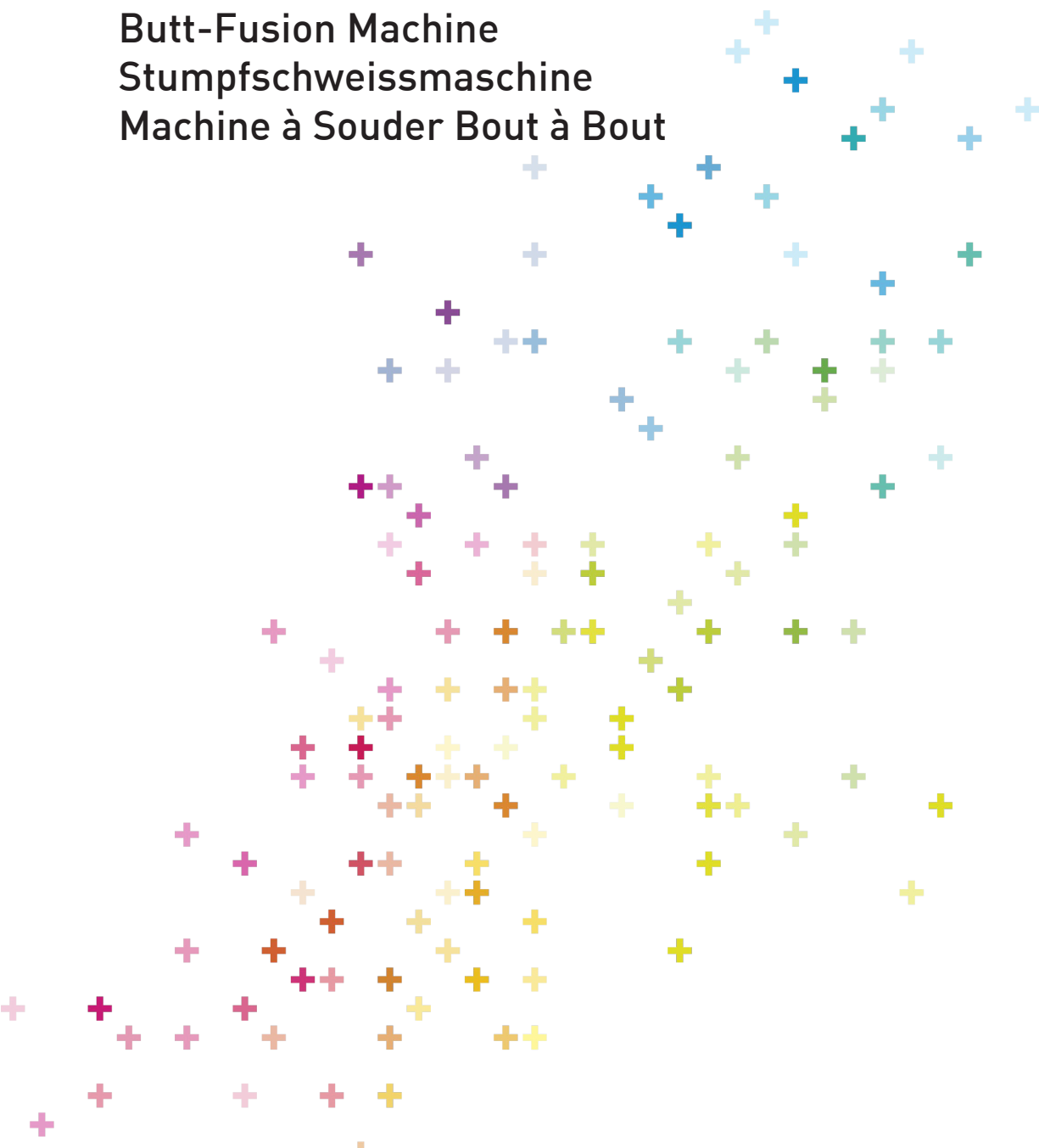


# Welding Table

Schweiss-Tabelle  
Table de Soudage

TOP - ECOS 160

Butt-Fusion Machine  
Stumpfschweissmaschine  
Machine à Souder Bout à Bout





## 1. Fusion data / Schweissdaten / Param. de soudage

### 1.1 Heating element butt-fusion of PE Heizelement-Stumpfschweissen von PE Soudage bout à bout pour PE

Fusion chart according to DVS 2207-1  
Schweisstabelle entsprechend DVS 2207-1  
Table de Soudage conformément aux DVS 2207-1

