

## Glass Composition (approximate oxide weight [%])

Oxide Component	Symbol	Corning® 51-V	Corning® 51-D (*)	Corning® 51-L (Amber)	Corning® 33
Silicon Dioxide	SiO <sub>2</sub>	72.0	73.0	69.0	80.0
Boron Oxide	B <sub>2</sub> O <sub>3</sub>	11.5	11.2	10.0	12.7
Aluminium Oxide	Al <sub>2</sub> O <sub>3</sub>	6.8	6.8	6.0	2.6
Calcium & Magnesium Oxide	CaO + MgO	0.7	1.0	1.0	< 0.1
Sodium Oxide	Na <sub>2</sub> O	6.5	6.8	6.0	4.3
Potassium Oxide	K <sub>2</sub> O	2.4	1.2	2.0	0.1
Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	< 600 ppm (**)	< 400 ppm (**)	1.0	< 500 ppm (**)
Barium Oxide	BaO	< 400 ppm (**)	< 400 ppm (**)	1.5	< 400 ppm (**)
Titanium Dioxide	TiO <sub>2</sub>	< 400 ppm (**)	< 300 ppm (**)	3.0	< 400 ppm (**)

(\*) Formulated for closed ampoules / (\*\*) Not introduced in the batch composition

## Chemical Resistance Classifications

Resistance Class	Specification	Corning® 51-V	Corning® 51-D	Corning® 51-L	Corning® 33
Hydrolytic Resistance (Glass Grain)	EP (3.2.1B) / USP <660>	Type I	Type I	Type I	Type I
Hydrolytic Resistance (Glass Grain)	ISO 720	HGA1	HGA1	HGA1	HGA1
Soluble Alkali Test	JP 7.01	Complies	Complies	Complies	Complies
Acid Resistance Class	DIN 12116	Class S1	Class S1	Class S1	Class S1
Alkali Resistance Class	ISO 695	Class A2	Class A2	Class A2	Class A2
ASTM Laboratory Glass Class	ASTM E 438	Class B	–	–	Class A

## Physical Properties

Name	Unit	Corning® 51-V	Corning® 51-D	Corning® 51-L	Corning® 33
Average Linear T.E.C.	10 <sup>-7</sup> K <sup>-1</sup>	54	51	53	32.5
Density	g cm <sup>-3</sup>	2.33	2.34	2.37	2.23
Relative Refractive Index	(number) *	1.49	1.49	1.50	1.47

\* λ at 587.6nm

## Viscosity Curve — Characteristic Temperatures

Name	Viscosity [Poise]	Corning® 51-V	Corning® 51-D	Corning® 51-L	Corning® 33
Working Point	10 <sup>4.0</sup>	1130 °C	1155 °C	1140 °C	1240 °C
Softening Point	10 <sup>7.6</sup>	785 °C	777 °C	765 °C	825 °C
Annealing Point	10 <sup>13.0</sup>	570 °C	555 °C	550 °C	565 °C
Strain Point	10 <sup>14.5</sup>	525 °C	515 °C	515 °C	515 °C

## Heavy Metals / Arsenic / Antimony

## Heavy Metals

Contents of Pb, Cd, Hg, Cr<sup>VI</sup> is below the 100 ppm limit value stated by the US Toxics in Packaging Clearing House (TPCH) and European Parliament and Council Directive Article 11 of 94/62/ EC of 10. Dec. 1994 on packaging and packaging waste with updates 2001/171/EC and 2006/340/EC.

## Arsenic and Antimony

Corning Pharmaceutical Glass does not introduce any arsenic nor antimony in the batch composition of its glasses. Tests performed as per U.S. and European Pharmacopoeia prescriptions on containers made from Corning clear glass tubes give the following results: As = Not detectable; Sb = Not detectable