

# Property comparison and ranking guide

Eastman clear medical grade plastics



Property comparison and ranking guide—Eastman clear medical grade plastics

| Physical comparison                                            | ASTM test method | DuraStar™ polymers |                   |                   | Easar™ copolyester |                   |                   |  |
|----------------------------------------------------------------|------------------|--------------------|-------------------|-------------------|--------------------|-------------------|-------------------|--|
|                                                                |                  | MN611              | MN621             | MN631             | MN058              | MN021             | MN211             |  |
| Physical properties                                            |                  |                    |                   |                   |                    |                   |                   |  |
| Clarity                                                        |                  |                    |                   |                   |                    |                   |                   |  |
| Haze (%)                                                       | D1003            | 0.3                | 0.3               | <1                | <1                 | 1                 | 0.3               |  |
| Transmittance (%)                                              | D1003            | 91                 | 91                | 92                | 82                 | 84                | 91                |  |
| Izod impact strength, notched @ 23°C (73°F), J/m (ft-lbf/in.)  | D256             | 80 (1.5)           | 370 (7.0)         | 80 (1.5)          | 51 (1.0)           | 40 (0.8)          | 101 (1.9)         |  |
| Flexural modulus, MPa (10 <sup>5</sup> psi)                    | D790             | 2000 (2.9)         | 1900 (2.8)        | 1900 (2.7)        | 2400 (3.5)         | 2500 (3.6)        | 2100 (3.0)        |  |
| Elongation @ break (%)                                         | D638             | 300                | 310               | 270               | 90                 | 120               | 110               |  |
| Tensile stress @ break, MPa (psi)                              | D638             | 51 (7400)          | 53 (7700)         | 43 (6300)         | 24 (3500)          | 25 (3600)         | 28 (4100)         |  |
| Tensile stress @ yield, MPa (psi)                              | D638             | 47 (6900)          | 46 (6700)         | 50 (7200)         | 58 (8400)          | 58 (8400)         | 50 (7300)         |  |
| Heat deflection temperature @ 0.455 MPa (66 psi), °C (°F)      | D648             | 74 (165)           | 73 (164)          | 70 (163)          | 69 (156)           | 69 (156)          | 70 (158)          |  |
| Heat deflection temperature @ 1.82 MPa (264 psi), °C (°F)      | D648             | 65 (149)           | 65 (149)          | 66 (150)          | 63 (145)           | 65 (149)          | 63 (145)          |  |
| Specific gravity                                               | D792             | 1.20               | 1.20              | 1.19              | 1.33               | 1.33              | 1.27              |  |
| Vicat softening point, °C (°F)                                 | D1525            | —                  | —                 | 86 (186)          | 80 (176)           | —                 | 85 (185)          |  |
| Thermal glass transition temperature, T <sub>g</sub> , °C (°F) | —                | 87 (189)           | 87 (189)          | 87 (189)          | 80 (176)           | 80 (176)          | 81 (178)          |  |
| Barrier                                                        |                  |                    |                   |                   |                    |                   |                   |  |
| Oxygen                                                         | —                |                    |                   |                   |                    |                   |                   |  |
| Water                                                          | —                |                    |                   |                   |                    |                   |                   |  |
| Processing                                                     |                  |                    |                   |                   |                    |                   |                   |  |
| Drying temperature, °C (°F)                                    | —                | 71 (160)           | 70 (160)          | 70 (160)          | 160 (320)          | 150–160 (300–320) | 71 (160)          |  |
| Drying time, hrs                                               | —                | 3–4                | 3                 | 4                 | 4–6                | 4–6               | 4–6               |  |
| Melt temperature, °C (°F)                                      | —                | 232–277 (450–530)  | 250–290 (480–550) | 230–280 (450–530) | 277–293 (530–560)  | 275–295 (530–565) | 249–271 (480–520) |  |
| Mold temperature, °C (°F)                                      | —                | 16–38 (60–100)     | 15–30 (60–80)     | 15–30 (60–80)     | 16–32 (60–90)      | 10–30 (50–90)     | 16–38 (60–100)    |  |
| Injection speeds                                               | —                | slow to moderate   | slow to moderate  | slow to moderate  | slow to moderate   | slow to moderate  | slow to moderate  |  |
| Product summary                                                |                  |                    |                   |                   |                    |                   |                   |  |
| Sterilization                                                  |                  |                    |                   |                   |                    |                   |                   |  |
| Gamma                                                          | —                |                    |                   |                   |                    |                   |                   |  |
| EtO                                                            | —                |                    |                   |                   |                    |                   |                   |  |
| E-beam                                                         | —                |                    |                   |                   |                    |                   |                   |  |
| Gas plasma                                                     | —                |                    |                   |                   |                    |                   |                   |  |
| Autoclave                                                      | —                |                    |                   |                   |                    |                   |                   |  |
| Joining                                                        |                  |                    |                   |                   |                    |                   |                   |  |
| Solvent bonding                                                | —                |                    |                   |                   |                    |                   |                   |  |
| Ultrasonic bonding                                             | —                |                    |                   |                   |                    |                   |                   |  |
| Laser welding                                                  | —                |                    |                   |                   |                    |                   |                   |  |
| Adhesives                                                      | —                |                    |                   |                   |                    |                   |                   |  |
| Swaging (cold bending)                                         | —                |                    |                   |                   |                    |                   |                   |  |
| Radio frequency welding                                        | —                |                    |                   |                   |                    |                   |                   |  |
| Thermal bonding                                                | —                |                    |                   |                   |                    |                   |                   |  |
| Process                                                        |                  |                    |                   |                   |                    |                   |                   |  |
| Injection molded                                               | —                |                    |                   |                   |                    |                   |                   |  |
| Extrusion blow molded                                          | —                |                    |                   |                   |                    |                   |                   |  |
| Injection blow molded                                          | —                |                    |                   |                   |                    |                   |                   |  |

