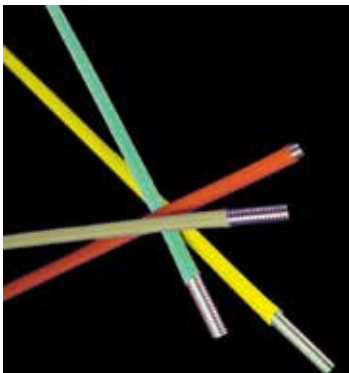


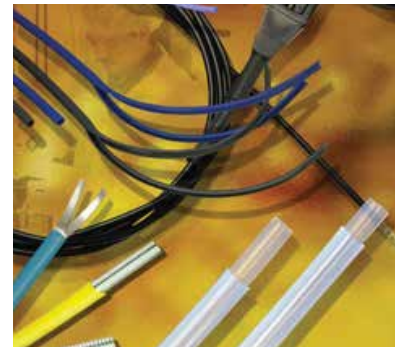


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process control
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Parker TexMed® Heat Shrink

Quick Reference Guide



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TexMed® Adds Value

Parker Hannifin specializes in the extrusion of custom heat shrinkable tubing products for medical applications. Manufactured under the TexMed® product brand, PTFE, FEP, PFA and ETFE resins are extruded and expanded to make heat shrink products that are suited for use in high temperature applications, when lubricity is an important factor and in critical environments where chemicals may be present.

With an emphasis on partnering, our engineers' work closely with our customer's engineers to create tubing products with increased performance. One of our newest developments is a medical grade FEP Heat Shrink for catheter forming. Unlike typical FEP heat shrink, which often wrinkles, twists or grows up to 20% in length when shrinking, the new heat shrink has a uniform recovery and a maximum constrained elongation up to +5%. This reduced elongation limits the possibility of curling or pigtailing, thus eliminating marks, ridges and thread effects.

With a faster recovery time, medical grade FEP Heat Shrink is very responsive in reflow applications for catheter manufacturing. It allows the heat shrink to soften and contain the resins being reflowed beneath, forming a smooth transition and uniform wall from one resin to the next. When using a slightly thicker wall, two paths can be scored 180 degrees apart, enabling easy removal after the reflow is complete. This reduces marring of the resins beneath from gripping or cutting after the shrink process.

In Texmed's on-site, Value Added Department, services such as laser marking, tube cutting, scoring, slitting and turnkey operations are available.

For more information or technical data on any of our materials or capabilities, please contact Parker/TexMed toll free at 800.423.6551 or email: texlocquote@parker.com.



Parker Medical Heat Shrink

Typical Sizes



Parker also produces custom medical heat shrinkable tubing in continuous lengths, cut lengths and in special configurations based on each customers' specific application.

| Part Number | AWG Size | Minimum Expanded I.D. | | Maximum Recovered Diameter | | Recovered Wall |
|-------------|----------|-----------------------|------|----------------------------|------|----------------|
| | | Inch | MM | Inch | MM | Thickness +/- |
| HSM1.3FEP24 | 24 | .031 | .787 | .027 | .686 | .008/.002 |
| HSM1.3FEP22 | 22 | .036 | .914 | .032 | .813 | .008/.002 |
| HSM1.3FEP20 | 20 | .045 | 1.14 | .039 | .991 | .008/.002 |
| HSM1.3FEP18 | 18 | .060 | 1.52 | .049 | 1.24 | .008/.002 |
| HSM1.3FEP16 | 16 | .075 | 1.91 | .061 | 1.55 | .009/.002 |
| HSM1.3FEP14 | 14 | .092 | 2.34 | .072 | 1.83 | .009/.002 |
| HSM1.3FEP12 | 12 | .115 | 2.92 | .089 | 2.26 | .009/.002 |
| HSM1.3FEP10 | 10 | .141 | 3.58 | .114 | 2.90 | .010/.003 |
| HSM1.3FEP09 | 9 | .158 | 4.01 | .124 | 3.15 | .010/.003 |
| HSM1.3FEP08 | 8 | .180 | 4.57 | .143 | 3.63 | .010/.003 |
| HSM1.3FEP07 | 7 | .197 | 5.00 | .158 | 4.01 | .011/.004 |
| HSM1.3FEP06 | 6 | .225 | 5.72 | .180 | 4.59 | .011/.004 |
| HSM1.3FEP05 | 5 | .248 | 6.30 | .198 | 5.03 | .011/.004 |

