PPR
PIPING SYSTEM

3

JOINING PROCEDURES

3.1 WELDING EQUIPMENT

Suitable equipment complying with guidelines DVS2207 shall be used for a fast and efficient installation of **PPR PIPING SYSTEM**:

1) Welder 800 W - 220V AC – 50 Hz model **00NSBEP** supplied in a special carrying case, complete with die pairs required for the welding of diameters 20 - 25 - 32. The welder is equipped with an automatic thermostat to maintain the temperature of the die pair constant at 260 ± 10 ° C and is available with a voltage of 110V or 48V upon request.

2) Welder on wheels (1400 W - 220V AC - 50 Hz) model **00STL125** is supplied on pallet complete with die pairs from diameter 25 to diameter 125 and pipe support.

Equipment	Item code	Power supply	16	20	25	32	40	50	63	75	90	110	125	160	200	250	315	355	400	450	500	560	630
	**00NSBEP**	220W 800W	X	X	X	X	Die pairs included: ø 20mm - 25mm - 32mm																
	00NSBEP63	220W 800W	X	X	X	X	X	X	X	Die pairs from ø 20mm to ø 63mm included													
	**00NPCCE**	800W	X	X	X	X	X	X	X	Die pairs NOT included													
	**00NPCCE125**	1400W	X	X	X	X	X	X	X	X	X	X	X	Die pairs NOT included									
	**00STL125**	1400W			X	X	X	X	X	X	X	X	X	Die pairs included									
	**00S10160**						X	X	X	X	X	X	X	X									
	**00S10250**								X	X	X	X	X	X	X	X							
	**00S10315**								X	X	X	X	X	X	X	X	X						
	**00E8500**	230W		X	X	X	X	X	X	X	X	X	X	X	X	X	X						
	**00E9001**	230V		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

3) The **multi-function electrofusion welding machine** for electrofusion fittings is available in two models:
- with automatic insertion of the welding parameters, i.e. provided with a scanner to read the barcodes on the fitting to be welded (model **00E9001**);
- with manual input of welding parameters (model **00E8500**).

Both welding machines are equipped with a power cable 3,5 m long.
The length of the connecting cables between the machine and the fitting is 3m.
The total weight is 15kg.

4) The **welding machines for butt fusion fittings** differ according to the diameter to be welded:
   a. from Ø40mm to Ø160mm (model **00E10160**);
   b. from Ø63mm to Ø250mm (model **00E10250**);
   c. from Ø63mm to Ø315mm (model **00E10315**).

Each unit is supplied complete with:
- basic machine;
- heating plate;
- hydraulic control unit;
- electric milling machine;
- hydraulic hoses;
- adapters.

Technical data

Voltage	230V - Single phase 50/60 Hz (TE)	230V - Single phase 50/60 Hz (TE)
Working temperature		TFE: 260°C (±1°) TE: 180 ÷ 290°C
Ambient temperature		-5 ÷ +40°C
Material		HDPE, PP, PP-R, PB, PVDF

Models	ø Max diameter	Power supply	Dimensions (W x D x H)	Weight
00NSBEP63	63 mm	500 W	115 x 50 x 320 mm	1,44 Kg
00NPCCE	63 mm	800 W	175 x 50 x 360 mm	1,82 Kg
00NPCCE125	125 mm	1400 W	115 x 50 x 396 mm	3,16 Kg

Technical Data

Working range	25 ÷ 125 mm	
Voltage	110V	230V
	Monophase - 50/60 Hz	
Total absorbed power	1400W	1400W
Working temperature	180 ÷ 280°C	
Room temperature range	-5°C ÷ +40°C	
Time to reach welding temperature	~ 10 min.	
Materials	PEAD, PP, PP-R, PB, PVDF	

