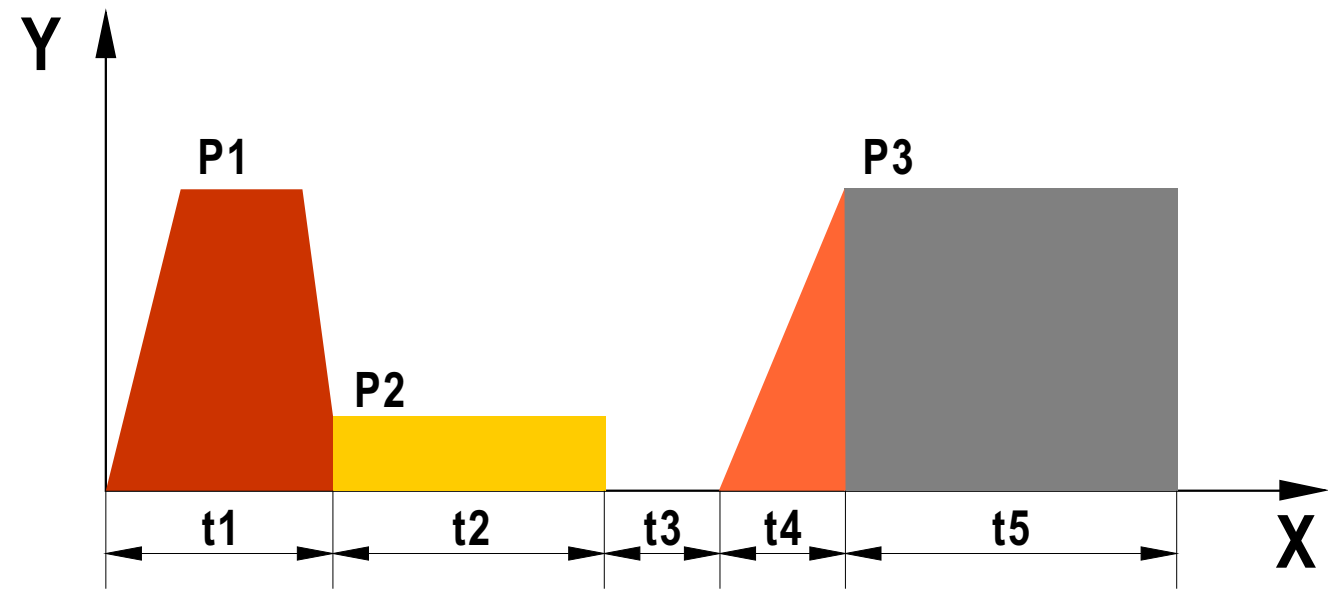


Butt Fusion Jointing Calculation



X: time
Y: pressure
P1: bead-up pressure
P2: drag pressure
P3: fusion jointing pressure

t1: bead-up time
t2: heat soak time
t3: heater plate removal time
t4: time to achieve fusion jointing pressure
t5: cooling time in the machine under pressure

The pressure can be calculated from the following formula:

$$P1, P3 = [IP \times \pi \times (dn - en) \times en] / S \times 10 + P2$$

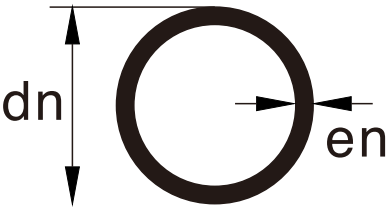
P2: Drag Pressure (bar)

IP: Interfacial pressure (MPa), it is generally considered to be 0.15

dn: nominal outside diameter of the pipe (mm)

en: nominal wall thickness of the pipe (mm)

S: Total piston area (mm²)



ISO21307:2017

Single low-pressure fusion jointing

Table 1 — Phases, parameters and values

Phase	Parameter	Unit	Value
1-2	Heating plate temperetaure	°C	225±10
1	Bead-up pressure	MPa	P1
	Minimum bad-up size	mm	0.5+0.1×en
2	Minimum heat soak time	s	(13.5±1.5)×en
	Heat soak pressure	MPa	0~P2
3	Maximum heating plate removal time	s	See Table 2
4	Maximum time to achieve fusion jointing pressure	s	3+0.03×dn
	Fusion jointing pressure	MPa	P3
5	Minimum cooling time in the machine under pressure, for wall thickness < 18 mm	min	en+3
	Minimum cooling time in the machine under pressure, for wall thickness ≥ 18 mm	min	0.015×en²-0.47×en+20

Table 2 Maximum time for removing the heating plate

en (mm)	t3
en≤4.5	≤5
4.5<en≤7	≤6
7<en≤12	≤8
12<en≤19	≤10
19<en≤26	≤12
26<en≤37	≤16
37<en≤50	≤20
50<en≤70	≤25
70<en≤90	≤30
90<en≤130	≤35

Calculation Demonstration

Pipe: OD315mm SDR11
Machine model: Welping 315
Total piston area: 2002mm²
Drag pressure: 10bar (just as an example)
dn: 315mm
en: 315/11≈28.64mm
P1=P3: [0.15×3.14×(315-28.64)×28.64/2002×10]+10≈29bar
Bead-up size: 0.15+0.1×28.64≈3.4mm
t2: (13.5±1.5)×28.64≈344s~430s
t3: 16s
t4: 3+0.03×dn≈12s
t5: 0.015×28.64²-0.47×28.64+20≈19min

DVS2207-1

Table 1 Recommended values for the heated tool butt welding of pipes, fittings and sheets made of PE-HD at an outside temperature of approx. 20 °C and moderate air flow (interim values have to be interpolated).

en (mm)	bead-up size (mm)	Heating-up time (s)	Changeover time (Maximum time)(s)	Joining pressure build-up time(s)	Cooling time under joining pressure(min)
en≤4.5	≤0.5	45	5	5	6
4.5<en≤7	≤1.0	45~70	5~6	5~6	6~10
7<en≤12	≤1.5	70~120	6~8	6~8	10~16
12<en≤19	≤2.0	120~190	8~10	8~11	16~24
19<en≤26	≤2.5	190~260	10~12	11~14	24~32
26<en≤37	≤3.0	260~370	12~16	14~19	32~45
37<en≤50	≤3.5	370~500	16~20	19~25	45~60
50<en≤70	≤4.0	500~700	20~25	25~35	60~80

Calculation Demonstration

Pipe: OD315mm SDR11
Machine model: Welping 315
Total piston area: 2002mm²
Drag pressure: 10bar (just as an example)
dn: 315mm
en: 315/11≈28.64mm
P1=P3: [0.15×3.14×(315-28.64)×28.64/2002×10]+10≈29bar
Bead-up size: 3mm
t2: 260s~370s
t3: 12~16s
t4: 14~19s
t5: 32~45min