

Fittings made of PE 100
for the safe gas and water supply

PE installation instructions

Bänninger Kunststoff-Produkte GmbH
Reiskirchen

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The details contained in the installation instructions are intended to inform you about and to help you with regard to the installation. No warranty promise can be derived from the installation instructions. We refer to our sales terms and delivery conditions.

As of: 10/2008

General

Material

The PE material used complies with the requirements of:
EN 1555 Plastics piping systems for the supply of gaseous fuels.
pr EN 12201 Plastics piping systems for drinking water supply .

The PE materials are classified according to the minimum long-term strength (MRS) PE 100.

Connection

Welded connection
Heating element butt welding according to DVS (German Welding Association) information sheet 2207, part 1, section 4.1.
Heating coil welding according to DVS information sheet 2207, part 1, section 5.1.
Devices and fixtures for heating element butt welding according to DVS information sheet 2208, part 1, section 4.1.
Devices and fixtures for electro fusion welding according to DVS information sheet 2208, part 1, section 6.1.

In the MFR range (0.3 -1.3) g/10 min., **B-R** fittings made of PE 100 can be welded together will all pipes which comply with the standards EN 1555 and Pr EN 12201. If the MFR value is beyond the aforementioned MFR range, one has to furnish proof according to DVS 2203-4 that the parts can be welded together.

Technical data

Density	according to ISO 1183	≥930 kg/m³
Melt index	according to ISO 1133	0.3 – 0.5 g/10 min.
Coefficient of linear expansion	according to DIN 53752	0,13 mm/m.k.
Colour		black

Geometrical properties and nominal pressures

Outer diameter and wall thickness according to EN 1555 and PrEN 12201 and DIN 16963
Explanations regarding:
Outer diameter/wall thickness ratio SDR with nominal pressure PN.

PE 100	SDR 11	nominal pressure PN 16
PE 100	SDR 17	nominal pressure PN 10

The nominal wall thicknesses are indicated in SDR 17 in the size measurement table. SDR 17,6 and SDR 17 comply with the actual wall thickness of the formed parts. The nominal pressure PN is calculated with safety factor SF 1.25.

The data do not apply to any component combination according to DIN 16963 (e.g. flange connections, screw fittings).

The following applies to gas:
The max. working pressure is not equal to the nominal pressure. See DVGW guideline VP 608 or the provisions of the individual countries.

Dimensions

z dimensions
± 3 mm up to d = 160 mm
± 10 mm from d = 180 mm

Resistance to chemicals

Detailed statements about the stability are made in DIN 8075, supplementary sheet 1.
The explanations on page 1 of the supplementary sheet must be observed.

As a matter of principle one has to bear in mind that the indicated resistance to chemicals cannot be applied to all operating conditions. In case of doubt, we advise you to contact us or to perform tests by means of installing pipes and fittings under real operating conditions.

Quality / certification / DVGW (German Technical and Scientific Association for Gas and Water) permission

B-R fittings are subject to constant quality checks which are an essential part of our comprehensive quality management system certified according to DIN EN ISO 9001.
The fittings meet the requirements of EN 1555-3 and pr 12201 and DIN 16963.
The DVGW permission according to VP 607 is available.

Working pressure

The permissible working pressures are defined according to the DVGW guideline VP 608.

Orders

When ordering, the dimension and the order no. must always be indicated in addition to the part designation.
Example: PE 100, angle 90°, d 110, no. 25.10.01.103

Marking

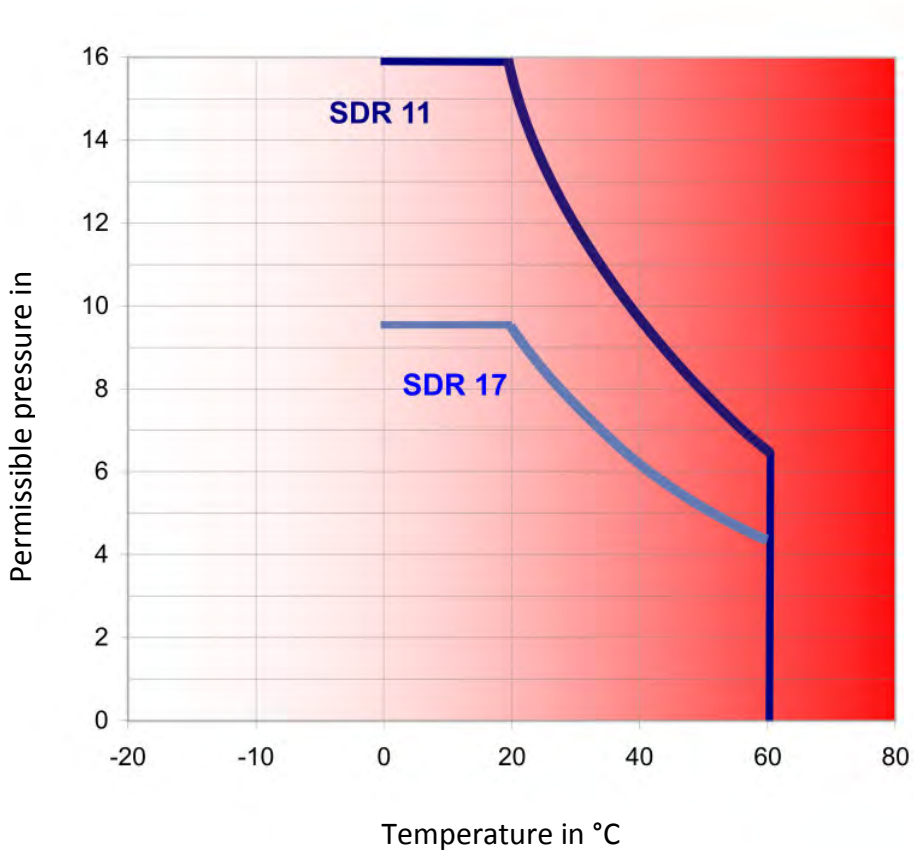
The fittings are provided with the following marking:
B-R, d, PE 100, SDR 11, 1/03

Signs and symbols

d	= nominal size = pipe outer diameter
DN	= nominal width
SDR	= standard dimension ratio
R	= conical external pipe thread
Rp	= cylindrical internal thread
Rc	= conical internal pipe thread
G	= cylindrical external thread
Stp	= standard packing
®	= registered trademark
AL	= number of screw holes

Pressure-temperature diagram PE 100

Application limits for pipes and fittings made of PE 100
25-year values, in consideration of the safety factor C (C=1.25),
with water as flow medium.