Dimensions (W x D x H) and Weight

Machine	1080 x 840 x 580 mm
Carrying case	1500 x 800 x 1300 mm
Weight	100 kg

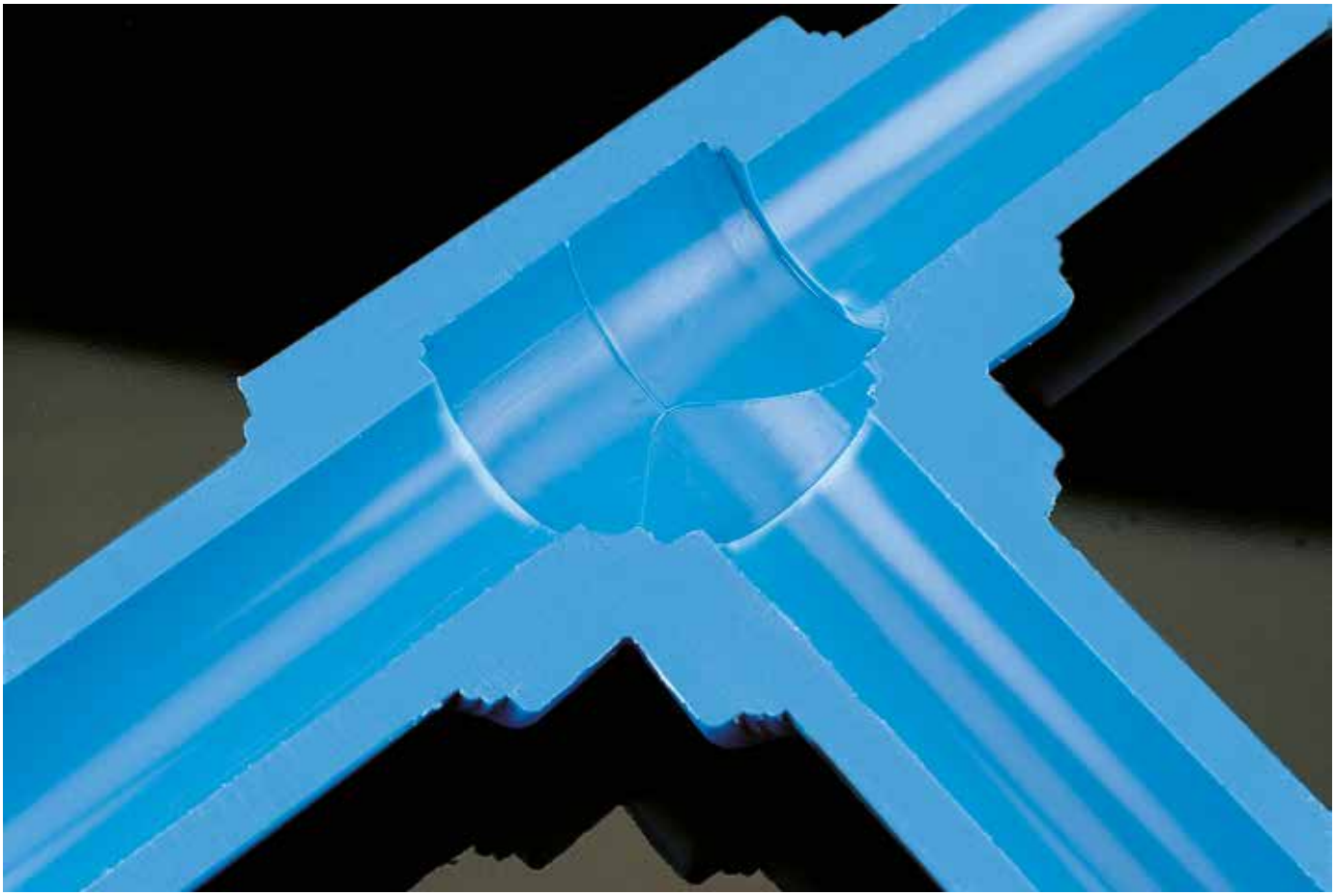
3.2 POLYFUSION WELDING

3.2.1 WARNINGS AND PRELIMINARY RECOMMENDATIONS

POLYFUSION welding is one of the most widely used junction techniques for the installation of PPR systems. There are just a few and simple steps necessary to complete it but they need the greatest attention.

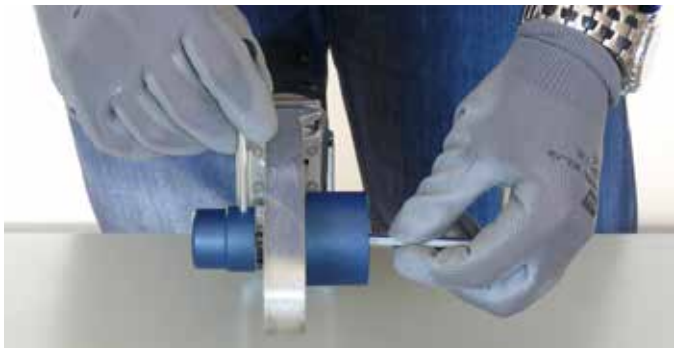
Welding equipment check
It is necessary to evaluate the efficiency of the equipment and tools to be used.

In particular you should carry out the following operations:
- check the functioning of the thermostat by measuring the temperature on the surface of the die pairs with an appropriate contact thermometer (260° C);
- if you are using a polyfusion welder, check the functioning of the clamps and the handling system of the welding machine so as to ensure the proper alignment of the parts to be welded;
- check the integrity of the non-stick coating of the die pairs.



If a perfect polyfusion welding of the **PPR PIPING SYSTEM** by **NUPIGECO** has been carried out, the section of the junction does not show any difference of material between the pipe and the fitting, proving correct molecular fusion.

3.2.2 POLYFUSION WELDING: FITTINGS

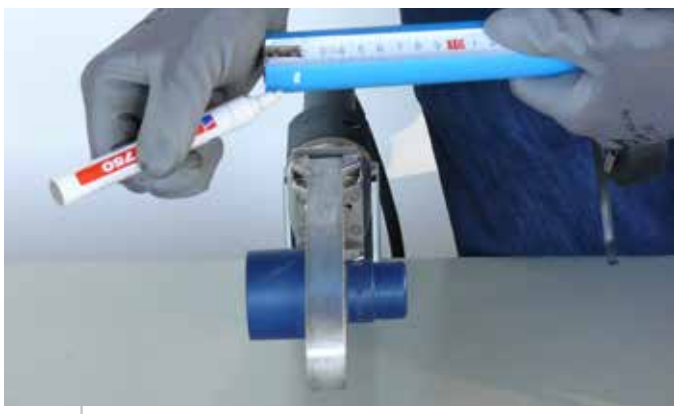


Assemble the die pairs on the cold plate and connect the welder to the power network.

Wait for the sound signal (see the user's manual of the welder) that informs that the required temperature has been reached.

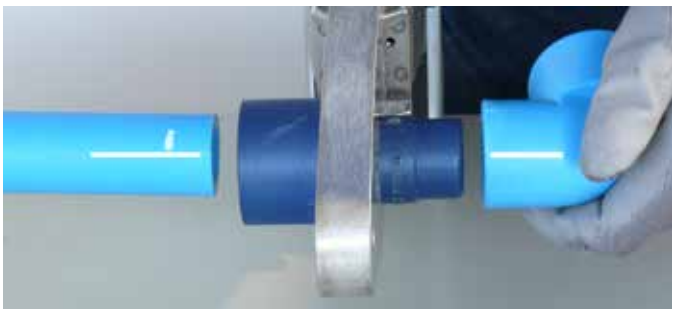
Cut the pipe perpendicularly to its axis using the suitable pipe cutter.

Inside the case that contains the welder you will find a sheet that shows the welding parameters (diameter, pipe insertion depth, heating time, fusion time and time prior to testing).

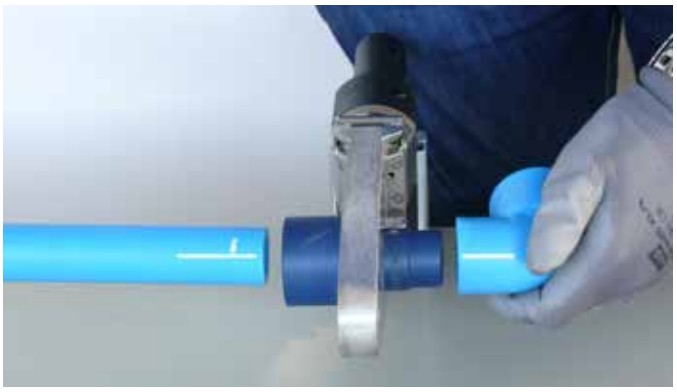


Mark the insertion length on the pipe.

