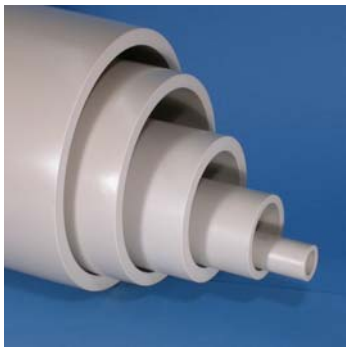
Chemflo
Pressure Piping System

Polypropylene & PVDF

Technical Manual



the complete chemical & corrosive pressure pipework solution

Chemflo The complete chemical & corrosive pressure pipework solution

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Quality

BS EN ISO 9001 : 2000

"At CPV we have worked hard to implement the ethos of continuous improvement whilst maintaining the focus on customer satisfaction. This means ensuring that we supply product fit for intended purpose and manufactured right first time."

Guy Osborne
Quality Manager

BS EN ISO 9001
FM 33749

ISO 9001 is our starting point and not an end in itself. Continuous improvement and customer awareness are central to the way we do things.

Assessment of the company's Quality Assurance systems to the ISO 9001 is carried out by an independent body, the British Standards Institute (BSI), who audit our systems and processes twice yearly. Products are manufactured to specific standards that ensure suitability for the intended purpose.

Standards

Chemflo products are manufactured in accordance with the following quality standards:-

POLYPROPYLENE (PP)	METRIC	INCH
Pipe	BS 4991 : 1974 Series 2 DIN 8077/8 Type 2 PP-B DIN 8077/8 Type 1 PP-H/ßPP-H	BS 4991 : 1974
Fittings	DIN 16962 Parts 5/6/7/8/9/12	To suit BS 4991:1974
Valves	DIN 3442, DIN 3230	DIN 3442, DIN 3230

POLYVINYLIDENE FLUORIDE (PVDF)	METRIC
Pipe	BS ISO 10931 : 1997 Part 2
Fittings	BS ISO 10931 : 1997 Part 3
Valves	ISO 9393, ISO 10931, DIN 3442

Chemflo Polypropylene (PP)

Polypropylene Materials

Polypropylene (PP) is the generic name for a wide variety of homopolymers and copolymers. Homopolymers are the most rigid version of PP, but they have the disadvantage of being more brittle with reduced impact strength at low temperatures. Copolymers have ethylene added that significantly improves impact strength at low temperatures. Beta nucleated homopolymers have improved impact strength, but copolymers still have the edge.

Standard **Chemflo** polypropylene (PP) pipes and fittings are manufactured in high heat stabilised block copolymer (PP-B) with excellent impact resistance at low temperatures and good chemical resistance in a temperature range -20°C to 120°C.

CPV manufactures **Chemflo** Polypropylene in beige grey for most applications and natural/pure un-pigmented for high purity applications

CPV can make products from other types of PP to your specification, including:

- Homopolymer PP-H
- Homopolymer (Beta Nucleated) ßPP-H
- Random Copolymer PP-R

Connections to other materials or equipment can be made by flanges, compression or threaded fittings. Metric to Inch size transition fittings are also available.

Applications

CPV Polypropylene products can be found in the chemical, pharmaceutical, biotechnology, hospital and laboratory, water treatment, brewing and distilling electronics, food, nuclear and many other industries. Examples include:

Acids
Alcohol
Alkalis
Alum / Bleach
Beer / Spirits
Blood
Brine
Coal Washing
De-icing Lines
De-ionised Water
De-mineralised Water
Ductwork
Effluent Drainage
Fruit Juices / Sugar Solutions
Fume Removal
Hyposulphite
Laboratory Drainage
Pickling and Etching
Pipelines
Plating Solutions
Radio Active Drainage
Silver Salts
Tower Packing
Ultra Pure Water
Vessels and Tanks
Water Treatment Plant

Properties and Advantages of Chemflo Polypropylene

Smooth Bore
Chemflo (PP) beige grey and pure/natural pipes and fittings have smooth bores resulting in low pressure loss and high volume flow.

Ductility
When overloaded **Chemflo** (PP) beige grey and pure/natural pipes and fittings will deform and return to their original shape after the load has been removed. This enables them to take up ground movement when buried or to be flexed for installation adjustment. Bends of radius 50 x 'outside pipe diameter' can be conveniently cold pulled.

Maintenance Free
Chemflo (PP) beige grey and pure/natural will not corrode or rot and can be buried underground or in concrete without any adverse effect.

Lightweight
With a lower density than other thermoplastic materials, **Chemflo** (PP) beige grey and pure/natural floats in water and can be easily handled before and during installation.

Heat Insulation
Condensation does not form on the outside of **Chemflo** (PP) beige grey and pure/natural pipes as readily as is the case with metal tubes as polypropylene is a poor conductor of heat.

UV Resistance
Chemflo (PP) beige grey has good resistance to sunlight and may be used outdoors in the UK. Elsewhere in the world in extreme UV conditions additional protection may be required. **Chemflo** (PP) pure/natural is NOT suitable for use outdoors.

Purity
Approved by the US Food and Drug Administration for food contact **Chemflo** (PP) pure/natural contains no pigment and is suitable for applications where the risk of contamination is unacceptable.

Temperature Resistance
Chemflo (PP) beige grey has a wide range of operating temperatures from -20°C to 110°C under continuous working conditions and may be steam sterilised at temperatures up to 130°C for short periods. **Chemflo** (PP) pure/natural has a wide range of operating temperatures from -20°C to 90°C under continuous working conditions and may be steam sterilised at temperatures up to 120°C for short periods.

Impact Strength
Chemflo (PP) beige grey and pure/natural have excellent impact resistance throughout their working temperature ranges, ensuring freedom from breakage during handling, installation or by abuse. Block copolymer (PP-B) has an impact resistance superior to Homopolymer (ßPP-H) particularly at sub-zero temperatures.

Wear Resistance
Resistance to abrasion is better than most other thermoplastic materials and **Chemflo** (PP) beige grey and pure/natural are both suitable for slurry conveyance.

Chemical Resistance

Polypropylene has the very high resistance to chemical attack now regarded as typical of polyolefine plastics and hence is very well suited to many packaging and chemical plant uses, especially those also requiring resistance to high temperatures.

The effects of many chemicals upon polypropylene have been investigated in laboratory and field trials and the results of this work with polypropylene are listed in the following tables. If you require any additional information please contact CPV, we would be pleased to help find the most suitable material for your application.

The resistance of polypropylene to water and other inorganic environments is extremely high. Polypropylene increases in weight by less than 0.2% when stored in most aqueous environments for six months at room temperature and less than 0.5% when stored for a similar period at 60°C (140°F). Its water absorption after 24 hours immersion by the method of ASTM D570-63 is 0.03%. It is not attacked by most strong mineral acids and bases and is only appreciably affected by reagents of an oxidising nature.

Substantial decomposition occurs in the presence of chlorosulphonic acid and oleum at room temperature and of 98% sulphuric acid, 30% hydrochloric acid and 30% hydrogen peroxide at 100°C (212°F). Considerable deterioration in properties is also caused by 98% sulphuric acid at 60°C (140°F), fuming nitric acid at room temperature and liquid bromine at room temperature. Where pipes and fittings are under mechanical strain, failure may occur with strong oxidising agents at temperatures lower than those quoted. With these exceptions, most inorganic chemicals produce negligible effects when in contact with polypropylene over a six months period at temperatures up to 120°C (248°F).

Absorption and Permeability

Polypropylene shows a very high resistance to most organic chemicals. In general, the suitability of polypropylene in contact with organic environments is governed by the extent to which the environment is absorbed and, for containers, by the permeability of the polymer to the environment. These two effects are really complementary because material absorbed from one side of a sheet will permeate through the polymer and be extended from the other side. Thus the permeability of Polypropylene to an environment will be governed to some extent by the rate at which maximum absorption is attained. Any absorption is normally accompanied by some degree of swelling and where extensive absorption occurs the polymer will become appreciably swollen. When the polypropylene is removed from an environment which has been absorbed, evaporation of the absorbed material will take place and the polypropylene will tend to return to its original state, although some swelling may remain. Changes in properties, which may have been caused by absorption, will be reversed if evaporation is allowed to take place.

The extent to which organic liquids are absorbed by polypropylene depends on a number of factors, notably temperature and the polarity of the organic medium. Absorption becomes greater as the temperature is increased and the polarity of the medium decreased; thus non-polar liquids such as benzene, carbon tetrachloride and petroleum ether are absorbed to a greater extent than are polar liquids such as ethanol and acetone. Depending on the nature and the amount of the organic medium absorbed, some reduction in tensile strength and increase in flexibility and elongation to break in tension occur, because the medium exerts what may be visualised as a plasticising effect on the polymer.

