Planning and finishing work 6

Cutting pipes to length

1. Safety precautions

All instructions made by the manufacturer with the aim of guaranteeing accident prevention are to be followed.
Appropriate protective clothing and safety equipment must be used when work is carried out.

2. Marking the cutting point

Cuts must be made at right-angles to the pipe axis.
Before cutting, mark the point where the pipe is to be cut with a line around the whole circumference of the pipe.
Tip: Wrap a wide steel band with straight edges around the pipe, mark along its edge.

3. Cutting

Use an appropriate cutting tool, e.g. circular saw.

4. Round off sharp edges

4.1 Push-in joint pipe

Bevel the spigot end of the cut pipe slightly.
A hand grinder is an appropriate tool for doing this.

Execution:
The radius (R) depends on the size of the push-in joint pipe.

DN	80-100	R 5 mm	DN	400	R 7 mm
DN	200-300	R 6 mm	DN	500,600	R 8 mm

Sharp edges must be sufficiently rounded off. Otherwise they make it difficult to insert the spigot and may cause damage to the sealing rings.

4.2 Threaded pipe

Sharp edges should be rounded off using a file or a hand grinder.

6

5. Protect cut surface against corrosion

Carefully clean all surfaces inside the shortened pipe.

Touch up the bare metal surfaces.
- for ducpur pipes with a bitumen compound suiable for drinking water.
- for ecopur pipes using the repair kit as described under “Repairing linings and outside coatings“.

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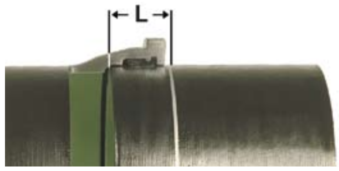
6. Markings on push-in joint pipes

The marking lines should be transferred to the spigot-end of the shortened pipe as appropriate to the type of piping element:

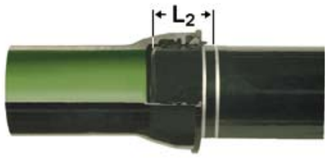
6.1 Markings for push-in joint adapter fittings (single-chamber)

DN	L mm
80	80
100	82
125	85
150	88
200	94
250	94
300	95
350	98
400	100
500	105
600	110
700	140



6.2 Markings for push-in joint pipes and adapter fittings such as UNI 1 / slide-valve (double-chamber) with internal thrust-resisting ring Fig. 2807

DN	L_2 mm
80	126
100	127
125	130
150	133
200	138
250	138
300	137

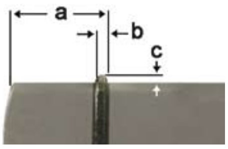


6.3 Markings for push-in joint pipes and adapter fittings such as UNI 1 / slide-valve (double-chamber) without internal thrust-resisting ring Fig. 2807

DN	L_1 mm
80	109
100	110
125	113
150	116
200	121
250	121
300	120

7. Positioning welded beads

Welded beads should only be added to piping on-site only if absolutely necessary and using special welding electrodes for ductile cast iron. As a result of the heat caused by welding, both the inside and outside coatings will be damaged. These must be correctly repaired afterwards (see "Repair of linings and outside coatings")



DN	a mm	b mm	c mm
400	113 +/-3	6-8	4 +1
500	125 +/-3	6-8	4 +1
600	135 +/-3	6-8	4 +1

RESICOAT® RS Repair Material

1. User Manual

RESICOAT® RS is a ready-to-use, two-component solvent free epoxy-repair material packed in the correct mixing ratio of 2:1.
The user friendly packaging in 2-chamber cartridge enables the immediate repair of damages after quick assembling.

The repair kit consists of
- dispenser
- double-chamber cartridge (2:1)
- mixing tube

- Open up the frame

- Insert the cartridge into the frame of the dispenser

- Close the frame with a „click“

- Twist off the plug

- Assemble the mixing tube by a 1/4 twist

- Move the plunger with the dispenser into the cartridge. This pressure causes the material flow through the mixing tube, the built- in spiral elements lead to a homogenuous mixture.

For further technical data please refer to the Technical Data Sheet and to the Material Safety Data Sheet.

phone +41 62 388 14 00, fax +41 62 388 14 20, www.vonroll-hydro.ch, info@vonroll-hydro.ch

RESICOAT® RS 2K-Repair Material

1. Usage

Repair of faults caused by supporting devices during the coating process. Repair of uncoated areas after sawing drilling or milling. Repair of mechanical damage caused during transportation and installation.