Resistance to pressure PE 100

Max. working pressure (bar) depending on temperature and period of operation

The statements apply to water as flow medium
Safety factor 1.25

SDR 11 = diameter/wall thickness ratio
S = pipe series 5
PN 16 = old pressure stage designation

	Years of operation				
	5	10	25	50	100
Temperatur	Max. working pressure				
10	20,2	19,8	19,3	19,0	18,7
20	16,9	16,6	16,2	16,0	15,7
30	14,4	14,1	13,8	13,5	-
40	12,3	12,1	11,8	11,6	-
50	10,7	10,4	9,5	-	-
60	7,7	-	-	-	-
70	6,2	-	-	-	-

SDR 17 = diameter/wall thickness ratio
S = pipe series 8
PN 10 = old pressure stage designation

	Years of operation				
	5	10	25	50	100
Temperatur	Max. working pressure				
10	12,6	12,4	12,1	11,9	11,6
20	10,6	10,4	10,1	10,0	9,8
30	9,0	8,8	8,6	8,4	-
40	7,7	7,6	7,4	7,2	-
50	6,7	6,5	5,9	-	-
60	4,8	-	-	-	-
70	3,9	-	-	-	-

Linear deformation of PE pipes under heat in fluence

Thermoplastic pipes made of PE-HD are generally subject to heat expansion, like all materials. This fact must be considered at all costs during the installation. Therefore, with regard to the arrangement of the pipes, all possibilities should be exploited as early as during the planning stage in order to compensate for the expansion processes within any pipe section.

The average heat expansion coefficient for PE 100 pipes is:

$$\varepsilon t = 0{,}2 \cdot 10^{-4} \ (K^{-1})$$

The linear expansion of a pipeline is calculated on the basis of the following formula:

$$\Delta L = \varepsilon t \cdot L \cdot \Delta t \ (mm)$$

In this regard, the following symbols mean the following:

ΔL = Linear expansion in mm

εt = Heat expansion coefficient in mm / m °K

L = Length of the pipeline in m

Δt = Temperature difference in °K

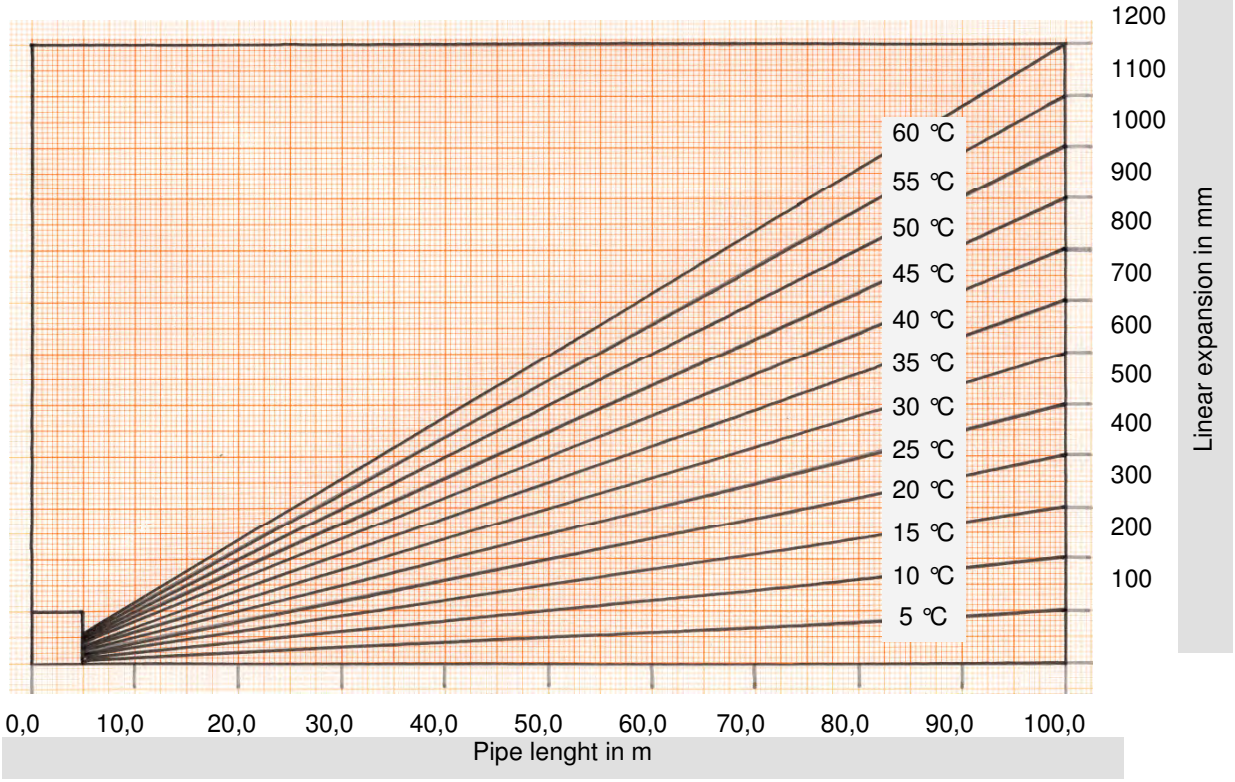
The installation temperature is taken as basis for the calculation of the alternation of length.

Example of a pipe length L = 60 m

Installation temperature: 16 °C
Highest pipe wall temperature: 31 °C
= temperature difference 15 °C
Expansion coefficient = 0.2 mm / m °K

$\Delta L = 0{,}2 \cdot 60 \cdot 15 = 18$ cm

Diagram and table for determining the temperature-related linear expansion



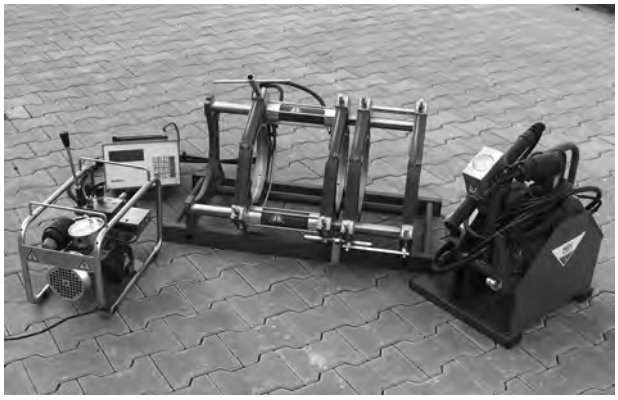
	Temperatur difference ΔT in K											
Pipe	5	10	15	20	25	30	35	40	45	50	55	60
10,0 m	10	20	30	40	50	60	70	80	90	100	110	120
20,0 m	20	40	60	80	100	120	140	160	180	200	220	240
30,0 m	30	60	90	120	150	180	210	240	270	300	330	360
40,0 m	40	80	120	160	200	240	280	320	360	400	440	480
50,0 m	50	100	150	200	250	300	350	400	450	500	550	600
60,0 m	60	120	180	240	300	360	420	480	540	600	660	720
70,0 m	70	140	210	280	350	420	490	560	630	700	770	840
80,0 m	80	160	240	320	400	480	560	640	720	800	880	960
90,0 m	90	180	270	360	450	540	630	720	810	900	990	1080
100,0 m	100	200	300	400	500	600	700	800	900	1000	1100	1200
	Alternation of lenght ΔL in mm											