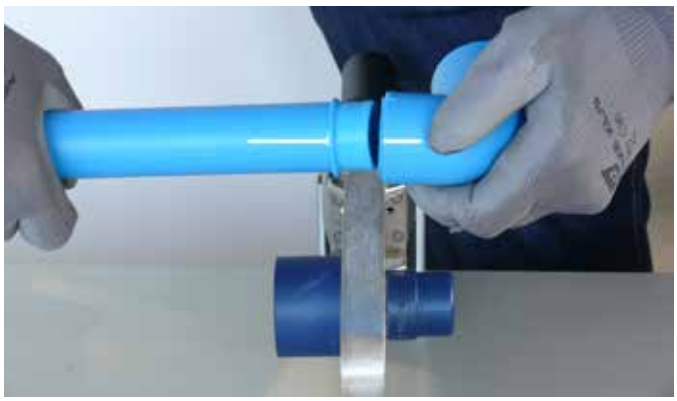
Mark a longitudinal sign as a reference on the external surfaces of the pipe and fitting to avoid turning the components to be welded while performing the welding procedure (do not cut the surface of the pipe and fitting).



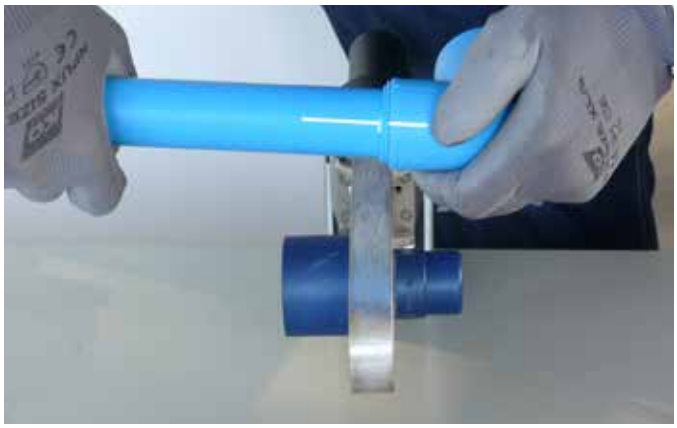
Place the ends to be welded close to each other to be able to begin the heating process of the material simultaneously.



After checking the surface temperature of the die pairs, insert the pipe inside the female die pair without rotating it and the fitting into the male die pair up to the sign previously marked for the heating time t1 as shown in table A (page 76). Do not heat up the parts to be welded twice.



After the heating time, quickly remove the elements from the die pairs and insert them one inside the other, within time t2, until you reach the insertion depth previously marked. Be careful not to rotate the pipe into the fitting and carefully align the reference longitudinal signs.



Once the assembly is complete it is possible to **TEST** it according to the indications as per Standards CEN TR 12108 and EN806-4).

TABLE A

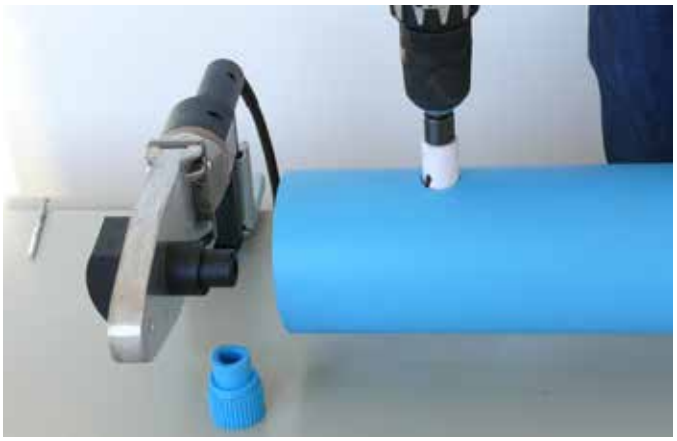
Ø	Heating sec (t1)	Assembly sec (t2)	Test after min	Pipe insertion mm	Welding procedure (Standard DVS 2207 – Sec. 1-6.1)
16	5	4	2	13	• Manual (welder - item code 00NSBEP) • With suitable equipment (welding machines - item code 00STL) • With suitable equipment (welding machines - item code 00STL)
20	5	4	2	14	
25	7	4	3	15	
32	8	6	4	17	
40	12	6	4	18	
50	18	6	4	20	
63	24	8	6	26	
75	30	8	6	29	
90	40	8	6	32	
110	50	10	8	35	
125	60	10	8	40	
160	Butt fusion welding or electric socket welding				• With suitable equipment
200					
250					
315	Butt fusion welding				• With suitable equipment
355					
400					
450					
500					
560					
630					

3.2.3 POLYFUSION WELDING: WELDING SADDLES

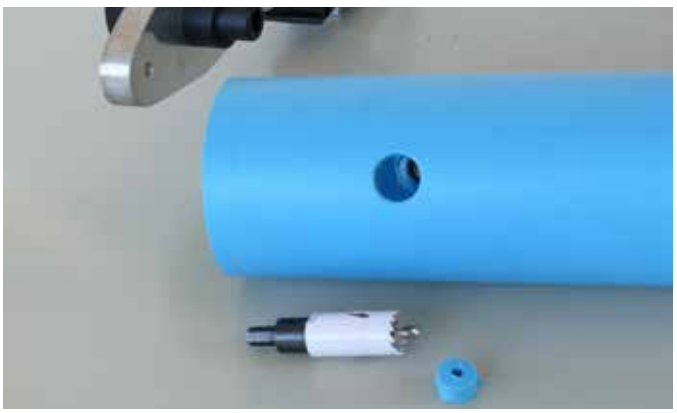
Threaded and not threaded welding saddles allow to make intervals or derivations on large section pipes already installed and also pipe arrays for water meters.

Drill a hole in the pipe with the suitable cutter (item code 00FGS) at the point where you want to make a new derivation.

Make sure that the parts to be welded (especially the pipe) are clean and dry.



Check that the welder and die pairs have reached the correct operating temperature (260° C).