Heating element temperature: 220°C ± 10°C

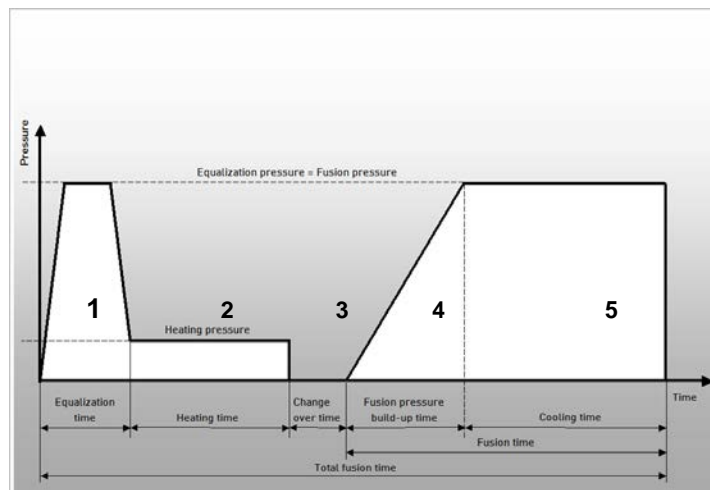
Heizelementtemperatur : 220°C ± 10°C

Température de l'élément chauffant: 220°C ± 10°C

|                                    | 1  | 2  | 3                  | 4   | 5   |
|------------------------------------|--|--|--------------------|---|---|
| <b>Nominal wall thickness</b>      | <b>Equalization</b><br>Bead height on heating element after equalization         | <b>Heat soak</b><br>Heat soak time = 10 x wall thickness       | <b>Change-over</b> | <b>Join</b><br>Time until max pressure reached                                | <b>Cooling</b><br>Cooling time at fusion pressure                           |
| <b>Nennwanddicke</b>               | <b>Angleichen</b><br>Wulsthöhe am Heizelement am Ende der Angleichzeit           | <b>Anwärmen</b><br>Anwärmzeit = 10 x Wanddicke                 | <b>Umstellen</b>   | <b>Fügen</b><br>Zeit bis zur vollen Druckaufbringung                          | <b>Abkühlen</b><br>Abkühlzeit unter Fügedruck                               |
| <b>Épaisseur nominale du tuyau</b> | <b>Formation du bourrelet</b><br>Épaisseur du bourrelet sur la plaque chauffante | <b>Chauffage</b><br>Temps de chauffe = 10 x épaisseur du tuyau | <b>Transition</b>  | <b>Augment. de la pression</b><br>Temps pour atteindre la pression de soudage | <b>Refroidissement</b><br>Temps de refroidissement à la pression de soudage |
|                                    | P1=0.15N/mm <sup>2</sup>   | P2=0.01N/mm <sup>2</sup>                                       |                    |   | P5=0.15N/mm <sup>2</sup>  |
| [mm]                               | Min. [mm]  | [sec]  | Max. [sec]         | [sec]   | Min. [min]  |
| up to 4.5                          | 0.5  | 45   | 5                  | 5   | See next table  |
| 4.5 – 7.0                          | 1.0  | 45 – 70  | 5 – 6              | 5 – 6   |   |
| 7.0 – 12.0                         | 1.5  | 70 – 120   | 6 – 8              | 6 – 8   |   |
| 12.0 – 19.0                        | 2.0  | 120 – 190  | 8 – 10             | 8 – 11  |   |
| 19.0 – 26.0                        | 2.5  | 190 – 260  | 10 – 12            | 11 – 14   |   |
| 26.0 – 37.0                        | 3.0  | 260 – 370  | 12 – 16            | 14 – 19   |   |
| 37.0 – 50.0                        | 3.5  | 370 – 500  | 16 – 20            | 19 – 25   |   |
| 50.0 – 70.0                        | 4.0  | 500 – 700  | 20 – 25            | 25 – 35   |   |
| 70.0 – 90.0                        | 4.5  | 700 – 900  | 25 – 30            | 35  |   |
| 90.0 – 110.0                       | 5.0  | 900 – 1100   | 30 – 35            | 35  |   |
| 110.0 – 130.0                      | 5.5  | 1100 – 1300  | 35                 | 35  |   |

|                                    |   |  |  |
|------------------------------------|---|--|--|
| <b>Nominal wall thickness</b>      | <b>Cooling time at fusion pressure <math>p = 0.15 \text{ N/mm}^2 \pm 0.01</math> depending on the ambient temperature (<math>T_a</math>)</b>          |  |  |
| <b>Nennwanddicke</b>               | <b>Abkühlzeit unter Fügedruck <math>p = 0,15 \pm 0,01 \text{ N/mm}^2</math> in Abhängigkeit von der Umgebungstemperatur (<math>T_a</math>)</b>        |  |  |
| <b>Épaisseur nominale du tuyau</b> | <b>Temps de refroidissement à la pression <math>p = 0,15 \pm 0,01 \text{ N/mm}^2</math> en fonction de la température ambiante (<math>T_a</math>)</b> |  |  |
| mm                                 | $T_a \leq 15^\circ\text{C}$<br>Min. [min]   | $15^\circ\text{C} < T_a \leq 25^\circ\text{C}$<br>Min. [min] | $25^\circ\text{C} < T_a \leq 40^\circ\text{C}$<br>Min. [min] |
| up to 4.5                          | 4.0   | 5.0  | 6.5  |
| 4.5 – 7.0                          | 4.0 – 6.0   | 5.0 – 7.5  | 6.5 – 9.5  |
| 7.0 – 12.0                         | 6.0 – 9.5   | 7.5 – 12   | 9.5 – 15.5   |
| 12.0 – 19.0                        | 9.5 – 14  | 12 – 18  | 15.5 – 24  |
| 19.0 – 26.0                        | 14 – 19   | 18 – 24  | 24 – 32  |
| 26.0 – 37.0                        | 19 – 27   | 24 – 34  | 32 – 45  |
| 37.0 – 50.0                        | 27 – 36   | 34 – 46  | 45 – 61  |
| 50.0 – 70.0                        | 36 – 50   | 46 – 64  | 61 – 85  |
| 70.0 – 90.0                        | 50 – 64   | 64 – 82  | 85 – 109   |
| 90.0 – 110.0                       | 64 – 78   | 82 – 100   | 109 – 133  |
| 110.0 – 130.0                      | 78 – 92   | 100 – 118  | 133 – 157  |

Process steps for heating element butt fusion  
 Verfahrensschritte beim Heizelement-Stumpfschweißen  
 Graphique temps/pression pour le soudage bout à bout



t1 Equalization time / Angleichzeit / Temps de formation du bourrelet

t2 Heating time / Anwärzeit / Temps de chauffe

t3 Change over time / Umstellzeit / Temps de retrait de l'élément chauffant

t4 Fusion pressure build-up time / Fügedruck Aufbauzeit / Temps de augmentation de la pression

t5 Cooling time / Abkühlzeit / Temps de refroidissement

Heating element butt fusion of **PE** according to DVS 2207-1

Heizelement-Stumpfschweißen von **PE** nach DVS 2207-1

Soudage bout à bout par élément chauffant pour **PE** conformément aux DVS 2207-1

|    |                       |                          |                                    |
|----|-----------------------|--------------------------|------------------------------------|
| ∅  | Outside pipe diameter | Rohr - Aussendurchmesser | Diamètre extérieur du tuyau        |
| e  | Wall thickness        | Wanddicke                | Épaisseur nominale du tuyau        |
| A  | Fusion surface        | Schweißfläche            | Surface de soudage                 |
| P1 | Equalization pressure | Angleich Druck           | Pression de formation du bourrelet |
| P2 | Heating pressure      | Anwärmdruck              | Pression de chauffe                |
| P5 | Fusion pressure       | Fügedruck                | Pression de soudage                |
| ta | Ambient Temperature   | Umgebungstemperatur      | Température ambiante               |

| ∅: Pipe outer diameter |                                     | mm               | 40  | 50 | 63 | 75 | 90  | 110 | 125  | 140  | 160  |   |
|------------------------|-------------------------------------|------------------|-----|----|----|----|-----|-----|------|------|------|---|
| SDR<br>41              | e: Wall thickness                   | mm               | -   | -  | -  | -  | 2,2 | 2,7 | 3,1  | 3,5  | 4,0  |   |
|                        | A: Fusion surface                   | mm <sup>2</sup>  | -   | -  | -  | -  | 606 | 905 | 1187 | 1501 | 1960 |   |
|                        | p1/p5: Equalization/fusion pressure | bar              | -   | -  | -  | -  | 3   | 4   | 5    | 6    | 8    |   |
|                        | Bead size                           | mm               | -   | -  | -  | -  | 0,5 | 0,5 | 0,5  | 0,5  | 0,5  |   |
|                        | p2: Heating pressure                | bar              | -   | -  | -  | -  | 1   | 1   | 1    | 1    | 1    |   |
|                        | t2: Heating time                    | sec              | -   | -  | -  | -  | 22  | 27  | 31   | 35   | 40   |   |
|                        | t3: Change over time                | sec              | -   | -  | -  | -  | 5   | 5   | 5    | 5    | 5    |   |
|                        | t4: Pressure build-up time          | sec              | -   | -  | -  | -  | 5   | 5   | 5    | 5    | 5    |   |
|                        | t5: Cooling time                    | Ta ≤ 40°C        | min | -  | -  | -  | -   | 7   | 7    | 7    | 7    | 7 |
|                        |                                     | 15°C < Ta ≤ 25°C | min | -  | -  | -  | -   | 5   | 5    | 5    | 5    | 5 |
| Ta ≤ 15°C              |                                     | min              | -   | -  | -  | -  | 4   | 4   | 4    | 4    | 4    |   |

