



**GEVACRIL** THE ACRYLIC SPECIALIST

○ ● ■ Cast and Extruded Acrylic Tubes, Rods, Bars, Balls ■ ● ○

## Polycarbonate tubes – technical properties

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## Preface

Extruded polycarbonate tubes are polymerized plastic semi-finished products. They are manufactured through extrusion. After the production process they are clear and bright on both the internal and external wall. They have the same thermo-plastic features of extruded polycarbonate sheets<sup>1</sup>. That is to say:

- clearness: a transparency of 92%;
- brightness of the walls: very good transmittance of the light (88,0%);
- good resistance to weather conditions and corrosion;
- good chemical resistance<sup>2</sup>;
- good break resistance,
- high temperature resistance,
- high dimensional stability.

## 1 Technical properties

The most important technical characteristics which are analytical described in the following chapters are to find also in the table 2 of § 1.4.

### 1.1 Mechanical properties

The polycarbonate glass is a light stuff: its specific weight is 1,20 g/cm<sup>3</sup>. Thanks to its molecular structure it is a hard but elastic material, it has a high tensile resistance to the traction and to break and at the same time is easy to be manufactured on mechanical tools. Polycarbonated acrylic glass is according to the Rockwell's scale is one of the hardest within the thermo-plastic materials.

### 1.2 Thermic and electric properties

The service temperature of all polycarbonate products is max. 120° C. As the transformation from solid into liquid takes easily place as for the other thermo-plastic materials, mould and form them does not require a lot of energy. The PC glass remains in the solid state until 100° C. The forming temperature is between 160 and 180° C.<sup>3</sup>

Polycarbonate glass is besides a more isolating stuff as glass or rubber; it does not conduct energy. Like all kind of plastics it is an electrostatic material.

<sup>1</sup> Extruded acrylic glass is normally called PLEXIGLAS ® as a trademark of Röhm GmbH, the German firm that invented it

<sup>2</sup> As indicated in the table 1

<sup>3</sup> See § 2.5



## 1.3 Chemical properties

Polycarbonate glass resists to the most common chemical products. It does not resist to alcohol and spirits with more than 30° vol., some solvents and some acids. The table 1 shows the chemical resistance of polycarbonate tubes in PMMA.

**TABLE 1: Chemical resistance of polycarbonated acrylic tubes in PMMA**  
R= resistant; N= non resistant; M= medium resistance

CHEMICAL RESISTENCE							
Acetaldehyde	N	Acetic Acid < 10 %	R	Acetic Acid <30 %	M	Acetic Acid 100%	N
Acetone	N	Ammonium hydroxide	N	Ammonium sulphate	R	Amyl acetate	N
Amyl alcohol	R	Aniline	N	Benzaldehyde	N	Benzene	N
Benzin	R	Benzine 70:30	N	Benzine regular	M	Benzoic acid	N
Borax	R	Brake fluide	N	Bromine, vapourous	N	Butane	R
Butanol	R	Calcium hydroxide	M	Calcium hypochlorite	R	Carbon dioxide	R
Carbon disulphide	N	Carbon tetrachloride	N	Chlorine, gas	M	Chlorine, liquid	N
Chlorobenzene	N	Chloroform	N	Chromic acid	R	Citric acid < 10%	R
Copper sulphate	R	Cyclohexane	N	Cyclohexanol	M	Cyclohexanone	N
Decahydronaphthalene	R	Diethylether	N	Dimethylformamide	N	Dioxane	N
Ethanol 96 Vol.	R	Ethyl acetate	N	Ethylene glycol	R	Formaldehyd <10%	R
Formic acid	M	Fruit juices	R	Glycerin	M	Grease	R
Heptane	R	Hydraulic oil	R	Hydrochloric acid < 20%	R	Hydrochloric acid 37 %	N
Hydrofluoric acid 5%	R	Hydrofluoric acid	N	Hydrogen peroxide 30%	R	Hydrogen sulphide	R
Iron III chloride	R	Lactic acid 10%	R	Magnesium chloride	R	Methanol	N
Methyl ethyl ketone	N	Methyl isobutyl ketone	N	Milk	R	Motor oil	R
Nitric acid <10%	R	Nitric acid 10-20%	M	Nitric acid <20	N	Nitrobenzene	N
nutrient fat (butter)	R	Nutrient fat (margarine)	R	Paraffin oil	R	Perchloroethylene	N
Petroleum	M	Potassium dichromate	R	Potassium hydroxide	N	Potassium nitrate	R
Potassium permanganate	R	Propane	R	Propanol	R	Salad oil	R
Silicon oil	R	Sodium chlorite	R	Sodium hydrogen carbonate	R	Sodium hydroxide	N
Sodium thiosulfate	R	Sulphur dioxide	N	Sulphuric acid <50%	R	Sulphuric acid 70%	M
Sulphuric acid 98%	N	Toluene	N	Trichloroethylene	N	Water	R
Xylene	N	Zinc chlorid	R				



