



LG-DOW Polycarbonate



# CALIBRE Polycarbonate Resins

Product Information Guide – Asia Pacific



LG DOW  
Polycarbonate Ltd.,  
– the leading  
polycarbonate  
manufacturer  
providing excellent  
products and  
services.

## CALIBRE™ Polycarbonate Resins

LG DOW Polycarbonate Ltd. (LG-DOW), a joint venture between LG Corporation (former LG Chemical) and The Dow Chemical Company was formed in early 1999.

On July 1, 2001, LG-DOW celebrated the successful start-up of the LG-DOW polycarbonate plant in Yeosu, Korea, and the transfer of Dow's polycarbonate market franchise in Asia Pacific.

Built on the strength and capabilities of the two parent companies, LG-DOW combines the knowledge and experience of these two global plastic leaders with the flexibility to meet the needs of local customers.

In Asia, LG-DOW is uniquely capable of delivering proven polycarbonate technology, the benefits associated with the worldwide CALIBRE™ Polycarbonate brand, and the local logistics flexibility to meet the just-in-time demands of a diverse customer base.

CALIBRE polycarbonate offers an unique balance of impact strength, heat resistance, and optical clarity. Other features include: good dimensional stability, electrical properties and processability. CALIBRE polycarbonate resins have become the best choice for a multitude of applications.

LG-DOW is optimistic about the future of polycarbonate, with its exceptional performance and excellent value. Growth in Asia Pacific should outpace other regions. Therefore, LG-DOW has already built the infrastructure for a second polycarbonate plant at Yeosu and intends to continue investing in capacity expansion to meet the needs of our customers.



## Applications

CALIBRE™ polycarbonate resins have successfully been used in a wide range of markets and applications. For a given application with specialized objectives, LG-DOW's Technical Services & Development team would provide in-depth information and conduct pilot testing to ensure the same performance is achieved at full-scale manufacturing.

In the following sections, you will find the range of CALIBRE grades that are developed for a wide range of applications.

### Appliances

The two groups of CALIBRE polycarbonate grades that are suitable for appliances applications are:

- CALIBRE 201-5, 8, 10, 15 and 22. These polycarbonates feature exceptional practical impact resistance, high heat resistance, and excellent clarity and are suitable for use in fruit mixers / processors, steam pots, control panels, iron water tanks, etc.
- CALIBRE 301V-10, 301EP-22, and 301EP-30 achieve UL94 V2 (1.5 ~ 3.0 mm) ratings to fit the needs of applications such as hair dryers, CD-players, audio, vacuum cleaners etc.

### Automotive

CALIBRE polycarbonate not only satisfies the requirements of lightweight and reliability in continuous service but also offers design flexibility and moldability for forming into complex shapes.

The grade CALIBRE 303-10 complies with the standards stipulated by the regulatory bodies. For instance, it is accepted by the U.S. Automotive Manufacturers Equipment Compliance Agency (AMECA) for meeting the three-year weathering test of the U.S. Society of Automotive Engineers (SAE J576). This test is applicable to optical lenses and reflectors, made of plastics that are used on motor vehicles.

In addition, it also complies with the U.S. Federal Motor Vehicle Safety Standards (FMVSS 571.108) which specifies minimum levels of safety performance.



### Data Storage

To target the optical media industry, LG-DOW works with customers to modify its CALIBRE 1080DVD polycarbonate resins, to meet the requirements of VCD, CD-ROM, CD-R, CD-RW, DVD and DVD-R formats.

The environmental friendly resins CALIBRE 1080DVD resins achieve optimal balance of toughness and flowability, exceptional purity, high clarity and low yellow index.

### Electrical and Electronics

Switches, sockets, plugs, pages, cellular phones, computer housings, etc require low melt viscosity and high toughness polycarbonate resins.

LG-DOW works with customers to produce CALIBRE 301V-10, 301EP-20 and 301EP-30 polycarbonates achieving high clarity, excellent flowability, high heat resistance and high impact strength and UL94 V2 at 1.5 and 3.0 mm to satisfy their needs.

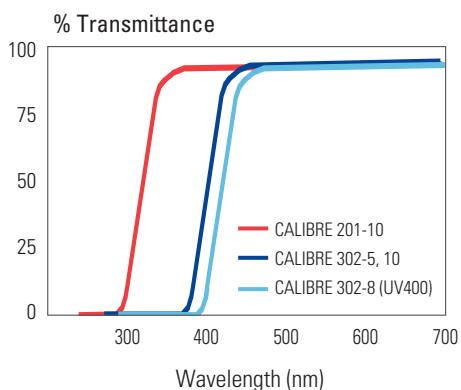




## Eyewear

To protect human eyes, LG-DOW formulates polycarbonates to absorb the harmful ultraviolet (UV) radiations and to meet the requirements of Standards EN 1836:1997 (280~780 nm) and ANSI Z87.1-1989 for ophthalmic applications.

The grades applicable for eyewear are: CALIBRE™ 302-5, 8 and 10. They reach 0% light transmittance below the wavelength of 380 or 400 nm for the specific needs of lens, safety goggles and sunglasses.



## Films and Diffuser Plates

To satisfy the stringent requirements of the extruded films (0.1~0.8 mm), LG-DOW works with customers to formulate CALIBRE 200-8, 10 and 15 polycarbonate achieving ultra-clean conditions with the state-of-the-art filter technology and packaging, high purity and high toughness.