| Part Number | Size | Minimum Expanded I.D. | | Maximum Recovered Diameter | | Recovered Wall |
|-------------|------|-----------------------|------|----------------------------|------|----------------|
| | | Inch | MM | Inch | MM | Thickness +/- |
| HSM1.6-1/16 | 1/16 | .062 | 1.57 | .037 | 0.94 | .008/.003 |
| HSM1.6-3/32 | 3/32 | .093 | 2.36 | .056 | 1.42 | .008/.003 |
| HSM1.6-1/8 | 1/8 | .125 | 3.18 | .075 | 1.91 | .010/.003 |
| HSM1.6-3/16 | 3/16 | .188 | 4.78 | .115 | 2.92 | .010/.003 |
| HSM1.6-1/4 | 1/4 | .250 | 6.35 | .150 | 3.81 | .010/.003 |
| HSM1.6-5/16 | 5/16 | .313 | 7.95 | .187 | 4.75 | .010/.003 |
| HSM1.6-3/8 | 3/8 | .375 | 9.53 | .225 | 5.72 | .012/.003 |
| HSM1.6-1/2 | 1/2 | .500 | 12.7 | .300 | 7.62 | .015/.004 |

FEP Continuous Use Temperature: -100 to 400°F
-75 to 200°C

FEP Shrink Temperature: 410°F/ 210°C
Longitudinal Change: ± 5%

Supplied in 5 foot lengths



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Quick Reference

PTFE (Polytetrafluoroethylene)

- Best Stress Crack Resistance
- Lowest Coefficient of Friction
- Superior Dielectric Strength
- Best Chemical Resistance
- High Temperature Range
- Wider Expansion Ratio's than PFA or FEP
- Best Flexibility
- Shrink Temperature: 620°F (327°C)
- Shrink ratio: up to 4:1

FEP (Fluorinated Ethylene Propylene)

- Lowest Refractive Index (Transparency)
- Lower Shrink Temperature than PTFE
- Easy to Work With
- Excellent for Field Applications
- Shrink Temperature: 410°F (210°C)
-Over 1" Diameter, 430°F (221°C)
- Shrink ratio: up to 1.67/1

PFA (Perfluoroalkoxy)

- Better Stress Crack Resistance than FEP
- Outstanding Permeation Resistance
- Better Transparency than PTFE
- Higher Purity than FEP and PTFE
- High Temperature Range
- Shrink Temperature: 400°F (210°C)
- Shrink ratio: up to 1.67/1

Sterilization

ETFE (Ethylene Tetrafluoroethylene)

- Moderate Temperature Range
- Outstanding Abrasion Resistance
- Accepts Most Sterilization Methods: (Steam, Gamma, and Gas)
- Best Shore Hardness
- Shrink Temperature: 347°F(175°C)
- Shrink ratio: up to 1.5/1

| | Poor Not Recommended | Fair | Good | Excellent |
|-------------|----------------------|------|------|-----------|
| Gamma/EBeam | | | | |
| Steam | na | na | na | |
| EtO | na | na | na | |
| Other | | | | |
| Autoclave | | | | |

Property Comparison

| Material | Temperature Range | | | | | Fluoropolymer Property Comparison | | | | | | | | | | | | | |
|----------|-------------------|-----|-----|-----|-----|-----------------------------------|---------------|---------------|------------------------|---------------------|----------------|------------------|--------------------|--|-----------|------------------|---------------------|--|--|
| | 200 | 250 | 300 | 350 | 400 | 500 | Sterilization | FDA Compliant | USP Class VI Compliant | Chemical Resistance | Shore Hardness | Tensile Strength | Tensile Elongation | High Flexural Modulus Stiffness/Torque | Flex Life | Water Absorption | Abrasion Resistance | | |
| PTFE | | | | | | | | | | | | | | | | | | | |
| FEP | | | | | | | | | | | | | | | | | | | |
| ETFE | | | | | | | | | | | | | | | | | | | |
| ECTFE | | | | | | | | | | | | | | | | | | | |
| PFA | | | | | | | | | | | | | | | | | | | |

Material Properties

The table below lists a generally accepted summary of properties that we believe to be reliable. Please note that many of these resins are produced in several varieties and property characteristics may vary. Therefore, determination of resin is dependent on the application and this table is only meant to serve as a general guideline.

