

9 Jointing techniques

9.1 Health and safety regulations

! There is always a certain risk of injury when operating with plastic pipe welding machines. Observation of the following accident prevention regulations reduces this danger to a minimum. Non-observation of them can lead to accidents!

1. Dirty and untidy workplaces increase the chances of accidents.
2. Ambient surroundings: protect electrical tools from rain and drips. Do not use them in wet or moist rooms. Keep onlookers and visitors away from the places where welding is carried out (safety distance).
3. Storage: store machines and devices under dry conditions and secured against unauthorized access.
4. Working clothing: wear tightly fitting clothing and no rings or jewellery when working: loose clothing and rings or jewellery could be caught by moving parts.
5. Electrical parts: before connecting a device to the mains, check that it is switched off. Always pull out the plug before carrying repairs. Replace damaged or brittle connection cables and pull reliefs immediately. Protect cables from heat and sharp edges. Never pull plugs out of the socket by pulling on the cable. Never carry a device by the cable.
6. Workpieces: ensure that the pipe and fitting are always located firmly in the clamping devices.
7. Danger of injury: beware of squashing when closing the clamps.
8. Danger of burning: the metal parts on the heating element will have temperatures up to 300°C. Take precautions so that it is not possible to touch them. Keep inflammable materials at a safe distance away.
9. Spare parts: replace damaged parts immediately. Protect electrical parts carefully. Dirt and moisture are very good electrical conductors. Use only original spare parts. Always state the machine number and version number when ordering spare parts.

Preparations

Use only Wefatherm tools for welding of the Wefatherm pipe system. Before starting the assembly check the welding tools for impurities. If necessary clean tools with absorbent, lint-free and non-dyed paper and PP cleaner. Replace worn out and damaged parts, specially tools with damaged coating.

Safety instruction

The general industrial hygiene and accident prevention regulations of the particular country or state in which the device is to be used, are to be observed.



Wear suitable work clothing



Wear a safety helmet



Wear safety shoes



Wear safety glasses



Wear hearing protection



Improper use can cause severe cuts, bruising or dismemberment

Jointing techniques

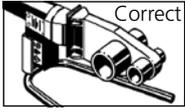
9.2 Socket welding

9.2.1 Socket welding - manual

This jointing technique is suitable for d16-63 mm.

The described process is according guideline DVS 2207 Part 11.

Welding device



1. Tighten up in cold condition the threaded inserts for holding the tools and clean with absorbent, lint-free and non-dyed paper. Screw on the tools hand tight. They may not extend beyond the edge of the tongue!



2. Switch on the device. The thermostat lamp and control lamp must light up. Set the thermostat to **260°C**. The heating-up process is completed when the thermostat lamp switches off.

3. Tighten up the tools once again with the Allen wrench. Never use pliers to avoid damage of the coating.
4. The welding tools have to be mounted according to the diameters so that the edges do not loom over the heating device. Tools from d40 mm are always to be installed at the back hole.
5. Plug in the welding device and check if the green operating lamp is switched on. The warm-up phase takes between 5 and 20 minutes, depending on the environment temperature. The welding device is operational as the orange lamp is switched on.



6. After the device has been switched off, wait until it has cooled down. Never cool down the device with water! It causes danger of injury! Electronic parts such as the thermostat could be damaged. Remove contamination with absorbent, lint-free and non dyed paper and PP cleaner.
7. The device may only be used when it is in a dry state. It must be stored in dry and dust-free conditions.
8. Proper functioning of the device can only be guaranteed when the tongue and tools are in perfect condition. Defective or contaminated parts must always be replaced.

Pipe outside diameter (mm)	Welding depth (mm)	Heating-up time (sec)	Processing time (sec)	Cooling down time (mm)
16	13	5	4	2
20	14	5	4	2
25	15	7	4	2
32	17	8	6	4
40	18	12	6	4
50	20	18	6	4
63	26	24	8	6
75	29	30	8	8
90	32	40	8	8
110	35	50	8	8
125	41	60	10	8

Table 9.1 General guideline of socket welding DVS 2207 Part 11

If welding is to be carried out outdoors when the temperature is below + 5°C, the heating-up time in accordance with DVS 2207 Part 11 should be increased by 50%.

Socket welding - manual process



1. Prepare the welding device according to the device manual.
2. Cut the pipe square. Use the pipe shear or pipe cutter for plastic pipes.
3. Deburr the pipe and remove the cutting chips.



4. Mark the insertion depth with a gauge on the pipe.
5. Align the position of the fitting with the aid of the auxiliary marking on the fitting and the continuous line on the pipe.
6. For stabi pipes remove the aluminium cover with the peeling tool up to the insertion depth. Use only original Wefatherm peeling devices with sharp blades. Replace blunt peeling blades!