## Housewares

CALIBRE polycarbonate has been widely used in the domestic, commercial and institutional catering markets.

CALIBRE 201-5, 8, 10, 15, 22 and 30 resins comply with the FDA and EU food regulations and offer benefits such as: high impact strength for products that is virtually unbreakable, excellent thermal and dimensional stability allowing repeated washing at high temperatures using hot air and water bath or re-heating of foodstuffs in microwave oven.

## Lighting

CALIBRE polycarbonate is widely used in lighting industries for both outdoor and indoor applications.

CALIBRE 303-10, 15 and 22 with UV stabilizers are most suitable for outdoor applications such as linear fluorescent luminaries, street lamps, traffic lights, and spotlights.

These grades can also be used in indoor applications with other grades to be considered include CALIBRE 301EP-22 and 30 which exhibit fast cycle time through excellent processability.

## Packaging

The use of CALIBRE polycarbonate resins for plastic bottles, feed bottles, caps, cups, disposable carbons, etc. requires glass-like clarity and gloss. This complies with the US Food and Drug Administration (FDA) and European (EU) food contact regulations, and achieves high heat resistance to withstand repeated wash cycles. The cost-effective resins include CALIBRE 201-5, 8, 10, 15 and 22 just fit the needs.

The branched resin CALIBRE 621-2 is tailor-made for the production of high-quality big water bottles with uniform wall thickness. The bottle features its taste neutrality, excellent cleanability and high impact resistance.

## Sheets

CALIBRE 302-5, 7 and 10 resins have been widely used for extruded sheets. The resins achieve critical industry standards for outdoor weatherability and feature consistent ease of processing, excellent surface finish and outstanding impact performance.

The branched resin CALIBRE 603-6 can be readily extruded on conventional equipment for multi- and twin-wall sheets.

## Toys

CALIBRE 201-5, 10, 15 and 22 resins are most suitable for producing a variety of designs for toys. Due to the high clarity and high impact strength, the toys made from these resins are virtually unbreakable.

Most importantly, these resins comply with safety requirements stipulated by the FDA, EU food regulations and the requirements of the EU norm EN71 Part 3.

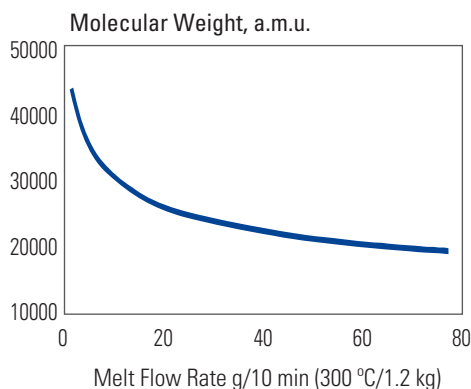
## Attributes

The ability of CALIBRE™ polycarbonate resins to provide unique properties attributes to its molecular structure.

The unique balance of toughness, heat resistance and clarity is the key factor that makes CALIBRE polycarbonate the right choice for a multitude of applications. Precise control of chemical processing and state-of-the-art compounding technology allows LG-DOW to offer many different CALIBRE resins.

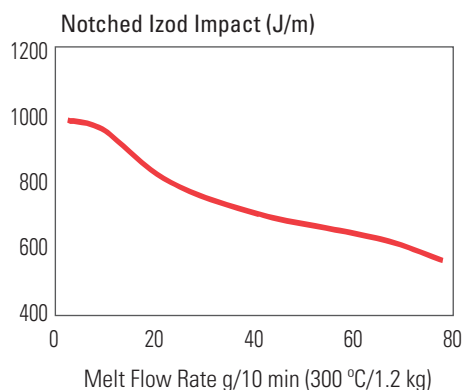
### Molecular Structure

The physical and mechanical properties increase with increasing molecular weight. However, processing becomes more difficult as the melt flow rate decreases. Thus, customers must choose between optimum physical and mechanical properties and high flow characteristics that permit the filling of complex molds.



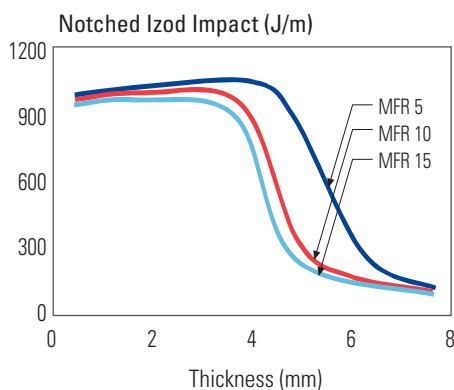
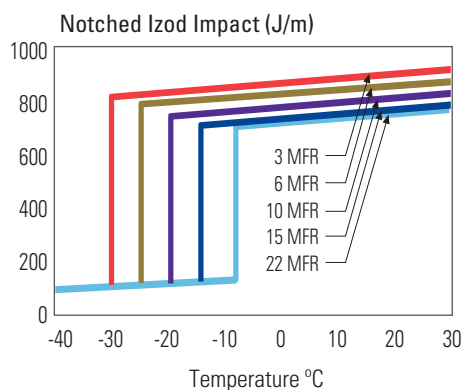
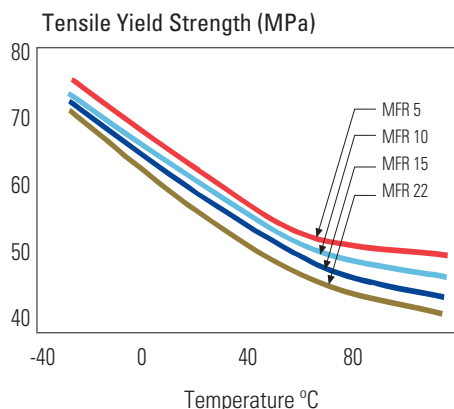
### Impact Strength

CALIBRE resins offer excellent impact resistance. At room temperature, CALIBRE resins do not show brittle behavior but sharp notches, or thick sections may cause a decrease in impact strength at low temperature. For applications requiring optimum impact properties, a low melt flow rate (MFR) material would generally be the best choice. For applications where low temperature impact is not crucial, but optimum processing is a must, a higher MFR material would be the best selection.