| Injection molded properties |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|-----------------------------|-------------------|-----------------------------|-------------------|-------------------|-----------------------------|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| rs                          |                   | Eastman Tritan™ copolyester |                   |                   | Eastman Provista™ copolymer | Tenite™ cellulotics  |                   |                   | Ecdel™ elastomers |                   |                   |
| MN006                       | MB002             | MX711                       | MX731             | MX811             | MP002                       | 350A-14 <sup>a</sup> | 360A-7            | 360A-16           | 9965              | 9966              | 9967              |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
| <1.0                        | 1.3               | <1                          | <1                | <1                | 1.3                         | <8.5                 | <8.5              | <8.5              | 1 <sup>b</sup>    | 1 <sup>b</sup>    | 1 <sup>b</sup>    |
| 92                          | 91                | 90                          | 91                | 92                | 91                          | >90                  | >90               | >90               | 93 <sup>b</sup>   | 93 <sup>b</sup>   | 94 <sup>b</sup>   |
| NB <sup>c</sup>             | NB <sup>c</sup>   | 980 (18.4)                  | 860 (16.1)        | 650 (12.2)        | NB <sup>c</sup>             | 416 (7.8)            | 203 (3.8)         | >533 (>10)        | NB <sup>c</sup>   | NB <sup>c</sup>   | NB <sup>c</sup>   |
| 1800 (2.6)                  | 1900 (2.7)        | 1550 (2.25)                 | 1575 (2.28)       | 1585 (2.28)       | 1900 (2.7)                  | 1517 (2.2)           | 1862 (2.7)        | 1241 (1.8)        | 150 (2.2)         | 150 (2.2)         | 150 (2.2)         |
| 330                         | 300               | 210                         | 210               | 140               | 300                         | 40                   | 50                | 45                | 300               | 400               | 400               |
| 54 (7800)                   | 48 (7000)         | 53 (7700)                   | 52 (7500)         | 53 (7700)         | 48 (7000)                   | 37 (5300)            | 41 (5900)         | 30 (4400)         | 20 (2900)         | 22 (3200)         | 23 (3300)         |
| 44 (6300)                   | 47 (6900)         | 43 (6200)                   | 43 (6200)         | 44 (6400)         | 47 (6900)                   | 32 (4600)            | 41 (6000)         | 27 (3900)         | 14 (2030)         | 14 (2030)         | 13 (1900)         |
| 73 (163)                    | 73 (163)          | 99 (210)                    | 94 (201)          | 109 (228)         | 73 (163)                    | 84 (183)             | 92 (198)          | 80 (176)          | 58 (136)          | 58 (136)          | 58 (136)          |
| 64 (147)                    | 63 (145)          | 85 (185)                    | 81 (178)          | 92 (198)          | 63 (145)                    | 76 (169)             | 82 (180)          | 72 (162)          | 46 (115)          | 44 (111)          | 42 (108)          |
| 1.23                        | 1.25              | 1.18                        | 1.18              | 1.17              | 1.25                        | 1.20                 | 1.21              | 1.19              | 1.13              | 1.13              | 1.13              |
| 88(190)                     | 85 (185)          | —                           | —                 | —                 | 85 (185)                    | 100 (212)            | 107 (225)         | 92 (198)          | 170 (338)         | 170 (338)         | 170 (338)         |
| 85 (185)                    | 85 (185)          | 110 (212)                   | 110 (212)         | 120 (248)         | 85 (185)                    | 110 (230)            | 118 (244)         | 97 (207)          | −3 (27)           | −3 (27)           | −3 (27)           |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
| 71 (160)                    | 70 (160)          | 88 (190)                    | 88 (190)          | 88 (190)          | 70 (160)                    | 70 (160)             | 70 (160)          | 70 (160)          | 65 (150)          | 65 (150)          | 65 (150)          |
| 6                           | 4–6               | 4–6                         | 4–6               | 4–6               | 4–6                         | 4                    | 4                 | 4                 | 4                 | 4                 | 4                 |
| 249–271 (480–520)           | 220–235 (430–450) | 260–282 (500–540)           | 260–282 (500–540) | 260–282 (500–540) | 210–225 (415–440)           | 200–225 (390–430)    | 200–225 (390–430) | 200–225 (390–430) | 225–260 (435–500) | 225–260 (435–500) | 225–260 (435–500) |
| 16–38 (60–100)              | 5–32 (40–90)      | 38–66 (100–150)             | 38–66 (100–150)   | 38–66 (100–150)   | 15–40 (60–100)              | 55–60 (130–140)      | 55–60 (130–140)   | 55–60 (130–140)   | 50–80 (120–180)   | 50–80 (120–180)   | 50–80 (120–180)   |
| slow to moderate            | slow to moderate  | slow to moderate            | slow to moderate  | slow to moderate  | slow to moderate            | slow to moderate     | slow to moderate  | slow to moderate  | slow to moderate  | slow to moderate  | slow to moderate  |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |
|                             |                   |                             |                   |                   |                             |                      |                   |                   |                   |                   |                   |