7. Insert simultaneous, without turning, the pipe end into the heating sleeve up to the marking of the insertion depth and the fitting onto the mandrel up to the stop. Observe the heating-up time mentioned in table. Timing for heating-up time starts when the full insertion depth of the pipe is reached and fitting is pushed against the stop.



8. At the end of the heating-up time, draw the pipe and fitting rapidly from the sleeve and push them immediately together up to the point that the insertion depth marking is covered by the bead that has been formed. Do not insert the pipe too far into the fitting to prevent the internal diameter of the pipe being reduced. Do not rotate the pipe and fitting relative to each other.

9. During the processing time keep the pipe and fitting in fixed position relative to each other. The parts can still be aligned relative to each other during this phase but may not be rotated relative to each other! After completion of the cooling time the joint can be fully loaded. This welding joint is an inseparable joint, the material of the fitting and pipe have melted together.

9.2.2 Socket welding - mechanical

This joining technique is suitable for d75-125 mm.

The described process is according guidelines DVS 2207 Part 11.

Welding device



Illustration 9.1

The axial movements are brought about by a transport wheel and a toothed rod. V-shaped clamping tools of hardened steel are for holding the components independently of their external diameter. Two V-shaped clamps for pipe fixation and a single one with insert stop are for fitting fixation. The two tool carriages can be aligned axially. The insertion depth is limited by a stop. The electronically controlled heating plate can be swung into the machine.

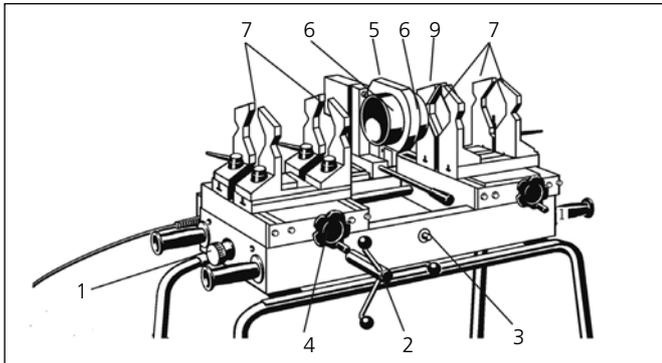


Illustration 9.2

Setting up the welding machine

1. Remove the machine and accessories from the transport case and place the machine on a suitable non-slip base. Clamp it if necessary.
2. Slide heating plate (5) into the guide.
3. Fold welding plate (5) between the clamping tools (7) and adjust if necessary.

Aligning the welding machine

4. Select a heating mandrel (6) and a heating sleeve (6) in accordance with the dimensions of the pipe and fitting and fit them on the plate (heating mandrel on the right, heating sleeve on the left).
5. Unscrew the clamping tools (7) in accordance with the diameter of the pipe and fitting.
6. Clean tools, pipe and fitting on the inside and outside with lint-free and non-dyed paper and PP cleaner.
7. Heat up the welding reflector and set the welding temperature at 260°C according the manual. The processing temperature has been reached and the device is ready for use when the control lamp switches off.

Socket welding - machined process

1. Press the fitting into the clamping tool (number 7) up to the stop (9) and clamp firmly.
2. Push the button (3).
3. Move the carriage with hand wheel (2) up to the stop (3) and secure with the locking screw (4). Position the pipe before the fitting in such a way that its face is in contact with the fitting. Clamp firmly with clamping tools (7).
4. Set the diameter stop (1) to the diameter to be processed.
5. Check the welding plate temperature and adjust if necessary.
6. Swing the in welding plate (5) between the pipe and fitting.
7. Slide the pipe and fitting at the same time into the heating tools (6) up to the stops and hold in this position for the heating-up time.
8. After the heating-up time has expired, move the carriages rapidly back and swing out the plate (5). Then move up the pipe and press it into the fitting up to the stop and lock it in this position.
9. Remove the welded parts from the machine and align if necessary, but do not rotate them relative to each other! After the cooling down time has expired, the welded parts can be loaded to pressure.

For the heating-up, processing and cooling down times see table 9.2.

Maintenance

1. The heating element is operated with 230 V/50 Hz.
2. Keep guide shafts, toothed rods and trapezoidal spindles free of dirt.
3. Clean the heating tools with absorbent, lint-free and non-dyed paper and PP cleaner.
4. Use only original spare parts for repairs.
5. Cover the machine when it is not used.