| ∅: Pipe outer diameter |                                     | mm               | 40  | 50 | 63 | 75 | 90  | 110  | 125  | 140  | 160  |   |
|------------------------|-------------------------------------|------------------|-----|----|----|----|-----|------|------|------|------|---|
| SDR<br>33              | e: Wall thickness                   | mm               | -   | -  | -  | -  | 2,8 | 3,4  | 3,9  | 4,3  | 4,9  |   |
|                        | A: Fusion surface                   | mm <sup>2</sup>  | -   | -  | -  | -  | 767 | 1139 | 1484 | 1833 | 2388 |   |
|                        | p1/p5: Equalization/fusion pressure | bar              | -   | -  | -  | -  | 3   | 5    | 6    | 8    | 10   |   |
|                        | Bead size                           | mm               | -   | -  | -  | -  | 0,5 | 0,5  | 0,5  | 0,5  | 1,0  |   |
|                        | p2: Heating pressure                | bar              | -   | -  | -  | -  | 1   | 1    | 1    | 1    | 1    |   |
|                        | t2: Heating time                    | sec              | -   | -  | -  | -  | 28  | 34   | 39   | 43   | 49   |   |
|                        | t3: Change over time                | sec              | -   | -  | -  | -  | 5   | 5    | 5    | 5    | 5    |   |
|                        | t4: Pressure build-up time          | sec              | -   | -  | -  | -  | 5   | 5    | 5    | 5    | 5    |   |
|                        | t5: Cooling time                    | Ta ≤ 40°C        | min | -  | -  | -  | -   | 7    | 7    | 7    | 7    | 7 |
|                        |                                     | 15°C < Ta ≤ 25°C | min | -  | -  | -  | -   | 5    | 5    | 5    | 5    | 5 |
| Ta ≤ 15°C              |                                     | min              | -   | -  | -  | -  | 4   | 4    | 4    | 4    | 4    |   |

## PE (DVS 2207-1)

| SDR<br>26                           | Ø: Pipe outer diameter | mm  | 40 | 50 | 63  | 75  | 90   | 110  | 125  | 140  | 160 |
|-------------------------------------|------------------------|-----|----|----|-----|-----|------|------|------|------|-----|
|                                     | e: Wall thickness      | mm  | -  | -  | -   | 2,9 | 3,5  | 4,2  | 4,8  | 5,4  | 6,2 |
| A: Fusion surface                   | mm <sup>2</sup>        | -   | -  | -  | 654 | 941 | 1406 | 1815 | 2277 | 2974 |     |
| p1/p5: Equalization/fusion pressure | bar                    | -   | -  | -  | 3   | 4   | 6    | 8    | 10   | 13   |     |
| Bead size                           | mm                     | -   | -  | -  | 0,5 | 0,5 | 0,5  | 1,0  | 1,0  | 1,0  |     |
| p2: Heating pressure                | bar                    | -   | -  | -  | 1   | 1   | 1    | 1    | 1    | 1    |     |
| t2: Heating time                    | sec                    | -   | -  | -  | 29  | 35  | 42   | 48   | 54   | 62   |     |
| t3: Change over time                | sec                    | -   | -  | -  | 5   | 5   | 5    | 5    | 5    | 6    |     |
| t4: Pressure build-up time          | sec                    | -   | -  | -  | 5   | 5   | 5    | 5    | 5    | 6    |     |
| t5: Cooling time                    | Ta <= 40°C             | min | -  | -  | -   | 7   | 7    | 7    | 7    | 8    | 8   |
|                                     | 15°C < Ta <= 25°C      | min | -  | -  | -   | 5   | 5    | 5    | 5    | 6    | 7   |
|                                     | Ta <= 15°C             | min | -  | -  | -   | 4   | 4    | 4    | 4    | 5    | 5   |

| SDR<br>22                           | Ø: Pipe outer diameter | mm  | 40 | 50 | 63  | 75   | 90   | 110  | 125  | 140  | 160 |
|-------------------------------------|------------------------|-----|----|----|-----|------|------|------|------|------|-----|
|                                     | e: Wall thickness      | mm  | -  | -  | -   | 3,5  | 4,1  | 5,0  | 5,7  | 6,4  | 7,3 |
| A: Fusion surface                   | mm <sup>2</sup>        | -   | -  | -  | 786 | 1104 | 1649 | 2130 | 2672 | 3490 |     |
| p1/p5: Equalization/fusion pressure | bar                    | -   | -  | -  | 3   | 5    | 7    | 9    | 11   | 15   |     |
| Bead size                           | mm                     | -   | -  | -  | 0,5 | 0,5  | 1,0  | 1,0  | 1,0  | 1,5  |     |
| p2: Heating pressure                | bar                    | -   | -  | -  | 1   | 1    | 1    | 1    | 1    | 1    |     |
| t2: Heating time                    | sec                    | -   | -  | -  | 35  | 41   | 50   | 57   | 64   | 73   |     |
| t3: Change over time                | sec                    | -   | -  | -  | 5   | 5    | 5    | 5    | 6    | 6    |     |
| t4: Pressure build-up time          | sec                    | -   | -  | -  | 5   | 5    | 5    | 5    | 6    | 6    |     |
| t5: Cooling time                    | Ta <= 40°C             | min | -  | -  | -   | 7    | 7    | 7    | 8    | 9    | 10  |
|                                     | 15°C < Ta <= 25°C      | min | -  | -  | -   | 5    | 5    | 6    | 6    | 7    | 8   |
|                                     | Ta <= 15°C             | min | -  | -  | -   | 4    | 4    | 4    | 5    | 5    | 6   |