Spans L in cm at a medium temperature of t℃ (filled with water)

d mm	20 ℃	30 ℃	40 ℃	50 ℃	60 ℃	70 ℃	80 ℃
50	85	75	70	65	60	55	50
63	95	85	75	75	70	65	60
75	105	90	85	80	75	70	65
90	115	100	90	85	80	75	70
110	125	110	100	95	90	85	80
125	130	120	110	100	95	90	85
140	140	125	115	105	100	95	90
160	150	135	120	115	105	100	95
180	160	140	130	120	115	105	100
200	170	150	135	125	120	110	105
225	175	160	145	135	125	115	110
250	185	170	150	140	130	125	115
280	200	175	160	150	140	130	120
315	210	190	170	160	150	140	130
355	220	200	180	165	155	145	135
400	235	210	190	175	165	155	145
450	255	230	210	190	175	165	155
500	265	240	215	200	180	170	160
560	280	245	230	210	195	180	170

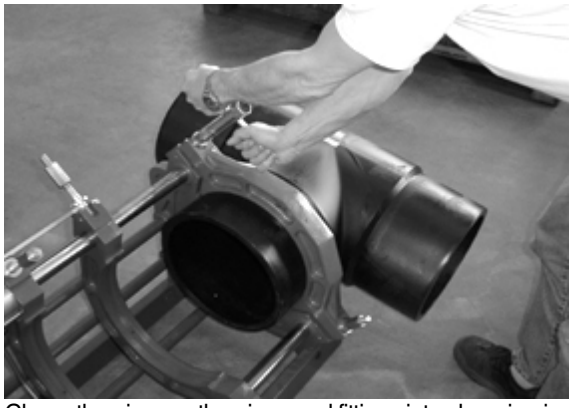
Operating sequence – butt welding with a welding machine

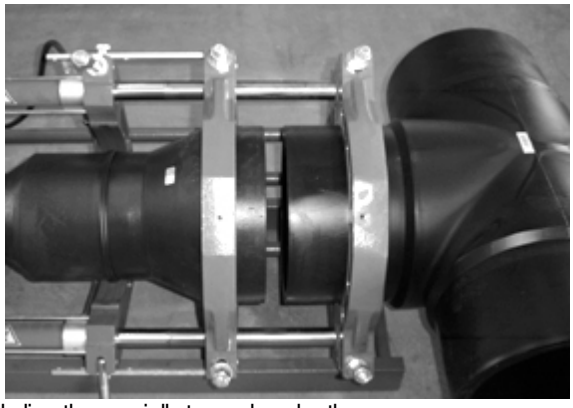
The welding machine is suitable for the butt welding of pipes and / or fittings made of PE-HD



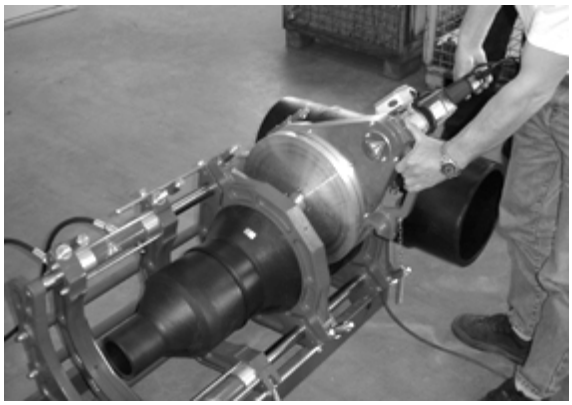
Preparation of the welding operation:

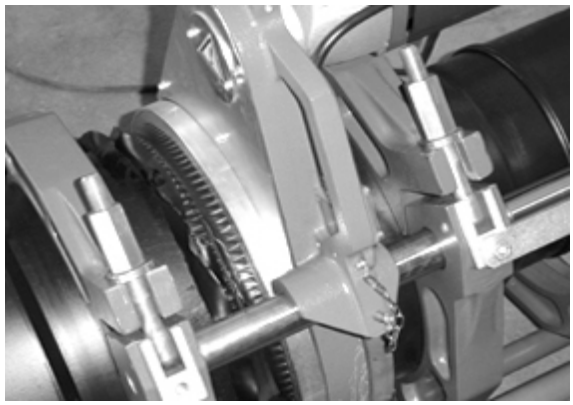
Heat the heating element up to 210°C. Check the welding temperature prior to the welding operation.
Temperature difference ± 10°C
The welding mirror must be clean, and must be cleaned prior to every welding operation.





Clamp the pipes or the pipes and fittings into clamping jaws, and align them axially toward each other.



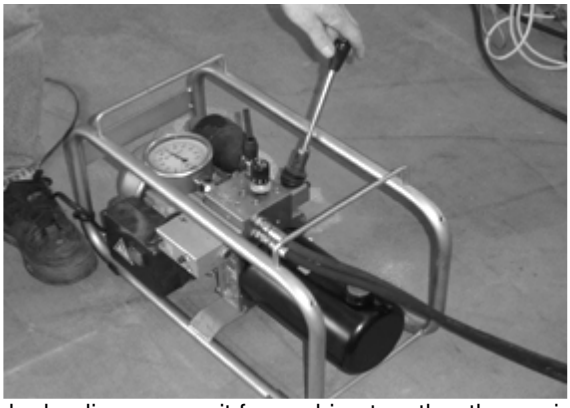


Use smoothing planer and plane the pipes or the pipes and fittings.