Pipe outside diameter (mm)	Welding depth (mm)	Heating-up time (sec)	Processing time (sec)	Cooling down time (mm)
16	13	5	4	2
20	14	5	4	2
25	15	7	4	2
32	17	8	6	4
40	18	12	6	4
50	20	18	6	4
63	26	24	8	6
75	29	30	8	8
90	32	40	8	8
110	35	50	8	8
125	41	60	10	8

Table 9.2 General guideline socket welding DVS 2207 Part 11

If welding is to be carried out outdoors when the temperature is below + 5°C, the heating-up time is accordance with DVS 2207 Part 11 should be increased by 50%.

Joining techniques

9.2.3 Weld-in saddle welding

The Wefatherm weld-in saddles weld both the pipe outer surface and the wall thickness of the pipe for a reliable joining.

+ Advantages

- realizing additional tees on distribution lines
- afterwards addition of sensors (thermometer, pressure gauge)
- construction of tees

Weld-in saddles can be used for PP-R and PP-R stabi pipes.

Installation



1. Drill a hole into the pipe with drill
Code 5150 30070.

! Notice the depth of the drill.



2. For stabi pipes: remove the rest of the aluminium in the bore hole with chamfering tool
Code 5150 30075.



3. Heat up the hole and weld-in saddle simultaneously. The heat up time is 30 sec (temperature 260°C). Heat time starts when full insertion depth of the saddle is reached and the saddle is pushed against the tool.



4. After heating up, remove the welding tool and weld the saddle immediately into the hole. The saddle should be pressed into the pipe for 15 sec. After 10 min of cooling down the weld-in saddle can be used.

9.3 Butt-welding

This joining technique is suitable for d160-315 mm.
The described process is according guideline DVS 2207 Part11.

Butt-welding is a very economical and reliable joining technique in which an additional tool is required to create the non-detachable joint. Butt-welding is very well-suited to the pre-fabrication of pipe elements and the construction of special fittings. In butt-welding, the welding surfaces (ends) of the components to be welded are first machined (planed). This produces coplanar ends that can later be simultaneously pressed against the heating element. The welding surfaces are then heated by the heating element (hot plate) and lined up under slight pressure (alignment pressure). Subsequently, heating proceeds under reduced pressure (heating time) and, after removing the heating element (conversion), the joint is formed under welding pressure. Table 9.3 provides a schematic representation of the butt-welding process.

Adjustable heating temperatures can be varied to match wall thickness (see illustration 9.3).

The process parameters can be established according this guideline. The calculated pressure needs to be loaded on the butt-weld components. Each butt-welding machine has specific internal friction and machine settings need to be adapted accordingly. The values given in this Specification Manual are specific for the butt-weld machine Ritmo Delta Dragon. When another butt-weld machine (fabricator or type) is applied, the welder needs to respect the specific parameters of this fabricator/type.

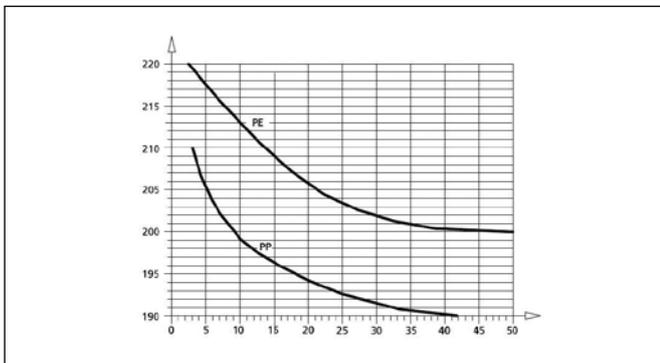


Illustration 9.3 Heating temperature as function of PP pipe wall thickness

Delta 250B
DVS 2207-11 (02/99)
PP

D (mm)	s (mm)	SDR = D/s	T (°C)	*P1 (bar)		1 P ₂ (bar)	2 t ₂ (sec)	3 t _{3 max} (sec)	4 t ₄ (sec)	5 *P ₅ (bar)	t ₅ (min)
160	14,6	11	210	7	1,0	1	277	8	13	11	24
160	17,8	9	210	13	1,0	1	315	9	16	13	28
160	21,9	7,4	210	16	1,55	2	359	10	19	16	34
160	26,6	6	210	19	2,0	2	405	11	23	19	41
200	18,4	11	210	18	1,0	2	320	9	16	18	29
200	22,3	9	210	21	1,5	2	363	10	19	21	35
200	27,4	7,4	210	25	2,0	3	411	11	23	25	42
200	33,2	6	210	30	2,0	3	456	13	29	30	50
250	22,7	11	210	28	1,5	3	367	10	20	28	35
250	27,8	9	210	33	2,0	3	414	11	24	33	42
250	34,2	7,4	210	39	2,0	4	463	13	29	39	51

Table 9.3 Add to this value the drag pressure of the welding machine

Joining techniques

9.4 Electrofusion welding

This joining technique is suitable for d20-315 mm. The described process is according guideline DVS 2207 Part 11.