Resistance to Environmental Stress

Cracking Polypropylene, when tested under similar conditions (ASTM D 1693-70), has not been observed to fail in the way that certain polyethylenes may, when stressed in contact with certain environments. This type of failure, known as environmental stress cracking, takes the form of brittle fracture and occurs with polyethylenes of high melt flow index when they are stressed in contact with environments such as polar organic liquids, detergents and silicone fluids. However, a few environments have also been known to cause cracking of polypropylene under stress and these are indicated thus † in the following Chemical Resistance Tables.

Long Term Resistance

As has been previously noted, the “life” of polypropylene at elevated temperatures is limited by oxidative degradation. The expected life at any given temperature is determined also by the conditions of service; for example, at 100°C (212°F) the life of both general-purpose and high-heat grades of polypropylene is at least three years in air, but in boiling water the general-purpose grade has only approximately half the expected life of the high-heat grade. This is due in part to the extraction of some of the antioxidant system. Hence, any medium that may extract the antioxidants present may lead to more rapid breakdown particularly at elevated temperatures.

When polypropylene is in contact with copper or copper alloys at temperatures above about 60°C (140°F) the resistance of the polymer to oxidation is reduced. This effect is particularly apparent when the polymer has been processed in the presence of copper, as in wire-covering or injection moulding around inserts. Provided that during the service life of an article or assembly the ambient temperature is to be below 60°C (140°F) polypropylene may safely be in contact with copper, i.e. moulded articles may be made from polypropylene with copper or brass inserts, or copper wires may be insulated with propylene. If higher temperatures are to be used, however, caution may be exercised, and tests should be carried out to ascertain whether the polymer will resist oxidation satisfactorily in any given application.

PHYSICAL AND MECHANICAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	NATURAL	BEIGE GREY
PHYSICAL				
Colour		-	-	RAL 7032
Specific gravity		-	0.90	0.92
Tensile yield stress	ISO-R527/ASTM D638	Mpa	27.0	26.0
Flexural modules	ASTM D790	Gpa	1.2	1.17
Izod impact strength	ISO-R180) 23° C	(	250	NB (300)
	ASTM D256) 0° C	J/m notch (	60	70
	0.25mm notch rad.)) –20° C	(	30	40
Elongation	ASTM D638	%	150-1200	150-1200
Rockwell hardness	ASTM D785	R scale	87	89
Abrasion resistance	Taber Abraser CS-17 wheel	mg/1000 cycles	18-28	-
Flammability	FMVSS 302	Burning Rate		
	(2mm thickness)	mm/min (	38	36
	(3mm thickness)	mm/min (	18	18
	UL 94			
	(3mm thickness)	-	94HB	94HB
THERMAL				
Coefficient of linear expansion	At 20° C	K^{-1}	1.1×10^{-4}	1.1×10^{-4}
	At 80° C	K^{-1}	1.7×10^{-4}	1.7×10^{-4}
Specific heat	At 20° C	J/kgK	1930	-
Coefficient of conductivity	At 20° C	W/mK	0.21	-
Softening temperature	ISO-R306	°C	141	146
ELECTRICAL				
Dielectric constant	At 50 Mhz (IEC 250)	-	2.25	-
Volume resistivity	1 min (IEC 93)	Ohm	> 10.15	-
Dielectric strength	ASTMS D149 / (IEC 243)	KV/mm	18	-
Power factor (tan 6)	IEC 250 at 100 Hz	-	0.00015	-
	at 10 kHz	-	0.0002	-
	at 1MHz	-	0.00015	-
GAS PERMEABILITY				
Carbon dioxide		cm^3 cm/ (	0.30	-
Oxygen		cm^2 sec cm Hg (	0.10	-
Nitrogen		X 10^9 (	0.02	-
Water vapour	At 90% RH	(	4.0	-
Moisture pick up	In humid atmosphere	%	0.05	-

Chemical Resistance Tables for Chemflo Polypropylene

Rating system

Test results have been represented in the table by four Letters which have the following significance:-

A = Negligible effect

Polypropylene should be suitable for all applications where these environmental conditions are encountered.

B = Limited absorption or attack

Polypropylene should be suitable for most applications, but the customer should satisfy himself beforehand, as to the suitability of polypropylene for the particular service conditions likely to be met.

C = Extensive absorption and/or rapid permeation

Polypropylene will probably be found suitable for applications where only intermittent contact occurs, or where the swelling produced would have no detrimental effect on the usefulness of the article in the application. However the customer should satisfy himself beforehand as above.

D = Extensive attack

The specimen dissolves or disintegrates.
Polypropylene should not be used for any applications where these environmental conditions are present.

† = May produce cracking under stress

Polypropylene may be subject to cracking under stress in this environment.

Agent	Conc.%	20°C	60°C	100°C	Agent	Conc.%	20°	60°	100°C
Acetic acid, glacial	97	A	B(80°C)	-	Benzyl alcohol		A	A(80°C)	-
Acetic acid	50	A	A(80°C)	-	Bismuth carbonate	Saturated	A	A	-
Acetic acid	40	A	-	-	Borax		A	A	-
Acetic acid	10	A	A	-	Boric acid		A	A	-
Acetone	100	A	A	-	Brine	Saturated	A	A	-
Acetophenone	100	B	B	-	Bromine liquid	100	D	-	-
Acriflavine (2% soln. in H_2O)	2	A	A(80°C)	-	Bromine water	†	C	-	-
Acrylic emulsion		A	A	-	Butyl acetate	100	-	C	C
Aluminium chloride		A	A	-	Butyl alcohol	100	A	-	-
Aluminium fluoride		A	A	-					
Aluminium sulphate		A	A	-	Calcium carbonate	Saturated	A	A	-
Alums, all types		A	A	-	Calcium chlorate	Saturated	A	A	-
Ammonia gas, dry		A	A	-	Calcium chloride	50	A	A	-
Ammonia, aqueous	30	A	-	-	Calcium hydroxide		A	A	-
Ammonium carbonate	Saturated	A	A	-	Calcium nitrate		A	A	-
Ammonium chloride	Saturated	A	A	-	Calcium phosphate	50	A	-	-
Ammonium fluoride	20	A	A	-	Calcium sulphate		A	A	-
Ammonium hydroxide	10	A	A	-	Calcium sulphite		A	A	-
Ammonium metaphosphate	Saturated	A	A	-	Carbon dioxide, dry		A	A	-
Ammonium nitrate	Saturated	A	A	-	Carbon dioxide, wet		A	A	-
Ammonium persulphate	Saturated	A	A	-	Carbon disulphide	100	B	C	-
Ammonium sulphate	Saturated	A	A	-	Carbon monoxide		A	A	-
Ammonium sulphide	Saturated	A	A	-	Carbon tetrachloride	100	C	C	C
Ammonium thiocyanate	Saturated	A	A	-	Carbonic acid		A	A	-
Amyl acetate	100	B	C	-	Castor oil		A	-	-
Amyl alcohol	100	A	B	-	Cetyl alcohol	100	A	-	-
Amyl chloride	100	C	C	-	Chlorine gas	100	D	D	-
Aniline	100	A	A	B	Chlorine gas, wet		-	D	-
Anisole	100	B	B	-	Chlorobenzene	100	C	C	-
Antimony chloride		A	A	-	Chloroform	100	C	D	D
Aqua regia	†	B	B	-	Chlorosulphonic acid	100	D	D	D
Aviation fuel (115/145 octane)	100	B	C	-	Chrome alum		A	A	-
Aviation turbine fuel	100	B	C	-	Chromic/sulphuric acid		D	D	-
					Chromic acid	80 †	A	-	-
Barium carbonate	Saturated	A	A	-	Chromic acid	50 †	A	A	-
Barium chloride	Saturated	A	A	-	Chromic acid	10 †	A	A	-
Barium hydroxide		A	A	-	Cider		A	A	-
Barium sulphate	Saturated	A	A	-	Citric acid	10	A	A	-
Barium sulphide	Saturated	A	A	-	Copper chloride	Saturated	A	A	-
Beer		A	A	-	Copper cyanide	Saturated	A	A	-
Benzene	100	B	C	C	Copper nitrate	Saturated	A	A	-
Benzioc acid		A	A	-	Copper fluoride	Saturated	A	A	-