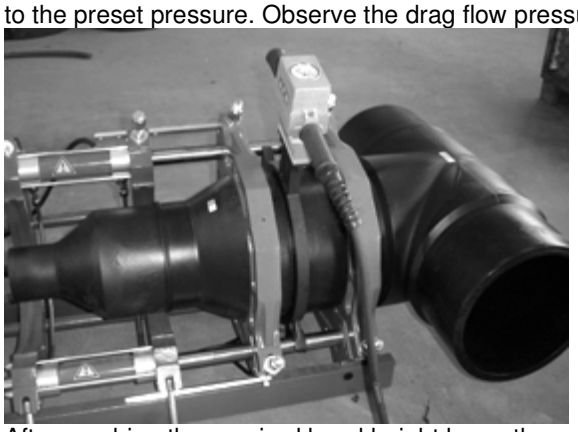
Welding:

(according to DVS information sheet 2207, part 1)

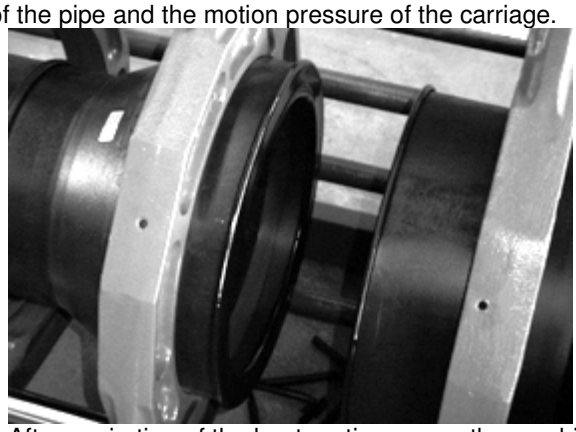




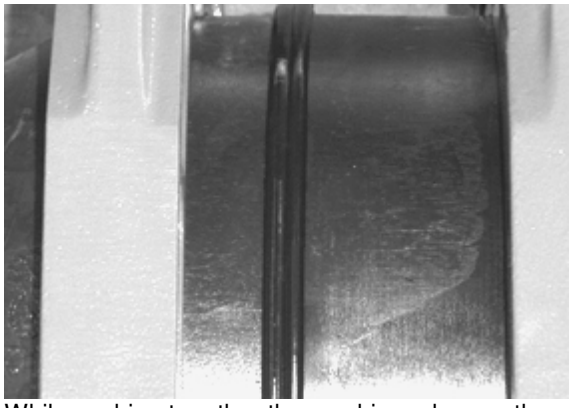
Insert the PTFE coated heating element, and operate the hydraulic power unit for pushing together the carriage to the preset pressure. Observe the drag flow pressure of the pipe and the motion pressure of the carriage.



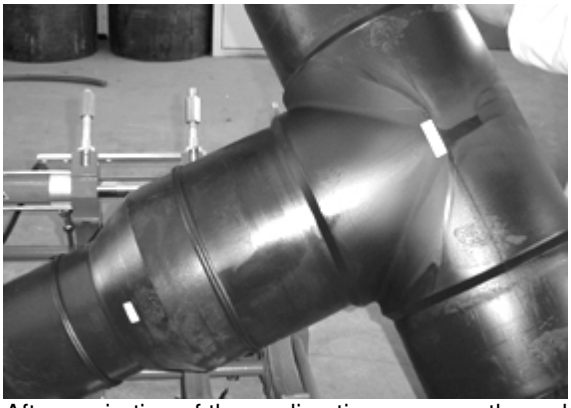
After reaching the required bead height,lower the pressure to 1/10 bar of the conformation pressure and heat the pipe according to the time table.-



After expiration of the heat-up time, open the machine, remove the heating element and push together the machine.

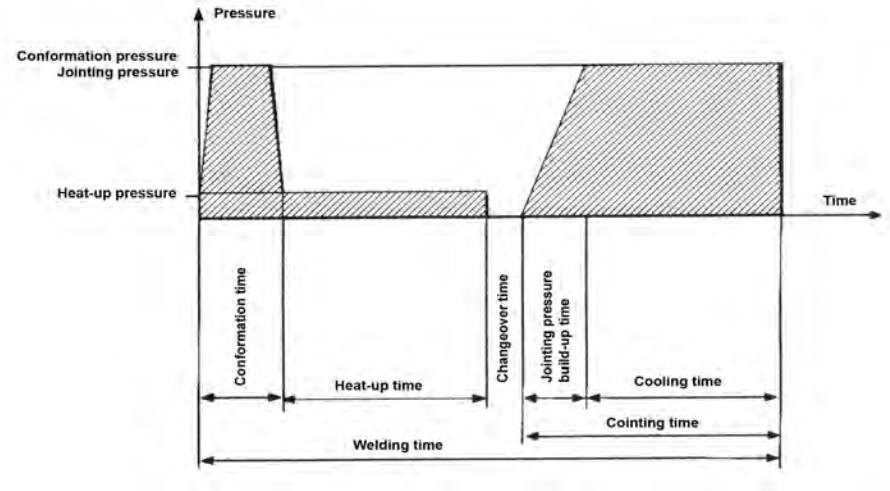


While pushing together the machine, observe the Changover time and the pressure increase until the final pressure of the pressure table is reached.
Cooling under pressure has to take place according to specification.



After expiration of the cooling time, remove the welded connection from the clamping jaws.

Heating element butt welding



Guiding values for PE-HD at an outside temperature of 20°C
according to DVS information sheet 2207, part 1

Nominal wall thickness mm	**Conformation** under 0,15N/mm² mm	**Heat up** s	**Change over** s	**Joining pressure build-up time** s	**Cooling time** under jointing pressure min
bis 4,5	0,5	45	5	5	6
4,5 - 7	1,0	45 - 70	5 - 6	5 - 6	6 - 10
7 - 12	1,5	70 - 120	6 - 8	6 - 8	10 - 16
12 - 19	2,0	120 - 190	8 - 10	8 - 11	16 - 24
19 - 26	2,5	190 - 260	10 - 12	11 - 14	24 - 32
26 - 37	3,0	260 - 370	12 - 16	14 - 19	32 - 45
37 - 50	3,5	370 - 500	16 - 20	19 - 25	45 - 60
50 - 70	4,0	500 - 700	20 - 25	25 - 35	60 - 80

Permissible wall offset 0.1 x wall thickness (s)

Operating sequence – electrofusion socket welding

Preparation of the welding operation:

With the help of a suitable tool (cutter or saw for synthetic material), the pipe is cut to length in a **rectangular** manner.
The welding area of the pipe surface must be machined in a shape cutting operation and the pipe end outside must be deburred.
Clean surfaces are crucial to the production of excellent welded connections.

Clean the machined surfaces with spirit. Use absorbent, lint-free paper for this purpose.

The joining surfaces must be machined immediately before starting the welding operation.
The pipes or the fittings and pipes to be welded together must be secured by clamps against displacement and twisting.
The pipe out-of-roundness must not exceed 1.5% of the outer diameter in the welding area.