Installation



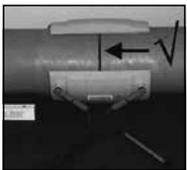
1. Cut off the end of the pipe square and deburr. Mark the welding depth of the coupler.



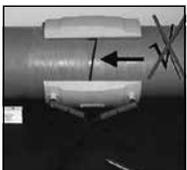
2. Prepare the pipe surface in the welding area. Remove the oxidation layer in the welding area, depth of the coupler + 0,5 cm processing surcharge. Use a rotary scraper tool. Remove the chips without touching the pipe surface.



3. Clean the pipe surface and the inside of the coupler with absorbent, lint-free and non dyed paper. Internal surface of the coupler must not be scraped. The fitting should only be taken out of the protection cover when starting the installation.



4. Slide the coupler onto the pipe, free of tension or stress up to the marking. Control by prior marking. Secure the pipe against dislocation, e.g. with a pipe clamp. Connect the two welding cables to the contact pins of the coupler and start the welding process.



5. Only start the welding process when the position of the pipes in the electrofusion coupler is even.

At the end of the welding cycle wait for the cooling time. After the cooling time you can stress the electrofusion joint to the permissible operating pressure.

d (mm)	Cooling time (min)
16 - 32	10
40 - 63	25
75 - 110	40
125	45
160 - 200	75
250 - 315	100

Table 9.4

9.5 Flange joining

This paragraph contains a recommendation to ensure a reliable and tight flange joint according to ESA/ESF guideline publication 009/98.

Alignment

1. The sealing faces of the two stub-ends in a joint should contact each other or in case of a rubber joint with gasket, be parallel to each other all around the circumference and in full contact.
2. The flange face should be in full contact all around the circumference with the upper face of the stub-end to avoid fulcrum effect which will lead to leaking and even breaking of the flange itself while torqueing the bolts.

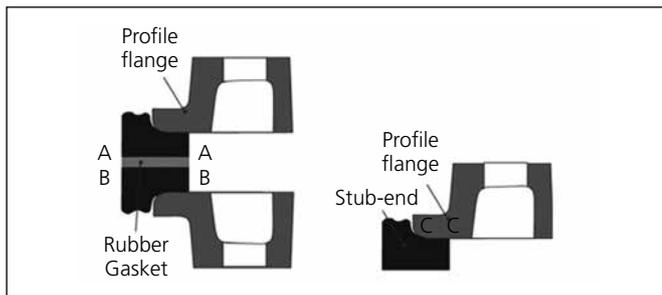


Illustration 9.4

Bolt tightening

1. Install all the bolts and nuts finger tight, ensuring at all times that the alignment is correct.
2. As the first torqueing step, tighten the bolts in a crisscross sequence as shown in illustration 9.5. Using a torque wrench with 20% of the final torque listed in table 9.5, taking care that points 1 and 2, are satisfied at all times.
3. In the four remaining steps, repeat step two four times, each time increasing the torque by 20% of the final value.
4. After reaching the final torque, use rotational tightening until all bolts are stable at the final torque value (in general two complete times around is required).

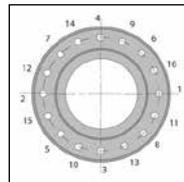


Illustration 9.5

! Always use the crisscross pattern!

d_2 (mm)	DN (mm)	Bolt hole	Bolt count	Bolt size	Bolt tightening torque (Nm)		
					Flat ring gasket ($p_{acc} \leq 10$ bar)	Profile gasket ($p_{acc} \leq 16$ bar)	O-ring gasket ($p_{acc} \leq 16$ bar)
32	25	85	14	4	M12	16	15
40	32	100	18	4	M16	16	20
50	40	110	18	4	M16	16	25
63	50	125	18	4	M16	16	35
75	65	145	18	4	M16	16	40
90	80	160	18	8	M16	16	40
110	100	180	18	8	M16	16	50
125	100	180	18	8	M16	16	50
160	150	240	22	8	M20	16	60
200	200	295	22	8	M20 *)	16	75
250	250	350	22	12	M20 *)	16	95
315	300	400	22	12	M20 *)	16	100

*) $p_{acc} \leq 6$ bar for elastomer sealing and accumulated friction factor $\mu R = 0,15$

Table 9.5 Standard values for torque (DVS 2210 part 1)