Agent	Conc.%	20°C	60°C	100°C
Copper sulphate	Saturated	A	A	-
Cotton seed oil		A	A	-
Cuprous chloride	Saturated	A	A	-
Cyclohexanol	100	A	B	-
Cyclohexanone	100	B	C	-
Decalin	100	C	C	C
Detergents	2	A	A	A
Developers (photographic)		A	A	-
Dibutyl phthalate	100	A	B	D
Dichloroethylene	100	C	-	-
Diethanolamine	100	A	A	-
Di-iso-octyl phthalate	100	A	A	-
Emulsifiers		A	A	-
Ethyl acetate	100	B	B	-
Ethyl alcohol	96	A	A	A(80°C)
Ethylene glycol		A	A	-
Ethanolamine	100	A	A	-
Ethyl ether	100	B	-	-
Ethyl chloride	100	C	C	-
Ethylene dichloride	100	B	-	-
Ethylene oxide	100	B(10°C)	-	-
Fatty acids (C_6)	100	A	A	-
Ferric chloride	Saturated	A	A	-
Ferric nitrate	Saturated	A	A	-
Ferric sulphate	Saturated	A	A	-
Ferrous chloride	Saturated	A	A	-
Ferrous sulphate	Saturated	A	A	-
Fluosilicic acid		A	A	-
Formaldehyde	40	A	A	-
Formic acid	100	A	-	-
Formic acid	10	A	A	-
Fructose		A	A	-
Fruit juices		A	A	-
Furfural	100	C	C	-
Gasoline	100	B	C	C
Gas liquor		C	-	-
Gear box oil	100	A	B	-
Gelatine		A	A	-
Glucose	20	A	A	-
Glycerine	100	A	A	A
Glycol		A	A	-
Hexane	100	C	C	-
Hydrobromic acid	50 †	A	A	-
Hydrochloric acid	30 †	A	B	D
Hydrochloric acid	20	A	A(80°C)	-
Hydrochloric acid	10	A	A(80°C)	B
Hydrochloric acid	2	A	A	A
50-50 HCL-HNO_3	†	B	D(80°C)	-
Hydrofluoric acid	40	A	-	-
Hydrofluoric acid	60 †	A	A(40°C)	-
Hydrogen peroxide	30	A	-	D
Hydrogen peroxide	10	A	B	-
Hydrogen peroxide	3	A	-	-
Hydrogen chloride gas, dry	100	A	A	-
Hydrogen sulphide		A	A	-
Hydroquinone		A	A	-

Agent	Conc.%	20°C	60°C	100°C
Inks		A	A	-
Iodine tincture		A	-	-
Isopropyl alcohol	100	A	A	-
Iso-octane	100	C	C	-
Ketones		A	-	-
Lactic acid	20	A	A	-
Lanolin	100	A	A	-
Lead acetate	Saturated	A	A	-
Linseed oil	100	A	A	-
Lubricating oil	100	A	B	-
Magenta dye (aqueous	2	A	A	-
Magnesium carbonte	Saturated	A	A	-
Magnesium chloride	Saturated	A	A	-
Magnesium hydroxide	Saturated	A	A	-
Magnesium nitrate	Saturated	A	A	-
Magnesium sulphate	Saturated	A	A	-
Magnesium sulphite	Saturated	A	A	-
Meat juices		A	A	-
Mercuric chloride	40	A	A	-
Mercuric cyanide	Saturated	A	A	-
Mercury	100	A	A	-
Mercurous nitrate	Saturated	A	A	-
Methyl ethyl ketone	100	B	C	-
Methyl alcohol	100	A	A	-
Methylene chloride	100	C	-	-
Milk and its products		A	A	A
Mineral oil	100	A	B	-
Molasses	100	A	A	-
Motor oil	100	A	B	-
Naphthalene	100	A	A	A
Nickel chloride	Saturated	A	A	-
Nickel nitrate	Saturated	A	A	-
Nickel sulphate	Saturated	A	A	-
Nitric acid	Fuming	D	D	D
Nitric acid	70 †	C	D	-
Nitric acid	60 †	B	D(80°C)	-
Nitric acid	10	A	A	A
50-50 HNO_3 -HCL	†	B	D(80°C)	-
50-50 HNO_3 -H_2SO_4	†	C	D(80°C)	-
Nitrobenzene	100	A	A	-
Oleic acid		A	B	-
Oleum		D	D	D
Olive Oil	100	A	A	-
Oxalic acid, aqueous	50	A	B	-
Paraffin	100	A	B	-
Paraffin wax	100	A	A	-
Petrol	100	B	C	-
Phenol	100	A	A	-
Phosphoric acid	95	A	A	-
Plating solutions Brass		A	A	-
Plating solutions Cadmium		A	A	-
Plating solutions		A	A	-
Plating solutions Copper		A	A	-
Plating solutions Gold		A	A	-
Plating solutions Indium		A	A	-

Agent	Conc.%	20°C	60°C	100°C	Agent	Conc.%	20°C	60°C	100°C
Plating solutions Lead		A	A	-	Sodium hypochlorite	20 †	B	B	B
Plating solutions Nickel		A	A	-	Sodium nitrate		A	A	-
Plating solutions Rhodium		A	A	-	Sodium nitrite		A	A	-
Plating solutions Silver		A	A	-	Sodium silicate		A	A	-
Plating solutions Tin		A	A	-	Sodium sulphate	Saturated	A	A	-
Plating solutions Zinc		A	A	-	Sodium sulphide	25	A	A	-
Petroleum ether (BP 100-	100	C	C	-	Sodium sulphite	Saturated	A	A	-
Potassium bicarbonate	Saturated	A	A	-	Stannous chloride	Saturated	A	A	-
Potassium borate	†	A	A	-	Stannic chloride	Saturated	A	A	-
Potassium bromate	10	A	A	-	Starch		A	A	-
Potassium bromide	Saturated	A	A	-	Sulphates of calcium &	Saturated	A	A	-
Potassium carbonate	Saturated	A	A	-	Sulphites of potassium &		A	A	-
Potassium chlorate	Saturated	A	A	-	Sulphur		A	A	-
Potassium chloride	Saturated	A	A	-	Sulphuric acid	98 †	C	C	D
Potassium chromate	40	A	A	-	Sulphuric acid	60	A	B(80°C)	-
Potassium cyanide	Saturated	A	A	-	Sulphuric acid	50	A	B	-
Potassium dichromate	40	A	A	-	Sulphuric acid	10	A	A	A
Potassium ferri/ferrocyanide		A	A	-	50-50 H_2SO_4 / HNO_3	†	C	D(80°C)	-
Potassium fluoride		A	A	-	Sugars and syrups		A	A	-
Potassium hydroxide	50	A	A	-	Sulphamic acid		A	A(80°C)	-
Potassium hydroxide	10	A	A	A					
Potassium nitrate	Saturated	A	A	-	Tallow		A	A	-
Potassium perborate	Saturated	A	A	-	Tannic acid	10	A	A	-
Potassium perchlorate	10	A	A	-	Tartaric acid		A	A	-
Potassium permanganate	20	A	A	-	Tetrahydrofuran	100	C	C	C
Potassium sulphate		A	A	-	Tetralin	100	C	C	C
Potassium sulphide		A	A	-	Toluene	100	C	C	-
Potassium sulphite		A	A	-	Tranformer oil	100	A	C	-
Propyl alcohol	100	A	A	-	Trichloracetic acid	10	A	A	-
Pyridine	100	A	-	-	Trichloroethylene	100	C	C	C
					Triethanolamine	100	A	A(80°C)	-
Silicone oil	100	B	B	-	Turpentine	100	C	C	C
Soap soln. (concentrated)		A	A	-					
Sodium acetate		A	A	-	Urea		A	A	-
Sodium bicarbonate	Saturated	A	A	-	Urine		A	A	-
Sodium bisulphate	Saturated	A	A	-					
Sodium bisulphite	Saturated	A	A	-	Vaseline *		A	A	-
Sodium borate		A	A	-	Vinegar		A	A	-
Sodium bromide oil solution		A	A	-					
Sodium carbonate	Saturated	A	A	-	Water, distilled, soft, hard &		A	A	A
Sodium chlorate	Saturated	A	A	-	Whisky		A	A	A
Sodium chloride	Saturated	A	A	A	White paraffin	100	A	B(80°C)	-
Sodium chlorite	2	A	A	-	White spirit	100	B	C	-
Sodium chlorite	5	A	A	-	Wines		A	A	-
Sodium chlorite	10	A	A	-					
Sodium chlorite	20	A	A	-	Xylene	100	C	C	C
Sodium cyanide	Saturated	A	A	-					
Sodium dichromate	Saturated	A	A	-	Yeast		A	A	-
Sodium ferricyanide	Saturated	A	A	-					
Sodium ferrocyanide	Saturated	A	A	-	Zinc choride	Saturated	A	A	-
Sodium fluoride	Saturated	A	A	-	Zinc oxide		A	A	-
Sodium hydroxide	50	A	A	-	Zinc sulphate	Saturated	A	A	-
Sodium hydroxide	10	A	A	A					

Note

* Trademark

The chemical resistance table refers only to the effects on polypropylene resulting from contact with the substances listed, and does not refer to any toxicological aspects. Grades of polypropylene are available to comply with particular requirements for contact with foodstuffs, potable water, cosmetics, pharmaceutical products etc. Information contained in this publication (and otherwise specified to users) is based on our general experience and is given in good faith, but we are unable to accept responsibility in respect of factors which are outside of our knowledge or control. Freedom under patents, copyright and registered designs cannot be assumed.