| SDR<br>21                           | Ø: Pipe outer diameter | mm  | 40 | 50 | 63  | 75   | 90   | 110  | 125  | 140  | 160 |
|-------------------------------------|------------------------|-----|----|----|-----|------|------|------|------|------|-----|
|                                     | e: Wall thickness      | mm  | -  | -  | -   | 3,6  | 4,3  | 5,3  | 6,0  | 6,7  | 7,7 |
| A: Fusion surface                   | mm <sup>2</sup>        | -   | -  | -  | 801 | 1154 | 1743 | 2226 | 2793 | 3684 |     |
| p1/p5: Equalization/fusion pressure | bar                    | -   | -  | -  | 3   | 5    | 7    | 9    | 12   | 16   |     |
| Bead size                           | mm                     | -   | -  | -  | 0,5 | 0,5  | 1,0  | 1,0  | 1,0  | 1,5  |     |
| p2: Heating pressure                | bar                    | -   | -  | -  | 1   | 1    | 1    | 1    | 1    | 1    |     |
| t2: Heating time                    | sec                    | -   | -  | -  | 36  | 43   | 53   | 60   | 67   | 77   |     |
| t3: Change over time                | sec                    | -   | -  | -  | 5   | 5    | 5    | 6    | 6    | 6    |     |
| t4: Pressure build-up time          | sec                    | -   | -  | -  | 5   | 5    | 5    | 6    | 6    | 6    |     |
| t5: Cooling time                    | Ta <= 40°C             | min | -  | -  | -   | 7    | 7    | 7    | 8    | 9    | 10  |
|                                     | 15°C < Ta <= 25°C      | min | -  | -  | -   | 5    | 5    | 6    | 6    | 7    | 8   |
|                                     | Ta <= 15°C             | min | -  | -  | -   | 4    | 4    | 5    | 5    | 6    | 6   |

| SDR<br>17,6                         | Ø: Pipe outer diameter | mm  | 40 | 50  | 63  | 75   | 90   | 110  | 125  | 140  | 160 |
|-------------------------------------|------------------------|-----|----|-----|-----|------|------|------|------|------|-----|
|                                     | e: Wall thickness      | mm  | -  | -   | 3,6 | 4,3  | 5,1  | 6,3  | 7,1  | 8,0  | 9,1 |
| A: Fusion surface                   | mm <sup>2</sup>        | -   | -  | 668 | 947 | 1364 | 2037 | 2631 | 3300 | 4310 |     |
| p1/p5: Equalization/fusion pressure | bar                    | -   | -  | 3   | 4   | 6    | 9    | 11   | 14   | 18   |     |
| Bead size                           | mm                     | -   | -  | 0,5 | 0,5 | 1,0  | 1,0  | 1,5  | 1,5  | 1,5  |     |
| p2: Heating pressure                | bar                    | -   | -  | 1   | 1   | 1    | 1    | 1    | 1    | 1    |     |
| t2: Heating time                    | sec                    | -   | -  | 36  | 43  | 51   | 63   | 71   | 80   | 91   |     |
| t3: Change over time                | sec                    | -   | -  | 5   | 5   | 5    | 6    | 6    | 6    | 7    |     |
| t4: Pressure build-up time          | sec                    | -   | -  | 5   | 5   | 5    | 6    | 6    | 6    | 7    |     |
| t5: Cooling time                    | Ta <= 40°C             | min | -  | -   | 7   | 7    | 7    | 9    | 10   | 11   | 12  |
|                                     | 15°C < Ta <= 25°C      | min | -  | -   | 5   | 5    | 6    | 7    | 8    | 8    | 9   |
|                                     | Ta <= 15°C             | min | -  | -   | 4   | 4    | 4    | 5    | 6    | 7    | 7   |

## PE (DVS 2207-1)

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63  | 75  | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|----|-----|-----|------|------|------|------|------|----|
| SDR<br>17              | e: Wall thickness                   | mm                | -   | -  | 3,8 | 4,5 | 5,4  | 6,6  | 7,4  | 8,3  | 9,5  |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | 707 | 997 | 1435 | 2144 | 2718 | 3434 | 4492 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | 3   | 4   | 6    | 9    | 12   | 15   | 19   |    |
|                        | Bead size                           | mm                | -   | -  | 0,5 | 1,0 | 1,0  | 1,0  | 1,5  | 1,5  | 1,5  |    |
|                        | p2: Heating pressure                | bar               | -   | -  | 1   | 1   | 1    | 1    | 1    | 1    | 1    |    |
|                        | t2: Heating time                    | sec               | -   | -  | 38  | 45  | 54   | 66   | 74   | 83   | 95   |    |
|                        | t3: Change over time                | sec               | -   | -  | 5   | 5   | 5    | 6    | 6    | 7    | 7    |    |
|                        | t4: Pressure build-up time          | sec               | -   | -  | 5   | 5   | 5    | 6    | 6    | 7    | 7    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -   | 7   | 7    | 8    | 9    | 10   | 11   | 13 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -   | 5   | 5    | 6    | 7    | 8    | 9    | 10 |
| Ta <= 15°C             |                                     | min               | -   | -  | 4   | 4   | 5    | 6    | 6    | 7    | 8    |    |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63  | 75   | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|----|-----|------|------|------|------|------|------|----|
| SDR<br>13,6            | e: Wall thickness                   | mm                | -   | -  | 4,7 | 5,6  | 6,7  | 8,1  | 9,2  | 10,3 | 11,8 |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | 861 | 1221 | 1753 | 2590 | 3344 | 4195 | 5479 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | 4   | 5    | 7    | 11   | 14   | 18   | 23   |    |
|                        | Bead size                           | mm                | -   | -  | 1,0 | 1,0  | 1,0  | 1,5  | 1,5  | 1,5  | 1,5  |    |
|                        | p2: Heating pressure                | bar               | -   | -  | 1   | 1    | 1    | 1    | 1    | 1    | 2    |    |
|                        | t2: Heating time                    | sec               | -   | -  | 47  | 56   | 67   | 81   | 92   | 103  | 118  |    |
|                        | t3: Change over time                | sec               | -   | -  | 5   | 5    | 6    | 6    | 7    | 7    | 8    |    |
|                        | t4: Pressure build-up time          | sec               | -   | -  | 5   | 5    | 6    | 6    | 7    | 7    | 8    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -   | 7    | 8    | 9    | 11   | 12   | 13   | 15 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -   | 5    | 6    | 7    | 8    | 9    | 10   | 12 |
| Ta <= 15°C             |                                     | min               | -   | -  | 4   | 5    | 6    | 7    | 8    | 8    | 9    |    |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50  | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|-----|------|------|------|------|------|------|------|----|
| SDR<br>11              | e: Wall thickness                   | mm                | -   | 4,6 | 5,8  | 6,8  | 8,2  | 10,0 | 11,4 | 12,7 | 14,6 |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | 656 | 1042 | 1460 | 2103 | 3142 | 4057 | 5089 | 6669 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | 3   | 4    | 6    | 9    | 13   | 17   | 22   | 28   |    |
|                        | Bead size                           | mm                | -   | 1,0 | 1,0  | 1,0  | 1,5  | 1,5  | 1,5  | 2,0  | 2,0  |    |
|                        | p2: Heating pressure                | bar               | -   | 1   | 1    | 1    | 1    | 1    | 1    | 1    | 2    |    |
|                        | t2: Heating time                    | sec               | -   | 46  | 58   | 68   | 82   | 100  | 114  | 127  | 146  |    |
|                        | t3: Change over time                | sec               | -   | 5   | 6    | 6    | 6    | 7    | 8    | 8    | 9    |    |
|                        | t4: Pressure build-up time          | sec               | -   | 5   | 6    | 6    | 6    | 7    | 8    | 8    | 9    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -   | 7    | 8    | 9    | 11   | 13   | 15   | 16   | 19 |
|                        |                                     | 15°C < Ta <= 25°C | min | -   | 5    | 6    | 7    | 9    | 10   | 11   | 13   | 14 |
| Ta <= 15°C             |                                     | min               | -   | 4   | 5    | 6    | 7    | 8    | 9    | 10   | 11   |    |

