

## about: pvc-u

Unplasticised Polyvinylchloride (PVC-U) is one of the oldest and most widely used plastics for piping systems worldwide. It is a versatile material that is used for both pressure and drainage piping systems for above and below ground applications. It has good tensile, flexural and mechanical strength, low moisture absorption, good flammability characteristics, and exceptional dimensional stability.

PVC-U has excellent chemical resistance across its operating temperature range of 0°C to 60°C, with a broad band of operating pressures. PVC-U systems are very cost-effective and typically account for a large proportion of thermoplastic piping installations.

PVC-U systems feature the widest range of pipe sizes, fitting configurations, valve choices and ancillary items compared to all other thermoplastic piping materials.

PVC-U piping systems are joined by solvent cement welding, whilst transition joints can be made using flanges, threaded connections, mechanical fittings, and compression fittings.

PVC-U piping systems are available from IPS in both inch and metric dimensions, according to BS, ASTM and ISO standards. Systems are available in inch sizes up to 24", and metric sizes up to 630mm. Pipes, fittings and valves are available in grey, white and clear PVC-U.



### General properties of PVC-U

PVC-U is thermally stable in the temperature range 0°C to 60°C, however at low temperatures the impact strength of PVC-U decreases. It is therefore not recommended for use at very low temperatures unless there is no likelihood of the piping materials being disturbed or subjected to impact damage. PVC-U is free from toxic metals thus ensuring that it is physiologically harmless for drinking water and foodstuffs applications.

Some important advantages of PVC-U are:

- Extensive choice of component parts
- Wide range of applications
- Good chemical and corrosion resistance
- Safe for potable water applications
- Low friction loss
- Self extinguishing
- High mechanical strength
- Simplified installation techniques using solvent cement welding
- Approved for potable water applications

Properties of PVC-U (Average values)	
Property	Value
Density	1.38 g/cm <sup>3</sup>
Tensile Strength	55 N/mm <sup>2</sup>
Elongation at Break	> 30 %
Impact Strength	No crack kJ/m <sup>2</sup> (23°C)
Modulus of Elasticity (Young's Modulus)	3000 N/mm <sup>2</sup>
Coefficient of Linear Expansion	0.08 mm/m °C
Maximum Operating Temperature	60°C
Minimum Operating Temperature	0°C
Vicat Softening Point	> 76°C (VST/B 50)
Water Absorption	< 4 mg/cm <sup>3</sup>
Surface Resistance	Approx. 10 <sup>13</sup> Ω
Thermal Conductivity	0.140 W/m · K
Flammability	V-0 UL94
Colour	7011 Dark Grey RAL

### Characteristics

#### Chemical resistance

PVC-U has excellent chemical resistance to common industrial chemicals such as acids, bases and salt solutions. Resistance to sodium hypochlorite solutions is also very good. PVC-U is not resistant to aromatic and chlorinated hydrocarbons, solvents, esters and ketones. The chemical resistance should be checked with our technical department for applications involving varnish, oils or fats, and PVC-U is not recommended for use with compressed air or gases.

#### Chemical resistance of solvent cement welded joints

The chemical resistance of the joints in a solvent welded piping system are the same as the material itself. However, PVC-U solvent welded joints in systems handling the following chemicals can be degraded and require the use of Weld On 724 solvent cement to ensure chemical compatibility:

Hydrochloric Acid 25%+ concentration  
 Nitric Acid 20%+ concentration  
 Sulphuric Acid 70%+ concentration  
 Hydrofluoric Acid in any concentration

#### Weathering resistance

With the use of additives such as ultraviolet absorbers, PVC-U systems display excellent weathering resistance to the long-term effects of sunlight, wind and rain. Over time, grey PVC-U will lose some of its colour because of exposure to UV light, and it will have slightly reduced impact strength. In extreme cases, the use of insulation or an application of a UV absorbent coating such as AGRU Coat, or the use of a water or latex based paint will help to minimise the effects of solar radiation. Solvent based paints should not be used on PVC-U piping. For outdoor installations, or where the aesthetic appearance of the piping system is important, a fully matched system of UV stabilised white PVC pipes and fittings is also available.

#### Electrical characteristics

PVC-U is non-conductive, therefore systems will remain free from electrolytic corrosion. Precautions should be taken to avoid static discharge should any part of a PVC-U piping system pass through an area where explosive gases may be present.

