# Makrolon® LQ2647

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|---|---|
| **Grades / Optical lenses** | MVR (300 °C/1.2 kg) 12 cm³/10 min; optical lens; medium viscosity; UV stabilized; easy release; injection molding - melt temperature 280 - 320 °C; available in clear tints only; safety glasses |
| **ISO Shortname** | ISO 7391-PC,MLR,(,,)-18-9 |

| | Property | Test Condition | Unit | Standard | typical Value |
|---|---|---|---|---|---|
| **Rheological properties** | | | | | |
| C | Melt volume-flow rate | 300 °C/ 1.2 kg | cm³/10 min | ISO 1133 | 12 |
| | Melt mass-flow rate | 300 °C/ 1.2 kg | g/10 min | ISO 1133 | 13 |
| C | Molding shrinkage, parallel | 60x60x2 mm³/ 500 bar | % | ISO 294-4 | 0.7 |
| C | Molding shrinkage, normal | 60x60x2 mm³/ 500 bar | % | ISO 294-4 | 0.75 |
| | Molding shrinkage, parallel/normal | Value range based on general practical experience | % | b.o. ISO 2577 | 0.6 - 0.8 |
| **Mechanical properties (23 °C/50 % r. h.)** | | | | | |
| C | Tensile modulus | 1 mm/min | MPa | ISO 527-1,-2 | 2400 |
| C | Yield stress | 50 mm/min | MPa | ISO 527-1,-2 | 67 |
| C | Yield strain | 50 mm/min | % | ISO 527-1,-2 | 6.1 |
| C | Nominal strain at break | 50 mm/min | % | ISO 527-1,-2 | > 50 |
| | Stress at break | 50 mm/min | MPa | ISO 527-1,-2 | 70 |
| | Strain at break | 50 mm/min | % | b.o. ISO 527-1,-2 | 130 |
| C | Tensile creep modulus | 1 h | MPa | ISO 899-1 | 2200 |
| C | Tensile creep modulus | 1000 h | MPa | ISO 899-1 | 1900 |
| | Flexural modulus | 2 mm/min | MPa | ISO 178 | 2400 |
| | Flexural strength | 2 mm/min | MPa | ISO 178 | 98 |
| | Flexural strain at flexural strength | 2 mm/min | % | ISO 178 | 7.0 |
| | Flexural stress at 3.5 % strain | 2 mm/min | MPa | ISO 178 | 74 |
| C | Charpy impact strength | 23 °C | kJ/m² | ISO 179/1eU | N |
| C | Charpy impact strength | -30 °C | kJ/m² | ISO 179/1eU | N |
| | Charpy impact strength | -60 °C | kJ/m² | ISO 179/1eU | N |
| | Charpy notched impact strength | 23 °C/ 3 mm | kJ/m² | ISO 21305/based on ISO 179/1eA | 70P |
| | Charpy notched impact strength | -30 °C/ 3 mm | kJ/m² | ISO 21305/based on ISO 179/1eA | 14C |
| | Izod notched impact strength | 23 °C/ 3 mm | kJ/m² | ISO 21305/based on ISO 180/A | 70P |
| | Izod notched impact strength | -30 °C/ 3 mm | kJ/m² | ISO 21305/based on ISO 180/A | 15C |
| C | Puncture impact properties - maximum force | 23 °C | N | ISO 6603-2 | 5400 |
| C | Puncture impact properties - maximum force | -30 °C | N | ISO 6603-2 | 6300 |
| C | Puncture energy | 23 °C | J | ISO 6603-2 | 60 |
| C | Puncture energy | -30 °C | J | ISO 6603-2 | 65 |
| | Ball indentation hardness | | N/mm² | ISO 2039-1 | 116 |



