'Perspex'* cast acrylic sheet and block have properties which are suitable for a wide variety of applications ranging from precision engineering components to domestic and commercial products. They are easy to machine using conventional engineering equipment and can be thermoformed into complicated shapes by inexpensive apparatus.

'PERSPEX' RANGE

Cast 'Perspex' is available in:
A variety of sheet and block sizes and thicknesses up to 130 mm in clear.
Gloss or patterned surfaces.
Transparent and translucent colours in thicknesses up to 6 mm.
Opals of various densities for light diffusion.
Grades for special applications.

GENERAL PROPERTIES

Clarity — Clear 'Perspex' has outstanding transparency.
Weathering resistance — Outstanding in all climates.
Water absorption — Reaches a maximum of 2% after 6 months at 100% relative humidity. At 2% absorption there is a 0.35% increase in dimensions.
Abrasion resistance — Comparable with aluminium.
Weight — Relative density is 1.19. A sheet 300 mm square by 3 mm thick weighs approximately 320g.
Chemical resistance — Good resistance to many common chemicals (see page 16).
Breakage — Good resistance to breakage. Tends not to shatter into multiple fragments.
Burning — Burns in a similar manner to hard wood but produces little smoke. Some special grades do not support burning.

THERMAL PROPERTIES

Maximum service temperature. 80° — 85°C for unstressed flat panels; 75° — 80°C for thermoformed articles.
Shrinkage — about 2% in length and breadth after heating to shaping temperature and cooling.

* ICI trade mark

Linear thermal expansion — 7.3 x 10^{-5} cm/cm °C (= K^{-1}); (about seven times that of steel) or approx. 0.001 inch/foot/°C change in temperature (.75 mm/metre/10°C change in temperature).
Thermal conductivity — 4.5 x 10^{-4} cal cm/cm^2 sec °C (0.19 W/mK).
Specific heat — 0.35 cal/g°C (1.5 kJ/kgK).

OPTICAL PROPERTIES

Refractive index — 1.49 for Sodium D line.
Light transmittance — Clear 'Perspex' — 92%.
Spectral transmission curve — For clear 'Perspex' see Figure 1.

ELECTRICAL PROPERTIES

Surface resistivity — Greater than 10^{14} ohms at 75% rh and 20°C (measured to BS 771).
Electrical strength — 153 kV/cm (measured to BS 771).

MECHANICAL PROPERTIES AND ENGINEERING DESIGN DATA

The mechanical properties of 'Perspex' necessary for engineering design depend on the temperature at which they are measured and the rate at which the 'Perspex' is stressed or strained. The relevant properties are given in Table 1 and 2 and Figure 2.

WORKSHOP PRACTICE

Storage
'Perspex' sheet and block are best stored either vertically or horizontally in cool dry conditions. The material should not be allowed to bow. Ensure that the protective paper remains in place.

Protective papering
Whenever possible the protective papering should be left attached to 'Perspex' to avoid surface damage. It is also useful for marking out shapes before machining. Before 'Perspex' is heated prior to thermoforming, normalising or annealing, or when it is to be cemented or screen printed, the paper must be removed and the sheet washed thoroughly in clean warm soapy water and dried with a clean soft cloth.