Users of any other materials mentioned in this publication are advised to obtain Health & Safety information from the suppliers.

Pressure / Temperature / Service Life

Factors influencing the use and service life of **Chemflo** (PP) pipe are operating temperatures, pressure and the fluids conveyed. Where a pipeline is required to operate at elevated temperatures, the permissible working pressure can be ascertained from the following chart. The chart is a guide that relates working pressure to service life and temperature for various classes of pipe. The figures are based on BS ISO 8584-1:1990 using water as the testing medium and should be taken as a guide only.

Chemflo Copolymer (PP-B) Pipe Maximum Sustained Working Pressure (Bar)								
TEMP	CLASS ► PN BARS ► LIFE/YEARS ▼	2.5	A 3	B 6	C 9	10	D 12	E 15
20° C	1	2.96	3.56	7.11	10.66	11.84	14.21	17.76
	2.5	2.85	3.42	6.83	10.25	11.38	13.66	17.07
	5	2.76	3.32	6.63	9.94	11.04	13.25	16.56
	10	2.68	3.22	6.44	9.65	10.72	12.87	16.08
	25	2.58	3.09	6.18	9.27	10.30	12.36	15.45
	50	2.50	3.00	6.00	9.00	10.00	12.00	15.00
30° C	1	2.39	2.87	5.74	8.61	9.56	11.48	14.34
	2.5	2.27	2.72	5.44	8.16	9.06	10.88	13.59
	5	2.19	2.63	5.26	7.89	8.76	10.52	13.14
	10	2.12	2.55	5.09	7.64	8.48	10.18	12.72
	25	2.03	2.44	4.88	7.31	8.12	9.75	12.18
	50	1.97	2.36	4.72	7.08	7.86	9.44	11.79
40° C	1	1.89	2.27	4.53	6.79	7.54	9.05	11.31
	2.5	1.80	2.16	4.32	6.48	7.20	8.64	10.80
	5	1.74	2.09	4.17	6.25	6.94	8.33	10.41
	10	1.68	2.01	4.02	6.03	6.70	8.04	10.05
	25	1.60	1.92	3.83	5.75	6.38	7.66	9.57
	50	1.41	1.69	3.38	5.06	5.62	6.75	8.43
50° C	1	1.51	1.81	3.62	5.42	6.02	7.23	9.03
	2.5	1.43	1.72	3.44	5.15	5.72	6.87	8.58
	5	1.38	1.65	3.30	4.95	5.50	6.60	8.25
	10	1.33	1.59	3.18	4.77	5.30	6.36	7.95
	25	1.13	1.35	2.70	4.05	4.50	5.40	6.75
	50	0.96	1.15	2.30	3.44	3.82	4.59	5.73
60° C	1	1.20	1.44	2.88	4.32	4.80	5.76	7.20
	2.5	1.14	1.37	2.73	4.09	4.54	5.45	6.81
	5	1.09	1.31	2.62	3.93	4.36	5.24	6.54
	10	0.96	1.15	2.30	3.44	3.82	4.59	5.73
	25	0.77	0.92	1.84	2.76	3.06	3.68	4.59
	50	0.65	0.78	1.55	2.33	2.58	3.10	3.87
70° C	1	0.96	1.16	2.31	3.46	3.84	4.61	5.76
	2.5	0.91	1.09	2.18	3.26	3.62	4.35	5.43
	5	0.77	0.92	1.84	2.76	3.06	3.68	4.59
	10	0.65	0.78	1.55	2.33	2.58	3.10	3.87
	25	0.52	0.63	1.25	1.88	2.08	2.50	3.12
80° C	0.5	0.81	0.97	1.94	2.90	3.22	3.87	4.83
	1	0.77	0.92	1.84	2.76	3.06	3.68	4.59
	2.5	0.62	0.74	1.48	2.22	2.46	2.96	3.69
	5	0.52	0.63	1.25	1.88	2.08	2.50	3.12
	10	0.44	0.53	1.06	1.59	1.76	2.12	2.64
90° C	0.5	0.62	0.74	1.48	2.22	2.46	2.96	3.69
	1	0.52	0.63	1.25	1.88	2.08	2.50	3.12
	2.5	0.42	0.50	1.00	1.50	1.66	2.00	2.49
	5	0.36	0.43	0.86	1.28	1.42	1.71	2.13
95° C	0.5	0.51	0.61	1.22	1.82	2.02	2.43	3.03
	1	0.43	0.52	1.04	1.55	1.72	2.07	2.58
	2.5	0.35	0.42	0.83	1.25	1.38	1.66	2.07
	5	0.29	0.35	0.70	1.05	1.16	1.40	1.74

e.g: Class B (6 bar) rated pipe operating at 50°C and 2.3 bar pressure has an anticipated service life of 50 years

Pipe Support Spacings

The recommended maximum support spacings for horizontal runs of **Chemflo** (PP) pipes are given in the table below. These spacings are based on maximum sag of 7.5mm between supports after 5 years' service. Spacings are given in metres for various sizes and temperatures assuming the pipes are carrying water and are pressure rated at 10 bar. For pipes rated at pressure other than 10 bar and for pipes carrying fluids of higher density than water the relevant correction factors are shown in the second table.

Sizes	Pipe Support Spacings In Metres At								
OD mm	20° C	30° C	40° C	50° C	60° C	70° C	80° C	90° C	100° C
16	.54	.50	.48	.46	.43	.42	.40	.38	.37
20	.60	.56	.54	.51	.49	.47	.45	.43	.41
25	.67	.63	.60	.57	.54	.52	.50	.48	.46
32	.76	.71	.68	.65	.61	.59	.57	.54	.52
40	.85	.80	.76	.72	.69	.66	.64	.60	.59
50	.95	.89	.85	.81	.77	.74	.71	.67	.66
63	1.07	1.00	.96	.91	.86	.83	.80	.76	.74
75	1.16	1.09	1.05	.99	.94	.91	.87	.83	.80
90	1.27	1.20	1.15	1.08	1.03	.99	.95	.90	.88
110	1.41	1.32	1.27	1.20	1.14	1.10	1.06	1.00	.97
160	1.70	1.60	1.53	1.44	1.37	1.32	1.27	1.21	1.17
225	2.01	1.89	1.81	1.71	1.63	1.57	1.51	1.43	1.39
250	2.12	1.99	1.91	1.80	1.72	1.65	1.59	1.51	1.46
280	2.25	2.11	2.02	1.91	1.82	1.75	1.68	1.59	1.55
315	2.38	2.24	2.14	2.02	1.93	1.86	1.79	1.69	1.64

Eg. A 90mm 10 bar pipe operating at 50ºC will require supporting at intervals not less than 1.08m to avoid a sag of greater than 7.5mm between supports after 5 years' service.

<<< Correction Factors >>>

Pipe Pressure Rating			
Pipe	Factor	Pipe	Factor
NP 1	0.63	NP 6	0.92
NP 2.5	0.77	NP 8	0.97
NP 3.2	0.81	NP 10	1.00
NP 4	0.85	NP 12.5	1.03
NP 5	0.89	NP 16	1.06

Pipe Contents Density	
g/cc	Factor
1.2	0.96
1.4	0.92
1.6	0.89
1.8	0.86
2.0	0.84

Chemflo Polyvinylidene Fluoride (PVDF)

Polyvinylidene Fluoride (PVDF) Material

Chemflo PVDF pipes, fittings and valves are manufactured from polyvinylidene fluoride (PVDF), a milky white translucent polymer produced by SOLVAY and CIE and marketed under the SOLEF trademark.