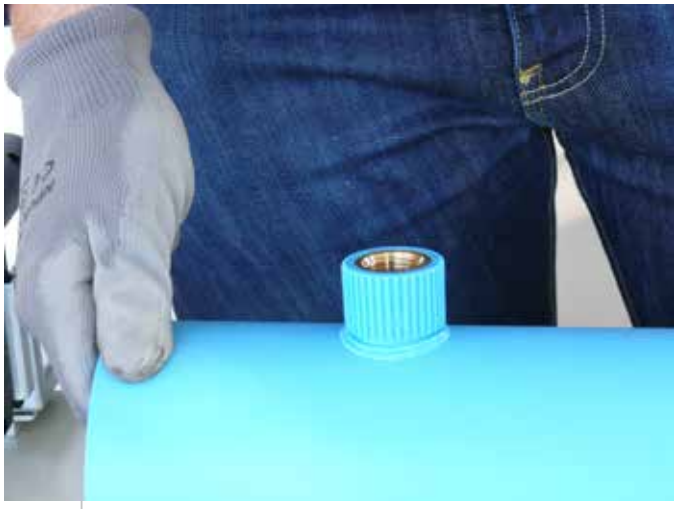


Insert the male die pair into the pipe hole until the concave part touches the outer surface of the pipe.

Insert the fitting into the female die pair simultaneously. The contact time between die pairs, fitting and pipe shall be those listed in the relevant table.

Once the heating time is over, immediately insert the welding saddle into the heated hole without turning. The fitting must be perfectly fixed and pressed against the pipe surface for about 30 seconds.

After a cooling time of 10 minutes, the new joint can support the operating parameters.



When making double pipe arrays for water meters we suggest to:

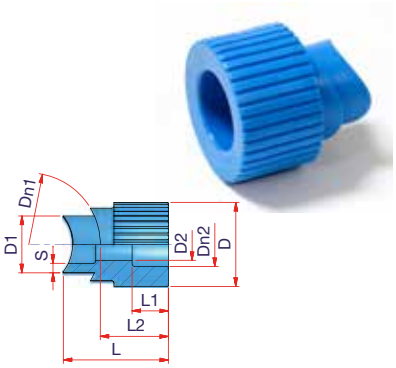
- mark in advance the two opposing drilling axes;
- make all the holes at the same time with the suitable cutter;
- make the joints staggered between them.

3.2.4 DIMENSIONAL TABLE FOR WELDING SADDLES

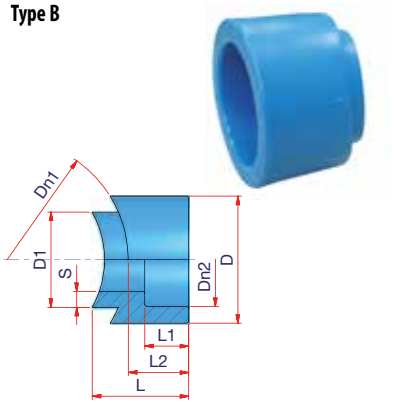
Code	Type	Ø	DN1	DN2	D1
03NGS5020	A	50/25x20	50	20	25
03NGS5025	A	50/25x25	50	25	25
03NGS6320	A	63/25x20	63	20	25
03NGS6325	A	63/25x25	63	25	25
03NGS6332	A	63/32x32	63	32	32
03NGS7520	A	75/25x20	75	20	25
03NGS7525	A	75/25x20	75	25	25
03NGS7532	A	75/32x32	75	32	32
03NGS9020	A	90/25x20	90	20	25
03NGS9025	A	90/25x20	90	25	25
03NGS9032	A	90/32x32	90	32	32
03NGS11020	A	110/25x20	110	20	25
03NGS11025	A	110/25x20	110	25	25
03NGS11032	A	110/32x32	110	32	32
03NGS12563	B	125/63x63	160	40	40
03NGS16040	B	160/40x40	125	63	63
03NGS16063	B	160/63x63	160	63	63

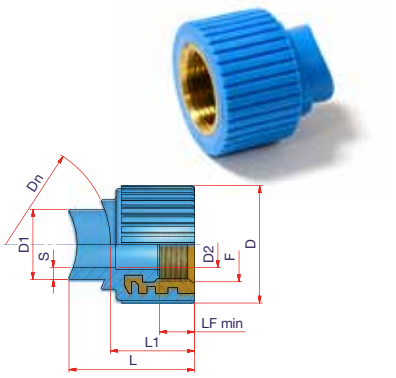
Code	Thread (F)	Ø	DN	D1
03NGSF4012	1/2″	40/25	40	25
03NGSF5012	1/2″	50/25	50	25
03NGSF6312	1/2″	63/25	63	25
03NGSF7512	1/2″	75/25	75	25
03NGSF9012	1/2″	90/25	90	25
03NGSF11012	1/2″	110/25	110	25
03NGSF5034	3/4″	50/25	50	25
03NGSF6334	3/4″	63/25	63	25
03NGSF7534	3/4″	75/25	75	25
03NGSF9034	3/4″	90/25	90	25
03NGSF11034	3/4″	110/25	110	25
03NGSF631	1″	63/32	63	32
03NGSF751	1″	75/32	75	32
03NGSF901	1″	90/32	90	32
03NGSF1101	1″	110/32	110	32

Type A



Type B





00FGS25 ø 25
00FGS32 ø 32

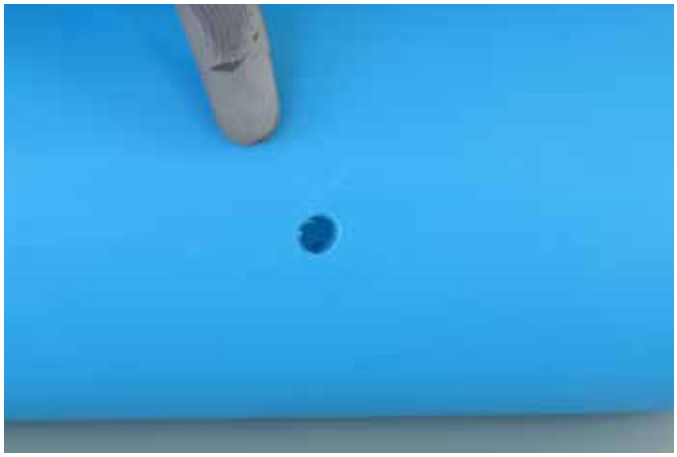
00MATGS40	ø 40/25
00MATGS50	ø 50/25
00MATGS63	ø 63/25
00MATGS75	ø 75/25
00MATGS7532	ø 75/32
00MATGS90	ø 90/25
00MATGS110	ø 110/25
00MATGS6332	ø 63/32
00MATGS9032	ø 90/32
00MATGS11032	ø 110/32

3.2.5 POLYFUSION WELDING: REPAIR OF A DAMAGED PIPE

This system applies when a pipe or a fitting have been pierced just from one side and perpendicularly to their axis.

