
Plastic Fusion Methods

Butt Fusion

Butt welding equipment needed. No weld fillers needed.

Both jointing areas of the plastic product are heated up under pressure using a metal heating element.

When welding temperature in the jointing area is reached, the heating element is removed and the plasticized jointing areas pressed together using hydraulic load.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, (PVC,ABS,PB,PA)
Recommended Use	Middle to large sized products
Recommended skill for proper use	Middle
Equipment costs	Fair
Welding tools costs	Fair

Electrofusion welding

Special electrofusion fittings with integrated metal wires and electrofusion welding equipment needed.

After cleaning and rough up the jointing areas the plastic products are pushed into the special electrofusion fitting.

The electrofusion fitting is connected to the electrofusion equipment providing controlled electrical power into the incorporated wires to heat up the jointing area. Pressure is given by the fitting design to limit the expansion of the jointing area.

Jointing area needs to cool down without movements.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, PB
Recommended Use	Middle to large sized products
Recommended skill for proper use	Low
Equipment costs	Fair
Fitting costs	High

Socket Fusion

Socket fusion equipment needed. No weld fillers needed.

Both jointing areas of the plastic product are pushed into or over a special designed socket heating element and heated up under pressure.

When welding temperature in the jointing area is reached, the socket heating element is removed and the plasticized jointing areas pressed together under load.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, PB
Recommended Use	Small to middle sized products
Recommended skill for proper use	Low
Equipment costs	Fair
Welding tools costs	Very fair

Hot Gas Fusion

Hot gas welding equipment and weld fillers needed.

Both jointing areas are prepared by cleaning, rough up and chamfering depending to the required calculated joint design.

The plastic products are fixed to each other at the jointing area and heated up by air of the hot gas welding equipment.

The weld filler material either called welding rod (available in different sizes and designs – mostly round of 3-5 mm size) is also preheated in the welding equipment and attached into the jointing area using manual pressure and the welding equipment.

Depending on the product wallthickness the method needs to be repeated unless the jointing area is filled to the calculated quantity of filler material.

Long-term welding quality of initial material	40-50%
Materials	HDPE,PP,PVDF, PVC,PB,PTFE,PFA
Recommended Use	Small sized products
Recommended skill for proper use	High
Equipment costs	Fair
Weld filler costs	Middle

Extrusion welding

Welding extruder and raw material resin needed.

Both jointing areas are prepared by cleaning, rough up and chamfering depending to the required calculated joint design.

The plastic products are fixed to each other at the jointing area and heated up by air of external heater.

During the preparation time plastic raw material resin is plasticized under heat and pressure in the extruder equipment. This filler material is continuously ejected out of the extruder through tool dies of different sizes and pressed into the preheated jointing area using PTFE (Teflon) welding heads of several design.

Long-term welding quality of initial material	80%
Materials	HDPE, PP, (PVC,PVDF)
Recommended Use	Middle to large sized products
Recommended skill for proper use	High
Equipment costs	Middle
Weld filler costs	Very fair

Infrared welding

Infrared welding equipment needed. No weld fillers needed.

Both jointing areas of the plastic product are positioned in a defined distance to the infrared heating element.

Plasticization of the jointing area is performed contact less by infrared radiation for specific time.

When welding temperature in the jointing area is reached, the infrared heating element is removed and the plasticized jointing areas pressed together using hydraulic load.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	PP, PVDF, (HDPE,PFA)
Recommended Use	Small to large sized products
Recommended skill for proper use	High
Equipment costs	Very High
Weld filler costs	High

Laser welding

Laser welding equipment needed. No weld fillers needed.

Both jointing areas of the plastic product are fixed to each other.

Plasticization of the jointing area is performed contact less by energy absorption of the jointing zone surface by laser radiation.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	PP, PVDF, (HDPE)
Recommended Use	Small to middle sized products
Recommended skill for proper use	Low
Equipment costs	Very High
Weld filler costs	High

Rotation friction welding

Rotation welding equipment needed. No weld fillers needed.

Rotation-symmetric jointing areas of the plastic products are pressed together in oscillating motion creating heat by friction losses in the contact zone.

The oscillating motion can be modulated linear, orbital or radial with adjustable amplitude.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, PVC
Recommended Use	Small to big sized products
Recommended skill for proper use	Low
Equipment costs	Middle
Weld filler costs	Middle

Vibration friction welding

Vibration welding equipment needed. No weld fillers needed.

Jointing areas of the plastic products are pressed together in oscillating motion creating heat by friction losses in the contact zone.

The oscillating motion can be modulated linear, orbital or radial with adjustable amplitude.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, PVC
Recommended Use	Very small to small sized products
Recommended skill for proper use	Low
Equipment costs	High
Weld filler costs	High

Induction friction welding

Induction welding equipment needed. Ferro-magnetic carriers needed.

Ferro-magnetic carriers are included in the jointing areas of the plastic products to build up a ferro-magnetic electric circuit.

Jointing areas are pressed together in the electro-magnetic field of the welding equipment creating heat by electric losses in the contact zone.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF, PVC, PFA, ABS, PB, PTFE
Recommended Use	Very small to big sized products
Recommended skill for proper use	Low
Equipment costs	Very High
Welding tools costs	High

High Frequency welding

High frequency welding equipment needed. No weld fillers needed.

Jointing areas of the plastic products with di-electric features are pressed together in the electro-magnetic high frequency field of the welding equipment creating heat by di-electric losses in the contact zone.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	PVDF, PFA, ABS, PVC
Recommended Use	Very small sized products
Recommended skill for proper use	Low
Equipment costs	Very High
Welding tools costs	High

Microwave welding

Microwave welding equipment needed. No weld fillers needed.

Joining areas of the plastic products with di-electric features are pressed together in the microwave field of the welding equipment creating heat by phase displacements and polarisation effects causing energy losses in the contact zone.

The joining area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	PVDF, PFA, ABS, PVC
Recommended Use	Very small sized products
Recommended skill for proper use	Low
Equipment costs	Very High
Welding tools costs	High

Ultrasonic welding

Ultrasonic welding equipment needed. No weld fillers needed.

Joining areas of the plastic products are pressed together with contact to the tool die of the welding equipment creating heat by energy directors causing friction losses in the contact zone.

The joining area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF
Recommended Use	Very small sized products
Recommended skill for proper use	Low
Equipment costs	High
Welding tools costs	Very High

Heat Impulse welding

Heat Impulse welding equipment needed. No weld fillers needed.

Joining areas of the plastic products are pressed together with contact to the tool die of the welding equipment creating heat by energy impulses causing friction losses in the contact zone.

The jointing area needs to cool down under pressure unless the material is re-solidified.

Long-term welding quality of initial material	100%
Materials	HDPE, PP, PVDF
Recommended Use	Very small sized products
Recommended skill for proper use	Low
Equipment costs	High
Welding tools costs	High