

# Selection of materials

## ABS: Acrylonitrile Butadiene Styrene



Acrylonitrile Butadiene Styrene (ABS) has been manufactured as a pressure piping system for more than 30 years, and it is a widely used versatile material that can also be found in car parts, household goods, DIY tools as well as thermoplastic piping.

ABS is a copolymer of Styrene and Acrylonitrile grafted to Polybutadiene. The chemical resistance of Acrylonitrile, added to the impact strength of Butadiene, combined with the processing properties of Styrene, produce and homogenous material with chemical resistance, ductility and tensile strength.

The Butadiene content of ABS provides exceptional resistance to impact damage at temperatures as low as -40°C and up to 70°C. ABS offers good abrasion resistance to aggressive slurries, and its smooth bore allows high flow velocities whilst inhibiting the formation of scale.

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

ABS piping systems are available from IPS in both inch and metric dimensions, according to BS and ISO standards. Systems are available in inch sizes from 3/8" to 12" and metric sizes from 16mm to 315mm. ABS products are mid grey in colour in accordance with BS5252.

### General properties of ABS

With the benefit of low temperature handling characteristics down to -40°C, ABS is used extensively for applications in conditioning and chilled water piping systems. Another key benefit is the high impact strength of the material, making ABS ideal for piping systems in exposed situations where potential damage may occur. ABS does not contain metallic stabilisers making it physiologically harmless and therefore suitable for use with food and water applications.

Some of the important advantages of ABS are:

- Low specific weight 1.04g/cm<sup>3</sup>
- Wide range of applications
- Good chemical and corrosion resistance
- Safe for potable water applications
- High impact strength at low temperatures
- Good abrasion resistance



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### Materials

ABS piping systems are produced without any harmful additives, making it a material that is ideally suited for food and water applications, including soft drinks, medical preparations and potable water. ABS is especially suitable for a wide range of applications at low temperatures, while in addition the low thermal conductivity of the material ( $0.2\text{W/m}^\circ\text{C}$ ) makes this piping material ideally suited to temperature sensitive applications, such as refrigeration and chilled water systems.

Properties of ABS (Average values)		
Property	Value	Unit
Density	1.03	$\text{g/cm}^3$
Tensile Strength	> 737	$\text{N/mm}^2$
Elongation at Break	> 10	%
Impact Strength	44	$\text{kJ/m}^2$ (23°C)
Modulus of Elasticity (Young's Modulus)	2100	$\text{N/mm}^2$
Coefficient of Linear Expansion	0.1	$\text{mm/m } ^\circ\text{C}$
Maximum Operating Temperature	70	$^\circ\text{C}$
Minimum Operating Temperature	-40	$^\circ\text{C}$
Vicat Softening Point	90	$^\circ\text{C(VST/B 50)}$
Water Absorption	< 1	%
Surface Resistance	Approx. $10^{13}$	$\Omega$
Thermal Conductivity	0.170	$\text{W/m} \cdot \text{K}$
Flammability	HB	UL94
Colour	7001 Light Grey	RAL

### Chemical resistance

ABS displays good chemical resistance to a wide range of chemicals including salt solutions, and most dilute acids and bases. ABS is not resistant to concentrated mineral acids, organic acids and solvents such as esters, ketones and chlorinated and aromatic hydrocarbons. For detailed guidance on the chemical resistance of ABS, consult the chemical resistance tables or our technical department.

### Weathering resistance

Over time, ABS will suffer some loss of properties when exposed to UV light. The surface of the material will lose shine and experience some colour change. 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 based paint will help to minimise the effects of solar radiation.

### Electrical characteristics

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

### Physiological characteristics

ABS 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.