Enlarge the hole up to a diameter of 6 mm or 10 mm with a suitable tip.

Make sure that the previous hole has not damaged the other inner surface of the pipe or fitting.



Insert the male die pair into the pipe hole and the repair cap into the female die pair.

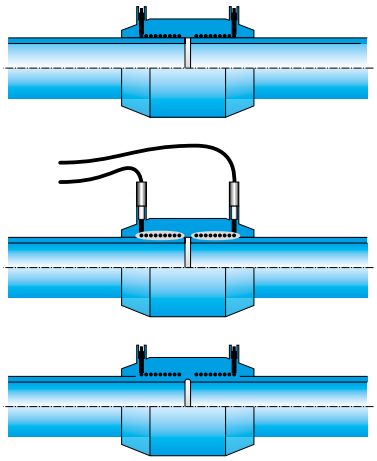
After the insertion, heat up for 5 seconds.

Once the heating time is over, insert the male cap inside the hole without rotating it.

Wait for a cooling time of 1 minute and cut the cap.

The picture shows how the pipe looks after the repair.

3.3 ELECTROFUSION WELDING



Electrofusion fittings are manufactured with a molded-in-place resistance wire which can be connected to suitable welding machines by means of a set of connecting wire leads.

When voltage is applied and electrical energy goes through, this resistance generates the heat needed to melt the PPR.

Energy is directly transmitted to the contact surface between the fitting and the pipe causing heat welding of the parts.

The main features of PPR PIPING SYSTEM electrofusion fittings are the high quality and the reliability of the joints. When it cools down, the joint is homogeneous, strong, safe and reliable.

WELDING BARCODE (in conformity with standard ISO13956)
Scan the barcode with the barcode scanner or manually enter the welding parameters of time and voltage reported on the barcode. You can carry out the welding procedure by using the multifunction welding unit in automatic mode (with barcode scanner) or in manual mode. In case of automatic welding, always check time and voltage parameters on the display after scanning the barcode. In case of manual welding, use time and voltage parameters indicated on the barcode. If the welding unit does not perform welding time compensation according to ambient temperature, use the parameters on the bag label.

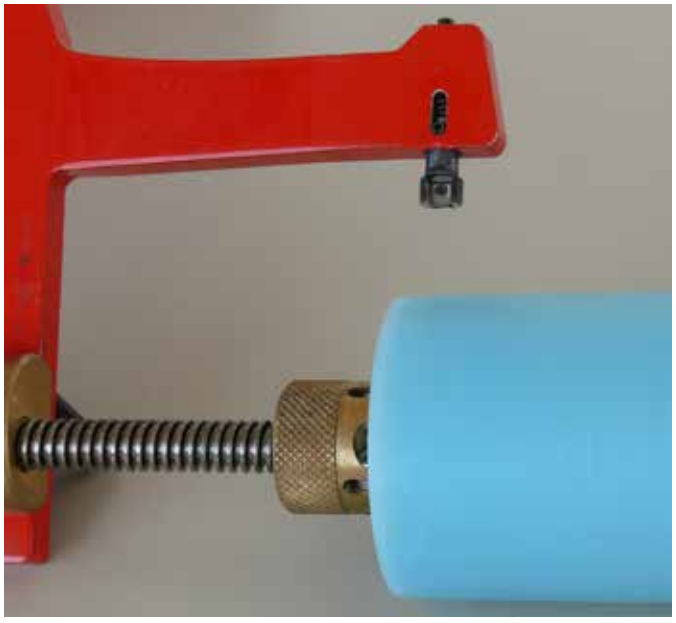
N.B.: Keep at a safe distance during the welding procedure.

Use the PPR PIPING SYSTEM welding units and follow the instructions below to obtain a reliable weld.

Cut the pipes at right angles with a pipe cutter.

Scrape the pipe surface and the fitting spigot uniformly with the appropriate pipe scraper. Scrape at least 1 cm beyond the insertion length of the fitting to completely remove the oxidized polypropylene layer.

Mechanical scrapers are recommended. Hand scrapers can be used.



Remove any mud, dust, grease or other traces of dirt from the pipe or spigot ends and the welding area of the fitting. Use only isopropanol (isopropyl alcohol) and a soft clean wiping cotton cloth. Wait until the cleaned parts are completely dry.

Measure the insertion length of the pipe inside the fitting.

Mark the welding length on the pipe (equal to the length of the electrofusion fitting socket) with the appropriate marker.

Insert the pipe or spigot ends into the fitting up to the marked insertion length (position the aligners in order to keep the position and avoid any mechanical stress during the welding procedure and cooling time if necessary).

AVOID ANY MECHANICAL STRESS ON THE WELDING AREA DURING THE WELDING PROCEDURE AND THE COOLING TIME.

IMPORTANT

Please refer to the user's manual of the welding machine for its correct use.

Prepare the pipe and fitting to be welded following the directions in the previous chapter. Make sure that the pipe and fitting to be welded are lined up without any possibility of movement (use a suitable aligner if necessary).

Connect the welding cables to the fitting connectors, scan the barcode with the barcode scanner or enter the welding parameters manually.

ATTENTION!

Always check the welding parameters before starting the welding procedure.

At the end of the welding procedure, disconnect the cables and wait for the cooling time indicated on the barcode.

The welding data can be downloaded using a USB pen drive or instantly printed through a printer. The exact position of the joint can be recorded with the Bluetooth GPS device (only for model E9001).

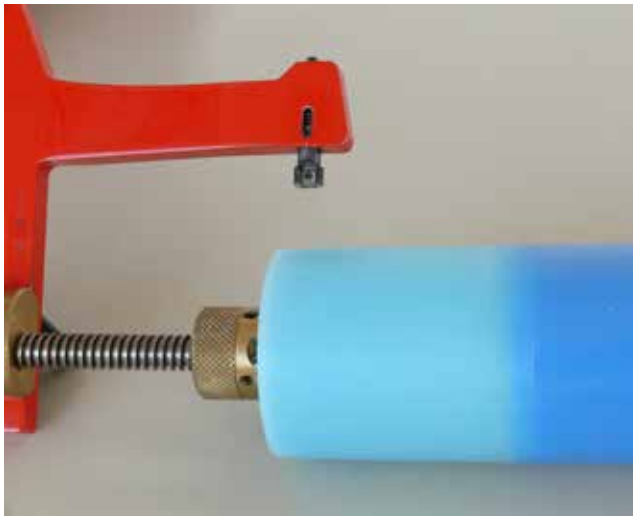
When the cooling time is over, remove the aligners and start the pressure test by using the pressure test unit.