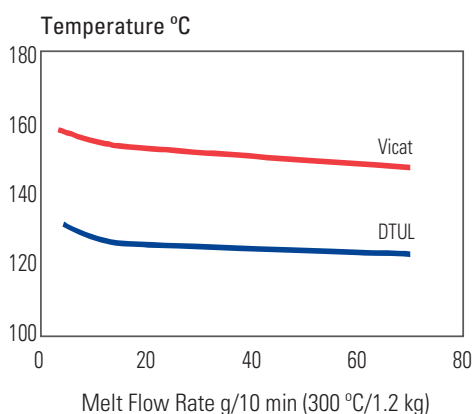
### Tensile Strength

Tensile strength is a measure of the force required to pull it apart, and of the amount of stretching it can withstand before breaking. CALIBRE polycarbonate is among the toughest engineering thermoplastics suitable for various applications that require high impact strength.



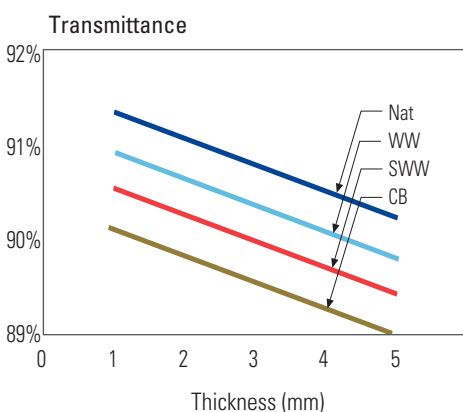
## Thermal Properties

A distinguishing characteristic of CALIBRE™ resins is high heat resistance, i.e. acceptable softening characteristic at elevated temperatures. They are ideal for many parts requiring high thermal stability because of its high heat deflection temperature and a high vicat softening point.



## Optical Properties

The excellent optical properties of CALIBRE polycarbonate allows the use in applications requiring good transparency. CALIBRE resins exhibit water-white clarity with visible light transmission of 87~91% depending on its thickness and base colors (Nat, WW, SWW or CB).



## Electrical Properties

Over a wide temperature range, CALIBRE resins exhibit excellent electrical insulation properties that are not significantly affected by moisture or MFR to make it desirable for electrical and electronic applications.

Basic Electrical Properties at 23° C	
Dielectric Strength (V/mils)	
@ 125 mils (3.18 mm)	410
@ 80 mils (2.03 mm)	530
@ 20 mils (0.50 mm)	1100
Volume Resistivity (Ω-cm)	2.0 x 10 <sup>17</sup>
Surface Resistivity (Ω-cm)	1.88 x 10 <sup>13</sup>
Dielectric Constant @ 10~1 MHz	3.0
Dissipation Factor @ 10~1 MHz	<0.0005~0.0017

## Quality

At every stage of production, LG-DOW ensures identical CALIBRE resins with dependable properties and precision performance. Although Yeosu plant is not ISO certified, LG-DOW follows Dow's practice to implement a comprehensive quality assurance management system.

Quality Assurance Management System	
•	Ensuring identical resins with dependable properties and precision performance through Statistical Quality Control procedures
•	Following Dow's practice to implement a comprehensive management system addressing all aspects of quality as required by ISO 9001:2000
•	Issuing Certificates of Analysis (COA) and Certificates of Compliance to assure product quality within sales specifications
•	Implementing the Quality Management System described in <a href="http://www.dow.com/about/aboutdow/qualinit/index.htm">http://www.dow.com/about/aboutdow/qualinit/index.htm</a>

## Chemical Resistance

The chemical resistance of polycarbonates is dependent on overall stress, which is a combination of part design, fabrication conditions and chemical and physical environments.

Chemical Resistance Ratings at 23° C & 50% RH	
Good	Dilute Acids; Alcohols; Cooling oils; Lubricating oils; Photochemicals; Detergents; Phenols; Acidic Salts; Neutral Salts; Ethylene glycol; Methanol; Ethanol; Motor Oil
Fair-good	Concentrated Acids
Fair	Basic Salts; Gasoline
Poor-Fair	Alkalis; Aliphatic Hydrocarbons
Poor	Chlorinated hydrocarbons; Aromatic hydrocarbons; Esters; Ketones; Zinc Stearate; Acetone; Brake Fluid; Methylene Chloride; Trichloroethane

Good	Little change, CW<1% and CTs<5%
Fair	Long exposure, CW>1% or CTs>5%
Poor	Short exposure, CW>1% and CTs>5%
CW:	Change in weight
CTs:	Change in tensile strength

## Processing

CALIBRE™ polycarbonate resins can be successfully processed by injection molding, extrusion, injection stretch blow molding and extrusion blow molding. Extruded sheet or films of CALIBRE resins can be thermoformed. Fast cycling times are possible and scraps can be reground and reused, provided that contamination has not occurred during processing.