Applications

With excellent physical, chemical and thermal properties **Chemflo** PVDF pipes, fittings and valves are used in many industries and applications. Eg. Chemical, Petrochemical, Hydrometallurgical, Pharmaceutical, Food, Nuclear, Paper and Pulp and Metal Surface Coatings. Also in pipe systems for the manufacture of Microchip and Integrated Circuits, particularly for handling Ultra Pure De-ionised water (18M Ω cm) and chemicals such as acids, chlorofluorinated solvents and hydrogen peroxide. **Chemflo** PVDF is used in the manufacture of Heat Exchangers and may also replace existing pipe systems in Stainless Steel, Hastelloy and Titanium.

Characteristics of PVDF

PROPERTY	TEST METHOD / STANDARD	UNITS	VALUE
PHYSICAL			
Density	ISO 1183	G/cm^3	1.78
Water Absorption (24hr at 23°C)	ISO 62/Method 1	%	<0.04
MECHANICAL(1)			
Tensile	ASTM D 638		
Tensile Stress at Yield	{	MPa	53.57
Tensile Stress at Break	{ 23°C	MPa	30-50
Elongation at Yield	{ 50 mm/min	%	7-10
Elongation at Break	{	%	10-50
E Modulus	23°C – 1 mm/min	MPa	2500
Flexion	ASTM D 790		
Maximum Load	{ 23 °C	MPa	77
Modulus	{ 2mm/min	MPa	2100
Compression	ASTM D 695		
Maximum Load	{ 23 °C	MPa	75
Modulus	{ 1.3mm/min	MPa	2100
IZOD Impact Strength (23°C.Notched V 10mm-thick 4mm)	ASTM D 256	J/m	110
SHORE HARDNESS (2MM)	ASTM D 2240	-	78
Abrasion Resistance	Taber CS 10/1Kg	Mg/1000 rev	5-10
Coefficient of Friction	ASTM D 1894		
/Static			0.2-0.4
/Dynamic			0.2-0.3
THERMAL(1)			
CRYSTALLINITY/DSC	ASTM D 3418		
Melting Point		°C	174
Heat Fusion	80°C to end of melting	J/g	65.6
Crystallising Temperature		°C	140
VICAT SOFTENING POINT(4mm)	ISO 306		
Load 1Kg		°C	168
Load 5Kg		°C	149
H.D.T. (4mm)	ASTM D 648		
Load 0.46 MPa	(Annealing	°C	147
Load 1.8 MPa	16h/150°C)	°C	113
Glass Transition Temperature (Tg)	DMTA	°C	-30
Brittleness Temperature (2mm pressed sheet)	ASTM D 746A	°C	0-10
Linear Thermal Expansion Coefficient	ASTM D 696	$10^{-6}.k^{-1}$	120-140
Thermal Conductance (23°C)	ASTM DC177	W/m.K	0.2
Specific Heat	23°C & 100°C	J/g.K	1.2 – 1.6
ELECTRICAL PROPERTIES (1)	23 °C		
Surface Resistance after 2 min / 500V	{ ASTM D 157 { DIN 53483	ohm	$\geq 1.10^{14}$
Volume Resistivity after 2 min.	{ ASTM D 257 { DIN 53483	ohm	$\geq 1.10^{14}$
FIRE RESISTANCE (1)			
LIMITING OXYGEN INDEX (3mm)	ASTM D 2863	%	44

(1) Typical values, not specification.

Chemflo Polyvinylidene Fluoride (PVDF)

Properties and Advantages

Purity
Chemflo PVDF pipes, fittings and valves are absolutely non toxic and F.D.A. approved in the U.S.A. for the conveyance of food and dairy products. They are suitable for pharmaceuticals, ultra-pure water and for other applications where the risk of contamination is unacceptable.

Temperature Resistance
Chemflo PVDF pipes, fittings and valves have a wide range of operating temperatures from -40^{o}C to + 140^{o}C.

UV Resistance
Chemflo PVDF pipes, fittings and valves are suitable for outdoor installation with excellent resistance to ultra violet, gamma rays and ageing.

Impact Strength
Chemflo PVDF has good impact resistance throughout its working temperature range ensuring freedom from breakage by abuse during handling and installation.

Wear Resistance
Chemflo PVDF has a low friction coefficient and resistance to abrasion, values being comparable with those of polyamide.

Comparison with Metal
Compared with metals, **Chemflo** PVDF has many advantages including ease of installation and corrosion resistance, particularly at higher temperatures. **Chemflo** PVDF pipes systems have been shown to be a very cost effective alternative to materials needing frequent replacement such as stainless steel.

Translucence
The level or colour of highly corrosive reagents can often be observed through the wall of **Chemflo** PVDF pipes.

Fire Resistance
Chemflo PVDF is non-flammable and self extinguishing.

Jointing
Chemflo PVDF pipe and fittings are jointed by the Polymatic Socket Heat Fusion process and cannot be jointed by adhesives or solvents.

Product Range and Packaging
Chemflo PVDF pipe is available from 16mm to 110mm OD in 5m lengths and 16mm to 32mm OD in 50m coils. Fittings are available from 20mm to 110mm OD. The valves range includes Double Union and Laboratory Ball Valves, Non-Return and Diaphragm Valves.

Chemical Resistance
Chemflo PVDF has outstanding resistance to most mineral and organic acids, oxidising environments, aliphatic and aromatic hydrocarbons, alcohol's and halogenated solvents. It is resistant to halogens, particularly to bromine (but not to fluorine) and to weak bases. It is degraded by fuming sulphuric acid, some strongly based amines, hot concentrated alkalis and alkaline metals. It swells in highly polar solvents such as acetone and ethyl acetate and is slightly soluble in aprotic solvents such as dimethylformamide and dimethylsulphoxide. It is not suitable for caustic solutions and a medium that may generate atomic chlorine. Tables giving the resistance of PVDF to a range of inorganic and organic compounds, in various concentrations and different temperatures, can be obtained upon request from CPV Technical Department.

Basic Stress Values

Basic stress values for **Chemflo** (PVDF) pipes with a MRS of 25 Mpa and an overall safety coefficient C* = 1.6

SERVICE TEMPERATURE **t °C**	SERVICE TIME **t (years)**	BASIC STRESS WITH WATER **σβ (Mpa)**
20	0.5	19.0
20	2.5	17.9
20	10.0	17.0
20	25.0	16.4
20	50.0	16.0
30	0.5	16.5
30	2.5	15.6
30	10.0	14.8
30	25.0	14.3
30	50.0	13.9
40	0.5	14.4
40	2.5	13.5
40	10.0	12.9
40	25.0	12.4
40	50.0	12.1
50	0.5	12.5
50	2.5	11.8
50	10.0	11.2
50	25.0	10.8
50	50.0	10.5
60	0.5	10.9
60	2.5	10.2
60	10.0	9.7
60	25.0	9.4
60	50.0	9.2
70	0.5	9.5
70	2.5	8.9
70	10.0	8.5
70	25.0	8.2
70	50.0	8.0
80	0.5	8.2
80	2.5	7.7
80	10.0	7.4
80	25.0	7.1
80	50.0	6.9
90	0.5	7.2
90	2.5	6.7
90	10.0	6.4
90	25.0	6.2
90	50.0	6.0
100	0.5	6.2
100	2.5	5.9
100	10.0	5.6
100	25.0	5.4
100	50.0	5.3
110	0.5	5.4
110	2.5	5.1
110	10.0	4.9
120	0.5	4.7

Pressure - Temperature

Approximate values for the maximum recommended working pressure for **Chemflo** (PVDF) pipes and fittings for a range of temperatures are shown in the table below. The given pressures apply to water or other safe media for a working life of 20 years and with a safety factor of > 2.2.

TEMPERATURE °C	MAXIMUM WORKING PRESSURE BAR			
	Pipes / Fittings	Valves		
		Ball	Cone	Diaphragm
-40	16.0	10.0	10.0	10.0
-20	16.0	10.0	10.0	10.0
0	16.0	10.0	10.0	10.0
20	16.0	10.0	10.0	10.0
40	11.6	10.0	10.0	10.0
60	9.2	8.7	8.7	7.5
80	7.5	6.5	6.5	5.2
100	6.0	4.5	4.5	3.5
120	4.5	3.0	3.0	2.0
140	3.5	2.0	2.0	-

Support Spacings for Chemflo (PVDF) Pipe

The recommended maximum support spacings for horizontal runs of **Chemflo** (PVDF) pipes are given in the table below. These spacings are based on a maximum sag of 5mm between supports after 10 years' service. Spacings are given in metres for various sizes and temperatures assuming the pipes are carrying water and pressure rated at 16 bar.

