Thermal Properties of Corning Glasses

For the convenience of those interested in the thermal properties of glasses manufactured by Corning, data on some representative glasses are listed in this document.

- The **strain point** represents the extreme upper limit of serviceability for annealed glass. The maximum service temperature will always be below this point.
- The **annealing point** is the temperature, at the upper end of the annealing range, at which the internal stress is reduced to a commercially acceptable value over a short period. In an annealing operation, the glass is slowly cooled from above the annealing point to somewhat below the strain point.
- The **softening point** is the temperature at which a small diameter fiber of the glass will elongate under its own weight. As one moves above this temperature, the glass becomes more workable.
- As a general rule, the **coefficient of expansion** indicates the thermal shock resistance of the glass. The lower the expansion, the greater the resistance of the glass to sudden temperature changes.

1.	**Corning Glass Code**		**0080**	**7740**	**7800**	**7913**	**0211**
2.	**Type**		Soda lime	Boro-silicate	Boro-silicate	96% Silica	Zinc Titanium
3.	**Color**		Clear	Clear	Clear	Clear	Clear
4.	**Principal Use**		Petri dishes	General Labware	Pharma-ceutical	High Temp.	Cover Glass
5.	**Thermal Expansion** Multiply by10^{-7} cm/cm/°C	0 - 300°C.	93.5	32.5	55	7.5	73.8
		25°C. to setting point	105	35	53	5.52	---
6[a].	**Upper Working Temp. for annealed glass** (Mechanical considerations only)	Normal service °C.	110	230	200	900	---
		Extreme service °C.	460	490	460	1200	---
7[b].	**Thermal Shock Resistance** (15x15cm annealed plates) Data are approximate; see footnote[c].	3.2mm thick °C	65	160	---	---	---
		6.4mm thick °C	50	130	---	---	---
		12.7mm thick °C	35	90	---	---	---
8[c].	**Thermal Stress Resistance °C.**		16	54	33	220	---
9.	**Viscosity Data** (These data are subject to normal manufacturing variations.)	Strain point °C.	473	510	521	890	508
		Annealing point °C.	514	560	565	1020	550
		Softening point °C.	696	821	785	1530	720
		Working point °C.	1005	1252	1189	---	1008
10.	**Density g/cm^3**		2.47	2.23	2.34	2.18	2.57
11.	**Young's Modulus** (multiply by 10^3 kg/mm^2)		7.2	6.4	---	6.8	7.6
	Poisson's Ratio		0.22	.20	---	0.19	0.22
12.	**Log$_{10}$ of Volume Resistivity ohm/cm.**	25°C	12.4	15.0	---	17+	---
		250°C	6.4	8.1	7.0	9.7	8.3
		350°C	5.1	6.6	5.7	8.1	6.7
13.	**Dielectric Properties** (1 MHz 20°C)	Power factor %	0.9	0.50	---	---	---
		Dielectric constant	7.2	4.6	---	3.8	6.7
		Loss factor %	6.5	2.6	---	0.15	0.46
14[d].	**Refractive index**		1.512	1.474	1.491	1.458	1.523
15.	**Stress-Optical Coefficient,** (nm/cm)/(kg/mm^2)		277	394	319	---	361

Footnote references:

a) For normal service no breakage from excessive thermal shock is assumed. Extreme service glass will be very vulnerable to thermal shock. Recommendations in this range are based on mechanical stability considerations only. Tests should be made before adopting final designs. These data are approximate only.

b) Based on plunging sample into cold water after oven heating resistance of 100°C (212°F), means no breakage if heated to 100°C (230°F) and plunged into water at 10°C (50°F). Tempered samples have over twice the resistance of annealed glass.

c) Resistance in °C is the temperature differential between the two surfaces of a tube or a constrained place that will cause a tensile stress of 0.7 kg/mm (1000psi) on the cooler surface.

d) Refractive index may be at either the sodium yellow line (589.3nm) or helium yellow line (587.6nm). Values at these wavelengths do not vary in the first three places beyond the decimal point.

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CORNING

Corning Incorporated
Life Sciences

Tower 2, 4th Floor
900 Chelmsford St.
Lowell, MA 01851
t 800.492.1110
t 978.442.2200
f 978.442.2476

www.corning.com/
lifesciences

Worldwide Support Offices

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t 61 2-9416-0492
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LATIN AMERICA
Brasil
t (55-11) 3089-7400
f (55-11) 6845-2236

Mexico
t (52-81) 8313-8400
f (52-81) 8313-8589

Corning Incorporated, One Riverfront Plaza, Corning, NY, 14831-0001 8/08