### Drying

Hydroscopic CALIBRE polycarbonate absorbs moisture under normal storage conditions. The water reacts with the polymer at normal processing temperatures to cause degradations, resulting in reduction of inherent impact strength and in poor aesthetics of finished parts such as sliver streaks, yellowness and bubbles.

Resins must be pre-dried at 120°C for 4 hours to limit the moisture below 0.02% and the time must be longer for regrind. Excessive drying over 24 hours will not affect the properties of polymers but might decrease release performance. Re-drying is necessary for pre-dried resins being exposed to ambient air longer than 15 minutes.

The dehumidifying dryer must meet requirements below for properly removing moisture.

- Hopper capacity equals 4 times the output/hr of the injection machine.
- Inlet air should have 120°C and dew point < 18°C.
- Airflow equals 1 CFM for every lb/hr of resins.

### Using Regrind

Depending upon the end-use requirement, up to 20% regrind of properly molded parts, sprues and runners from CALIBRE polycarbonate resins can be thoroughly blended and used with virgin resin prior to drying and processing.

#### Using Regrind Guideline

- Including but not limited to color, impact strength, and resin purity are negatively affected by regrind
- Regulatory organizations, e.g. Underwriters Laboratory (UL) may have specific requirement on limiting the amount of regrind
- Under no circumstances should degraded, discolored or contaminated materials be used
- The size of regrind particle should below 8 mm and the amount of fines must be minimized

### Purging and Cleaning

Before and after using CALIBRE polycarbonate resins, the residual polymers from previous run of the processing equipment must be purged thoroughly.

General purpose polystyrene (GPPS) and acrylic resins (PMMA) are commonly used material to flush the barrel. Nylon (PA) and ABS should not be used.

Mechanical cleaning on flights of a dismantled screw with brass brush/knife and rotary-type brush is necessary to eliminate profound black specs.

### Injection Molding

The chrome-plated but the flight lands and highly polished screw are preferred. The L/D ratio should be 18:1~22:1 but L/D > 22:1 can lead to resin degradation. The optimum shot size to fill the mold cavity should be 40~60% of the barrel capacity. Too large or too small a capacity may cause product yellowness or short-shot issues, respectively. A compression ratio of 2:1~3:1 is commonly used. The rapid transition type is not recommended because of localized shear heat generation.

The optimum *cycle time* requires fast filling, hold time just enough for gate freeze and cooling time (depending on wall thickness) just long enough for ejector not to penetrate the part.

Too high the *injection pressure* may not fill the mold but too low may over pack it.

High *speed* filling minimizes weld lines, flow lines and mold-in stress but excessive speed causes jetting, silver streaks and gate blush. Thin parts require rapid filling but very slow for thick parts to avoid bubbles.



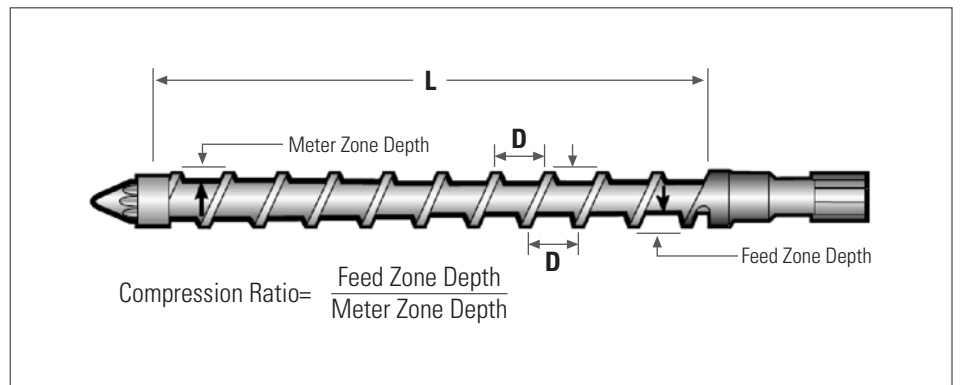
Too little *cushion* may cause screw bottom out and prevent packing. Too much may cause longer time and degradation. Its fluctuation indicates screw slippage or backflow through the non-return valve.

Adequate *back pressure* improves melt uniformity and color consistency through shear heating. Too low can cause inconsistent feeding and trapped air. Too high can cause thermal damage.

Higher *screw speed* can overheat and degrade resins. Too low leads to longer cycles and poor shear heating.

Lower *mold temperature* creates molded-in stress. Too high causes poor surface finish or lengthens cycles.

*Decompression* or such back can correct drooling but inadequate can cause splay.