O.D. mm	SUPPORT SPACINGS IN METRES AT					
	20°C	40°C	60°C	80°C	100°C	120°C
20	1.10	1.04	0.95	0.88	0.80	0.74
25	1.23	1.16	1.07	0.98	0.88	0.82
32	1.37	1.28	1.19	1.10	0.98	0.92
40	1.52	1.42	1.31	1.21	1.09	1.01
50	1.68	1.56	1.46	1.35	1.21	1.12
63	1.87	1.75	1.62	1.50	1.34	1.25
75	2.01	1.90	1.75	1.61	1.45	1.35
90	2.18	2.05	1.90	1.75	1.57	1.47
110	2.37	2.25	2.05	1.90	1.71	1.60

Jointing

Solvents
Polypropylene and PVDF can only be jointed by heat fusion or mechanical coupling and not by adhesives or solvent.

Socket Fusion
Polypropylene pipes and fittings up to 160mm OD / 6" nb, and PVDF upto 110mm OD are jointed by the socket fusion process which uses an electronic temperature controlled heating tool to melt the interior of the socket of the fitting and the exterior of the pipe. When suitably molten the pipe and fitting are withdrawn from the tool and pressed together to form a joint stronger than the individual component parts.

Butt Welding
Pipes and fittings of most sizes can be jointed by butt welding.

Electrofusion
Electrofusion couplers are available for jointing pipe and pupped/long spigot fittings in the range 20 - 225mm.

Speed of Joint
Chemflo pipe systems can be subjected to test pressure only minutes after a fusion joint has been completed. There is no waiting for 24 hours for the solvent to fully dry.

Compatibility between PP types
Pipes and fittings of the different forms of PP materials are interchangeable and may be fused to one another. PP should not be fused to other thermoplastics.

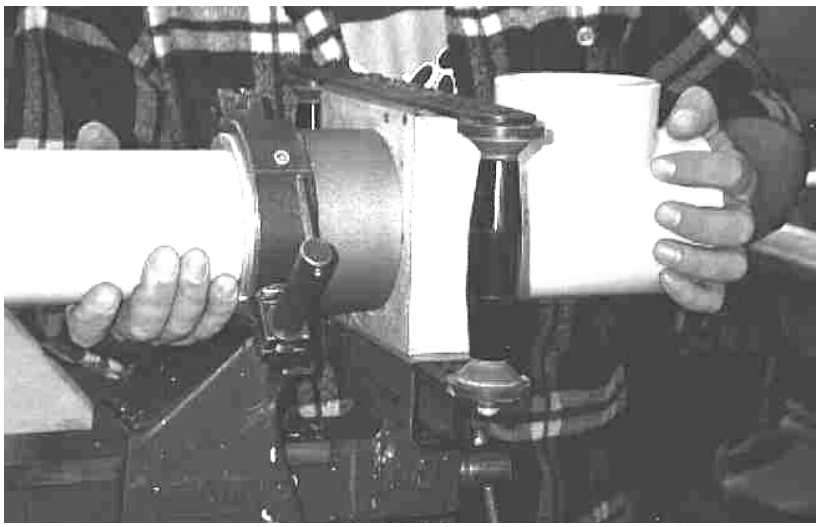
Compatibility between PVDF types
Pipes and fittings of the different forms of PVDF materials are interchangeable and may be fused to one another. PVDF should not be fused to other thermoplastics.

Other Materials
Connections to other materials or equipment can be made by flanges, compression or threaded fittings. Metric to Inch size transition fittings are also available.

Socket Fusion Jointing of Chemflo PP and PVDF

Introduction

In this method of heat fusion jointing the pipe end and socket of the fitting are heated to fusion temperature using an electrically heated socket fusion tool with a male (spigot) block for the fitting and female (socket) block for the pipe.



The heated end of the pipe is then pushed into the heated socket of the fitting.

No additional material is used and the resulting homogeneous joint can be tested and operational when cooled to ambient temperature, i.e. 30 minutes +/-.

Polymatic Fusion Tool

Consists of an electric heating element (Fusion Tool) to which fusion tool blocks (male/female) are bolted. Male and female blocks are available to match pipe and fitting sizes in the range 20mm - 110mm and ½" - 4".

The fusion tool blocks are made of aluminium alloy with a non-stick coating. They conform to DVS 2208 Part 1

The fusion tool has an electronic control unit with a factory set temperature of 265 -270^{o}C. A red LED on the unit indicates when power is on and an amber LED flashes when fusion temperature is reached.

Power supply required - 230v/110v step down isolating transformer, minimum 2KVA rating. If 13 AMP BS 1363 plug top fitted, use 13 AMP fuse.

Equipment Required:

a) Fusion tool with temperature control unit:-

b) Single handle for sizes 20mm/ ½" - 63mm/2"

c) Twin handle for sizes 75mm/2 ½" - 110mm/4"

d) 110v AC power supply

e) Alternatively a socket jointing machine may be used when there is a large number of joints to be made and for sizes 90mm - 110mm and 3"-4"

f) Set of fusion tool blocks with non-stick surface coating:

g) Female (socket) to match pipe O.D.

h) Male (spigot) to match I.D. of the socket of the fitting

i) Securing bolts and Allen key Pipe cutter or fine toothed saw

j) Safety equipment (gauntlets, protective clothing etc).

Socket Fusion Jointing of Chemflo PP and PVDF (cont.)

k) Pipe re-rounding clamps & Pipe depth gauges	*Use to ensure pipe reaches to the correct depth of the socket of the fitting*
l) Lint free cotton cloth & Cleaning fluid (MEK or similar)	*Use to clean the jointing surfaces of the pipe and fitting*
m) Wooden spatula	*To clean the heating tool ends before and after fusion jointing*
n) Electronic thermometer	*To check temperature of the heating tool*

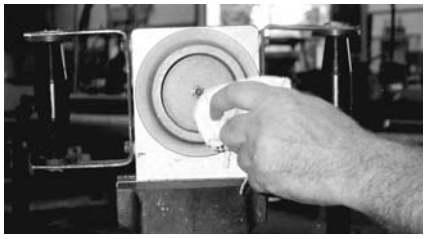
Making a Socket Fusion Joint - Procedure

1. Secure the fusion tool in a soft jawed vice:
   a) Single handle tool - clamp the base of the tool just above the handle
   b) Twin handle tool - clamp the metal rails

2. Bolt the male and female blocks to the hand tool heating element using the bolts and Allen key.

3. Plug into the 110v power supply and switch on - the red LED will glow.

4. When hot, clean off any traces of PP/PVDF or other matter using a clean, lint-free cotton cloth, dry paper or wooden spatula.



5. Cut the pipe square using a pipe cutter or a fine toothed saw. Chamfer the end of the pipe and deburr with a sharp knife. Remove any swarf or loose material.

6. Clean the pipe and socket of the fittings with a clean lint-free cloth and cleaning fluid (MEK or similar)

CAUTION!
When pipe has been left outdoors unprotected for a long period of time a pale deposit of oxidative degradation forms on the outer surface. This must be removed with a pipe scraper before welding.

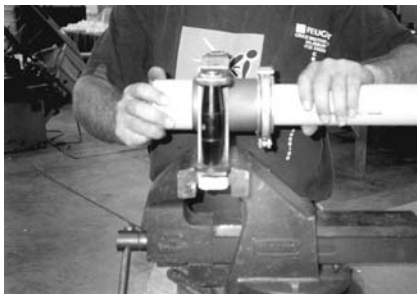
Making a Socket Fusion Joint – Procedure (cont.)

7. Place the depth gauge over the end of the pipe and fit the re-rounding clamp next to the end of the depth gauge. Remove the depth gauge. If no depth gauge is available use the plain depth dimensions listed in the table on page 4.5.

8. Check the temperature of the fusion blocks. After about 10 minutes (longer in cold weather) the amber LED will flash indicating that fusion temperature has been reached.

   From time to time check the temperature with an electronic thermometer. Temperature should be 265° to 275°C.

9. When fusion temperature has been reached offer up the pipe to the female fusion tool block, and the fitting socket to the male fusion tool block.
10. Steadily push the pipe and fitting on to the fusion tool blocks without twisting, until full depth has been reached. The pipe and fitting should remain in contact with the fusion tool blocks for the heating times shown in the table on page 4.5. The essential requirement for a good socket fusion joint is a uniform surface melt on the pipe and inside the socket of the fitting. A useful indication of this is the appearance of a 1mm - 2mm bead on the pipe at the mouth of the female heating tool block.



