	0.5	0.5
3.2	6.4	3.8	0.6	0.6	1.3	1.3
3.2	9.6	2.7	0.5	0.5	0.9	0.9
3.2	12.7	2.2	0.4	0.4	0.8	0.8
3.2	15.9	1.8	0.3	0.3	0.6	0.6

*WT: Wall thickness

Properties of ISMATEC® tubing







Proven quality for a wide range of laboratory applications. Be sure to choose the tubing most suitable for your application.

Type	Tygon® LFL	Tygon® ST R-3603/R-3607	PharMed® Ismaprene	Tygon® MHSL 2001	Tygon® MHLL
Special Properties	The tubing with the longest service-life of any clear Tygon® tubing	The inexpensive all-round tubing for general laboratory applications	The ideal tubing for pharmaceutical and medical applications, and for foodstuffs.	The transparent, plasticiser-free tubing with superior pump-life. Especially designed for MEK and other aggressive solvents.	Chemically resistant to acetone, MEK and other aggressive solvents. Long life tubing.
Advantages	<ul style="list-style-type: none"> • Transparent • Broad chemical resistance • Tasteless • Extremely low particulate spallation • Meets USP Class VI and FDA criteria • Non-aging • High dielectric constant 	<ul style="list-style-type: none"> • Transparent • Resistant to almost all inorganic chemicals • Tasteless • Smooth polished inner wall • Low gas permeability • Non-aging and non-oxidizing • High dielectric constant 	<ul style="list-style-type: none"> • Recommendable for cell and tissue cultures • Ideal for production filtration, fermentation and bioreactor process lines • Very long service-life • Non-toxic and non-hemolytic • Impermeable to normal light and UV-radiation • Appropriate for medical products and foodstuffs • Low particulate spallation • Can be autoclaved repeatedly • Withstands repeated CIP and SIP cleaning and sterilization • Meets USP class VI, FDA and NSF criteria 	<ul style="list-style-type: none"> • Plasticizer and oil-free • Smooth inner-bore • Low sorption maintains fluid and tube integrity • Does not impart anything into the pumping medium • No release of hazardous materials when properly incinerated 	<ul style="list-style-type: none"> • Plasticizer-free • Smooth innerbore • Low sorption maintains fluid integrity • Minimal adhesion and diffusion • Suitable for MEK, Acetone and other corrosive solvents • Long life tubing
Limitations	<ul style="list-style-type: none"> • Potential leaching of plasticizers • Not recommended for human blood and tissue 	<ul style="list-style-type: none"> • Potential leaching of plasticizers • Short service-life 	<ul style="list-style-type: none"> • Potential leaching of additives (lubricants) 	None	<ul style="list-style-type: none"> • Cannot be repeatedly sterilized • Only available as stopper tubing
Physical Properties	<ul style="list-style-type: none"> • Thermoplastic • PVC-based material with plasticizer • Flexible, firm, transparent 	<ul style="list-style-type: none"> • Thermoplastic • PVC-based material with plasticizer • Flexible, firm, transparent 	<ul style="list-style-type: none"> • Thermoplastic Elastomer based on polypropylene. • Flexible, firm, opaque 	<ul style="list-style-type: none"> • Polyolfin 	<ul style="list-style-type: none"> • Special thermoplastic of high purity • Without additives • Without plasticizer • Environmental-friendly disposal • Flexible, firm, opaque
Service Temperature Range	–50°C to +74°C (–58°F to +165°F)	–50°C to +74°C (–58°F to +165°F)	–60°C to +135°C (–75°F to +275°F)	–73°C to +57°C (–100°F to +135°F)	–70°C to +74°C (–94°F to +165°F)
Applications	Acids: good Alkaline solutions: good Solvents: not recommended Pressure: good Vacuum: good Viscous media: excellent Sterile Media: limited	Acids: good Alkaline solutions: good Solvents: not recommended Pressure: fair Vacuum: good Viscous media: excellent Sterile Media: limited	Acids: good Alkaline solutions: good Solvents: not recommended Pressure: not recommended Vacuum: excellent Viscous media: good Sterile Media: excellent	Acids: excellent Alkaline solutions: excellent Solvents: good/excellent Pressure: – Vacuum: – Viscous media: – Sterile Media: –	Acids: excellent Alkaline solutions: excellent Solvents: excellent Pressure: not recommended Vacuum: good Viscous media: good Sterile Media: good
Complies with the standards	FDA 21CFR175.300 US Pharmacopoeia Class VI	FDA 21CFR175.300	FDA 21CFR177.2600 US Pharmacopoeia Class VI NSF listed (Standard 51)	FDA	FDA 21CFR177.2600 USP Pharmacopoeia Class VI
Sterilization	Autoclavable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F); tubing will appear milky Gas sterilization with Ethylene oxide Not recommended for sterilization with radiation.	Autoclavable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F); tubing will appear milky Gas sterilization with Ethylene oxide Not recommended for sterilization with radiation.	Autoclavable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F) Gas sterilization with Ethylene oxide / Sterilization with radiation up to 2.5 mrad / Caution: Use special tubing version (welded stoppers) when autoclaving 2 or 3-stop colour-coded tubing.	Autoclavable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F) Gas sterilization with Ethylene oxide Sterilization with radiation up to 2.5 mrad	Autoclavable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F) Gas sterilization with Ethylene oxide Sterilization with radiation up to 2.5 mrad Caution: Can not be repeatedly sterilized
Gas permeability ¹	CO ₂ 563 O ₂ 124 N ₂ 67	360 80 40	1200 200 80	1140 76 190	– – –
Odour and Taste	none	none	low	–	–
Toxicity	non-toxic	non-toxic	non-toxic and non-hemolytic	–	–
Tubing life ³	at 0 bar 800 hrs at 0.7 bar 700 hrs	35 hrs 30 hrs	1000 + hrs 1000 hrs	75 hrs –	800 + hrs 800 + hrs