MFR (g/10min)		5	10	15	22	30	80		
Temperature (°C)	Zone						CD	CD-R	DVD
	Feed	270-290	260-275	255-270	250-265	245-260	280-300		
	Rear	280-300	270-285	265-280	260-270	255-265	270-310		
	Middle	290-320	280-295	275-290	270-280	265-275	300-320		
	Front	290-320	280-295	275-285	270-280	265-275	310-340		
	Nozzle	285-315	275-290	270-285	265-275	260-270	310-330		
Machine Conditions	Mold	80-110	70-100	65-95	60-95	60-95	65	110	95
	Pressure	Injection	70-140 MPa						
		Holding	50-70% of Injection Pressure						
		Back	30-100 MPa				1-6 MPa		
	Clamping	0.5-0.8 MT/cm <sup>2</sup>				2-50 Ton			
	Injection Speed	Moderate to Fast				50-180 mm/s			
	Cushion (mm)	3-6				1-3			
	Stroke (mm)	30-300				30	30	16	
	Cooling Time (s)	5-40				2	4	2.5	
Screw Speed	50-75 RPM				100-400 RPM				

## Injection Stretch Blow Molding (ISBM)

Since the ISBM provides tight neck tolerances, excellent clarity and no generation of scraps, it is commonly used to produce containers ranging from a few *ml* to 18l with the standard resins of MFR 3 ~ 15 g/10min such as CALIBRE 261WB-3 and the branched resins CALIBRE 621-2.

The procedure involves injection molding a parison, then blowing the finished article in a second mold.

Injection Stretch Blow Molding		
	Zone	
Temperature (°C)	Feed	270~280
	Middle	280~295
	Front	280~295
	Nozzle	280~295
	Die	60~80
Air P kg/cm <sup>2</sup>	1st stage	0.8~2
	2nd stage	8~10
	Sprue	295~300
	Gate	290~295

## Extrusion

The extruder is generally a 3-zone screw coated with universal corrosion protection with L/D ration of 25~33 and compression ratio of 2.5:1~3:1. Since the long screw is equipped with a vent zone for vacuum degassing like moisture, pre-drying is sometimes not necessary.

Low MFR resins that help produce well-mixed, homogeneous melts are particularly suited for sold sheets or for multi-layer coextruded sheets. High quality films are normally extruded in a clean room from high purity resins. Multi-wall sheets are generally made from high melt strength branched resins or specially formulated resin like CALIBRE 303-7.

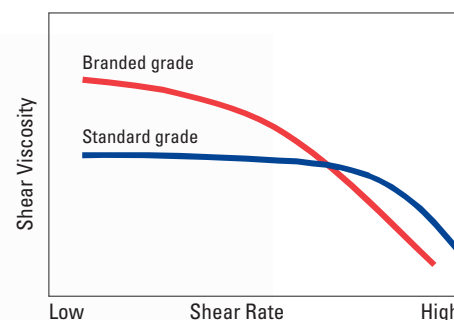
Extrusion Temperature (°C)	
Zone	
Feed	290~300
Compression	285~295
1st metering	270~290
Vent/Compression	260~280
2nd metering	270~290
Adapter	280~285
Die	260~295
Chill Roll (solid sheet)	120~150
Anneal Chamber (multi-wall sheet)	60~80

## Extrusion Blow Molding (EBM)

Small articles are generally made from low MFR resins (MFR 5~15 g/10 min). To make large articles like 18l water bottles, branched resins that exhibit high melt strength are required since the parison emerged from the die is freely suspended.

It has to bear its own weight without sagging. At low blowing pressure, low viscosity is desirable to form all the details of the article such as surface texture or identification letters of the mold. Typical polycarbonate resins for these applications include CALIBRE 621-3 or CALIBRE 261WB-3.

Extrusion Blow Molding		
	Zone	
Temperature (°C)	Feed	250~265
	Compression	245~260
	Metering	240~255
	Accumulator	230~260
	Die	230~260
	Mold	Bottom
Body		60~80
Neck		50~65
Screw Speed (RPM)		10~80
Pressure (bar)	Supporting	0.5~1
	Blowing	5~10
Time (s)	Blowing	25~35
	Cycle	35~60



The branched molecule chains display structure viscosity in the low shear-rate range, without notably impairing their low viscosity at higher shear rates.