**PE (DVS 2207-1)**

|              |                                     | mm                | 40  | 50  | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|--------------|-------------------------------------|-------------------|-----|-----|------|------|------|------|------|------|------|----|
| <b>SDR 9</b> | <b>Ø: Pipe outer diameter</b>       | mm                |     |     |      |      |      |      |      |      |      |    |
|              | e: Wall thickness                   | mm                | -   | 5,6 | 7,1  | 8,4  | 10,1 | 12,3 | 14,0 | 15,7 | 17,9 |    |
|              | A: Fusion surface                   | mm <sup>2</sup>   | -   | 776 | 1247 | 1758 | 2535 | 3775 | 4882 | 6131 | 7991 |    |
|              | p1/p5: Equalization/fusion pressure | bar               | -   | 3   | 5    | 7    | 11   | 16   | 21   | 26   | 34   |    |
|              | Bead size                           | mm                | -   | 1,0 | 1,5  | 1,5  | 1,5  | 2,0  | 2,0  | 2,0  | 2,0  |    |
|              | p2: Heating pressure                | bar               | -   | 1   | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 2  |
|              | t2: Heating time                    | sec               | -   | 56  | 71   | 84   | 101  | 123  | 140  | 157  | 179  |    |
|              | t3: Change over time                | sec               | -   | 5   | 6    | 7    | 7    | 8    | 9    | 9    | 10   |    |
|              | t4: Pressure build-up time          | sec               | -   | 5   | 6    | 7    | 7    | 8    | 9    | 10   | 11   |    |
|              | t5: Cooling time                    | Ta <= 40°C        | min | -   | 8    | 10   | 11   | 13   | 16   | 18   | 20   | 23 |
|              |                                     | 15°C < Ta <= 25°C | min | -   | 6    | 8    | 9    | 10   | 12   | 14   | 15   | 17 |
|              |                                     | Ta <= 15°C        | min | -   | 5    | 6    | 7    | 8    | 10   | 11   | 12   | 13 |

|                |                                     | mm                | 40  | 50  | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|----------------|-------------------------------------|-------------------|-----|-----|------|------|------|------|------|------|------|----|
| <b>SDR 7,4</b> | <b>Ø: Pipe outer diameter</b>       | mm                |     |     |      |      |      |      |      |      |      |    |
|                | e: Wall thickness                   | mm                | 5,5 | 6,9 | 8,6  | 10,3 | 12,3 | 15,1 | 17,1 | 19,2 | 21,9 |    |
|                | A: Fusion surface                   | mm <sup>2</sup>   | 596 | 934 | 1470 | 2094 | 3002 | 4502 | 5797 | 7286 | 9501 |    |
|                | p1/p5: Equalization/fusion pressure | bar               | 3   | 4   | 6    | 9    | 13   | 19   | 25   | 31   | 40   |    |
|                | Bead size                           | mm                | 1,0 | 1,0 | 1,5  | 1,5  | 2,0  | 2,0  | 2,0  | 2,5  | 2,5  |    |
|                | p2: Heating pressure                | bar               | 1   | 1   | 1    | 1    | 1    | 1    | 2    | 2    | 3    |    |
|                | t2: Heating time                    | sec               | 55  | 69  | 86   | 103  | 123  | 151  | 171  | 192  | 219  |    |
|                | t3: Change over time                | sec               | 5   | 6   | 7    | 7    | 8    | 9    | 9    | 10   | 11   |    |
|                | t4: Pressure build-up time          | sec               | 5   | 6   | 7    | 7    | 8    | 9    | 10   | 11   | 12   |    |
|                | t5: Cooling time                    | Ta <= 40°C        | min | 8   | 9    | 11   | 13   | 16   | 19   | 22   | 24   | 27 |
|                |                                     | 15°C < Ta <= 25°C | min | 6   | 7    | 9    | 10   | 12   | 15   | 16   | 18   | 20 |
|                |                                     | Ta <= 15°C        | min | 5   | 6    | 7    | 8    | 10   | 11   | 13   | 14   | 16 |



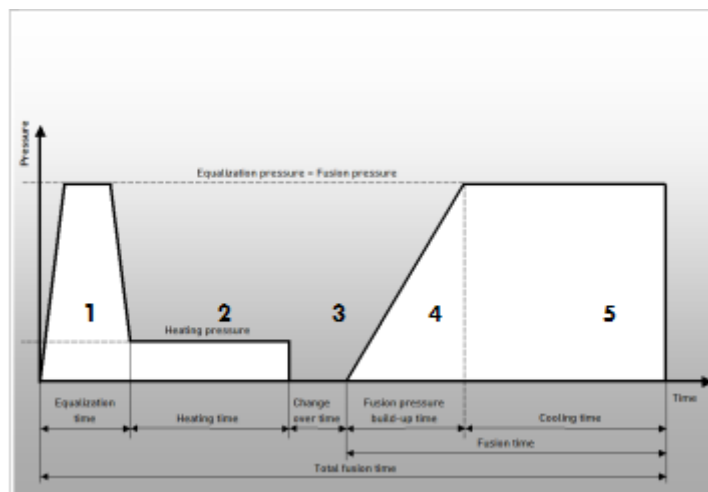
## 1.2 Heating element butt-fusion of PP Heizelement-Stumpfschweissen von PP Soudage bout à bout pour PP