**Eastman Chemical Company  
Corporate Headquarters**

P.O. Box 431  
Kingsport, TN 37662-5280 U.S.A.

Telephone:  
U.S.A. and Canada, 800-EASTMAN (800-327-8626)  
Other Locations, (1) 423-229-2000  
Fax: (1) 423-229-1193

**Eastman Chemical Latin America**

9155 South Dadeland Blvd.  
Suite 1116  
Miami, FL 33156 U.S.A.

Telephone: (1) 305-671-2800  
Fax: (1) 305-671-2805

**Eastman Chemical B.V.**

Fascinatio Boulevard 602-614  
2909 VA Capelle aan den IJssel  
The Netherlands

Telephone: (31) 10 2402 111  
Fax: (31) 10 2402 100

**Eastman (Shanghai) Chemical  
Commercial Company, Ltd. Jingan Branch**

1206, CITIC Square  
No. 1168 Nanjing Road (W)  
Shanghai 200041, P.R. China

Telephone: (86) 21 6120-8700  
Fax: (86) 21 5213-5255

**Eastman Chemical Japan Ltd.**

MetLife Aoyama Building 5F  
2-11-16 Minami Aoyama  
Minato-ku, Tokyo 107-0062 Japan

Telephone: (81) 3-3475-9510  
Fax: (81) 3-3475-9515

**Eastman Chemical Asia Pacific Pte. Ltd.**

#05-04 Winsland House  
3 Killiney Road  
Singapore 239519

Telephone: (65) 6831-3100  
Fax: (65) 6732-4930

[www.eastman.com](http://www.eastman.com)

Material Safety Data Sheets providing safety precautions that should be observed when handling and storing Eastman products are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

*It is the responsibility of the medical device manufacturer ("Manufacturer") to determine the suitability of all component parts and raw materials, including any Eastman product, used in its final product to ensure safety and compliance with requirements of the United States Food and Drug Administration (FDA) or other international regulatory agencies.*

*Eastman products have not been designed for nor are they promoted for end uses that would be categorized either by the United States FDA or by the International Standards Organization (ISO) as implant devices. Eastman products are not intended for use in the following applications: (1) in any bodily implant applications for greater than 30 days, based on FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" tests (including any cosmetic, reconstructive, or reproductive implant applications); (2) in any cardiac prosthetic device application, regardless of the length of time involved, including, without limitation, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems, and ventricular bypass assisted devices; or (3) as any critical component in any medical device that supports or sustains human life.*

*For manufacturers of medical devices, biological evaluation of medical devices is performed to determine the potential toxicity resulting from contact of the component materials of the device with the body. The ranges of tests under FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" include cytotoxicity, sensitization, irritation or intracutaneous reactivity, systemic toxicity (acute), subchronic toxicity (subacute), implantation, and hemocompatibility. For Eastman products offered for the medical market, limited testing information is available on request. The Manufacturer of the medical device is responsible for the biological evaluation of the finished medical device.*

*The suitability of an Eastman product in a given end-use environment is dependent on various conditions including, without limitation, chemical compatibility, temperature, part design, sterilization method, residual stresses, and external loads. It is the responsibility of the Manufacturer to evaluate its final product under actual end-use requirements and to adequately advise and warn purchasers and users thereof.*

DuraStar, Eastar, Eastman, Ecdel, Provista, Tenite, and Tritan are trademarks of Eastman Chemical Company.

© Eastman Chemical Company, 2012.