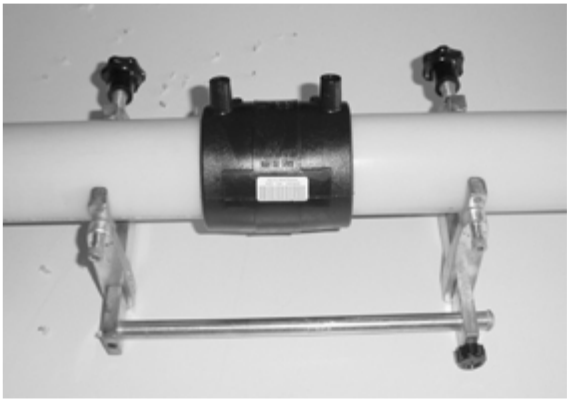
If required, use appropriate pressure clamps to achieve roundness.



Mark the insertion depth of the sleeve



Machine the welding area surface with a draw blade
Or a peeling tool in a shape cutting operation.



After applying the clamp, push the sleeve over the pipe. Take the sleeve out of the packaging Immediately before ist fixation. .



Connert the connection cables of the welding apparatus with the part to be weldet.
Fasten the welding cables in a weight-relieved manner.

Do not touch the cleaned pipe surfaces and the inner surface of the sleeve with your fingers.

Welding:

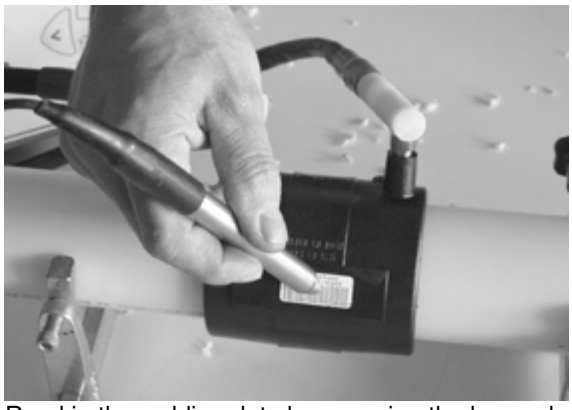
(according to DVS information sheet 2207, part 1)

The joining surfaces (outer surface of the pipe and inner surface of the sleeve) are heated to welding temperature, and are welded together. This welding operation is performed by means of electric current, with the help of resistance wires located in the sleeve.

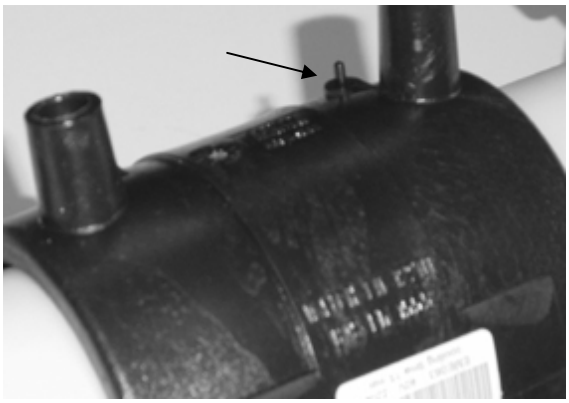
By means of a bar code reader which scans the relevant bar code, the data required for welding are automatically transferred from the welding apparatus.
The welding data (voltage and welding time on the bar code) can be entered manually, as well.

The welding operation and the control of the welding operation are performed automatically. The welding apparatus exactly controls the specific welding work required for fittings.
The apparatus monitors and stores all welding data which can be output by means of a computer or printer. Therefore, a gapless documentation of the welding operations is guaranteed.

Upon completion of the welding operation, the welding indicators are visible. However, the welding indicator does not make any statement on the quality of the weldment joint. The size of the indicator can vary, depending on the gap width between the heating coil welding sleeve and the pipe.



Read in the welding data by scanning the bar code with the bar code reader.



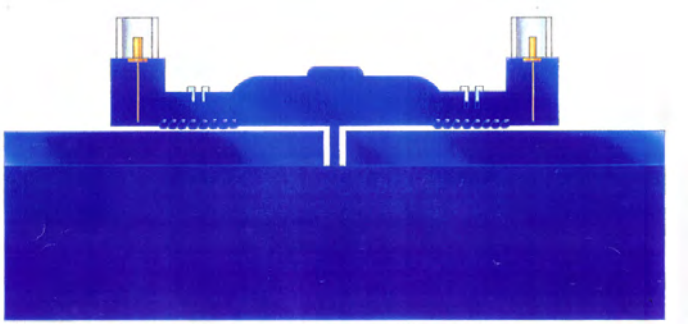
The welding indicator (arrow) indicates that the heating coil sleeve has been welded.

Cooling time:

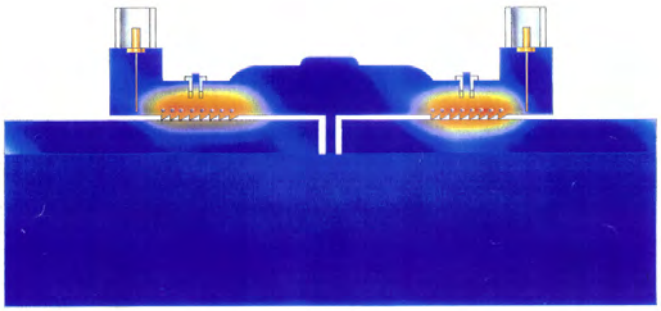
The cooling time must be adhered to at all costs.
The cooling time is indicated on the bar code label.
The cooling time must not be shortened by a quick temperature decrease (water, cold air etc.)

Do not remove the welded connection from the clamps until the cooling time has expired.

Schematic diagram of the heating coil sleeve welding operation

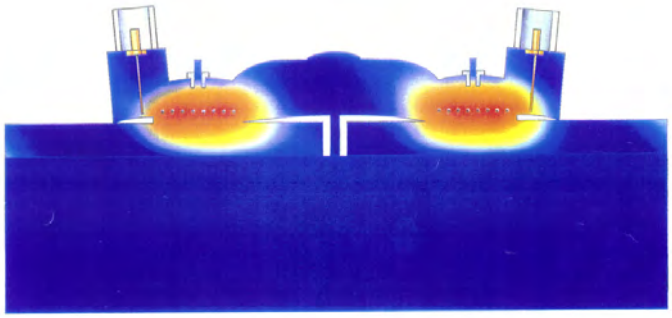


Starting position of the connection,
pipe and fitting must be positioned
without stresses,
use retaining clamps

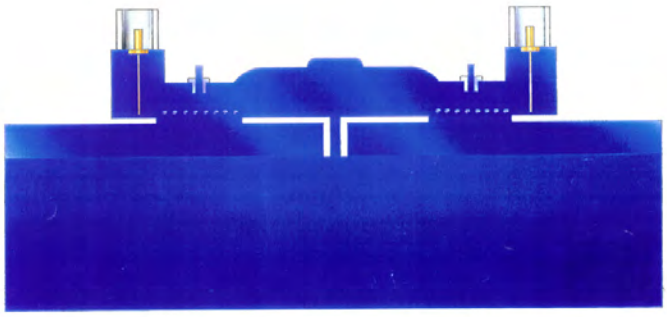


Energy is applied by the welding
apparatus.