Fusion chart according to DVS 2207-11  
Schweisstabelle entsprechend DVS 2207-11  
Table de Soudage conformément aux DVS 2207-11

|                                    | 1  | 2  | 3                  | 4   | 5   |
|------------------------------------|--|--|--------------------|---|---|
| <b>Nominal wall thickness</b>      | <b>Equalization</b><br>Bead height on heating element after equalization         | <b>Heat soak</b><br>Heat soak time = 10 x wall thickness       | <b>Change-over</b> | <b>Join</b><br>Time until max pressure reached                                | <b>Cooling</b><br>Cooling time at fusion pressure                           |
| <b>Nennwanddicke</b>               | <b>Angleichen</b><br>Wulsthöhe am Heizelement am Ende der Angleichzeit           | <b>Anwärmen</b><br>Anwärmzeit = 10 x Wanddicke                 | <b>Umstellen</b>   | <b>Fügen</b><br>Zeit bis zur vollen Druckaufbringung                          | <b>Abkühlen</b><br>Abkühlzeit unter Fügedruck                               |
| <b>Épaisseur nominale du tuyau</b> | <b>Formation du bourrelet</b><br>Épaisseur du bourrelet sur la plaque chauffante | <b>Chauffage</b><br>Temps de chauffe = 10 x épaisseur du tuyau | <b>Transition</b>  | <b>Augment. de la pression</b><br>Temps pour atteindre la pression de soudage | <b>Refroidissement</b><br>Temps de refroidissement à la pression de soudage |
|                                    | P1=0.10N/mm <sup>2</sup>   | P2=0.01N/mm <sup>2</sup>                                       |                    |   | P5=0.10N/mm <sup>2</sup>  |
| [mm]                               | Min. [mm]  | [sec]  | Max. [sec]         | [sec]   | Min. [min]  |
| Up to a 4.5                        | 0.5  | up to 53   | 5                  | 6   | See next table  |
| 4.5 – 7.0                          | 0.5  | 53 – 81  | 5 – 6              | 6 – 7   |   |
| 7.0 – 12.0                         | 1.0  | 81 – 135   | 6 – 7              | 7 – 11  |   |
| 12.0 – 19.0                        | 1.0  | 135 – 206  | 7 – 9              | 11 – 17   |   |
| 19.0 – 26.0                        | 1.5  | 206 – 271  | 9 – 11             | 17 – 22   |   |
| 26.0 – 37.0                        | 2.0  | 271 – 362  | 11 – 14            | 22 – 32   |   |
| 37.0 – 50.0                        | 2.5  | 362 – 450  | 14 – 17            | 32 – 43   |   |
| 50.0 – 70.0                        | 3.0  | 450 – 546  | 17 – 22            | 43  |   |

|                                    |   |  |  |
|------------------------------------|---|--|--|
| <b>Nominal wall thickness</b>      | <b>Cooling time at fusion pressure <math>p = 0.10 \text{ N/mm}^2 \pm 0.01</math> depending on the ambient temperature (<math>T_a</math>)</b>          |  |  |
| <b>Nennwanddicke</b>               | <b>Abkühlzeit unter Fügedruck <math>p = 0,10 \pm 0,01 \text{ N/mm}^2</math> in Abhängigkeit von der Umgebungstemperatur (<math>T_a</math>)</b>        |  |  |
| <b>Épaisseur nominale du tuyau</b> | <b>Temps de refroidissement à la pression <math>p = 0,10 \pm 0,01 \text{ N/mm}^2</math> en fonction de la température ambiante (<math>T_a</math>)</b> |  |  |
| mm                                 | $T_a \leq 15^\circ\text{C}$<br>Min. [min]   | $15^\circ\text{C} < T_a \leq 25^\circ\text{C}$<br>Min. [min] | $25^\circ\text{C} < T_a \leq 40^\circ\text{C}$<br>Min. [min] |
| up to 4.5                          | 4.0   | 5.0  | 6.5  |
| 4.5 – 7.0                          | 4.0 – 6.0   | 5.0 – 7.5  | 6.5 – 9.5  |
| 7.0 – 12.0                         | 6.0 – 9.5   | 7.5 – 12   | 9.5 – 15.5   |
| 12.0 – 19.0                        | 9.5 – 14  | 12 – 18  | 15.5 – 24  |
| 19.0 – 26.0                        | 14 – 19   | 18 – 24  | 24 – 32  |
| 26.0 – 37.0                        | 19 – 27   | 24 – 34  | 32 – 45  |
| 37.0 – 50.0                        | 27 – 36   | 34 – 46  | 45 – 61  |
| 50.0 – 70.0                        | 36 – 50   | 46 – 64  | 61 – 85  |

Process steps for heating element butt fusion  
 Verfahrensschritte beim Heizelement-Stumpfschweißen  
 Graphique temps/pression pour le soudage bout à bout



- t1 Equalization time / Angleichzeit / Temps de formation du bourrelet
- t2 Heating time / Anwärmzeit / Temps de chauffe
- t3 Change over time / Umstellzeit / Temps de retrait de l'élément chauffant
- t4 Fusion pressure build-up time / Fügedruck Aufbauzeit / Temps de augmentation de la pression
- t5 Cooling time / Abkühlzeit / Temps de refroidissement

Heating element butt fusion of **PP** according to DVS 2207-11Heizelement-Stumpfschweißen von **PP** nach DVS 2207-11Soudage bout à bout par élément chauffant pour **PP** conformément aux DVS 2207-11