¹ Permeability Coefficient = $\frac{\text{Amount of gas (cm}^3\text{)} \times \text{tubing wall thickness (cm)}}{\text{Surface area of tubing ID (cm}^2\text{)} \times \text{time (seconds)} \times \text{pressure drop across tubing wall (cmHg)}} \times 10^{-11}$

For more tubings for aggressive media, see page 35.

This information has been supplied to Ismatec by the tubing manufacturers. It is for your guidance only. We recommend you to test the tubing before use.

					
Tygon® HC F-4040-A	Tygon® SI Silicone 3350 (Platinum)	Silicone Peroxide	Norprene® A-60-G	Norprene® Chemical	Viton® Fluran® HCA F-5500-A
The special tubing for hydrocarbons, petroleum products and distillates.	The platinum-cured silicone tubing with an ultra-smooth inner surface for sanitary transfer of sensitive fluids.	Silicone tubing blended with organic peroxide for biological applications	The high performance tubing for industrial use.	Chemically resistant to acetone, MEK and other aggressive solvents. Long life tubing.	The special tubing for concentrated acids and corrosive solvents.
<ul style="list-style-type: none"> Specially formulated to transport hydrocarbons, petroleum products and distillates Ideal for gasoline, kerosene, heating oils, cutting liquids and coolants based on glycols High dielectric constant Low gas permeability 	<ul style="list-style-type: none"> Steam autoclaveability Excellent biological compatibility Ultra-smooth inner bore reduces potential for particle entrapment Lower level of protein binding. Entirely non-toxic, non-hemolytic and non-pyrogenic. Weather, ozone, sunlight and radiation resistant Resistant to fungus Odourless 	<ul style="list-style-type: none"> Steam autoclaveability Excellent biological compatibility Greater physical compression capability Not prone to mould Non-toxic Waterproof and resistant to ozone, radiation and sunlight Resistant to fungus Odourless 	<ul style="list-style-type: none"> Offers longest service-life with good flow consistency Good resistance to acids and alkaline chemicals Superior weathering Abrasion resistant Non-ageing and non-oxidizing Outstanding flexural fatigue resistance Low gas permeability versus rubber tubing Ozone (300 ppm) and UV light resistant Ideal for use in vacuum system 	<ul style="list-style-type: none"> Plasticizer-free Smooth innerbore Low sorption maintains fluid integrity Minimal adhesion and diffusion Suitable for MEK, Acetone and other corrosive solvents Long life tubing 	<ul style="list-style-type: none"> High chemical resistance Low gas permeability Wide temperature range