(manually or by bar code)



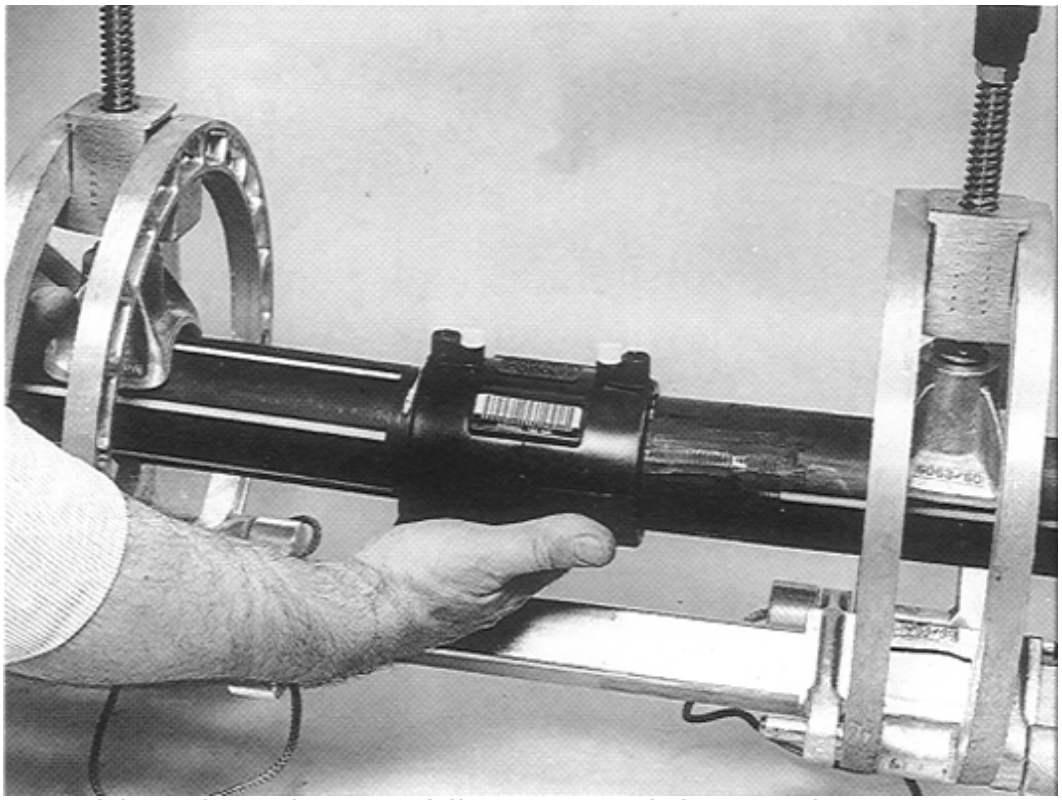
Welding pressure is generated by
energy and "cold zones"



The finished connection;
the weldment joint can be visually
recognized by the emerging welding
indicators.

Cause of faults in case of heating coil – sleeve welding

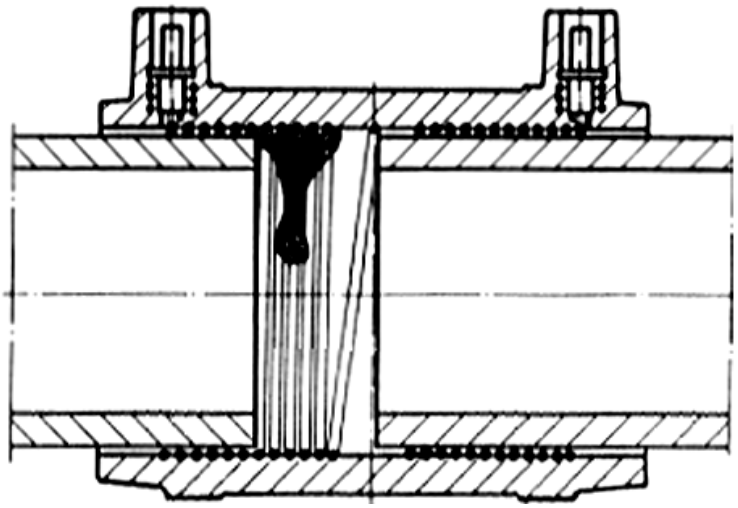
Twisted pipes with strong angular deviation



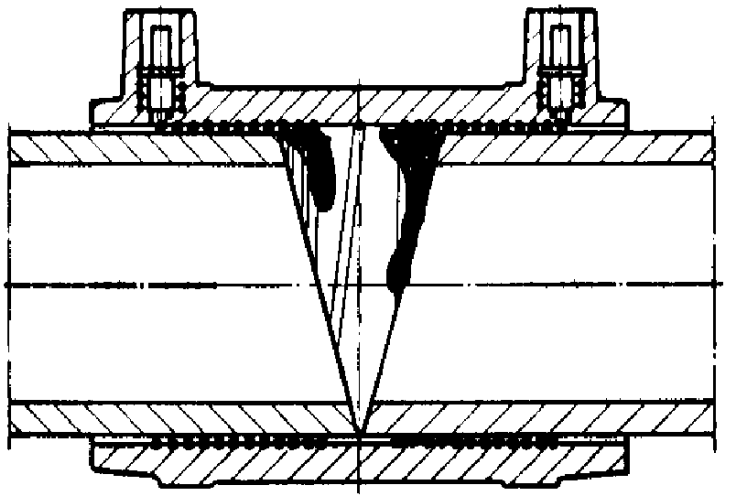
To avoid such serious welding errors, it is mandatory to secure the pipe by fastening a clamp.

To ensure that the fittings/pipes are welded together without stresses, the welding zone must be protected against tensile and bending stress.