|    |                       |                          |                                    |
|----|-----------------------|--------------------------|------------------------------------|
| Ø  | Outside pipe diameter | Rohr - Aussendurchmesser | Diamètre extérieur du tuyau        |
| e  | Wall thickness        | Wanddicke                | Épaisseur nominale du tuyau        |
| A  | Fusion surface        | Schweisfläche            | Surface de soudage                 |
| P1 | Equalization pressure | Angleich Druck           | Pression de formation du bourrelet |
| P2 | Heating pressure      | Anwärmdruck              | Pression de chauffe                |
| P5 | Fusion pressure       | Fügedruck                | Pression de soudage                |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63 | 75 | 90 | 110 | 125  | 140  | 160  |   |
|------------------------|-------------------------------------|-------------------|-----|----|----|----|----|-----|------|------|------|---|
| <b>SDR 41</b>          | e: Wall thickness                   | mm                | -   | -  | -  | -  | -  | 2,7 | 3,1  | 3,5  | 4,0  |   |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | -  | -  | -  | 905 | 1187 | 1501 | 1960 |   |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | -  | -  | -  | 3   | 3    | 4    | 6    |   |
|                        | Bead size                           | mm                | -   | -  | -  | -  | -  | 0,5 | 0,5  | 0,5  | 0,5  |   |
|                        | p2: Heating pressure                | bar               | -   | -  | -  | -  | -  | 1   | 1    | 1    | 1    |   |
|                        | t2: Heating time                    | sec               | -   | -  | -  | -  | -  | 32  | 37   | 41   | 47   |   |
|                        | t3: Change over time                | sec               | -   | -  | -  | -  | -  | 5   | 5    | 5    | 5    |   |
|                        | t4: Pressure build-up time          | sec               | -   | -  | -  | -  | -  | 6   | 6    | 6    | 6    |   |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -  | -  | -  | -   | 7    | 7    | 7    | 7 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -  | -  | -  | -   | 5    | 5    | 5    | 5 |
| Ta <= 15°C             |                                     | min               | -   | -  | -  | -  | -  | 4   | 4    | 4    | 4    |   |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63 | 75 | 90 | 110  | 125  | 140  | 160  |   |
|------------------------|-------------------------------------|-------------------|-----|----|----|----|----|------|------|------|------|---|
| <b>SDR 33</b>          | e: Wall thickness                   | mm                | -   | -  | -  | -  | -  | 3,4  | 3,9  | 4,3  | 4,9  |   |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | -  | -  | -  | 1139 | 1484 | 1833 | 2388 |   |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | -  | -  | -  | 3    | 4    | 5    | 7    |   |
|                        | Bead size                           | mm                | -   | -  | -  | -  | -  | 0,5  | 0,5  | 0,5  | 0,5  |   |
|                        | p2: Heating pressure                | bar               | -   | -  | -  | -  | -  | 1    | 1    | 1    | 1    |   |
|                        | t2: Heating time                    | sec               | -   | -  | -  | -  | -  | 40   | 46   | 51   | 57   |   |
|                        | t3: Change over time                | sec               | -   | -  | -  | -  | -  | 5    | 5    | 5    | 5    |   |
|                        | t4: Pressure build-up time          | sec               | -   | -  | -  | -  | -  | 6    | 6    | 6    | 6    |   |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -  | -  | -  | -    | 7    | 7    | 7    | 7 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -  | -  | -  | -    | 5    | 5    | 5    | 5 |
| Ta <= 15°C             |                                     | min               | -   | -  | -  | -  | -  | 4    | 4    | 4    | 4    |   |

## PP (DVS 2207-11)

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63 | 75 | 90  | 110  | 125  | 140  | 160  |   |
|------------------------|-------------------------------------|-------------------|-----|----|----|----|-----|------|------|------|------|---|
| SDR<br>26              | e: Wall thickness                   | mm                | -   | -  | -  | -  | 3,5 | 4,2  | 4,8  | 5,4  | 6,2  |   |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | -  | -  | 941 | 1406 | 1815 | 2277 | 2974 |   |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | -  | -  | 3   | 4    | 5    | 6    | 8    |   |
|                        | Bead size                           | mm                | -   | -  | -  | -  | 0,5 | 0,5  | 0,5  | 0,5  | 0,5  |   |
|                        | p2: Heating pressure                | bar               | -   | -  | -  | -  | 1   | 1    | 1    | 1    | 1    |   |
|                        | t2: Heating time                    | sec               | -   | -  | -  | -  | 41  | 50   | 56   | 63   | 72   |   |
|                        | t3: Change over time                | sec               | -   | -  | -  | -  | 5   | 5    | 5    | 5    | 6    |   |
|                        | t4: Pressure build-up time          | sec               | -   | -  | -  | -  | 6   | 6    | 6    | 6    | 7    |   |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -  | -  | -   | 7    | 7    | 7    | 8    | 8 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -  | -  | -   | 5    | 5    | 5    | 6    | 7 |
|                        |                                     | Ta <= 15°C        | min | -  | -  | -  | -   | 4    | 4    | 4    | 5    | 5 |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63 | 75  | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|----|----|-----|------|------|------|------|------|----|
| SDR<br>17,6            | e: Wall thickness                   | mm                | -   | -  | -  | 4,3 | 5,1  | 6,3  | 7,1  | 8,0  | 9,1  |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | -  | 947 | 1364 | 2037 | 2631 | 3300 | 4310 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | -  | 3   | 4    | 6    | 7    | 9    | 12   |    |
|                        | Bead size                           | mm                | -   | -  | -  | 0,5 | 0,5  | 0,5  | 1,0  | 1,0  | 1,0  |    |
|                        | p2: Heating pressure                | bar               | -   | -  | -  | 1   | 1    | 1    | 1    | 1    | 1    |    |
|                        | t2: Heating time                    | sec               | -   | -  | -  | 50  | 60   | 73   | 82   | 91   | 104  |    |
|                        | t3: Change over time                | sec               | -   | -  | -  | 5   | 5    | 6    | 6    | 6    | 6    |    |
|                        | t4: Pressure build-up time          | sec               | -   | -  | -  | 6   | 6    | 7    | 7    | 8    | 9    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -  | -   | 7    | 7    | 9    | 10   | 11   | 12 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -  | -   | 5    | 6    | 7    | 8    | 8    | 9  |
|                        |                                     | Ta <= 15°C        | min | -  | -  | -   | 4    | 4    | 5    | 6    | 7    | 7  |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50 | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|----|------|------|------|------|------|------|------|----|
| SDR<br>11              | e: Wall thickness                   | mm                | -   | -  | 5,8  | 6,8  | 8,2  | 10,0 | 11,4 | 12,7 | 14,6 |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | -  | 1042 | 1460 | 2103 | 3142 | 4057 | 5089 | 6669 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | -  | 3    | 4    | 6    | 9    | 11   | 14   | 19   |    |
|                        | Bead size                           | mm                | -   | -  | 0,5  | 0,5  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  |    |
|                        | p2: Heating pressure                | bar               | -   | -  | 1    | 1    | 1    | 1    | 1    | 1    | 2    |    |
|                        | t2: Heating time                    | sec               | -   | -  | 68   | 79   | 94   | 113  | 128  | 142  | 161  |    |
|                        | t3: Change over time                | sec               | -   | -  | 6    | 6    | 6    | 7    | 7    | 7    | 8    |    |
|                        | t4: Pressure build-up time          | sec               | -   | -  | 7    | 7    | 8    | 9    | 10   | 12   | 13   |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -  | -    | 8    | 9    | 11   | 13   | 15   | 16   | 19 |
|                        |                                     | 15°C < Ta <= 25°C | min | -  | -    | 6    | 7    | 9    | 10   | 11   | 13   | 14 |
|                        |                                     | Ta <= 15°C        | min | -  | -    | 5    | 6    | 7    | 8    | 9    | 10   | 11 |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50  | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|-----|------|------|------|------|------|------|------|----|
| SDR<br>9               | e: Wall thickness                   | mm                | -   | 5,6 | 7,1  | 8,4  | 10,1 | 12,3 | 14,0 | 15,7 | 17,9 |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | 776 | 1247 | 1758 | 2535 | 3775 | 4882 | 6131 | 7991 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | 2   | 4    | 5    | 7    | 11   | 14   | 17   | 23   |    |
|                        | Bead size                           | mm                | -   | 0,5 | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  |    |
|                        | p2: Heating pressure                | bar               | -   | 1   | 1    | 1    | 1    | 1    | 1    | 2    | 2    |    |
|                        | t2: Heating time                    | sec               | -   | 65  | 82   | 96   | 114  | 138  | 155  | 173  | 195  |    |
|                        | t3: Change over time                | sec               | -   | 5   | 6    | 6    | 7    | 7    | 8    | 8    | 9    |    |
|                        | t4: Pressure build-up time          | sec               | -   | 6   | 7    | 8    | 9    | 11   | 13   | 14   | 16   |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -   | 8    | 10   | 11   | 13   | 16   | 18   | 20   | 23 |
|                        |                                     | 15°C < Ta <= 25°C | min | -   | 6    | 8    | 9    | 10   | 12   | 14   | 15   | 17 |
|                        |                                     | Ta <= 15°C        | min | -   | 5    | 6    | 7    | 8    | 10   | 11   | 12   | 13 |