3.3.1 INSTRUCTIONS FOR THE WHITE BLUE AND DARK SYSTEMS

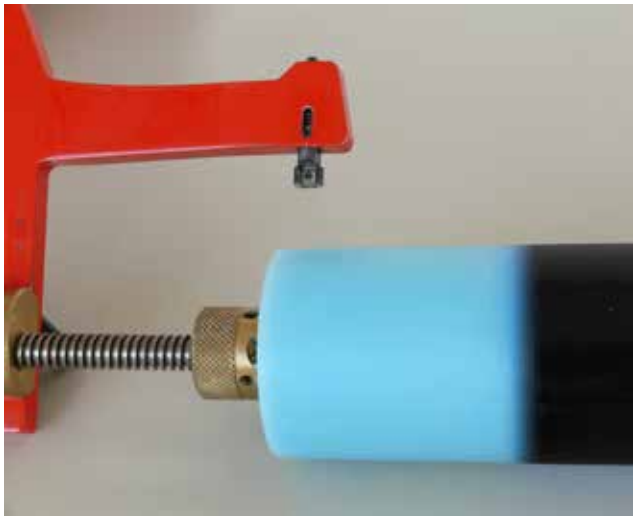
The installation of WHITE BLUE and DARK systems carried out using ELECTROFUSION FITTINGS rather than BUTT FUSION WELDING FITTINGS needs further attention, especially during the preparation of the pipe.

It is essential to completely remove the outer layer of the material until the PPR layer can be seen clearly. This operation makes the welding procedure fully reliable. If it is not performed, the fusion between the PPR used for the production of the fittings and the oxygen barrier or the UV protection layer does not occur.

NIRON
WHITE BLUE PPR PIPE



NIRON
DARK PPR PIPE



3.4 BUTT FUSION WELDING

3.4.1 INTRODUCTION

The welding process consists in the joining of two elements (pipes and/or fittings) of equal diameter and thickness in which the surfaces to be welded are heated until melting by contact with a heating element and then, after its removal, are butt joined by pressure welding.

The instructions below are for guidance only. Unlike socket fusion, butt fusion welding implies that the operators are suitably trained on the use of welding machines and have a thorough knowledge of the procedures to be performed.

ATTENTION!

Each manufacturer of BUTT FUSION WELDING equipment publish his/her own reference literature based on the working parameters of the equipment produced. The user SHALL REFER to this specific literature for every detail not expressly stated and for any reference information regarding the equipment.

3.4.2 RECOMMENDATIONS AND WARNINGS

To perform a proper fusion procedure and ensure a reliable joint, it is necessary to remember the following steps:

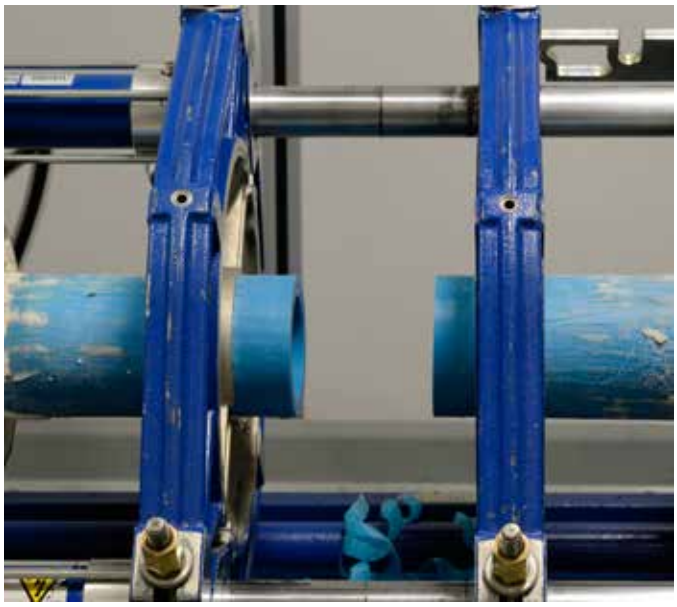
- the working temperature of the heating element shall be checked using a calibrated contact thermometer. This measurement shall be done after about 10 minutes from the moment when the nominal temperature is reached, allowing the heating element to heat up evenly over the entire section;
- check the surface of the heating element (integrity of the non-stick layer) and properly clean it by using soft paper or cloth, free of fibers;
- check the proper functioning of the welding machine;
- check the efficiency of the clamp supports of the welding machine so that the correct alignment of the pieces to be welded and the parallelism of the surfaces touching each other are ensured;
- check the drag force of the movable trolley, both as friction and in relation to the load being handled (pipes and/or fittings);
- check the efficiency of the measuring equipment (pressure gauge and timer);
- check that the pipes and/or fittings to be welded are of the same diameter and thickness (SDR);
- the planing tool supplied with the welding machine shall mill and align the pipes and fittings frontally and also absorb the pressures developed during the welding process without deforming the welding point irreversibly;
- the welding machine should be prepared for use according to the manufacturer's instructions.

3.4.3 BUTT FUSION WELDING PROCEDURE

PREPARATION FOR WELDING

Cleaning the surfaces

Before positioning the parts to be welded, clean the welding area to remove any dust, grease or dirt.