Further welding errors:



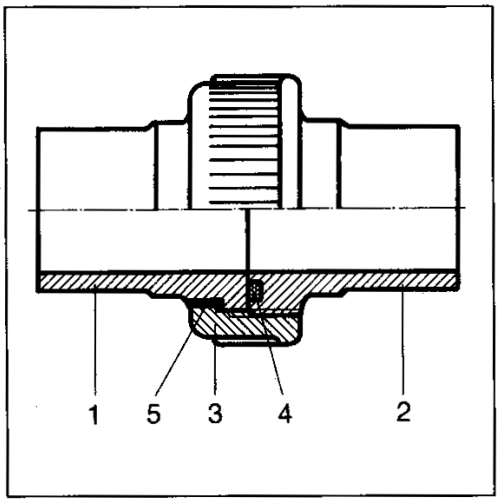
Insufficient insertion of the pipe



Pipe ends are cut diagonally

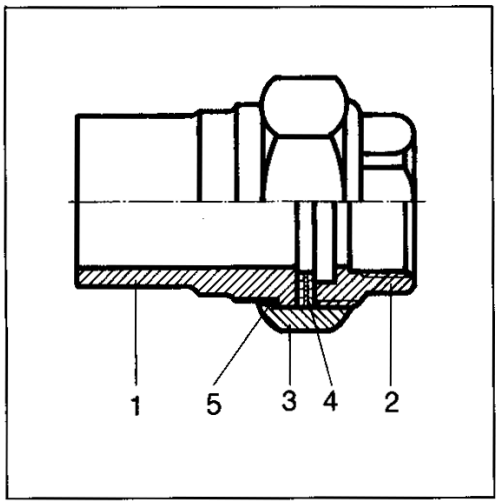
In all cases, the welding operator and the welding supervisor are responsible for the welding operation, irrespective of manufacturers' recommendations.

Itemization of the screw fittings



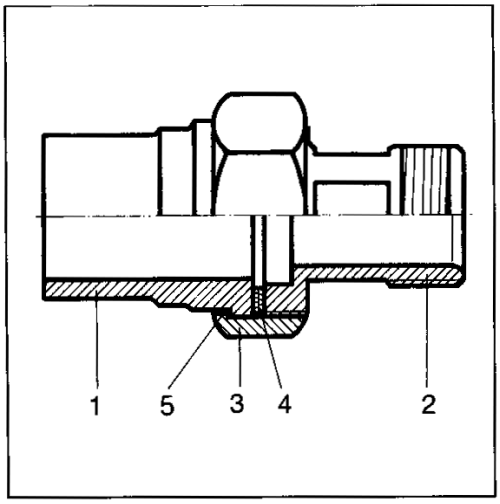
Screwed pipe joint PE
Round sealing ring

1st. insert made of PE
2nd. screw-in part made of PE
3rd. union nut made of PVC
4th. round sealing ring made of EPDM
4th. round sealing ring made of Viton A
5th. thrust collar made of PVC-U



Screwed pipe joint PE/V2A
connection for metal thread

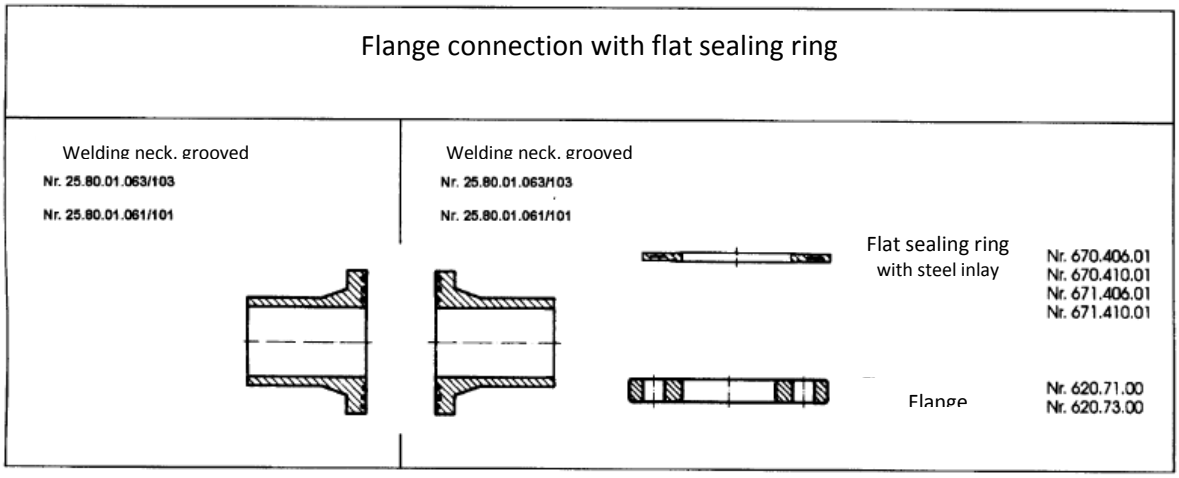
1st. insert made of PE
2nd. screw-in part made of V2A
3rd. union nut made of V2A
4th. flat sealing ring made of EPDM
5th. thrust collar made of PVC-U



Screwed pipe joint PE/V2A
connection for metal thread

1st. insert made of PE
2nd. screw-in part made of V2A
3rd. union nut made of V2A
4th. flat sealing ring made of EPDM
5th. thrust collar made of PVC-U

Overview of the range of flange connections with welding neck, flange and seals



Guiding values for the screw fastening,

Loose flanges made of PP with steel inlay according to DIN 16962/16963 part 4, up to DN 150 = PN 10/PN 16, from DN 200 = PN 10: drilled

Outer diameter∅ (mm)	Nominal width (mm)	Torque (Nm)	Number Holes	Hole circle (mm)
32	25	15	4	85
40	32	20	4	100
50	40	30	4	110
63	50	35	4	125
75	65	40	4	145
90	80	40	8	160
110	100	40	8	180
125	100	40	8	180
140	125	50	8	210
160	150	60	8	240
180	150	60	8	240
200	200	70	8	295
225	200	70	8	295
280	250	80	12	350
315	300	90	12	400
355	350	100	16	460
400	400	120	16	515

The screw length can vary, depending on the flange thickness.
Flange connection dimensions (hole circle) and number of holes according to DIN 2501 part 1.

Pressure test

Prior to putting into operation, every complete pipeline or every pipeline section must be subjected to a pressure test to ensure the tightness and the proper installation of the shaped parts, pipes, connections and other pipeline parts as well as the house service connections.

