Thermoplastics

Introduction

Thermoplastics are rigid and solid at normal temperatures but at elevated temperatures they soften and melt.

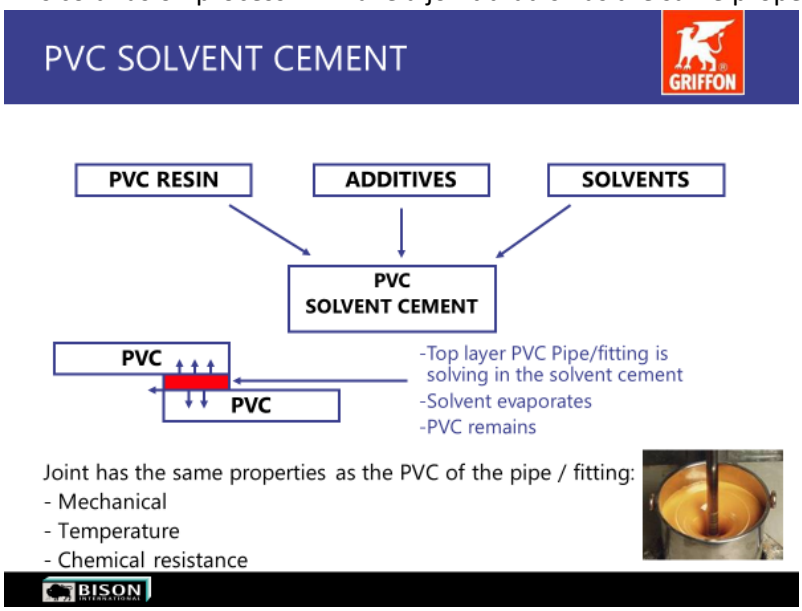
Thermoplastics are further delineated into amorphous and semi-crystalline polymers. Amorphous polymers have a random molecular structure that does not have a sharp melting point. Instead, amorphous material softens gradually as temperature rises.
Amorphous materials are more sensitive to stress failure due to the presence of hydrocarbons. ABS and PVC are common amorphous thermoplastics. Semi-crystalline polymers have a highly ordered molecular structure. These do not soften as the temperature rises, but rather have a defined and narrow melting point. This melting point is generally above that of the upper range of amorphous thermoplastics. PP, PE & PVDF are common semi-crystalline plastics.

Jointing & Welding of Thermoplastics

Amorphous Thermoplastics

Solvent bonding is applicable only for joining of amorphous thermoplastics. **PVC-U, ABS, cPVC** materials are all joined firstly by applying an appropriate cleaner and then followed by applying solvent cement.

This cold fusion process will have a joint that is has the same properties as the pipe/fitting.



Before testing the joint we must consider the drying time, subject to environmental conditionals and humidity.

DRYING TIME			
Diameter	Temp	10bar	16bar
16-63mm	>10°C	2H	4H
	5-10°C	4H	8H
75-110mm	>10°C	4H	8H
	5-10°C	8H	16H
125-315mm	>10°C	8H	16H
	5-10°C	16H	32H

Time before loading pressure systems

Drying Time UNI-100

***NOTE**:*
Low temperatures (<+0°C)
• Extended drying times (solvent evaporates slower)
• Higher risk for 'stress-cracking' because (C)PVC gets more friable
***Recommendation**: Warm up parts to be bonded (temperature preferably around +20°C)*

Semi crystalline Thermoplastics

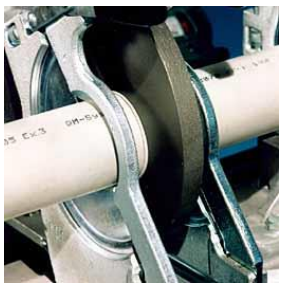
Introduction

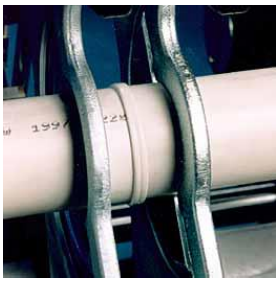
After the set up and preparation has been completed in line with the machine instructions guide. The newly prepared pipes and fittings can be introduced to the heat source ensuring that both the pipe and the fitting are entered to the correct depth. They are then allowed to heat for the pre-determined time. A bead of molten material should be visible forming on both the pipe and the fitting as heating takes place. When the time has elapsed, the pipe and fitting can be removed from the heat source. A change over time is shown on the table, this should be adhered to. The two parts should be joined ensuring that the pipe is entered to the stop point inside the fitting. The joint should be held in position, and then allowed to cool in line with the correct table of parameters. A uniform double weld bead should be visible around the neck of the fitting, and a single weld bead should be evident inside the fitting. Testing can take place 1 hour after the last weld is complete.

Butt Fusion

Butt fusion welding is the name given to hot plate welding of thermoplastic pipes.

The joint area of the plastic pieces is held against a hot plate, to the surfaces of melt. The hot plate is removed and the melted surfaces are pressed together, and maintained for the items has cooled. Normally used in joints > 63mm





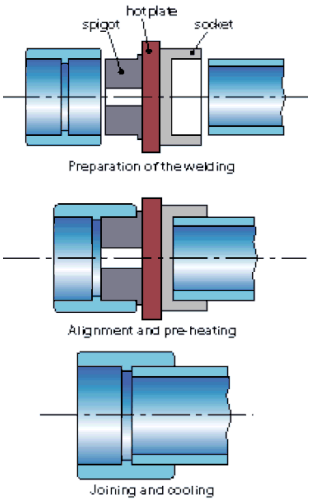
Socket Fusion

Socket fusion welding is a widely used technique for assembling plastics piping systems using injection moulded fittings.

A metal socket mounted on a hot plate heats the outside circumference of the pipe. Heating occurs along a defined length which will vary depending on the size of pipe and fitting being welded. A metal spigot on the opposite side of the hot plate simultaneously heats the inside surface of the injection moulded fitting. The length of the heated region is the same as that for the pipe.

Both fitting and pipe are heated for a set length of time after which the heated socket/spigot tooling is removed and the pipe is pushed into the fitting. Pipe and fitting are left for a predetermined time to cool and form a weld.

Depending on the size of pipe, socket fusion welding can either be done by hand or carried out on a manually operated machine. Often used on 20-63mm fittings



Electrofusion

The electrofusion welding process involves the use of a moulded socket fitting containing an electrical resistive heating coil. The prepared pipe ends are inserted into the sockets and clamped. An electric current is then passed through the coil for a pre-set time. Heating of the surrounding polymer and heat transfer to the pipe wall takes place. Cold zones at the ends of the fitting contain the melt in the central section, allowing a high melt pressure to develop and the formation of a homogeneous joint.