<ul style="list-style-type: none"> Not recommended for strong acids and alkalis, foodstuffs, beverages and medicines Potential leaching of plasticizers 	<ul style="list-style-type: none"> Not suitable for concentrated solvents, oils, acids or diluted sodium hydroxide Relatively high gas permeability 	<ul style="list-style-type: none"> Not recommended for concentrated solvent, oils, acids or diluted sodium hydroxide Relatively high gas permeability 	<ul style="list-style-type: none"> Potential leaching of blend material 	<ul style="list-style-type: none"> Cannot be repeatedly sterilized Only available as stopper tubing 	<ul style="list-style-type: none"> Limited service-life
<ul style="list-style-type: none"> Thermoplastic PVC-based material with plasticizer Flexible, firm, translucent, yellow 	<ul style="list-style-type: none"> Thermal set rubber Siloxane polymers and amorphous silica Soft, translucent, clear to light amber Excellent compression strength 	<ul style="list-style-type: none"> Polydimethylsiloxane with silica filler and silicone oil Excellent resistance to compression Soft, translucent, clear to light amber 	<ul style="list-style-type: none"> Thermoplastic elastomer based on polypropylene Excellent tensile strength Firm, opaque, black 	<ul style="list-style-type: none"> Special thermoplastic of high purity Without additives Without plasticizer Environmental-friendly disposal Flexible, firm, opaque 	<ul style="list-style-type: none"> Fluoropolymerelastomer Firm, opaque, black
-37°C to +74°C (-35°F to +165°F)	-60°C to +200°C (-75°F to +392°F)	-51°C to +238°C (-60°F to +460°F)	-60°C to +135°C (-75°F to +275°F)	-70°C to +74°C (-94°F to +165°F)	-31°C to +204°C (-25°F to +400°F)
limited	limited	limited	excellent	excellent	excellent
not recommended	limited	good	excellent	excellent	excellent
not recommended	limited	not recommended	not recommended	excellent	limited
good	not recommended	not recommended	not recommended	not recommended	not recommended
good	good	good	good	good	good
excellent	fair	fair	excellent	good	good
limited	excellent	excellent	not recommended	good	fair
None	US Pharmacopoeia XXIII Class VI FDA 21CFR177.2600 also exceeds 3A sanitary standards	US Pharmacopoeia Class VI FDA 21CFR177.2600	None	FDA 21CFR177.2600 USP Pharmacopoeia Class VI	None
Not recommended	Autoclaveable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F) Gas sterilization with Ethylene oxide Sterilization with radiation up to 2.5 mrad	Autoclaveable for 30 min at 1 bar (15 psi), 121°C (250°F) Radiation: Irradiate at up to 2.5 mrad Gas: Not recommended to sterilize with Ethylene oxide	Not recommended	Autoclaveable with steam 30 minutes at 1 bar (15 psi) and 121°C (250°F) Gas sterilization with Ethylene oxide Sterilization with radiation up to 2.5 mrad Caution: Can not be repeatedly sterilized	Not recommended
100	25147	25147	1200	—	38
22	4715	4715	200	—	14
12	2284	2284	80	—	5
²	none	—	²	—	²
²	non-toxic	—	²	—	²
60 hrs	200 hrs	—	1000 + hrs	800 + hrs	150 hrs
60 hrs	100 hrs	—	1000 hrs	800 + hrs	90 hrs

² Must not be used for foodstuffs, beverages, and drugs

³ Tubing 6.4 mm i.d., 1.6 mm wall, 3-roller pump head, 600 rpm, 23°C, service-life ending with rupture (ISMATEC® tubing pumps run at approx. 11 rpm – 500 rpm)