2. Handling

The user-friendly touch-up 2-chamber cartouches ensure an exact dosage of resin/hardener components in a ratio of 2:1.

3. Cartouche with piston

In this case a mixing tube ensures the homogenizing of both constitents.
If no mixing tube is available, both components must be homogenized thorougly.

4. Construction site

If no special pistol is available on a construction site or during on-site installation, a press out unit can be used alternatively.

5. Processing instructions

The substrate must be free from oil, dust and oxides.
Its temperature has to be 3 °C minimum above the dew point of the surrounding air, but not below 5 °C.
Care for a correct outcome of both components before assembling the mixing-tube. Dispose the volume of approx. 3ml.

6. Curing

Pot-life at 23 °C : 15 minutes
Dust-dry at 23 °C : approx. 2 hours
Fully cured at 23 °C : 24 hours

7. Drinking water contact

Contact with drinking water has been certified and approved according to the UBA Guideline.

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Installation instructions for ducpurPLUS corrosion-protection film

1. General remarks

DucpurPLUS corrosion-protection film is delivered as a film tube in handy rolls.
It is made of environment-friendly polypropylene.
DucpurPLUS corrosion-protection film is highly resistant.
Once laid, it exhibits a practically unlimited resistance to ageing effects.
It is used to protect cast-iron piping against the following corrosive elements:

Aggressive soils

- in acidic soils (e.g. marshy ground).
- In soils with a high salt content, e.g. as a result of treating roadways against frost and snow.
- Around roots.

Formation of macro-elements

- in the case of varying corrosion potentials between the cast-iron piping and other metallic parts in contact with it, e.g. iron reinforcements.
- in the case of different electrical potentials between the cast-iron piping and other metallic parts in electrical contact with it, e.g. copper.
- in the case of inhomogeneous bedding, e.g. when trenches are filled in with various types of earth, contact between pipe surface and lumps of clay, masonry etc.

Stray currents

- near railways that run on direct current, e.g. tramways, too.
- Near metallic structures that are fitted with cathodic protection devices.

Our customer service division is at your disposal for:

- professional instruction on the laying of ducpurPLUS corrosion-protection film.
- taking soil samples.
- advice on the corrosion-protection of pipelines.

2. Preparation

DucpurPLUS corrosion-protection film is fitted in an on-going manner as the pipes and adapter fittings are laid.
The film should be cut about 0.3 m longer than for the total pipe length required (L1).
Slide the ducpurPLUS corrosion-protection film over the pipe (make a bellows).
Lift the pipe by hand or using lifting gear and pull the film onto the whole length of the pipe. Push-in joint should be left free.

6

3. Pipe connection

Prepare the piping to be laid – in or outside the trench – as shown.

Connect DN 80 – 700 push-in joint pipes using the appropriate installation appliances (Fig. 252, Fig. 293 or Fig. 254).

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4. Seal the connection

- Grasp the ducpurPLUS corrosion-protection film at its topmost point and fold it into the pipe.
  The fold must lie below the apex of the pipe and point downwards towards the bottom of the trench.
  Tape the fold at one-meter intervals along the pipe using SCOTCHRAP adhesive tape. Avoid pockets of air.
- First seal the ducpurPLUS corrosion-protection film onto the spigot-end of the pipe about 2 – 3 cm away from the markings.
- Pull the overlapping part of the ducpurPLUS corrosion-protection film over the pipe connection.
- Using SCOTCHRAP adhesive tape, fasten the film tightly around the joint (avoid voids).
- Use the SCOTCHRAP adhesive tape to both fasten the film and to seal it.
  Adjust the ducpurPLUS corrosion-protection film to fit closely onto the pipe.
  Fasten and seal the ducpurPLUS corrosion-protection film onto the previously laid and already sealed section of piping using $1\frac{1}{2}$ turns of SCOTCHRAP adhesive tape.

5. Fill in the trench

- Embed the sealed-up section of piping in using fine material.
  In order to protect the ducpurPLUS corrosion-protection film from damage when filling in the trench, place a wooden board on the top of the pipe. The board should be removed before more coarse material is filled in.
- Fill in the trench with fine material up to 30 cm over the top of the pipe.
- Only now may the trench be completely filled with excavated or coarse material using mechanical means.