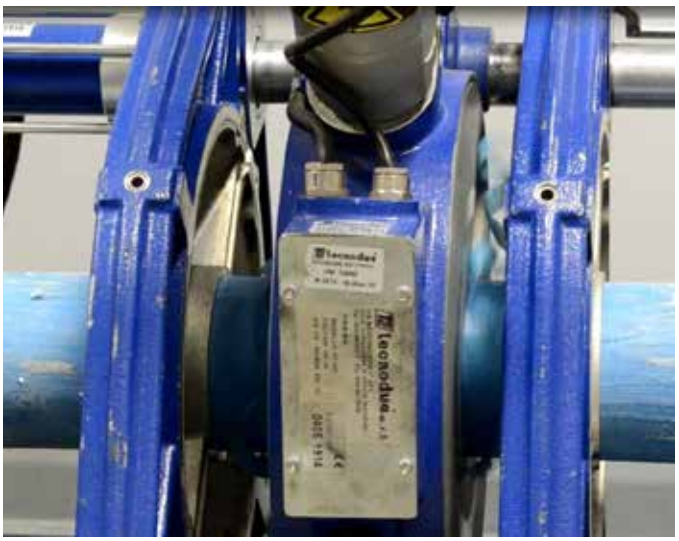
Locking the ends

The pipes and/or fittings must be locked in the clamps of the welding machine so that the contact surfaces to be welded are aligned between them. The possibility of axial movement without significant friction shall be ensured by using rollers or oscillating suspensions to allow the pipe sliding to remove any mechanical stress from the clamps resulting from the weight of the locked pipes.

The pipes and/or fittings shall be positioned so as to contain the misalignment within 10%. To obtain this result, rotate at least one of the elements until the most favorable coupling condition is reached and/or the locking force exerted on the fastening systems of the clamps is not excessive as it could damage the surfaces of the components.

Milling the edges to be welded

The ends of the two components to be welded shall be milled to ensure adequate parallelism and to remove any trace of oxide.



The milling operation shall be carried out by bringing the parties close to each other only when the milling cutter inserted between them is working and by exerting gradual pressure so as not to stop the tool and prevent excessive heating of the surfaces in contact.

The milling chips must be formed continuously on both edges to be welded: otherwise, investigate the cause and repeat the process until the required result is reached.

The milling machine must be turned off only after the removal of the ends to be welded.

After the milling procedure is finished, milling chips shall be removed from the inner surface and the surrounding area of the elements to be welded, by using a brush or a clean cloth, free of fibers, fluff and lint, and not synthetic soaked in a suitable cleaning liquid (e.g. isopropyl alcohol, trichloroethane chlorothene). Do not use any solvent such as gasoline, denatured alcohol or trichlorethylene.

The milled surfaces shall not be touched or otherwise contaminated.

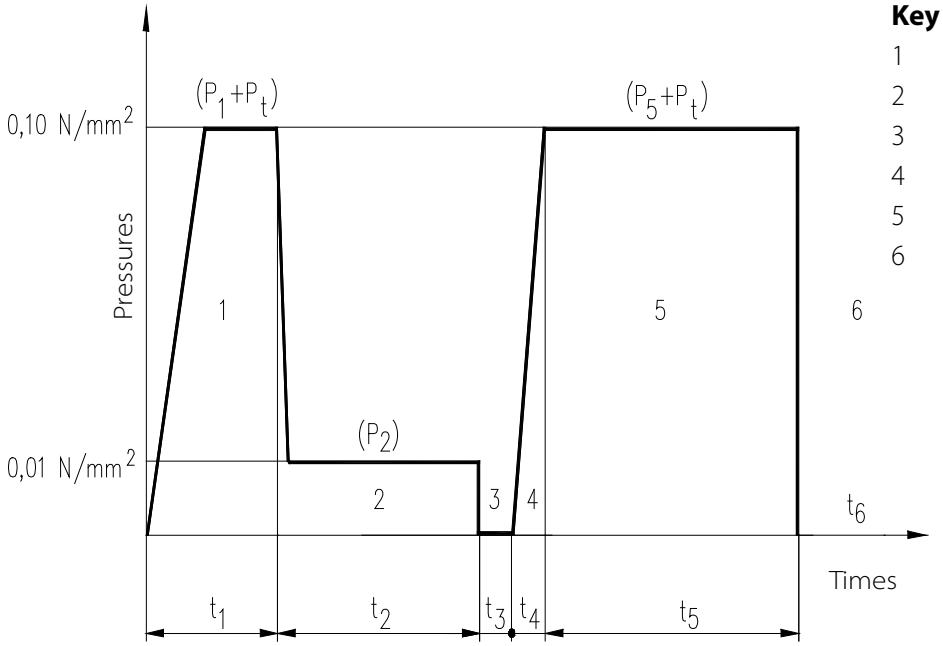
At the end of this phase, by bringing the two ends into contact, the space between the two edges must not exceed the value of 0,5 mm.

WELDING PROCEDURE

Welding procedure by means of contact heating elements

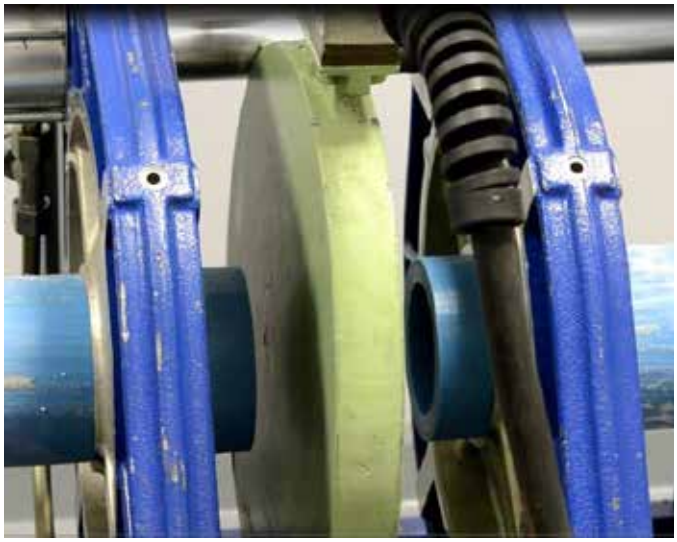
The butt fusion welding of pipes and/or fittings by means of contact heating elements shall be carried out following the different steps of the welding procedure shown in the drawing.

