



BS 6180:2011 [1], section 6.2 still allows provision for permissible stress design, which is the simplest form of determining the expected suitability of glass and glazing subjected to imposed loads. Under permissible stress design, loads provided by BS 6180:2011 are used as working loads.

ALLOWABLE STRESS

Detail on the mechanical properties, failure modes and theoretical strength of glass is provided in a separate document. To simplify the determination of the ability of glass to withstand applied loads, the allowable stresses for glass are predominantly dependent upon the type of glass and the duration of a load, and factored as such.

Within BS 6180:2011, no guidance is provided on glass strength, as such alternative sources, such as German TRLV [2] guidelines can be considered.

STATISTICAL VALUES

Product standards for float glass and processed float glass provide mechanical strength values based on a short-term quasi-static loading, with a 5% probability of breakage (fractile value). The values shouldn't be used for the allowable stress of glass under loading, but do contribute towards the permissible stresses provided, and for limit state design calculations.

Table 1 – Glass types, product standards and mechanical strength

Glass Type	Product Standard	Mechanical Strength (5% Fractile) (N/mm ²)
Soda-Lime-Silicate Glass	EN 572-1	45
Heat Strengthened SLS Float Glass	EN 1863-1	70
Enamelled Heat Strengthened SLS Glass	EN 1863-1	45
Heat Strengthened SLS Patterned Glass	EN 1863-1	55
Thermally Toughened SLS Float Glass	EN 12150-1	120
Enamelled Thermally Toughened SLS Glass	EN 12150-1	75
Thermally Toughened SLS Patterned Glass	EN 12150-1	90

TRLV GUIDANCE

German guidelines TRLV (Technical Rules for the Use of Line Bedded Glazing) [2] provides the following allowable stress limits;

Table 2 – TRLV permissible glass strength values

Glass Type	Permissible Stress (N/mm ²)	
	Vertical Glazing	Overhead Glazing
Thermally Toughened Float Glass	50	50
Thermally Toughened Patterned Glass	37	37
Enamelled Thermally Toughened Float Glass*	30	30
Heat Strengthened Glass	29	29
Enamelled Heat Strengthened Glass*	18	18
Annealed Float Glass	18	12
Annealed Patterned Glass	10	8
Laminated Annealed Float Glass	22.5	15 (25**)

* Permissible stress of enamelled surface.

** Allowable stress of lower laminated pane within an IGU in the even the upper pane has failed.

STRUCTURAL USE OF GLASS

Additional recommendations for allowable stresses are provided in Structural Use of Glass [3], which defines values based on load type and glass type;

Table 3 – IStructE permissible glass strength values

Load Type	Load Example	Glass Type Allowable Stress (N/mm ²)	
		Annealed	Thermally Toughened
Short Term Body Stress	Wind	28*	59
Short Term Edge Stress	Wind	17.8*	59
Medium Term	Snow	10.75	22.7
Medium Term	Floors	8.4	35
Long Term	Self-Weight, Water, Shelves	7	35

* Valid for annealed glass greater than 10 mm nominal thickness. For 6 mm nominal thickness glass, values may be multiplied by 1.4.

REFERENCES

- [1] British Standards Institute, *BS 6180:2011 - Barriers in and about buildings. Code of practice*, BSI, 2011.
- [2] Deutsches Institut für Bautechnik, *Technische Regeln für die Verwendung von linienförmig gelagerten Verglasungen (TRLV)*, DIBt, 2006.
- [3] M. Haldimann, A. Luible and M. Overend, *Structural Use of Glass*, IABSE, 2008.