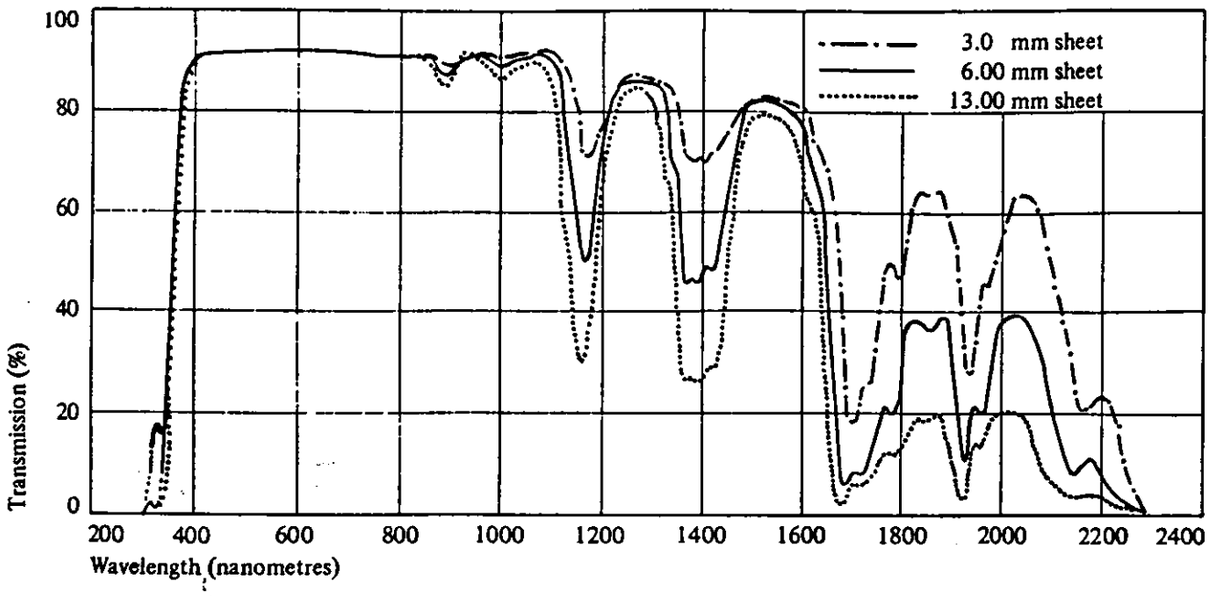

Figure 1. Spectral transmission of clear 'Perspex'

Cleaning

General cleaning is carried out using warm soapy water applied with a soft cloth. If this does not remove foreign matter then paraffin or white spirit may be used. Methylated spirit, paint removers, or other strong solvents or chemicals should not be used.

Static

To remove static, use 'Perspex' Anti-static Cleaner or other approved products.

MACHINING

The machining characteristics of 'Perspex' cast acrylic sheet are similar to those of brass or hard aluminium, but there is one very important difference. This is that 'Perspex' will soften if it is heated to temperatures in excess of 80°C. Therefore the heat generated by the cutting tool must be kept to a minimum. This will also avoid unnecessary stress.

Table 1. Mechanical properties of 'Perspex' at 20°C

Property	Units	Mean value	Standard deviation	Remarks
Tensile strength	kgf/cm^2	840	35	Straining rate: 1% per sec
	MPa	83	3.5	
	lbf/in^2	12 000	500	
Flexural strength	kgf/cm^2	1400	70	
	MPa	138	6.9	
	lbf/in^2	20 000	1000	
Shear strength	kgf/cm^2	800	35	
	MPa	76	3.5	
	lbf/in^2	11 000	500	
Impact strength	J/m notch	17	—	ASTM D 256 — 56 (Izod)
	ft lbf per inch of notch	0.32	—	
Impact strength	J	0.3	—	Falling weight BS 2782 (Method 306B) 3 mm thick. Moduli in flexure, tension and compression substantially the same
	ft lbf	0.2	—	
Young's Modulus in flexure	kgf/cm^2	3.0×10^4	0.1×10^4	
	GPa	2.9	0.1	
	lbf/in^2	4.2×10^5	0.15×10^5	
Pyramid hardness	—	22	—	In accordance with BS 427 ASTM D 785
Rockwell hardness		M90		
Poisson's ratio	—	0.38	—	

Table 2. 'Perspex' design data at 20°C

Property	Units	Short term design (6 hours)	Long term design (10 years)
Tensile strength (unexposed)	kgf/cm^2	170	88
	MPa	17	8.6
	lbf/in^2	2500	1250
Tensile strength (exposed)	kgf/cm^2	140	70
	MPa	14	7
	lbf/in^2	2000	1000
Modulus	kgf/cm^2	2.5×10^4	1.25×10^4
	GPa	2.5	1.25
	lbf/in^2	3.6×10^5	1.8×10^5
Poisson's ratio		0.39	0.40

Coolants
Water, soluble oil, or paraffin. Never use proprietary brands of cutting fluids used for metals, which may contain solvents that could cause crazing in stressed sheet.