| Properties* | ASTM or Unit | PTFE | FEP | PFA | High Purity PFA | ETFE |
|---|---|---------------------------------------|---------------------------------------|---------------------------------------|------------------------|----------------------------|
| MECHANICAL PROPERTIES | | | | | | |
| Specific Gravity | D792 D3307 | 2.13-2.22 - | 2.12-2.17 - | 2.12-2.17 - | - 2.14-2.16 | 1.74 - |
| Elongation % | D638 D3307 | 200-450 - | 250-330 - | 280-400 - | - 370 | 430 - |
| Tensile Strength (psi) | D638(psi) D3307(psi) | 2000-7000 - | 2800-4000 - | 4000-5000 - | - 4693 | 6962 - |
| Flexural Strength (psi) | D790 | no break | no break | no break | no break | 5500 |
| Compressive Strength (psi) | D695 | 700-900 | 725-2200 | 725-810 | na | 2500 |
| Tensile Elastic Modulus (Young's Modulus) (psi) | D638 | 57,000 - | 50,000 - | 72,500- 87,000 | na | 116,030 |
| Flexural Modulus | D790(psi) D790 103MPa (103kgf/cm ²) | 71,000-85,000 0.5-0.6 (5.0-6.0) | 78,000-92,000 0.5-0.6 (5.5-6.4) | 94,000-99,000 0.6-0.7 (6.6-7.0) | - 647-686 - | 130,534 - - |
| Flex Life (MIT cycles) | D2176 | >1,000,000 | 5,000-80,000 | 10,000-500,000 | 2000 x 10 ³ | na |
| Hardness Durometer Shore D | D2240 | D50-65 | D55 | D55-D60 | D60 | D67 |
| Coefficient of Friction | (on steel) | 0.02 | 0.05 | 0.04-0.06 | 0.05 | 0.20 |
| Abrasion Resistance 1000 cycles | Taber | 8-90 | 14-20 | 0.00-96.75 | na | 0.005 |
| Impact Strength IZOD 73°F/23°C notched ft/lbs/in | D256 | 3 | no break | no break | no break | no break |
| THERMAL PROPERTIES | | | | | | |
| Melting Point | °C | 327 | 260 | 305 | 305 | 260 |
| | °F | 621 | 500 | 582 | 582 | 500 |
| Upper Service Temperature(20000h) | °C | 260 | 204 | 260 | 260 | 180 |
| | °F | 500 | 400 | 500 | 500 | 356 |
| Flammability | UL 94 | V-0 | V-0 | V-0 | V-0 | V-0 |
| Thermal Conductivity | BTU-in/hr-ft ² , °F | 1.7-2.08 | 1.4 | 1.3 | na | 1.65 |
| Thermal Conductivity | Cal-cm/sec-cm ² , °C | 6 x 10 ⁻⁴ | 6 x 10 ⁻⁴ | 6 x 10 ⁻⁶ | na | 5.7 x 10 ⁻⁴ |
| Linear Coefficient of Thermal Expansion Min/in°F 73.4-140°F | D696 | 55.6 | 46.1-58.3 | 66.7 | na | 9.4 (10 ⁻⁵ /°C) |
| Heat of Fusion | BTU/LB | 29-37 | 4-35 | 13 | na | 20 |
| Heat of Combustion | BTU/LB °F | 2200 | 2200 | 2300 | na | 8100 |
| Low Temperature Embrittlement | °C | -268 | -268 | -268 | -268 | -76 |
| | °F | -450 | -450 | -450 | -450 | -105 |
| ELECTRICAL PROPERTIES | | | | | | |
| Dielectric Constant | D150/10 ³ Hz | 2.1 | 2.1 | 2.1 | 2.1 | 2.6 |
| | D150/10 ⁶ Hz | 2.1 | 2.1 | 2.1 | 2.1 | |
| Dielectric Strength | D149/125 MIL | 500 | 508 | 500 | 500 - 600 | na |
| | D149/10 MIL | ≥1400 | >610 | ≥1400 | na | |
| Volume Resistivity | D257/ohm-cm | >10 ¹⁸ | >10 ¹⁸ | >10 ¹⁸ | na | 10 ¹⁷ |
| Surface Resistivity | D257/ohm-cm | >10 ¹⁸ | >10 ¹⁷ | >10 ¹⁷ | na | >10 ¹⁵ |
| GENERAL PROPERTIES | | | | | | |
| Chemical/Solvent Resistance | D543 | Excellent | Excellent | Excellent | Excellent | Excellent |
| Refractive Index | | 1.35 | 1.338 | 1.34 | 1.34 | 1.447 |
| Limiting Oxygen Index, % | D2868 | >95 | >95 | ≥95 | na | 31 |
| Water Contact Angle | Angle to Level | 110 | 114 | 115 | na | na |
| Water Absorption 24h,% | D570 | <0.01 | <0.01 | <0.03 | <0.01 | 0.03 |
| Weatherability | | Excellent | Excellent | Excellent | Excellent | Excellent |

*General resin properties; Tubing properties may vary.





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