CAUTION!
Pipe and fittings will usually have a slight interference fit with the fusion tool blocks. However, when the pipe and fitting are at extremes of tolerance there could be a small clearance and in this situation the heating time needs to be increased and started when the pipe and socket of the fitting have swelled to just contact the fusion tool blocks.

10. At the end of the heating time (when the 1mm - 2mm bead has formed) withdraw the pipe and fitting from the fusion tool blocks and immediately, without twisting, push the pipe into the socket of the fitting until the pipe re-rounding clamp meets the face of the fitting and correct depth has been achieved

11. The completed joint must be held securely for about 30 seconds or until sufficient bond has been achieved to prevent the fitting sliding off the pipe. The joint must be allowed to cool (see cooling times in table) before subjecting the joint to undue strain, i.e. moving jointed lengths.

12. Remove the re-rounding clamp from the pipe and clean off any residual materials from the fusion tool blocks using the spatula or dry paper/clean cloth.
13. Wait for 30 minutes or until the joint has completely cooled to the ambient temperature before applying working or test pressure

Socket Fusion Heating and Cooling Times: PP & PVDF

		PP			PVDF		
Pipe OD	Pipe Insertion Depth (into fitting)	Min. Wall (mm)	Heating Time (secs)	Cooling Time (mins)	Min. Wall (mm)	Heating Time (secs)	Cooling Time (mins)
16	13	2.0	5	2	1.5	4	2
20	13	2.5	5	2	1.9	6	2
25	15	2.7	7	2	1.9	8	2
32	17	3.0	8	4	2.4	10	4
40	19	3.7	12	4	2.4	12	4
50	22	4.6	18	4	3.0	18	4
63	25	3.6	24	6	3.0	20	6
75	29	4.3	30	6	3.6	22	6
90	33	5.1	40	6	4.3	25	6
110	39	6.3	50	8	5.3	30	8

Pipe n.b.	Pipe Insertion Depth (into fitting)	Min. Wall (mm)	Heating Time (secs)	Cooling Time (mins)
½"	15	2.9	15	2
¾"	18	3.6	15	2
1"	20	3.7	15	2
1¼"	21	4.6	15	4
1½"	23	4.1	18	4
2"	26	3.5	18	4
3"	35	5.2	30	6
4"	42	6.6	35	8

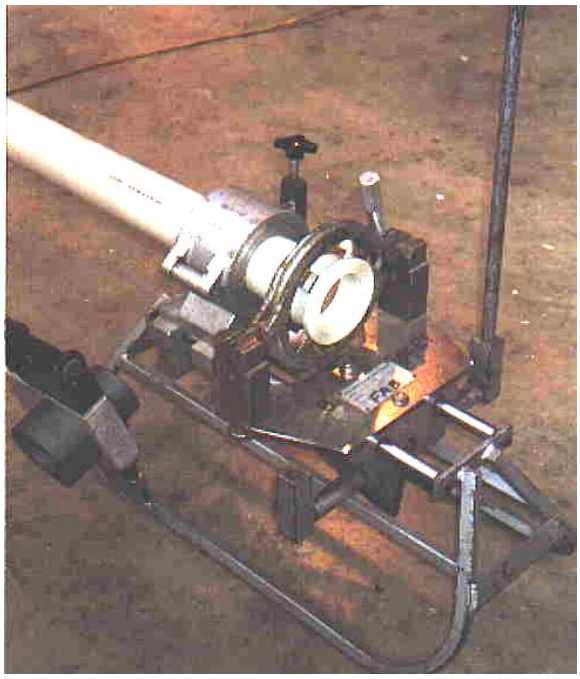
Universal Socket Jointing Machine

Application and Range

The Universal Socket Joining Machine is a mechanical aid for socket fusion of pipe and fittings including tees and elbows etc. The machine will accept fittings of the same nominal size from all major manufacturers without the need for separate liners.

Description

The machine consists of a pipe clamp and floating fittings holder mounted on two sliding bases which are linked together by a system of pivot arms. The fittings holder consists of a steel clamp carrying four knife edge shoes to give maximum grip with minimum fitting distortion.



Operation

The main feature of the Universal Socket Joining Machine is its ease of use. Setting up the machine is carried out in two distinct operations. Firstly the fitting is clamped in the holder, square to the face of the pipe clamp. The complete fitting holder clamp is then floated until it centres on the aluminium mandrel held in the pipe clamp. It is then locked in place, guaranteeing exact alignment with the pipe to be joined.

Illustrated operating instructions are supplied with every machine

For more information of this equipment please consult our sales office.

Socket Fusion Method – Trouble Shooting

FAULT	REASON	CURE
Excessive flash in bore of joint	(a) Pipe & fitting left too long on fusion tool	Rectify accordingly
	(b) Excessive force applied when inserting pipe into fitting	Ensure pipe meets land of socket without further pressure
Excessive flash in one side of joint	(a) Pipe not cut square	Rectify accordingly
	(b) Pipe not inserted squarely into fitting	Rectify accordingly
Leaking joint	(a) Sized ends damaged or not bolted tightly together	Check that faces of Head and Sized Ends are not damaged and are bolted tightly together. Damaged Sized Ends should be replaced
	(b) Fusion weld too cold	Ensure tool is up to temperature before welding
	(c) Pipe & Fitting not left long enough on tool	Rectify accordingly
	(d) Pipe & fitting not joined together immediately after taking off tool	Rectify accordingly
	(e) Sized ends dirty	Clean tool after every joint

Health and Safety

General

Welding temperatures in the region of 265° to 270°C are used for socket fusion welding.

Small quantities of fumes are given off at about 225/230°C. These gradually increase as temperature rises, until at about 300°C decomposition and oxidative pyrolysis takes place at an appreciable rate.

Higher temperatures should only be encountered as a result of equipment malfunction, but at about 300°C the heat of oxidation may produce a rapid rise in temperature which accelerates the pyrolysis.

Under these conditions carbon monoxide, formaldehyde and acrolein are evolved. The occupational exposure limits for these gases are 50ppm, 2ppm and 0.1ppm respectively.

The irritantcy of the aldehydes which is noticeable even at the OEL level stated, provides a good warning of excessive exposure.

Carbon monoxide cannot be detected by smell but the irritant effect of the aldehydes which are emitted at the same time may give warning of its possible presence. Symptoms of exposure to carbon monoxide may include headache, fatigue and dizziness.

The self ignition temperature for PP is 375°C and so no problems should result during normal jointing.

First Aid Procedures

Skin Burns	*Any molten material on the skin should be cooled as quickly as possible with cold water, but should not be pulled off.* *Medical attention should be obtained immediately in severe cases* *Fumes are unlikely to cause ski problems*
Eyes	*Should fumes cause irritation, flush with large quantities of luke warm water. Seek medical attention if trouble persists*
Inhalation	*Move to fresh air, keep warm and apply artificial respiration if necessary.* *Seek medical attention promptly*

Handling Advice

When making joints	*Avoid direct inhalation of fumes. Work in a well ventilated area or use local exhaust ventilation. Avoid contact with hot tooling. Regularly remove any buildup of molten/burnt material from the heater plate or fusion tooling.* *Keep working area clean and remove any material debris to avoid contact with hot tooling*
Protective clothing	*Wear protective gloves (and face shield if desired) when it is necessary to handle hot or molten material*
Waste disposal	*No hazard from cold, scrap PP. Dispose of by tipping or incineration under approved conditions*

System Design Considerations

Above Ground Installation:

Thermoplastics have significantly higher coefficient of thermal expansion than metals. However this effect is reduced by the thermal insulation properties of thermoplastics that gives an average wall temperature, and therefore less expansion, unless of course the temperature is the same inside and out.

Above ground pipe systems have to be designed with the effects of this expansion and contraction in mind. There are two key principles to controlling these effects.

1) **Absorbing the expansion and contraction.**
   a) Use frequent bends and avoiding long straight runs. (L bends, U bends. Z bends etc.)
   b) Avoid placing support clips too close to the bend. Allow the freedom of movement.
   c) Use anchor points (pipe clips either side of a fitting) to control the direction of movement.