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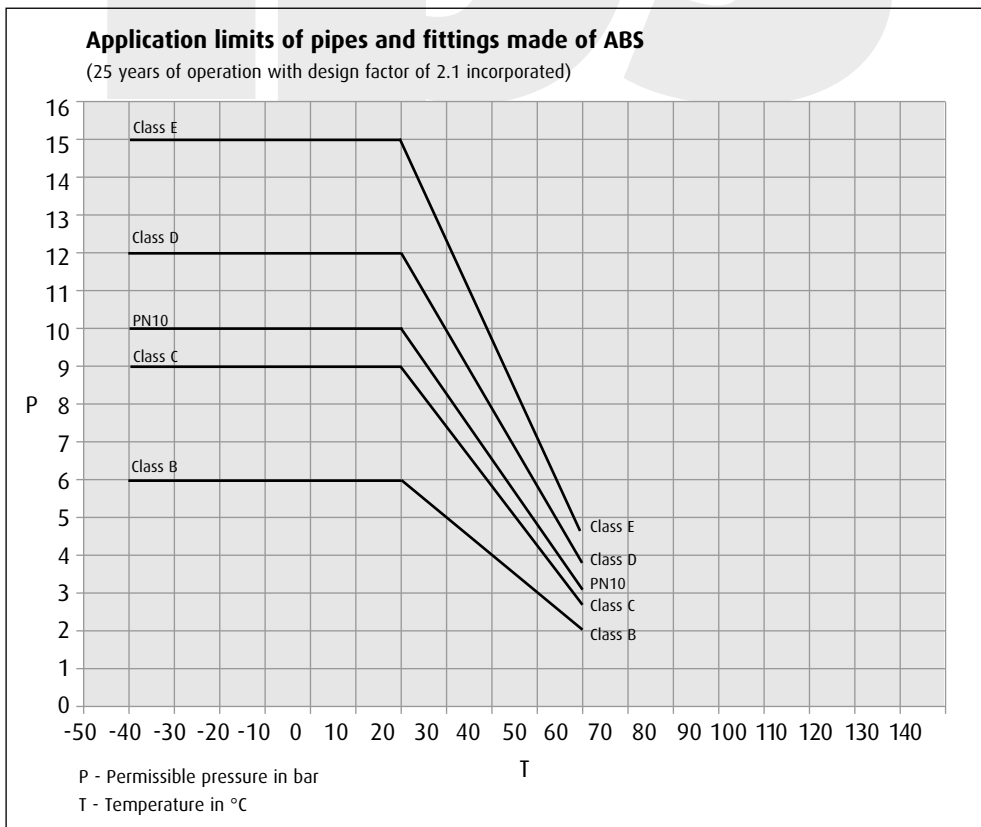
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### Pressure ratings for ABS pipe, fittings and valves

For guidance, the following table gives an indication of the pressure ratings for ABS pipes, fittings and valves. The pressure rating of individual items should always be verified with our technical department before installation.

Product	Size	Pressure Rating at 20°C
ABS Class B Pipe	10"-12"	6 bar
ABS Class C Pipe	3/8"-8"	9 bar
ABS Class D Pipe	3/8"-6"	12 bar
ABS Class E Pipe	3/8"-4"	15 bar
ABS Class B Fittings	10"-12"	6 bar
ABS Class C Fittings	2 1/2", 5" and 8"	9 bar
ABS Class D Fittings	6"	12 bar
ABS Class E Fittings	3/8"-4"	15 bar
ABS Metric Pipe & Fittings	16mm-250mm	10 bar
ABS Metric Pipe & Fittings	315mm	8 bar
ABS Ball Valves	3/8"/16mm-2"/63mm	16 bar
ABS Ball Valves	2 1/2"/75mm-4"/110mm	10 bar
ABS Valves (other types)	3/8"/16mm-12"/315mm	10 bar or 6 bar

Pressure ratings for thermoplastic pipes are determined in a water environment at a temperature of 20°C. As the temperature of the media (and/or the piping environment) increases, the thermoplastic material becomes more ductile, causing a decrease in the tensile strength. Because of this, the pressure rating of the system must be reduced as the temperature rises to allow for safe operation. The application limits for ABS piping material are shown in the following diagram:



**ABS pipe availability: inch sizes**



Inch Sizes BS 5391						Metric Sizes ISO 161				
Class	Colour	B	C	D	E	T	Class	Colour	PN6	PN10
		Grey	Grey	Grey	Grey	Grey			Grey	Grey
3/8"	O.D. (mm)				17.1	17.1	16	O.D. (mm)		16
	Wall (mm)				1.7	3.5		Wall (mm)		1.4
	Max WP (bar)				15	12		Max WP (bar)		10
	Weight/m (kg)				0.09	0.16		Weight/m (kg)		0.07
1/2"	O.D. (mm)				21.4	21.4	20	O.D. (mm)		20
	Wall (mm)				2.0	3.6		Wall (mm)		1.5
	Max WP (bar)				15	12		Max WP (bar)		10
	Weight/m (kg)				0.14	0.22		Weight/m (kg)		0.10
3/4"	O.D. (mm)				26.7	26.7	25	O.D. (mm)		25
	Wall (mm)				2.5	3.6		Wall (mm)		1.8
	Max WP (bar)				15	12		Max WP (bar)		10
	Weight/m (kg)				0.21	0.29		Weight/m (kg)		0.15
1"	O.D. (mm)		33.6		33.4	33.4	32	O.D. (mm)		32
	Wall (mm)		2.0		3.1	4.3		Wall (mm)		2.0
	Max WP (bar)		9		15	12		Max WP (bar)		10
	Weight/m (kg)		0.22		0.33	0.44		Weight/m (kg)		0.22
1 1/4"	O.D. (mm)		42.2		42.2	42.2	40	O.D. (mm)		40
	Wall (mm)		2.5		3.9	5.3		Wall (mm)		2.5
	Max WP (bar)		9		15	12		Max WP (bar)		10
	Weight/m (kg)		0.34		0.52	0.68		Weight/m (kg)		0.34
1 1/2"	O.D. (mm)		48.3		48.3	48.3	50	O.D. (mm)		50
	Wall (mm)		2.8		4.5	6.0		Wall (mm)		3.2
	Max WP (bar)		9		15	12		Max WP (bar)		10
	Weight/m (kg)		0.45		0.68	0.87		Weight/m (kg)		0.52
2"	O.D. (mm)		60.3		60.3	60.3	63	O.D. (mm)		63
	Wall (mm)		3.6		5.6	7.2		Wall (mm)		4.0
	Max WP (bar)		9		15	12		Max WP (bar)		10
	Weight/m (kg)		0.70		1.06	1.31		Weight/m (kg)		0.83
2 1/2"	O.D. (mm)		75.2				75	O.D. (mm)		75.0
	Wall (mm)		5.0					Wall (mm)		4.7
	Max WP (bar)		9					Max WP (bar)		10
	Weight/m (kg)		1.35					Weight/m (kg)		1.15
3"	O.D. (mm)		88.9		88.9		90	O.D. (mm)		90
	Wall (mm)		5.2		8.3			Wall (mm)		5.7
	Max WP (bar)		9		15			Max WP (bar)		10
	Weight/m (kg)		1.48		2.28			Weight/m (kg)		1.67
4"	O.D. (mm)		114.3		114.3		110	O.D. (mm)		110
	Wall (mm)		6.7		10.6			Wall (mm)		6.9
	Max WP (bar)		9		15			Max WP (bar)		10
	Weight/m (kg)		2.48		3.76			Weight/m (kg)		2.47
							125	O.D. (mm)		125
								Wall (mm)		7.9
								Max WP (bar)		10
								Weight/m (kg)		3.18
5"	O.D. (mm)		140.2				140	O.D. (mm)		140
	Wall (mm)		9.2					Wall (mm)		8.8
	Max WP (bar)		9					Max WP (bar)		10
	Weight/m (kg)		4.65					Weight/m (kg)		4.02
6"	O.D. (mm)		168.3	168.3			160	O.D. (mm)		160
	Wall (mm)		9.9	7.1				Wall (mm)		10.0
	Max WP (bar)		9	12.4				Max WP (bar)		10
	Weight/m (kg)		5.47	5.3				Weight/m (kg)		5.27
							200	O.D. (mm)		200
								Wall (mm)		12.5
								Max WP (bar)		10
								Weight/m (kg)		8.14
8"	O.D. (mm)		219.1				225	O.D. (mm)		225
	Wall (mm)		12.7					Wall (mm)		14.1
	Max WP (bar)		9					Max WP (bar)		10
	Weight/m (kg)		9.53					Weight/m (kg)		10.35
10"	O.D. (mm)	273.0					250	O.D. (mm)	250	250
	Wall (mm)	12.1						Wall (mm)	9.7	15.7
	Max WP (bar)	6						Max WP (bar)	6	10
	Weight/m (kg)	10.2						Weight/m (kg)	10.20	12.65
12"	O.D. (mm)	323.9					315	O.D. (mm)	315	315
	Wall (mm)	13.1						Wall (mm)	12.2	19.7
	Max WP (bar)	6						Max WP (bar)	6	10
	Weight/m (kg)	14.17						Weight/m (kg)	14.20	20.08