NSG GROUP

Technical Bulletin

ATS-129
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PROPERTIES OF SODA-LIME SILICA FLOAT GLASS

Modulus of Rupture (MOR): tensile stress at fracture originating in the glass surface, not in the scored and cut glass edge, for 60-Second load duration on weathered, in-service, glass.

Typical Mean MOR (50% Probability of breakage)

6,000 psi	(41 MPa)	Annealed
12,000 psi	(83 MPa)	Heat-Strengthened
24,000 psi	(165 MPa)	Fully Tempered

Typical Design Stress for 0.8% Breakage Probability

2,800 psi	(19 MPa)	Annealed
5,600 psi	(39 MPa)	Heat-Strengthened
11,200 psi	(77 MPa)	Fully Tempered

Modulus of Elasticity (Young's)	10.4×10^6 psi (72 GPa)
Modulus of Rigidity (Shear)	4.3×10^6 psi (30 GPa)
Bulk Modulus	6.2×10^6 psi (43 GPa)
Poisson's Ratio	0.23
Density	156 lb/ft³ (2500 kg/m³)
Coefficient of Thermal Stress	50 psi/°F (0.62 MPa/°C)
Thermal Conductivity at 75°F	6.5 Btu.in/hr.°F.ft² (0.937 W.m/m².°C)
Specific Heat at 75° F	0.21 $Btu/lb_m.°F$ (0.88 kJ/kg.°C)
Coefficient of Linear Expansion (75-575°F)	4.6×10^{-6} in/in.°F (8.3×10^{-6} mm/mm.°C)
	e.g. 200" of glass heated 100 °F expands 0.09"
Hardness (Moh's Scale)	5-6

Pilkington North America, Inc.
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Softening Point (ASTM C 338) 1319°F (715°C)

Pilkington **Optiwhite™** ~732°C Logη = 6.6

Annealing Point (ASTM C336) 1018°F (548°C)

Pilkington **Optiwhite™** ~559°C Logη = 12.0

Strain Point (ASTM C 336) 952°F (511°C)

Pilkington **Optiwhite™** ~526°C Logη = 13.5

Where Logη = Viscosity (Pa.s)

Index of Refraction:

(0.5893 μm, Sodium D Line)	1.523
(1 μm)	1.511
(2 μm)	1.499

Emissivity (Hemispherical) at 75°F 0.84

Stress-Optical Coefficient Stress (psi) = 2.18 x Retardation (μm) **/** thickness (in)

Raw Materials used in Typical Float Glass:

Sand	Soda Ash	Limestone	Dolomite	Salt Cake	Cullet (recycled glass)
SiO_2	Na_2CO_3	$CaCO_3$	$MgCa(CO_3)_2$	Na_2SO_4	

Chemical Analysis:

	SiO_2	Na_2O	CaO	MgO	Al_2O_3	K_2O	SO_3	Fe_2O_3
Typical Clear Float Glass	Silica	Soda	Calcium Oxide	Magnesium	Alumina Oxide	Potassium Oxide		Iron Oxide
	72.6%	13.9%	8.4%	3.9%	1.1%	0.6%	0.2%	0.11%
Pilkington **Optiwhite™**	72.7%	13%	8.8%	4.3%	0.6%	0.4%	0.2%	0.02%

(Iron Oxide aids the melting process and produces the very light green tint seen at the cut edge of a typical clear float glass)

Tinted glass is produced by the addition of small (typically less than 1%) amounts of metal oxides. These small amounts do not change the basic physical properties of the glass, other than the color and solar/optical transmission/reflection.

Ref.: "Glass In Building" by Button & Pye, Butterworth Architecture (Reed International Books), 1993.

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Recycled Materials:

The float glass process recycles virtually all the glass waste from the in-plant production melting and cutting processes. This broken glass, known as cullet, is reintroduced with the raw materials batch mix in the furnace as an aid to melting. It takes half the amount of energy to produce glass from cullet as it does to produce it from raw materials. Float glass contains approximately 20% Cullet (recycled glass).

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