## CALIBRE™ Polycarbonate Resins Product Selection Guide\*

PROPERTIES <sup>1</sup>		TEST METHOD	UNITS	200-3 <sup>6</sup>	200-8	200-10	200-15	200-22	201-5
Physical	Melt Flow Rate @ 300°C, 1.2 kg	ASTM D 1238	g/10min	3	8	10	15	22	5
	Specific Gravity (Density)	ASTM D 792	kg/m <sup>3</sup>	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200
	Mold Shrinkage	ASTM D 955	mm/mm	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007
	Water Absorptions @ 23°C, 24 hrs	ASTM D 570	%	0.15	0.15	0.15	0.15	0.15	0.15
	Water Absorptions @ equilibrium, 23°C, 50% RH	ASTM D 570	%	0.32	0.32	0.32	0.32	0.32	0.32
Optical	Refractive Index	ASTM D 542		1.586	1.586	1.586	1.586	1.586	1.586
	Light Transmittance	ASTM D 1003	%	89	89	89	89	89	89
	Haze	ASTM D 1003	%	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5
Thermal	Deflection Temperature Under Load (DTUL) <sup>2</sup>	ASTM D 648							
	@0.45 MPa (66 psi), annealed		°C	146	145	144	143	142	146
	@1.82 MPa (264 psi), annealed		°C	143	142	141	140	139	143
	@1.82 MPa (264 psi), unannealed		°C	132	129	128	127	126	132
	Vicat Softening Point, 50°C/hr, 50 N Load	ASTM D 1525	°C	151	150	149	148	147	151
Coefficient of Linear Thermal Expansion @-40-82°C	ASTM D 696	mm/mm/°C	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	
Mechanical	Tensile Yield Strength (50 mm/min)	ASTM D 638	psi MPa	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60
	Ultimate Tensile Strength	ASTM D 638	psi MPa	10,500 72	10,500 72	10,300 71	10,300 71	9,500 66	10,500 72
	Elongation @ Yield	ASTM D 638	%	6	6	6	6	6	6
	Elongation @ Break	ASTM D 638	%	150	150	150	150	120	150
	Tensile Modulus	ASTM D 638	psi MPa	360,000 2,480	350,000 2,410	350,000 2,410	340,000 2,340	340,000 2,340	360,000 2,480
	Flexural Strength	ASTM D 790	psi MPa	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96
	Flexural Modulus	ASTM D 790	psi MPa	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410
	Notched Izod <sup>3</sup> Impact @ 23°C	ASTM D 790	ft-lb/in J/m	18 950	17 900	17 900	16 850	14 750	18 950
	Unnotched Izod Impact <sup>4</sup> @ 23°C	ASTM D 790		No break	No break	No break	No break	No break	No break
	Instrumented Dart Impact, Total Energy @ 23°C	ASTM D 3763	in-lb J	830 94	800 90	770 87	770 87	640 72	830 94
	Rockwell Hardness	ASTM D 785	R Scale M Scale	118 74	118 73	118 73	118 72	118 72	118 74
	Taber Abrasion Resistance – Haze	ASTM D 1044	%	45	45	45	45	45	45
	Electrical	GWT @ 2.0 mm, 5 seconds	IEC 695-2-1	°C	850	850	850	850	850
Ball Indentation Temperature		IEC 598-1	°C	>125	>125	>125	>125	>125	>125
Comparative Tracking Index @ 2.0 mm		IEC 112	V	250	250	250	250	250	250
Dielectric Strength @ 60 Hz		ASTM D 149	V/mil	17	17	17	17	17	17
Dissipation Factor @ 60 Hz		ASTM D 150		0.001	0.001	0.001	0.001	0.001	0.001
Volume resistivity @ 23°C, dry		ASTM D 257	Ω-cm	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>
Ignition Resistance	Flammability <sup>5</sup> @ 0.44 mm	UL94							
	Flammability @ 0.75 mm	UL94							
	Flammability @ 1.5 mm	UL94		HB	HB	HB	HB	HB	HB
	Flammability @ 3.0 mm	UL94		HB	HB	HB	HB	HB	HB
	Limiting Oxygen Index	ASTM D 2863	%	26	26	26	26	26	26
	Average Extent of Burning	ASTM D 635	in mm	1 25	1 25	1 25	1 25	1 25	1 25

1. Typical properties, not to be construed as specifications

2. 0.157" (4 mm)

3. 0.125" (3.2 mm); 0.01" (0.25 mm) notch

201-8	201-10	201-15	201-18	201-22	201-30	302-5	302-7	302-8 (UV400)	302-15	303-7
8	10	15	18	22	30	5	7	8	15	7
1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200
0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007
0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586
89	89	89	89	89	89	89	89	89	89	89
0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5
145	144	143	143	142	139	146	145	145	143	145
142	141	140	140	139	136	143	142	142	140	142
129	128	127	127	126	122	132	129	129	127	129
150	149	148	148	147	144	151	150	150	148	150
68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>
8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60
10,500 72	10,300 71	10,300 71	9,900 69	9,500 66	8,840 61	10,500 72	10,500 72	10,500 72	10,300 71	10,500 72
6	6	6	6	6	6	6	6	6	6	6
150	150	150	150	120	120	150	150	150	150	150
350,000 2,410	350,000 2,410	340,000 2,340	340,000 2,340	340,000 2,340	340,000 2,340	360,000 2,480	350,000 2,410	350,000 2,410	340,000 2,340	350,000 2,410
14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96
350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410
17 900	17 900	16 850	15 800	14 750	13 700	18 950	17 900	17 900	16 850	17 900
No break	No break	No break	No break	No break	No break	No break	No break	No break	No break	No break
800 90	770 87	770 87	700 80	640 72	- -	830 94	800 90	800 90	770 87	800 90
118 73	118 73	118 72	118 72	118 72	- -	118 74	118 73	118 73	118 72	118 73
45	45	45	45	45	45	45	45	45	45	45
850	850	850	850	850	850	850	850	850	850	850
>125	>125	>125	>125	>125	>125	>125	>125	>125	>125	>125
250	250	250	250	250	250	250	250	250	250	250
17	17	17	17	17	17	17	17	17	17	17
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
26	26	26	26	26	26	26	26	26	26	26
1 25	1 25	1 25	1 25	1 25	1 25	1 25	1 25	1 25	1 25	1 25

4. 0.125" (3.2 mm); 8000 ipm (203 m/min)

5. UL94 file: E306922

6. When used unmodified for the manufacture of food contact articles, CALIBRE™ 200, 201 and 621 Series polycarbonate resins comply with the U.S. Food, Drug, and Cosmetic Act and Food Additive Regulations 21 CFR 177.1580 and E. U. Food Contact Regulations.