In particular:
Phase 1 : Approaching and preheating
Phase 2 : Heating
Phase 3 : Removing the heating element
Phase 4 : Reaching the welding pressure
Phase 5 : Welding
Phase 6 : Cooling



Key

1 Phase 1 : Approaching and preheating
2 Phase 2 : Heating
3 Phase 3 : Removing the heating element
4 Phase 4 : Reaching the welding pressure
5 Phase 5 : Welding
6 Phase 6 : Cooling



WELDING PHASES

Phase 1: Approaching and preheating

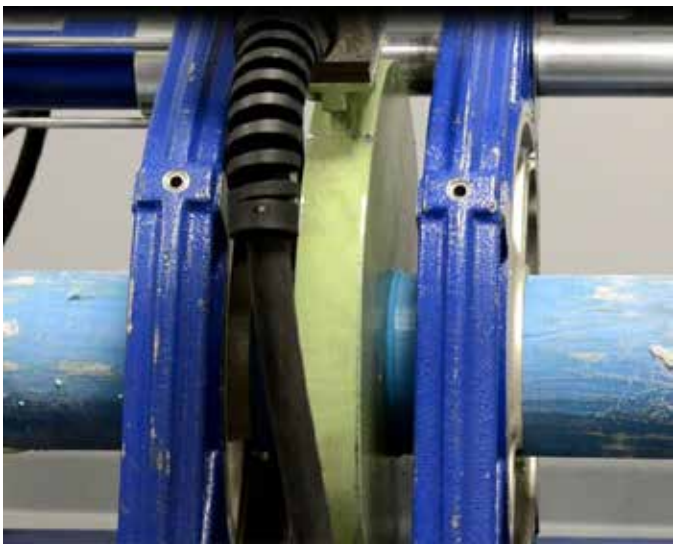
Place the heating element on the welding machine, taking care to insert it properly in order to ensure its stability on the supports of the machine base.

Place the edges close to the heating element, apply the pressure (P1 + Pt) for a time t1 and wait until the bead has reached height h on both welding edges, as shown in table 2 (page 92).

Phase 2: Heating

Once the bead has reached height h, the contact pressure between the edges and the heating element is reduced to the value P2.

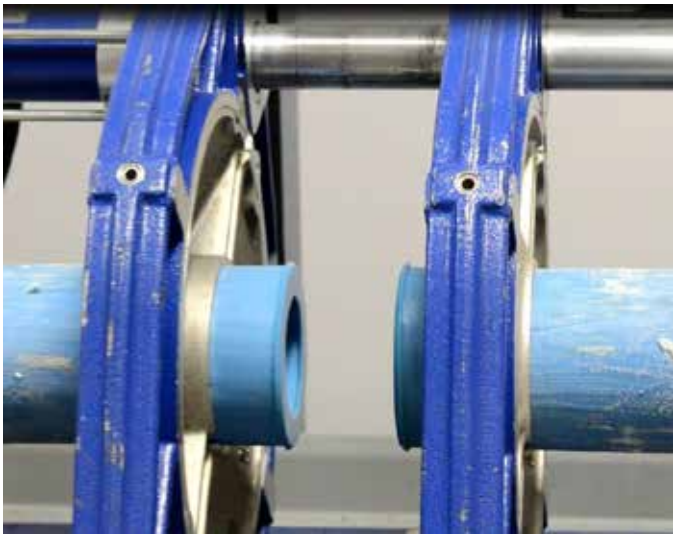
Keep the edges in contact with the heating element for the time t2 shown in table 2.



Phase 3: Removing the heating element

Remove the heating element, making sure not to damage the edges of the two parts to be welded.

The removal must be rapid to avoid excessive cooling of the heated edges. Time t3, in seconds, from the removal of the heating element to the contact with the edges (phase 4), however, must be consistent with what is reported in table 2.

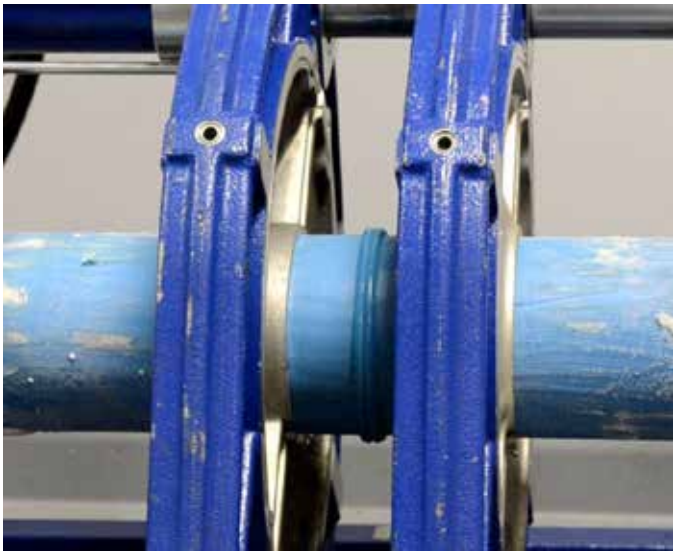


Phase 4: Reaching the welding pressure

Once the heating element has been removed, bring the edges into contact. Gradually increase pressure until the value (P5 + Pt) (phase 5) is reached and, anyway, so as to prevent excessive leakage of melted material from the edges in contact. Reaching the welding pressure (P5+ Pt) must take the amount of time t4 shown in table 2.

Phase 5: Welding

Keep the edges in contact under pressure (P5+ Pt) for a time t5, expressed in minutes, as shown in table 2.



Phase 6: Cooling

Once the welding time is over (phase 5), the welded joint can be removed from the welding machine, without being subjected to significant stress. Wait until complete cooling to ambient temperature.

Table 2: Parameters for welding by contact

Wall thickness e_n (mm)	Approaching and Preheating Minimum height of the bead at the end of preheating time under pressure P_1 of 0,10 N/mm² h (mm)	Heating Pressure ≤ 0,01 N/mm² Time t_2 (s)	Removing the heating element Time t_3 max (s)	Reaching the welding pressure Time t_4 max (s)	Welding Pressure = 0,10 N/mm² ± 0,01 Time t_5 min (min)
from . . . . to		from . . . . to	from . . . to	from . . . to	from . . . to
2,0 4,5	0,5	60 135	4 5	5 6	3 6
4,5 7	0,5	135 175	5 6	6 7	6 12
7 12	1,0	175 245	6 7	7 11	12 20
12 19	1,0	245 330	7 9	11 17	20 30
19 26	1,5	330 400	9 11	17 22	30 40
26 37	2,0	400 485	11 14	22 32	40 55
37 50	2,5	485 560	14 17	32 43	55 70

N.B.: for thickness values other than those listed, interpolate times linearly for each scheduled interval.