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| | Property | Test Condition | Unit | Standard | typical Value |
|---|---|---|---|---|---|
| **Thermal properties** | | | | | |
| C | Glass transition temperature | 10 °C/min | °C | ISO 11357-1,-2 | 144 |
| C | Temperature of deflection under load | 1.80 MPa | °C | ISO 75-1,-2 | 123 |
| C | Temperature of deflection under load | 0.45 MPa | °C | ISO 75-1,-2 | 135 |
| C | Vicat softening temperature | 50 N; 50 °C/h | °C | ISO 306 | 143 |
| | Vicat softening temperature | 50 N; 120 °C/h | °C | ISO 306 | 144 |
| C | Coefficient of linear thermal expansion, parallel | 23 to 55 °C | $10^{-4}$/K | ISO 11359-1,-2 | 0.65 |
| C | Coefficient of linear thermal expansion, normal | 23 to 55 °C | $10^{-4}$/K | ISO 11359-1,-2 | 0.65 |
| C | Burning behavior UL 94 [UL recognition] | 0.75 mm | Class | UL 94 | V-2 |
| | Burning behavior UL 94 [UL recognition] | 2.5 mm | Class | UL 94 | HB |
| C | Oxygen index | Method A | % | ISO 4589-2 | 28 |
| | Thermal conductivity, through-plane | 23 °C; 50 % r. h. | W/(m·K) | ISO 8302 | 0.20 |
| | Resistance to heat (ball pressure test) | | °C | IEC 60695-10-2 | 135 |
| | Relative temperature index (Tensile strength) [UL recognition] | 1.5 mm | °C | UL 746B | 125 |
| | Relative temperature index (Tensile impact strength) [UL recognition] | 1.5 mm | °C | UL 746B | 115 |
| | Relative temperature index (Electric strength) [UL recognition] | 1.5 mm | °C | UL 746B | 125 |
| | Flash ignition temperature | | °C | ASTM D1929 | 480 |
| | Self ignition temperature | | °C | ASTM D1929 | 550 |
| **Electrical properties (23 °C/50 % r. h.)** | | | | | |
| C | Relative permittivity | 100 Hz | - | IEC 60250 | 3.1 |
| C | Relative permittivity | 1 MHz | - | IEC 60250 | 3.0 |
| C | Dissipation factor | 100 Hz | $10^{-4}$ | IEC 60250 | 5 |
| C | Dissipation factor | 1 MHz | $10^{-4}$ | IEC 60250 | 90 |
| C | Volume resistivity | | Ohm·m | IEC 62631-3-1 | 1E14 |
| C | Surface resistivity | | Ohm | IEC 62631-3-2 | 1E16 |
| C | Electrical strength | 1 mm | kV/mm | IEC 60243-1 | 34 |
| C | Comparative tracking index CTI | Solution A | Rating | IEC 60112 | 250 |
| | Comparative tracking index CTI M | Solution B | Rating | IEC 60112 | 125M |
| | Electrolytic corrosion | | Rating | IEC 60426 | A1 |
| **Other properties (23 °C)** | | | | | |
| C | Water absorption (saturation value) | Water at 23 °C | % | ISO 62 | 0.30 |
| C | Water absorption (equilibrium value) | 23 °C; 50 % r. h. | % | ISO 62 | 0.12 |
| C | Density | | kg/m³ | ISO 1183-1 | 1200 |
| | Water vapor permeability | 23 °C; 85 % RH/ 100 µm film | g/(m²·24 h) | ISO 15106-1 | 15 |
| | Gas permeation | Oxygen/ 100 µm film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 670 |
| | Gas permeation | Oxygen/ 25.4 µm (1 mil) film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 2760 |
| | Gas permeation | Nitrogen/ 100 µm film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 120 |
| | Gas permeation | Nitrogen/ 25.4 µm (1 mil) film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 510 |
| | Gas permeation | Carbon dioxide/ 100 µm film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 3800 |
| | Gas permeation | Carbon dioxide/ 25.4 µm (1 mil) film | cm³/(m²·24 h·bar) | b.o. ISO 2556 | 16900 |
| | Bulk density | Pellets | kg/m³ | ISO 60 | 660 |
| **Material specific properties** | | | | | |
| | Refractive index | Procedure A | - | ISO 489 | 1.586 |
| | Haze for transparent materials | 3 mm | % | ISO 14782 | < 0.5 |
| | Luminous transmittance (clear transparent materials) | 1 mm | % | ISO 13468-2 | 89 |
| C | Luminous transmittance (clear transparent materials) | 2 mm | % | ISO 13468-2 | 89 |
| | Luminous transmittance (clear transparent materials) | 3 mm | % | ISO 13468-2 | 88 |
| | Luminous transmittance (clear transparent materials) | 4 mm | % | ISO 13468-2 | > 87 |
| | Abbe value | | | - | 30 |



