



Technical Bulletin

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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 x 10 ⁶ psi | (72 GPa) |
| Modulus of Rigidity (Shear) | 4.3 x 10 ⁶ psi | (30 GPa) |
| Bulk Modulus | 6.2 x 10 ⁶ psi | (43 GPa) |
| Poisson's Ratio | 0.23 | |
| Density | 156 lb/ft ³ | (2500 kg/m ³) |
| Coefficient of Thermal Stress | 50 psi/°F | (0.62 MPa/°C) |
| Thermal Conductivity at 75°F | 6.5 Btu.in/hr.°F.ft ² | (0.937 W.m/m ² .°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 x 10 ⁻⁶ in/in.°F | (8.3 x10 ⁻⁶ mm/mm.°C) |
| | e.g. 200" of glass heated 100 °F expands 0.09" | |
| Hardness (Moh's Scale) | 5-6 | |

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Softening Point (ASTM C 338) 1319°F (715°C)

Pilkington **Optiwhite**™ ~732°C Log η = 6.6

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

Pilkington **Optiwhite**™ ~559°C Log η = 12.0

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

Pilkington **Optiwhite**™ ~526°C Log η = 13.5

Where Log η = Viscosity (Pa.s)

Index of Refraction:

(0.5893 μ m, Sodium D Line) 1.523

(1 μ m) 1.511

(2 μ m) 1.499

Emissivity (Hemispherical) at 75°F 0.84

Stress-Optical Coefficient Stress (psi) = 2.18 x Retardation (μ m) / thickness (in)

Raw Materials used in Typical Float Glass:

| | | | | | |
|------------------|---------------------------------|-------------------|-------------------------------------|---------------------------------|-------------------------|
| Sand | Soda Ash | Limestone | Dolomite | Salt Cake | Cullet (recycled glass) |
| SiO ₂ | Na ₂ CO ₃ | CaCO ₃ | MgCa(CO ₃) ₂ | Na ₂ SO ₄ | |

Chemical Analysis:

| | SiO ₂ | Na ₂ O | CaO | MgO | Al ₂ O ₃ | K ₂ O | SO ₃ | Fe ₂ O ₃ |
|---|------------------|-------------------|---------------|-----------|--------------------------------|------------------|-----------------|--------------------------------|
| <i>Typical Clear Float Glass</i> | 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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