Tubing for special applications

From GORE™ for single channel tubing pumps



e.g. for the Flowmaster®
dispensing pump up to 13 liters/min



For high-pressure application
Gore Style 100

- Extremely stable flow rates
- Variability in flow rate within 1% during total life time
- Virtually eliminates spallation (ensures continuously high purity in fluid transfer)
- For differential pressures up to 4 bar (60 psi)
- High burst strength (up to 25 bar / 360 psi)
- Exhibits 18 times the life of silicone rubber tubing

Application
in pharmaceutical, food and biotech processes

- Tangential flow filtration and other high-pressure applications
- Addition of anti-foam
- Long-term fermentation: continuous media recirculation over 75 days
- Transfer of live-cells from one container into another featuring excellent service life at low temperatures
- Ultra-filtration: high pressure stability allows higher system pressure and flow rate, which results in longer service life and fewer down-times due to tube exchanges

Specifications

Unique pressed composite material, not extruded, produced in clean room

- Platinum cured Silicone and expanded PTFE
- Available in bore sizes up to 50 mm ID
- USP Class VI approved and classified nontoxic
- Cited in FDA Type II Material Master File (MMF)
- Operates at pressures up to 4 bar (60 psi)
- In-line steam sterilizable



e.g. for the tubing pump
REGLO Quick™ up to 230 ml/min



For aggressive media
Gore Style 100CR

- Extremely long life perfluorelastomer tubing
- Stable flow rates, variation less than 1% over tubing life
- Low solvent swell
- Extreme long service life
- Suitable for almost all aggressive chemicals, including organic solvents, such as:
 - Methylenechloride
 - Toluene and Acetone

Application
in electronic, medical, textile, industry

- Solvent-based ink for gravure printing
- Coating of glass bottles
- Chemical coating of plastic plates and film
- Chemical-based flow in waste water treatment
- Solvent-based coating of tablets
- Synthesis with high through-put
- Laboratory analysis or dispensing

Specifications

Fluoroelastomer tubing with expanded PTFE, not extruded, produced in clean room

- 1,6 to 16 mm ID
- Permanently stable flow rates
- USP Class VI approved
- FDA for food contact
- Operates at pressures up to 4 bar (60 psi)

Special tubing for aggressive media

From Tygon® for single and multi-channel tubing pumps

1



Stopper tubing for aggressive media Tygon® MHLL

- Resistent to highly aggressive chemicals
- Meets USP Class VI criteria
- Low sorption maintains the fluid integrity
- Unequaled combination of chemical resistance, clarity and flexibility
- Color opaque, beige
- Extreme long service life (+800h)

Applications

- Battery acid filling
- Addition of anti-foam
- Hazardous material handling
- Applications with acids, bases, ketones, salts and alcohols

Its exceptionally smooth inner surface inhibits particulate buildup and reduces the potential for contamination.

Specifications

- Combination of MH- and Pharmed-tubing, opaque
- Available as stopper-tubing up to 2.79 mm i.d.
- USPPXIII Class VI
- FDA for food contact
- Autoclaveable, gas sterilisation, radiation
- Absolutely no odor or taste



Standard- and stopper tubing for chemical applications Tygon® MHSL

- Chemically resistant to a wide range of fluids
- Meets FDA criteria for food contact
- Plastizier and oil free
- No contamination of the fluids
- Color clear, transparent
- Long service life in peristaltic pumps (75h)

Applications

- Transparent for visible flow monitoring
- Coating of tablets
- Laboratory analysis and dispensing
- Chemical-based flow in waste water treatment

Smooth inner surface, low sorption maintains fluid and tube integrity

Specifications

- Ultra-pure tubing for peristaltic pumps
- Stopper tubing up to 2.79 mm i.d.
- Standard tubing up to 15.9 mm i.d.
- FDA for food contact
- Autoclaveable, gas sterilisation, radiation
- Absolutely no odor or taste