Cutting tools
These must be kept sharp, not only to produce a good surface finish, but to minimise the amount of heat generated.

Hand sawing
'Perspex' may be cut using a hacksaw, fretsaw, or other multi-purpose saws provided they are sharp and have fine teeth. Coarse tooth saws and heavy pressures may cause chipping. Preferably clamp the 'Perspex' along the line of the cut.

Power sawing
Band saws, circular saws, jig saws and fretsaws are used in production work. Recommended conditions are given in Table 3. Details of a suitable circular saw are given in Figure 3; high-speed steel (HSS) blades can be used but carbide-tipped (TCT) blades are recommended.

Drilling
Standard twist drills are quite suitable for drilling 'Perspex', as also are many of the drills specially developed for plastics. Standard drills should have zero cutting rake, as shown in Figure 4. The normal point angle is suitable for most drilling except for large holes in thin 'Perspex', where a point of wider angle is recommended to avoid 'grabbing' and consequent breakage. Always clamp the 'Perspex' sheet firmly against a piece of wood or other soft material before

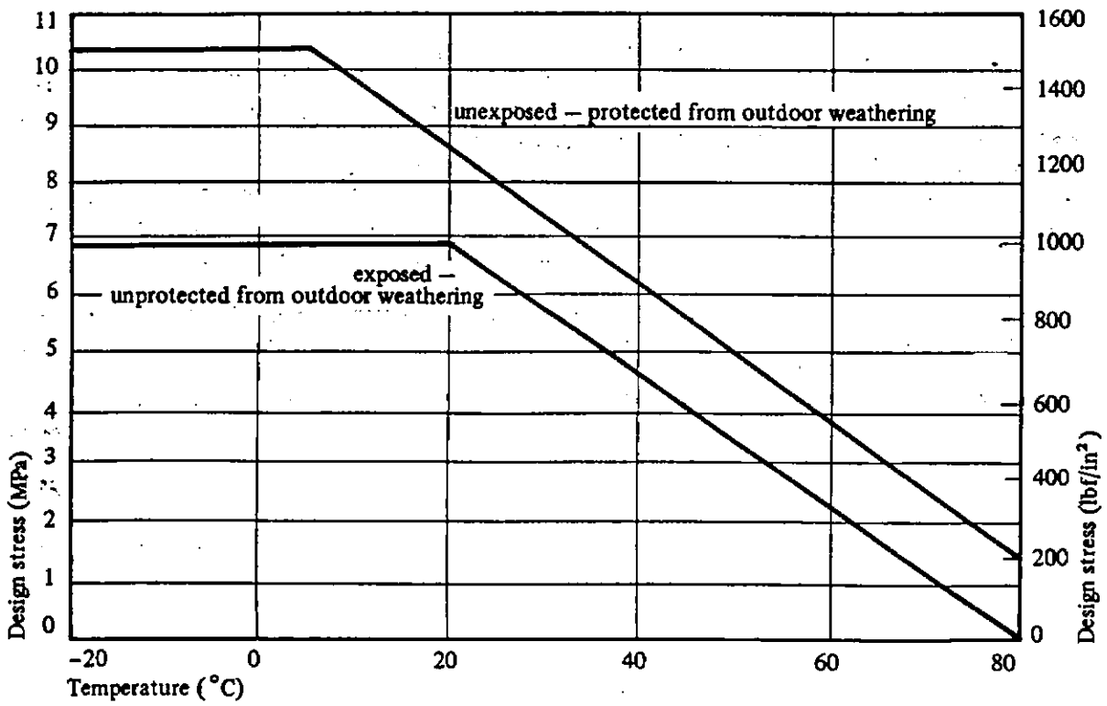

Figure 2. Design stress for 'Perspex' as a function of temperature