## 1.4 Optical qualities

All polycarbonate products are characterised by a good purity and brightness. PC tubes are one of the plastic materials with the highest light transmittance: 88,0%. This property remains unalterable over years. Light is reflected without any absorption or dispersion: a ray of light that strikes the surface of a tube is completely reflected over the whole surface; for this reason extruded PC is also very good as light conductor. The tubes are UV protected and can be used in indoor and outdoor applications.

## 1.5 Technical properties: synthetic table

TABLE 2: Technical properties

PROPERTY	NORM <sup>4</sup>	UNIT	VALUES
<b>MECHANICAL PROPERTIES</b>			
specific weight	ISO 1183	gr/cm <sup>3</sup>	1,20
water absorption	DIN 53495	%	0,35
flexural strength	ISO 178	MPa	100
tensile strength at break	ISO 527	MPa	-
modulus of elasticity	ISO 527	MPa	3200
elongation at break	ISO 527	%	110
notch impact strength	ISO 179	kJ/m <sup>2</sup>	30
ball indentation hardness (Rockwell)	ISO 2039-1	MPa	110
<b>THERMIC – ELECTRIC PROPERTIES</b>			
Service temperature (without mech. stress)	-	°C	-150 +120
softening temperature (Vicat)	ISO 306	°C	150
coefficient of linear thermic expansion	DIN 53752	mm/m.°C	0,65
thermic conductivity at 20°C	DIN 52612	W/(m*K)	0,21
dielectric constant at 50 Hz	DIN 53483	-	3
dielectric loss factor at 1 MHz	DIN 53483	-	0,008
dielectric strength	DIN VDE 0303	Kv/mm	27
<b>CHEMICAL PROPERTIES</b>			
see table 1 in § 1.3	-	-	-
<b>OPTICAL PROPERTIES</b>			
index of refraction	-	-	-
light transmittance	D 5036	%	88,0
UV transmission			yes
light absorbtion	-	%	-

<sup>4</sup> The norms indicated in this table are taken from: a) DIN (Das Ist Norm): German Society for Standardisation; b) D (or ASTM): American Society for Testing Materials



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## 1.6 Polycarbonate tubes under pressure: synthetic table

TABLE 3: Polycarbonate tubes under pressure

PC TUBES : service pressure at 18 °C							
Outside diameter mm.	Standard length mm.	Packing Unit	Thicknes s				
			1,5	2	3	4	5
10	2000	25	30,00	46,67	105,00	***	***
12	2000	25	***	35,00	70,00	***	***
15	2000	25	***	25,45	46,67	***	***
20	2000	5	***	17,50	30,00	***	***
25	2000	5	***	13,33	22,11	***	***
30	2000	5	***	10,77	17,50	25,45	35,00
38	2000	5	***	8,24	13,13	***	***
40	2000	1	***	7,78	12,35	17,50	23,33
50	2000	1	***	6,09	9,55	13,33	17,50
60	2000	1	***	5,00	7,78	10,77	14,00
70	2000	1	***	4,24	6,56	9,03	11,67
80	2000	1	***	3,68	5,68	7,78	10,00
90	2000	1	***	3,26	5,00	6,83	8,75
100	2000	1	***	2,92	4,47	6,09	7,78
110	2000	1	***	***	4,04	5,49	7,00
120	2000	1	***	***	3,68	5,00	6,36
130	2000	1	***	***	3,39	4,59	5,83
140	2000	1	***	***	3,13	***	5,38
150	2000	1	***	***	2,92	3,94	5,00
200	2000	1	***	***	2,16	2,92	3,68

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