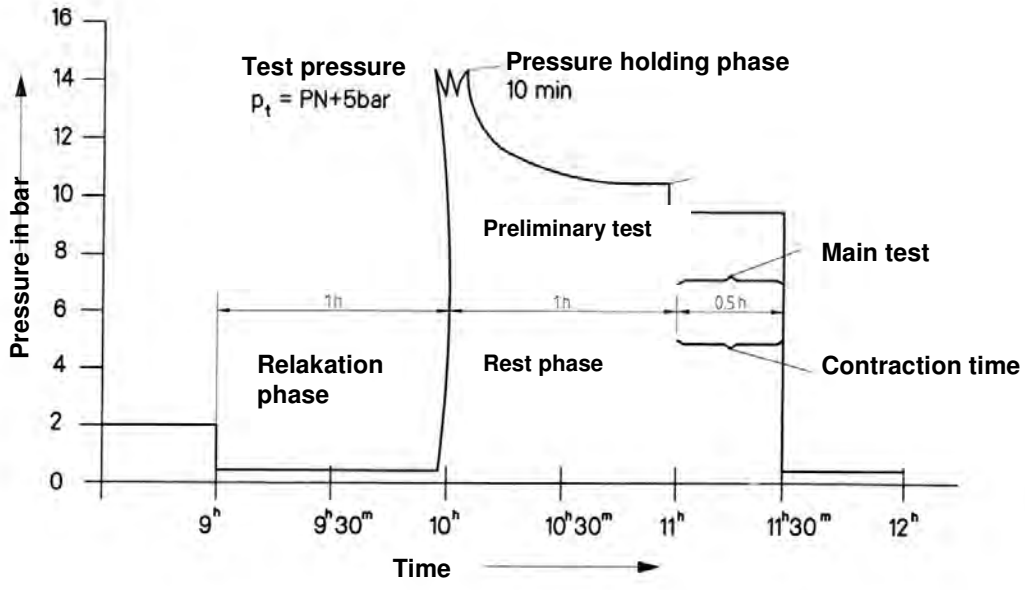
Internal pressure test of pressure pipelines for water

(according to DIN V 4279-7):

Contraction method

A preliminary test is imperative for this test procedure. The objective of the preliminary test is to bring any pressure-, time- and temperature-dependent volume change within the piping to a halt so that a clear statement on the tightness can be made during the subsequent main test.

The following test steps must be performed to prevent the test result from being affected by distorted aspects:



Preliminary test:

For the one-hour relaxation phase after filling, the pipeline filled up to working pressure must be completely depressurized. For this purpose, it must be ensured that no air enters the piping.

The test pressure is to be applied within a period of 10 minutes; it results from the nominal pressure SDR (PN) + 5 bar.
By means of performing constant, subsequent pumping strokes, the test pressure is to be maintained over a period of 10 minutes.

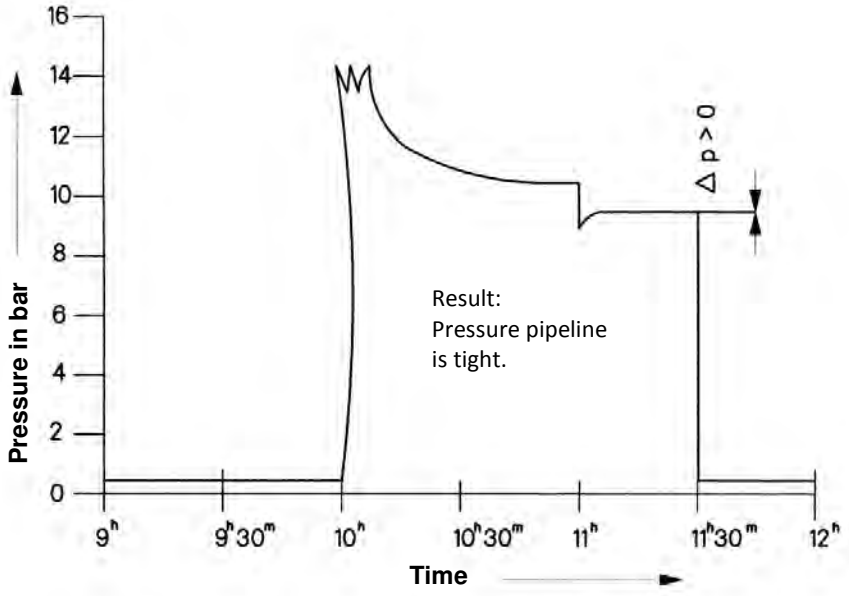
The aforementioned period is followed by a one-hour rest period during which the pipeline deforms viscoelastically due to the internal pressure.
During this period, the maximum pressure drop may not exceed 30% of the test pressure.

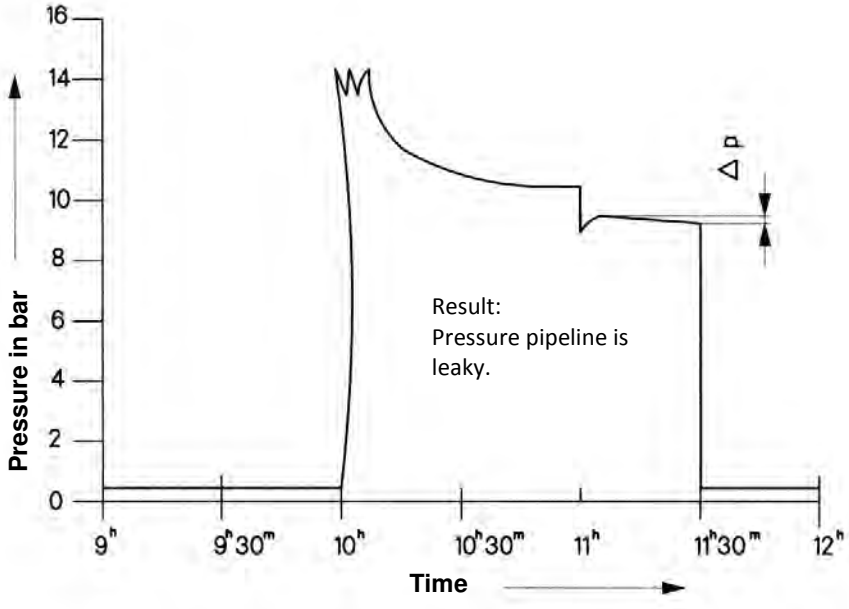
The main test can only be performed after successful completion of the preliminary test.

Main test:

Despite the one-hour pre-load, the pipeline continues to expand. This process is interrupted by a short-term pressure drop by 2 bar in drinking water pipelines up to 10 bar, and by 3 bar in drinking water lines up to 16 bar. This pressure drop causes a contraction of the pipeline. Afterwards, the pipeline tightness can be securely evaluated in the course of a period of 30 minutes.

The pipeline is regarded as tight if the pressure curve formed in the course of the contraction time shows an inclining tendency up to a constant tendency.
The following illustrations show the pressure course during the pressure test performed in a tight and a leaky pipeline.





A test report must be drawn up on the pressure test progression.
DIN 4279 part 9 contains the relevant test report examples.