6. Repairing damage to the ducpurPLUS corrosion-protection film

Small, visible damage to the ducpurPLUS corrosion-protection film that can occur during the laying of the pipes can be repaired using SCOTCHRAP adhesive tape without incurring any problems.

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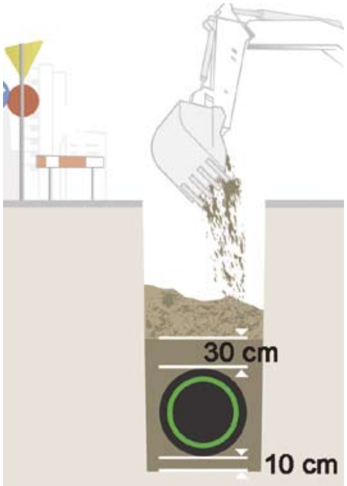
Information for planners and pipe fitters

1. Bedding-in and back-filling pipe trenches

The following instructions must be followed unconditionally:

1.1 In city areas subsidence-free back-filling:

When laying ecopur and ducpur pipes:
Well-compacted covering material, up to 32 mm grain (sandy gravel, gravel, fine excavated or recycled material).
Bedding ≥10 cm.



1.2 Overland Full use of excavated material:

ecopur-pipes:
Fuss use of excavated material:

ducpur-pipes:
Homogeneous covering material, such as ravel, sand or recycled material or reuse of excavated material if ducpurPLUS corrosion-protection film is used.
Use finer material (up to 60 mm grain) for bedding-in, the coarser material to back-fill.
Bedding ≥ 10 cm

Take the EN 805 standard into consideration.

vonRoll *rock* with rock protection coating is used in rocky ground, in order to protect the pipe against damages by rocks when filling back. vonRoll *rock* is suitable for all applications where sharp-edged back fill materiel is used.

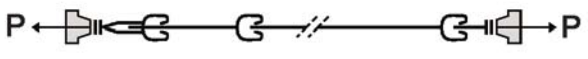
2. Anchoring the pipeline

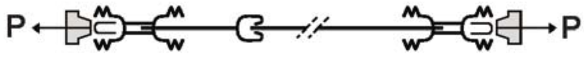
Covering:
Before making pressure tests, every pipe is to be sufficiently covered with soil, whereby the joints should be left free.

Anchors:
Before making pressure tests on non-thrust-resisting piping (i.e. without thrust resisting rings), all bends, T-pieces and the closures at both ends of the section to be tested should be sufficiently anchored.

Making the supports:

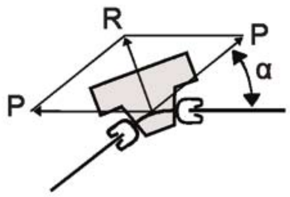
- Usually concrete anchors are used but, in special cases, stiffening with wedged-in profiles can also be used.
- The dimensioning of the anchors depends on the forces defined by the internal pressure and the diameter of the pipe on the one hand and on the load-carrying capacity of the ground on the other.





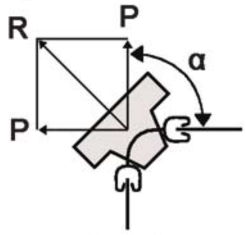
Adapter fittings:

Adapter fittings can be secured against changes in position using anchors.
The push-in joints remain free.
P = axial force
R = resulting force



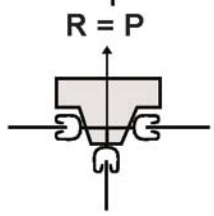
Anchors for bends:

$$R = 2 \cdot P \cdot \sin\frac{\alpha}{2} \quad \text{in N}$$



Anchors for T-pieces:

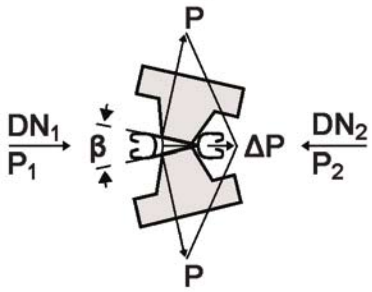
$$R = P \quad \text{in N}$$



Anchors for tapers:

$$\Delta P = P_1 - P_2 \quad \text{in N}$$

$$P = \frac{\Delta P}{2 \cdot \sin\frac{\beta}{2}} \quad \text{in N}$$



Resulting forces (R) in daN (1N = 0.102 kp) at 1 Mpa (10 bar) internal pressure:

DN	DE mm	dummy flange	bend α 90°	bend α 45°	bend α 30°	bend α 22 ½°	bend α 11 ¼°	bend α 5 ⁵/₈°
80	98	754	1'067	577	390	294	148	67
100	118	1'094	1'547	837	566	427	214	98
125	144	1'629	2'303	1'246	843	635	319	146
150	170	2'270	3'210	1'737	1'175	886	445	203
200	222	3'871	5'474	2'963	2'004	1'510	759	346
250	274	5'896	8'339	4'513	3'052	2'301	1'156	527
300	326	8'347	11'804	6'388	4'321	3'257	1'636	746
350	378	11'222	15'870	8'589	5'809	4'379	2'200	1'003
400	429	14'455	20'442	11'063	7'482	5'640	2'834	1'293
500	532	22'229	31'436	17'013	11'506	8'673	4'358	1'988
600	635	31'669	44'787	24'239	16'393	12'357	6'208	2'832
700	738	42'776	60'495	32'740	22'143	16'690	8'386	3'825

3. Permissible pressures

3.1 Pressures according to EN 545:2002 for push-in joint pipes and adapter fittings

	Pipe class K9			Pipe class K10		
DN	PFA	PMA	PEA	PFA	PMA	PEA
40	85	102	107	85	102	107
50	85	102	107	85	102	107
65	85	102	107	85	102	107
80	85	102	107	85	102	107
100	85	102	107	85	102	107
125	85	102	107	85	102	107
150	79	95	100	85	102	107
200	62	74	79	71	85	90
250	54	65	70	61	73	78
300	49	59	64	56	67	72
350	45	54	59	51	61	66
400	42	51	56	48	58	63
500	38	46	51	44	53	58
600	36	43	48	41	49	54
700	34	41	46	38	46	51

(values in bar)

PFA:
Permissible component operating pressure.
Highest hydrostatic pressure that a pipeline component can take in continuous operation.

PMA:
Highest permissible component operating pressure.
Highest temporarily occurring hydrostatic pressure, including the pressure surge, that a pipeline component can take in continuous operation.

PEA:
Permissible component testing pressure.
Highest hydrostatic pressure that a newly installed pipeline component can take for a relatively short period of time, in order to test the completeness and tightness of pipe-work installed above or below ground.

Note:
This test pressure is not the same as the system test pressure (STP) which refers to the calculated pressure for the pipeline and serves to guarantee its quality and tightness.

3.1 Permissible pressures for thrust-resisting rings

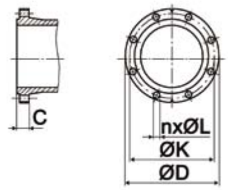
	Internal thrust-resisting rings		External thrust-resisting rings		
	Fig. 2807	Fig. 2504 (Tyton SIT)	Fig. 2806	Fig. 2505	Fig. 2506
DN	PFA	PFA	PFA	PFA	PFA
80	25	16*	63**		
100	25	16*	63**		
125	25	16*	63**		
150	25	16*	63**		
200	25	16*	63**		
250	16	10	40		
300	16	10	40		
350			25		
400		10		16	16
500				16	on request
600				16	on request
700				on request	on request

(values in bar)

* for ecopur pipes 10 bar
** for pressures > 40 bar, class K10 or higher pipes must be used Higher pressures on demand

4. Table of flanges for ductile cast iron flanges in dependence of DN and PN

According to ISO 2531 (EN 1092-2): Flanges and their connection – round flanges for pipes, fittings, adapters and accessories, sorted by PN – Part 2: cast-iron flanges.