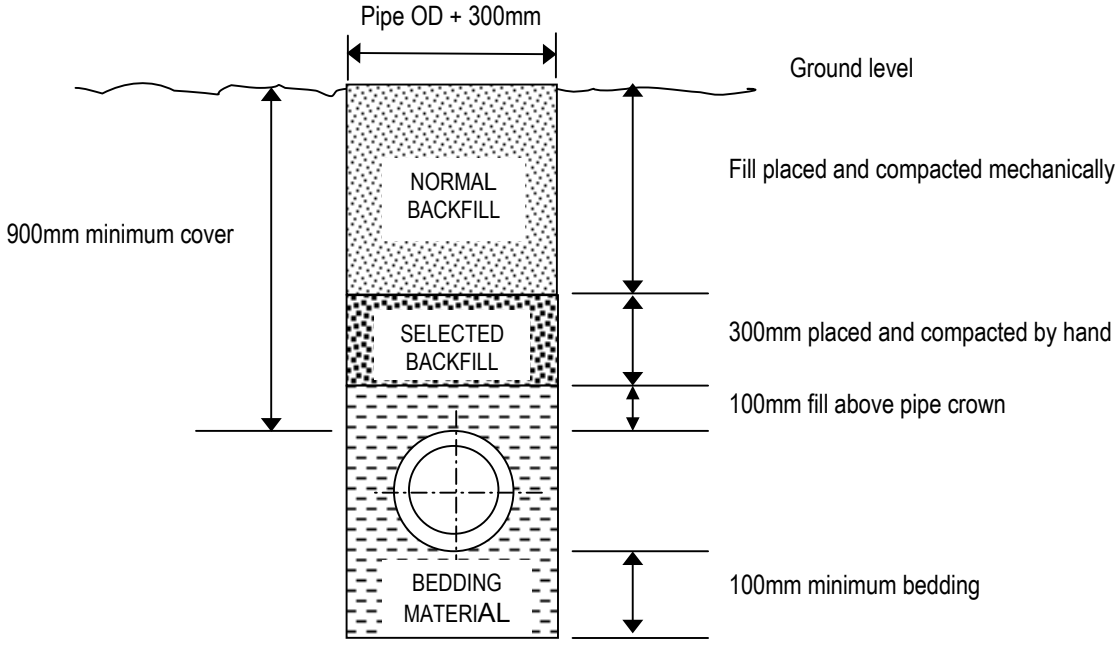
2) **Preventing lateral movement giving causing buckling or snaking of the pipes.**
   a) Use pipe support clips that allow free axial movement but restrict lateral movement.
   b) Where possible use fixed support brackets rather than hangers.
   Thermoplastic pipes are less stiff than metal pipes and therefore require more frequent supports. It is important to ensure that maximum support spacings are as per the tables in the materials sections of this catalogue.

Below Ground Installation - Trench Details:

1) **Bedding Material**
   Typically 5-10mm pea gravel. Other fine grained, granular material can be used as long as it is free from large stones, flints or other large objects. Bricks or other hard objects should not be used for support. Bedding material should be placed carefully in the trench and compacted by hand.

2) **Backfill**
   Backfill materials may consist of excavated materials but initial layers should be compacted by hand and be free from topsoil, large stone and debris. Mechanical compactors should not be used until the required depth of hand compacted material has been achieved.

It is recommended that clay or hard chalk is not used for bedding or backfill as these may decompose when in wet environments.



Chemflo Specification Clauses

Metric Polypropylene Beige Grey Pressure Pipe

Metric pressure polypropylene pipes shall be manufactured from beige grey (RAL 7032) polypropylene block copolymer (PP-B) to dimensions and tolerances as specified in ISO 15494 : 2003. The pipe shall have a high impact resistance particularly at sub zero temperatures to -20°C. The quality standards and testing regime for the manufacture of the pipe shall be to DIN 8078 (Type 2 (PP-B)):1994. The pipes shall be **Chemflo** metric polypropylene pressure pipes from CPV Ltd., (01794 322884).

Metric Polypropylene Beige Grey Pressure Fittings

Metric pressure polypropylene fittings shall be manufactured from beige grey (RAL 7032) polypropylene block copolymer (PP-B) to dimensions and tolerances as specified in DIN 16962 & ISO 7279:1984 and ISO 15494 : 2003 Type B. The quality standards and testing regime for the manufacture of the fittings shall be to DIN 16962-5 and ISO 15494 : 2003. The fittings shall be **Chemflo** metric polypropylene pressure fittings from CPV Ltd., (01794 322884).

Metric Polypropylene Beige Grey Pressure Valves

Metric pressure polypropylene valves shall be manufactured from beige grey (RAL 7032) polypropylene homopolymer (PP-H) to dimensions and tolerances as specified in DIN 3442. The valve connections shall be manufactured to DIN 16962 (Socket & butt fusion), ANSI, ASA, DIN, JIS and BS flanges. The quality standards and testing regime for the valve shall be to DIN 3442 TI and certified DIN EN19. The valves shall be Praher metric polypropylene pressure valves from CPV Ltd., (01794 322884).

Inch Polypropylene Beige Grey Pressure Pipes

Inch pressure polypropylene pipes shall be manufactured from beige grey (RAL 7032) polypropylene block copolymer (PP-B) to materials, dimensions, tolerances, marking and test methodology as specified in BS 4991: 1974 Series 2. The pipe shall have a high impact resistance particularly at sub zero temperatures to -20°C. The pipes shall be **Chemflo** inch polypropylene pressure pipes from CPV Ltd., (01794 322884).

Inch Polypropylene Beige Grey Pressure Fittings

Inch pressure polypropylene fittings shall be, manufactured from beige grey (RAL 7032) polypropylene copolymer (PP-B) to fit pipes of dimensions and tolerances as specified in BS 4991: 1974 Series 2. The fittings shall either be socket fusion (10 bar), or threaded (6 bar) up to 4" diameter. The fittings shall have a high impact resistance particularly at sub zero temperatures to -20°C. The fittings shall be **Chemflo** inch polypropylene pressure fittings from CPV Ltd., (01794 322884).

Inch Polypropylene Beige Grey Pressure Valves

Inch pressure polypropylene valves shall be socket fusion type, manufactured from beige grey (RAL 7032) polypropylene homopolymer (PP-H) to fit pipes of dimensions and tolerances as specified in BS 4991: 1974 Series 2. The quality standards and testing regime for the valve shall be to DIN 3442 TI and certified DIN EN19. The valves shall be Praher inch polypropylene pressure valves from CPV Ltd., (01794 322884).

Inch Polypropylene Pure / Natural Pressure Pipes

Inch pressure polypropylene pipes shall be manufactured from natural pure polypropylene block copolymer (PP-B) to materials, dimensions, tolerances, marking and test methodology as specified in BS 4991: 1974 Series 1. The pipes shall be **Chemflo** inch natural polypropylene pressure pipes from CPV Ltd., (01794 322884).

Chemflo Specification Clauses (cont.)

Inch Polypropylene Pure / Natural Pressure Fittings

Inch natural pressure polypropylene fittings shall be, manufactured from pure unpigmented polypropylene block copolymer (PP-B) to fit pipes of dimensions and tolerances as specified in BS 4991: 1974 Series 1. The fittings shall be socket fusion (10 bar) up to 4" diameter. The fittings shall have a high impact resistance particularly at sub zero temperatures to -20°C. The fittings shall be **Chemflo** inch natural polypropylene pressure fittings from CPV Ltd., (01794 322884).

Metric Polyvinylidene Fluoride (PVDF) Pressure Pipe

Metric pressure PVDF pipes shall be manufactured from pure un-pigmented Solef PVDF to dimensions and tolerances as specified in BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The quality standards and testing regime for the manufacture of the pipe shall be to BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The pipes shall be **Chemflo** metric PVDF pressure pipes from CPV Ltd., (01794 322884).

Metric Polyvinylidene Fluoride (PVDF) Pressure Fittings

Metric pressure PVDF fittings shall be manufactured from pure un-pigmented Solef PVDF to dimensions and tolerances as specified in BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The quality standards and testing regime for the manufacture of the fittings shall be to BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The fittings shall be **Chemflo** metric PVDF pressure fittings from CPV Ltd., (01794 322884).

Metric Polyvinylidene Fluoride (PVDF) Pressure Valves

Metric pressure PVDF valves shall be manufactured from pure un-pigmented Solef PVDF to dimensions and tolerances as specified in BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The valve connections shall be manufactured to BS ISO 10931 Pts 1-5 : 1997 (Pipes, Fittings and Valves). The quality standards and testing regime for the valve shall be to ISO / FDIS 9393-2 and certified DIN EN19. The valves shall be Praher metric PVDF pressure valves from CPV Ltd., (01794 322884).