#### Physiological characteristics

PVC-U piping systems from IPS are free from lead, cadmium or other poisonous heavy metals. They are suitable for use in contact with cold potable water, and are WRAS listed for this application.

## Pressure ratings for pvc-u systems

### Maximum continuous pressure ratings

Pipes, fittings and valves are designed to operate continuously for 50 years at their maximum rated pressure at 20°C as follows, unless otherwise stated.

#### Inch sizes - ASTM Standard

PVC-U piping systems manufactured in accordance with ASTM requirements use a 'schedule' system of pressure ratings. Pipes are produced in three different 'schedules', 40, 80 & 120. Under this system the pressure rating of the pipe changes according to the pipe nominal bore size. Reference should be made to the pipe availability guide to verify the pressure ratings available for the sizes required.

Unlike pipe, there is presently no industry standard that specifies a working pressure for fittings. Moulded pipe fittings are manufactured to meet the minimum burst pressure requirements to that of schedule 40 and schedule 80 pipe. In common with the pipe, the pressure rating of the fittings decreases as the nominal pipe sizes increases. The advisory pressure ratings for ASTM fittings is as follows:-

Industrial Range		Size Range	Max. Operating Pressure
		1/4" to 12"	15 Bar*
		14" to 24"	10 Bar
	NPT Reinforced Threaded	1/4" to 4"	15 Bar
	NPT Unreinforced Threaded	1/4" to 4"	12 Bar
	* Reduced margin of safety for 10" and 12"		
Standard Range		Size Range	Max. Operating Pressure
		1/2" to 1 1/2"	15 Bar
		2" to 6"	12 Bar
		8"	9 Bar
		10" & 12"	8 Bar
	NPT Reinforced Threaded	1/4" to 4"	12 Bar
	NPT Unreinforced Threaded	1/2" to 4"	10 Bar

#### Inch sizes - European Standard

PVC-U pipes according to BS/EN 1452 (formerly BS 3505/6) and PVC-U fittings according to BS 4346 use the 'class' system of pressure rating their components. Regardless of size, pipes and fittings are rated for use at a maximum working pressure according to the 'class'. Care must be taken to ensure that the integrity of the system is not compromised through the incorrect match of pipes and fittings from different pressure 'classes'. The pressure ratings of inch sized PVC-U pipes and fittings according to the European standard is as follows:-

Pipe	Class	Size Range	Max. Operating Pressure
	PN9 (Class C)	2" to 12"	9 Bar
	PN12 (Class D)	1 1/4" to 6"	12 Bar
	PN15 (Class E)	3/8" to 6"	15 Bar
	Class T	1/2" to 2"	12 Bar
	PN10*	2 1/2" and 5"	10 Bar
	* 2 1/2" and 5" ABS pipes are manufactured to DIN 8062		
Fittings	Type	Size Range	Max. Operating Pressure
	Solvent Socket	10" to 12"	6 Bar
	Solvent Socket	8" to 12"	9 Bar
	Solvent Socket	3/8" to 6"	15 Bar (3" & 4" socket unions 9 Bar)
	BSP Threaded	3/8" to 4"	12 Bar (3" & 4" barrel nipples 9 Bar)
	PN10*	2 1/2" and 5"	10 Bar
	* 2 1/2" and 5" ABS fittings are manufactured to DIN 8063		

#### Metric sizes

The pressure ratings for PVC-U pipes according to EN 1452 or DIN 8062 and PVC-U fittings according to DIN 8063 are defined by the 'nominal pressure' method, whereby pipes, fittings and valves are grouped together according to a single nominal pressure rating. The PN rating is the maximum permitted operational pressure in bars calculated at 20°C, for example PN6 indicates a maximum working pressure of 6 bars. Reference should be made to the pipe availability guide to verify the pressure ratings available for the pipe sizes required. The pressure ratings of metric sized PVC-U fittings is as follows:-

Industrial Range	Size Range	Max. Operating Pressure
	10mm to 160mm	16 Bar
	200mm to 450mm	10 Bar
	500mm	6 Bar
Standard Range	Size Range	Max. Operating Pressure
	20mm to 225mm	10 Bar
	250mm to 400mm	6 Bar