# Udel® P-3500 LCD MB
## polysulfone

Udel® polysulfone is a tough, rigid, high-strength thermoplastic with outstanding hydrolytic resistance. Udel® P-3500 LCD MB series polymers are particularly well suited for the fabrication of porous hollow fiber and flat sheet membranes using a solvent-based process. These high molecular weight polymers are used in a variety of membrane filtration applications, such as renal dialysis, water treatment, bio-processing, food and beverage processing, and industrial gas separation.

Udel® polysulfone polymers possess a number of attributes that are valued by the membrane industry, including excellent mechanical properties, stability at pH levels from 2-13, excellent resistance to caustic and good resistance to moderate concentrations of chlorine. They feature low levels of extractible and insoluble materials making them suitable for drinking water and food contact uses. They may be sterilized using steam, ethylene oxide and e-beam radiation.

Udel® P-3500 LCD MB series polymers are available in various narrow molecular weight range grades, as shown below. Each grade features reduced levels of cyclic dimer compared to the previous grade, P-3500 NT 11. This can be important in solution processing applications such as membrane production, as it leads to improved dope solution stability and reduced equipment fouling.

The Udel® P-3500 LCD MB series polymers are soluble in commercially available, water-miscible, dipolar, aprotic solvents, such as dimethylacetamide (DMAC), dimethylformamide (DMF), and N-methylpyrrolidone (NMP). These materials offer membrane producers very good control of pore size and pore size distribution, high membrane strength, and good film-forming properties.

- Udel P-3500 LCD MB3
- Udel P-3500 LCD MB7

### General

| | | |
|---|---|---|
| Material Status | • Commercial: Active | |
| Availability | • Asia Pacific<br>• Europe | • Latin America<br>• North America |
| Features | • Acid Resistant<br>• Alcohol Resistant<br>• Alkali Resistant<br>• Chemical Resistant | • Good Toughness<br>• High Heat Resistance<br>• Hydrocarbon Resistant<br>• Hydrolytically Stable |
| Uses | • Membranes | |
| Agency Ratings | • FDA 21 CFR 177.1655<br>• ISO 10993 | • JHOSPA |
| RoHS Compliance | • RoHS Compliant | |
| Appearance | • Natural Color | |
| Forms | • Pellets | |
| Processing Method | • Cast Film<br>• Injection Molding | • Solution Processing |

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| Physical | Typical Value | Unit | Test method |
|---|---|---|---|
| Density / Specific Gravity | 1.24 | | ASTM D792 |
| Melt Mass-Flow Rate (MFR) (343°C/2.16 kg) | 4.0 | g/10 min | ASTM D1238 |
| Molding Shrinkage - Flow | 0.70 | % | ASTM D955 |
| Water Absorption (24 hr) | 0.30 | % | ASTM D570 |
| Molecular Weight | | | |
| P-3500 LCD MB3 | 78000 to 84000 | g/mol | |
| P-3500 LCD MB7 | 77000 to 83000 | g/mol | |
| Solution Viscosity[1] | | | |
| P-3500 LCD MB3 | 2.2 to 2.8 | Pa·s | |
| P-3500 LCD MB7 | 2.2 to 2.7 | Pa·s | |

| Mechanical | Typical Value | Unit | Test method |
|---|---|---|---|
| Tensile Modulus | 2480 | MPa | ASTM D638 |
| Tensile Strength (Yield) | 70.3 | MPa | ASTM D638 |
| Tensile Elongation | | | ASTM D638 |
| Yield | 5.5 | % | |
| Break | 50 to 100 | % | |
| Flexural Modulus | 2690 | MPa | ASTM D790 |
| Flexural Strength | 106 | MPa | ASTM D790 |

| Impact | Typical Value | Unit | Test method |
|---|---|---|---|
| Notched Izod Impact | 69 | J/m | ASTM D256 |
| Tensile Impact Strength | 420 | kJ/m² | ASTM D1822 |

| Thermal | Typical Value | Unit | Test method |
|---|---|---|---|
| Deflection Temperature Under Load | | | ASTM D648 |
| 1.8 MPa, Unannealed | 174 | °C | |
| CLTE | | | ASTM D696 |
| Flow | 5.7E-5 | cm/cm/°C | |
| Transverse | 5.7E-5 | cm/cm/°C | |

| Electrical | Typical Value | Unit | Test method |
|---|---|---|---|
| Volume Resistivity | 3.0E+16 | ohms·cm | ASTM D257 |
| Dielectric Strength | 17 | kV/mm | ASTM D149 |
| Dielectric Constant | | | ASTM D150 |
| 60 Hz | 3.03 | | |
| 1 kHz | 3.04 | | |
| 1 MHz | 3.02 | | |
| Dissipation Factor | | | ASTM D150 |
| 60 Hz | 7.0E-3 | | |
| 1 kHz | 1.0E-3 | | |
| 1 MHz | 6.0E-3 | | |

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| Injection | Typical Value | Unit |
|---|---|---|
| Drying Temperature - Desiccant Dryer | 135 to 163 | °C |
| Drying Time - Desiccant Dryer | 2.0 to 4.0 | hr |
| Suggested Max Moisture | < 0.050 | % |
| Processing (Melt) Temp | 350 to 380 | °C |
| Mold Temperature | 138 to 160 | °C |
| Injection Rate | Slow-Moderate | |
| Back Pressure | 1.50 to 3.00 | MPa |
| Screw Compression Ratio | 1.8:1.0 to 2.6:1.0 | |

| Extrusion | Typical Value | Unit |
|---|---|---|
| Drying Temperature | 135 to 163 | °C |
| Drying Time | 4.0 to 8.0 | hr |
| Suggested Max Moisture | < 0.010 | % |
| Melt Temperature | 315 to 370 | °C |

## Notes

Typical properties: these are not to be construed as specifications.

[1] 25 wt% polymer solution in DMAc measured at 40°C and 30s-1 shear rate

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