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303-10	303-15	301V-7	301V-10	301EP-22	301EP-30	303EP-22	2061-15	MEGARAD 2081-15	261WB-3	1080DVD
10	15	7	10	22	30	22	15	15	3	70
1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200	1.2 1,200
0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007	0.005-0.007
0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586	1.586
89	89	89	89	89	89	89	89	89	89	89
0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5	0.7-1.5
144	143	145	144	142	139	142	143	-	146	-
141	140	142	141	139	136	139	140	-	143	137
128	127	129	128	126	122	126	127	122	132	124
149	148	150	149	147	144	147	148	147	151	147
68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>	68 x 10 <sup>-6</sup>
8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60	8,700 60
10,300 71	10,300 71	10,500 72	10,300 71	9,500 66	8,840 61	9,500 66	10,300 71	9,800 67	10,500 72	7,000 48
6	6	6	6	6	6	6	6	6	6	6
150	150	150	150	120	120	120	150	150	150	60
350,000 2,410	340,000 2,340	350,000 2,410	350,000 2,410	340,000 2,340	340,000 2,340	340,000 2,340	340,000 2,340	320,000 2,210	360,000 2,480	334,000 2,300
14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,000 96	14,500 100
350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	350,000 2,410	363,000 2,500
17 900	16 850	17 900	17 900	14 750	13 700	14 750	16 850	14 750	18 950	5 270
No break	No break	No break	No break	No break	No break	No break	No break	No break	No break	No break
770 87	770 87	800 90	770 87	640 72	- -	640 72	770 87	720 81	830 94	830 94
118 73	118 72	118 73	118 73	118 72	- -	118 72	118 73	118 73	118 74	124 58
45	45	45	45	45	45	45	-	-	45	-
850	850	850	850	850	850	850	-	-	850	-
>125	>125	>125	>125	>125	>125	>125	-	-	>125	-
250	250	250	250	250	250	250	-	-	250	-
17	17	17	17	17	17	17	17	17	17	-
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-
2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	2.0 x 10 <sup>17</sup>	-
										-
HB	HB	V2	V2	V2	V2	V2	-	-	HB	-
HB	HB	V2	V2	V2	V2	V2	-	-	HB	-
26	26	26	26	26	26	26	-	-	26	-
1	1	1	1	1	1	1	-	-	1	-
25	25	25	25	25	25	25	-	-	25	-

\* NOTICE: This information is presented in good faith, and is believed to be accurate, but no warranty, express or implied, is given nor is freedom from any patent owned by The Dow Chemical Company or by others to be inferred. Inasmuch as any assistance furnished by LG DOW Polycarbonate Ltd. with reference to the proper use and disposal of its products is provided without charge, LG-DOW assumes no obligation or liability therefor.

## Products

CALIBRE™ polycarbonate resins are grouped into different series based on key performance attributes. They are tinted into Q30003, IC03003, IC030004 and IC030008 base colors. LG-DOW offers them in 25 kg, 700 kg, 1000 kg and bulk packages.

### Code Designations

CALIBRE 201-10		
Series	Additives	MFR (g/10 min)
200 Food contact grade	0 No additives	3~5 High viscosity
300 General-purpose grade	1 MRA	7~10 Medium viscosity
600 Branched grade	2 UV stabilizer	15~22 Low viscosity
700 Ignition-resistant grade	3 MRA + UV stabilizer	30~80 Very low viscosity
1000 Optical storage grade		

### CALIBRE 200 and 201 Series

#### Food Contact Approved Resins

These resins comply with the US Food and Drug Administration (FDA) and EU food contact regulations. CALIBRE 200 features exceptional clean with special packaging for making PC films and diffuser plates of LCD.

### CALIBRE 301EP Series

#### Resins with superior processability

The resin offers a balance of easy processing and impact strength for complex and thin-part applications such as media housing, appliances, keypads of mobile phones, etc.

### CALIBRE 301V Series

#### Ignition Resistance UL94 V-2

The resin achieves V-2 at 1.5 and 3.0 mm thick while retaining excellent optical and physical properties. Applications include switches, circuit breakers, sockets, hairdryers, etc.

### CALIBRE 302 and 303 Series

#### Resins for outdoor and lens applications

The 302 resin is supplied with UV stabilizer and 303 with UV stabilizer plus mold release package. Applications include appliances, extruded sheets, lighting, lens, automotive, etc.

### CALIBRE 600 Series

#### High Melt Strength

The branched resins achieve high melt strength while retaining similar impact strength. It is ideal for multi-wall and profile sheets, and large blow molded items like water bottles.

### CALIBRE 700 Series

#### Ignition Resistance UL94 V-0

These enhanced resins reach V-0 at 3.0 mm thick while maintaining optical and physical properties. They are well suited for use in electronic, optical, appliance, and transportation applications.

### CALIBRE 800 Series

#### Superior Ignition Resistance UL94 5VA

These resins reach V-0 at 1.6 mm and 5VA at 3.2 mm. They are typically used in electronic, business equipment, appliance and transportation applications.

### CALIBRE 1080DVD

#### Optical Media Resins

It is a high flow and high purity resins for optical media industry to make CD-ROM, CD-R, CD-RW and DVD.

### CALIBRE 2000 Series

#### Health Care Resins

This resins are used in applications involving steam or ethylene oxide sterilization – though suitability for use is dependent upon autoclave cycle times and temperatures. Product is USP Class VI compliant.

MEGARAD resins provide end users of radiation sterilized medical devices a color close to the water clear look of natural resins.