## PP (DVS 2207-11)

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50  | 63   | 75   | 90   | 110  | 125  | 140  | 160  |    |
|------------------------|-------------------------------------|-------------------|-----|-----|------|------|------|------|------|------|------|----|
| SDR<br>7,4             | e: Wall thickness                   | mm                | -   | 6,9 | 8,6  | 10,3 | 12,3 | 15,1 | 17,1 | 19,2 | 21,9 |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | 934 | 1470 | 2094 | 3002 | 4502 | 5797 | 7286 | 9501 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | 3   | 4    | 6    | 9    | 13   | 16   | 21   | 27   |    |
|                        | Bead size                           | mm                | -   | 0,5 | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,5  | 1,5  |    |
|                        | p2: Heating pressure                | bar               | -   | 1   | 1    | 1    | 1    | 1    | 2    | 2    | 3    |    |
|                        | t2: Heating time                    | sec               | -   | 80  | 98   | 117  | 138  | 166  | 187  | 208  | 233  |    |
|                        | t3: Change over time                | sec               | -   | 6   | 6    | 7    | 7    | 8    | 8    | 9    | 10   |    |
|                        | t4: Pressure build-up time          | sec               | -   | 7   | 8    | 10   | 11   | 14   | 15   | 17   | 19   |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -   | 9    | 11   | 13   | 16   | 19   | 22   | 24   | 27 |
|                        |                                     | 15°C < Ta <= 25°C | min | -   | 7    | 9    | 10   | 12   | 15   | 16   | 18   | 20 |
|                        |                                     | Ta <= 15°C        | min | -   | 6    | 7    | 8    | 10   | 11   | 13   | 14   | 16 |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50   | 63   | 75   | 90   | 110  | 125  | 140  | 160   |    |
|------------------------|-------------------------------------|-------------------|-----|------|------|------|------|------|------|------|-------|----|
| SDR<br>6               | e: Wall thickness                   | mm                | -   | 8,3  | 10,5 | 12,5 | 15,0 | 18,3 | 20,8 | 23,3 | 26,6  |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | 1091 | 1732 | 2454 | 3534 | 5280 | 6818 | 8552 | 11148 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | 3    | 5    | 7    | 10   | 15   | 19   | 24   | 32    |    |
|                        | Bead size                           | mm                | -   | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,5  | 1,5  | 2,0   |    |
|                        | p2: Heating pressure                | bar               | -   | 1    | 1    | 1    | 1    | 1    | 2    | 2    | 3     |    |
|                        | t2: Heating time                    | sec               | -   | 95   | 119  | 140  | 165  | 199  | 223  | 246  | 276   |    |
|                        | t3: Change over time                | sec               | -   | 6    | 7    | 7    | 8    | 9    | 10   | 10   | 11    |    |
|                        | t4: Pressure build-up time          | sec               | -   | 8    | 10   | 11   | 14   | 16   | 18   | 20   | 23    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -    | 11   | 14   | 16   | 19   | 23   | 26   | 29    | 33 |
|                        |                                     | 15°C < Ta <= 25°C | min | -    | 9    | 11   | 12   | 15   | 17   | 20   | 22    | 25 |
|                        |                                     | Ta <= 15°C        | min | -    | 7    | 8    | 10   | 11   | 14   | 15   | 17    | 19 |

| Ø: Pipe outer diameter |                                     | mm                | 40  | 50   | 63   | 75   | 90   | 110  | 125  | 140  | 160   |    |
|------------------------|-------------------------------------|-------------------|-----|------|------|------|------|------|------|------|-------|----|
| SDR<br>5               | e: Wall thickness                   | mm                | -   | 10,1 | 12,7 | 15,1 | 18,1 | 22,1 | 25,1 | 28,1 | 32,1  |    |
|                        | A: Fusion surface                   | mm <sup>2</sup>   | -   | 1266 | 2007 | 2842 | 4088 | 6103 | 7878 | 9878 | 12898 |    |
|                        | p1/p5: Equalization/fusion pressure | bar               | -   | 4    | 6    | 8    | 12   | 17   | 22   | 28   | 37    |    |
|                        | Bead size                           | mm                | -   | 1,0  | 1,0  | 1,0  | 1,0  | 1,5  | 1,5  | 2,0  | 2,0   |    |
|                        | p2: Heating pressure                | bar               | -   | 1    | 1    | 1    | 1    | 2    | 2    | 3    | 4     |    |
|                        | t2: Heating time                    | sec               | -   | 114  | 142  | 166  | 197  | 235  | 263  | 288  | 321   |    |
|                        | t3: Change over time                | sec               | -   | 7    | 7    | 8    | 9    | 10   | 11   | 12   | 13    |    |
|                        | t4: Pressure build-up time          | sec               | -   | 9    | 12   | 14   | 16   | 19   | 21   | 24   | 28    |    |
|                        | t5: Cooling time                    | Ta <= 40°C        | min | -    | 13   | 16   | 19   | 23   | 28   | 31   | 34    | 39 |
|                        |                                     | 15°C < Ta <= 25°C | min | -    | 10   | 13   | 15   | 17   | 21   | 23   | 26    | 30 |
|                        |                                     | Ta <= 15°C        | min | -    | 8    | 10   | 11   | 13   | 16   | 18   | 21    | 23 |





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