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| | Property | Test Condition | Unit | Standard | typical Value |
|---|---|---|---|---|---|
| **Processing conditions for test specimens** | | | | | |
| C | Injection molding - Melt temperature | | °C | ISO 294 | 290 |
| C | Injection molding - Mold temperature | | °C | ISO 294 | 80 |
| C | Injection molding - Injection velocity | | mm/s | ISO 294 | 200 |
| **Recommended processing and drying conditions** | | | | | |
| | Melt temperatures | | °C | - | 280 - 320 |
| | Standard Melt temperature | | °C | - | 300 |
| | Barrel Temperatures - Rear | | °C | - | 250 - 260 |
| | Barrel Temperatures - Middle | | °C | - | 270 - 280 |
| | Barrel Temperatures - Front | | °C | - | 280 - 290 |
| | Barrel Temperatures - Nozzle | | °C | - | 290 - 300 |
| | Mold Temperatures | | °C | - | 80 - 120 |
| | Hold Pressure (% of injection pressure) | | % | - | 50 - 75 |
| | Plastic Back Pressure (specific) | | bar | - | 50 - 150 |
| | Peripheral Screw Speed | | m/s | - | 0.05 - 0.2 |
| | Shot-to-Cylinder Size | | % | - | 30 - 70 |
| | Dry Air Drying Temperature | | °C | - | 120 |
| | Dry Air Drying Time | | h | - | 2-3 |
| | Moisture Content max. (%) | | % | - | <= 0,02 |
| | Vent Depth | | mm | - | 0.025 - 0.075 |

**C** These property characteristics are taken from the CAMPUS plastics data bank and are based on the international catalogue of basic data for plastics according to ISO 10350.

Impact properties: N = non-break, P = partial break, C = complete break



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## Disclaimer

Typical value

These values are typical values only. Unless explicitly agreed in written form, the do not constitute a binding material specification or warranted values. Values may be affected by the design of the mold/die, the processing conditions and coloring/pigmentation of the product. Unless specified to the contrary, the property values given have been established on standardized test specimens at room temperature.

General

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance, information and recommendations to determine to your own satisfaction whether our products, technical assistance and information are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by Covestro. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale which are available upon request. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with any claim of any patent relative to any material or its use. No license is implied or in fact granted under the claims of any patent. With respect to health, safety and environment precautions, the relevant Material Safety Data Sheets (MSDS) and product labels must be observed prior to working with our products.

Non Medical and non Food Contact Grade

This product is not designated for the manufacture of a pharmaceutical/medicinal product, medical device or of intermediate products for medical devices1). This product is also not registered for Covestro for the use in other specifically regulated applications, in particular applications requiring regulatory registration, approval or notification (e.g. including cosmetics, plant protection, food processing, food contact and others). If the intended use of the product is for the manufacture of a pharmaceutical, medical device or of intermediate products for medical devices or for other specifically regulated applications which may lead to a regulatory obligation of Covestro, Covestro must be contacted in advance to provide its agreement to sell such product for such purpose. Nonetheless, any determination as to whether a product is appropriate for use in a pharmaceutical, medical device or intermediate products for medical devices or for the use in other specifically regulated applications, must be made solely by the purchaser of the product without relying upon any representations by Covestro, irrespective of the existence of any regulatory obligation for the registration, approval or notification. 1) Please see the "Guidance on Use of Covestro Products in a Medical Application" document.

Recommended Processing and Drying Conditions

Barrel temperatures are valid for a standard 3-zone barrel. Temperature set-up for different barrel types may change according to configuration. Values for hold pressure as percentage of injection pressure may vary depending on, amongst others, part geometry, injection molding machine and injection mold. Drying conditions are for dry air dryers only. Drying times and drying temperatures may differ depending on valid dryer type. Further information is provided by your local Covestro support as well as in the following brochures: Injection Molding of High Quality Molded Parts - Drying; Determining the Dryness of Makrolon by TVI Test; The fundamentals of shrinkage in thermoplastics; Shrinkage and deformation of glass fiber reinforced thermoplastics [...]. https://www.plastics.covestro.com/Library/Overview.aspx

Disclaimer shrinkage data

Shrinkage data is provided as a reference only, and is based on sample plaques molded under specific, controlled processing conditions. Shrinkage rates in production parts can vary and are influenced by several variables such as, but not limited to: part design (e.g. part size, thickness and geometry), mold design (e.g. gate type and location, runner design, mold materials, cooling system), molding conditions (e.g. processing temperature, mold temperature, packing time and pressure, injection speed). We suggest materials be evaluated in existing applicable molds to achieve the most accurate shrinkage estimation for your specific application and processing practices. The final choice of shrinkage is the responsibility of the user of the material, and should be made based on your experience and testing results. We shall not be liable for any damage caused by the use of the shrinkage data as provided by us. If you have any questions, pls consult technical representatives from Covestro.

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