## Safety and Handling Considerations

Material Safety Data (MSD) sheets for CALIBRE™ polycarbonate resins are available from LG DOW Polycarbonate Ltd. MSD sheets are provided to help customers satisfy their own handling, safety and disposal needs, and those that may be required by locally applicable health and safety regulations, such as OSHA (U.S.A.), MAK (Germany), or WHMIS (Canada). MSD sheets are updated regularly, therefore, please request and review the most current MSD sheet before handling or using any product. The following comments are general and apply only to CALIBRE polycarbonate resins as supplied. Various additives and processing aids used in fabrication and other materials used in finishing steps have their own safe use profile and must be investigated separately.

### Hazards and Handling Precautions

CALIBRE polycarbonate resins have a very low degree of toxicity and under normal conditions of use should pose no unusual problems from ingestion, eye or skin contact. However, caution is advised when handling, storing, using, or disposing of these resins and good housekeeping and controlling of dusts are necessary for safe handling of product. Workers should be protected from the possibility of contact with molten resin during fabrication. Handling and fabrication of plastic resins can result in the generation of vapors and dusts. Dusts resulting from sawing, filing, and sanding of plastic parts in post-molding operations may cause irritation to eyes and the upper respiratory tract. In dusty atmospheres, use an approved dust respirator. Pellets or beads may present a slipping hazard. Good general ventilation of the polymer processing area is recommended. Processing may release fumes that may include polymer fragments and other decomposition products. Fumes can be irritating. At temperatures exceeding melt temperature, polymer fragments can occur. Processing improperly dried resin can result in the production of bisphenol A. Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations. Use safety glasses. If there is a potential for exposure to particles, which could cause mechanical injury to the eye, wear chemical goggles. If vapor exposure causes eye discomfort, use a full-face respirator. No other precautions other than clean body covering clothing should be needed for handling CALIBRE polycarbonate resins. Use gloves with insulation for thermal protection, when needed.

### Medical Application Policy

LG DOW Polycarbonate Ltd. will not knowingly sell or sample any products into any commercial or developmental application that is intended for:

- Long-term contact with internal body fluids or internal body tissues (long-term is a use which exceeds 72 continuous hours);
- Use in cardiac prosthetic devices regardless of the length of time involved (cardiac prosthetic devices include, but are not limited to: pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems, and ventricular bypass assisted devices);
- Use as a critical component in medical devices that support or sustain human life; or
- Use specifically by pregnant women or in applications designed specifically to promote or interfere with human reproduction.

In addition, for LG-DOW products, new business opportunities require a business assessment prior to sale or sampling of LG-DOW products. Authorized distributors and resellers will adhere to the LG-DOW medical policy.

LG-DOW does not endorse or claim suitability of its products for specific medical applications. It is the responsibility of the medical device or pharmaceutical manufacturer to determine that the LG-DOW product is safe, lawful, and technically suitable for the intended use. **LG-DOW MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE SUITABILITY OF ANY LG-DOW PRODUCT FOR USE IN MEDICAL APPLICATIONS.**

If products are described as "experimental" or "developmental": 1) product specifications may not be fully determined; 2) analysis of hazards and caution in handling and use are required; and 3) there is greater potential for LG-DOW to change specifications and/or discontinue production.

### Combustibility

Although CALIBRE polycarbonate resins may contain ignition resistant chemical additives, these resins will burn and, once ignited, may burn rapidly under the right conditions of heat and oxygen supply. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or by other ignition sources. When suspended in air, dust can pose an explosion hazard. Dense black smoke is produced when product burns. Toxic fumes are released in fire situations. Fire fighters should wear positive-pressure, self-contained breathing apparatus and full protective equipment. Water or water fog is the preferred extinguishing media. Foam, alcohol resistant foam, carbon dioxide, or dry chemicals may also be used. Soak thoroughly with water to cool and prevent re-ignition.

### Disposal

**DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER.** For unused or uncontaminated material, the preferred options include sending to a licensed recycler, reclaimer, incinerator or other thermal destruction device. **LG DOW POLYCARBONATE LTD. HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN THE MSD SHEET COMPOSITION SECTION.** For used or contaminated material, the disposal options remain the same, although additional evaluation is required (see, for example, in the U.S.A., 40 CFR, Part 261, "Identification and Listing of Hazardous Waste"). All disposal methods must be in compliance with Federal, State/Provincial, and local laws and regulations.

### Environment

Generally speaking, in the environment, lost pellets are not a problem except under unusual circumstances - when they enter the marine environment. They are inert and benign in terms of their physical environmental impact, but if ingested by waterfowl or aquatic life, they may mechanically cause adverse effects. Spills should be minimized and they should be cleaned up when they happen. Plastics should not be discarded into the ocean or any other body of water.

### Product Stewardship

LG DOW Polycarbonate Ltd. has a fundamental concern for all, who make, distribute and use its products, and for the environment in which we live. This concern is the basis of our Product Stewardship philosophy, by which we assess the health and environmental information on our products and then take appropriate steps to protect employee and public health and the environment. Our Product Stewardship program rests with every individual involved with LG-DOW products from initial concept and research to the manufacture, sale, distribution, and disposal of each product.

### Customer Notice

LG-DOW encourages its customers and potential users of LG-DOW products to review their applications for such products from the standpoint of human health and environmental quality. To help ensure that LG-DOW products are not used in ways for which they are not intended or tested, LG-DOW personnel will assist customers in dealing with ecological and product safety considerations. Your LG-DOW sales representative can arrange the proper contacts. LG-DOW literature, including Material Safety Data sheets, should be consulted prior to the use of LG-DOW products. These are available from your LG-DOW representative.

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