DN	PN	Ø D mm	Ø K mm	C mm	n Stk.	Ø L mm	bolts
40	10	150	110	19.0	4	19	M16
	16	150	110	19.0	4	19	M16
	25	150	110	19.0	4	19	M16
	40	150	110	19.0	4	19	M16
	63	170	125	28.0	4	23	M20
50	10	165	125	19.0	4	19	M16
	16	165	125	19.0	4	19	M16
	25	165	125	19.0	4	19	M16
	40	165	125	19.0	4	19	M16
	63	180	135	28.0	4	23	M20
65	10	185	145	19.0	4	19	M16
	16	185	145	19.0	4	19	M16
	25	185	145	19.0	8	19	M16
	40	185	145	19.0	8	19	M16
	63	205	160	28.0	8	23	M20
80	10	200	160	19.0	8	19	M16
	16	200	160	19.0	8	19	M16
	25	200	160	19.0	8	19	M16
	40	200	160	19.0	8	19	M16
	63	215	170	31.0	8	23	M20
100	10	220	180	19.0	8	19	M16
	16	220	180	19.0	8	19	M16
	25	235	190	19.0	8	23	M20
	40	235	190	19.0	8	23	M20
	63	250	200	33.0	8	28	M24
125	10	250	210	19.0	8	19	M16
	16	250	210	19.0	8	19	M16
	25	270	220	19.0	8	28	M24
	40	270	220	23.5	8	28	M24
	63	295	240	37.0	8	31	M27
150	10	285	240	19.0	8	23	M20
	16	285	240	19.0	8	23	M20
	25	300	250	20.0	8	28	M24
	40	300	250	26.0	8	28	M24
	63	345	280	39.0	8	34	M30
200	10	340	295	20.0	8	23	M20
	16	340	295	20.0	12	23	M20
	25	360	310	22.0	12	28	M24
	40	375	320	30.0	12	31	M27
	63	415	345	46.0	12	37	M33
250	10	400	350	22.0	12	23	M20
	16	400	355	22.0	12	28	M24
	25	425	370	24.5	12	31	M27
	40	450	385	34.5	12	34	M30
	63	470	400	50.0	12	37	M33
300	10	455	400	24.5	12	23	M20
	16	455	410	24.5	12	28	M24
	25	485	430	27.5	16	31	M27
	40	515	450	39.5	16	34	M30
	63	530	460	57.0	16	37	M33
350	10	505	460	24.5	16	23	M20
	16	520	470	26.5	16	28	M24
	25	555	490	30.0	16	34	M30
	40	580	510	44.0	16	37	M33
	63	600	525	61.0	16	41	M36
400	10	565	515	24.5	16	28	M24
	16	580	525	28.0	16	31	M27
	25	620	550	32.0	16	37	M33
	40	660	585	48.0	16	41	M36
	63	670	585	65.0	16	44	M39
500	10	670	620	26.5	20	28	M24
	16	715	650	31.5	20	34	M30
	25	730	660	36.5	20	37	M33
	40	755	670	52.0	20	44	M39
600	10	780	725	30.0	20	31	M27
	16	840	770	36.0	20	37	M33
	25	845	770	42.0	20	41	M36
	40	890	795	58.0	20	50	M45
700	10	895	840	32.5	24	31	M27
	16	910	840	39.5	24	37	M33
	25	960	875	46.5	24	44	M39

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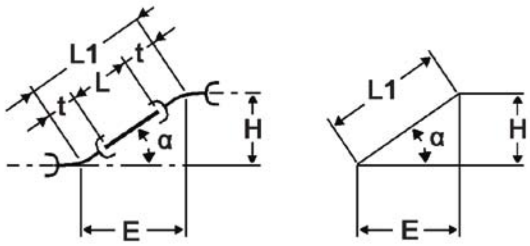
5. Tables for defining constructional dimensions

5.1 Table for defining the dimensions of two spigot/socket or threaded bends each with two sockets and a straight piece of pipe (L).



$L = L_1 - 2t$

The bend's constructional dimension t can be found in the adapter fittings table:

	α = 5 ⅝ °		α = 11 ¼°		α = 22 ½°		α = 30°		α = 45°	
H mm	E mm	L_1 mm	E mm	L_1 mm	E mm	L_1 mm	E mm	L_1 mm	E m	L_1 mm
1	10.2	10.2	5.0	5.1	2.4	2.6	1.7	2	1	1.4
2	20.3	20.4	10.1	10.3	4.8	5.2	3.5	4	2	2.8
3	30.5	30.6	15.1	15.4	7.2	7.8	5.2	6	3	4.2
4	40.6	40.8	20.1	20.5	9.7	10.5	6.9	8	4	5.7
5	50.8	51.0	25.1	25.6	12.1	13.1	8.7	10	5	7.1
6	60.9	61.2	30.2	30.8	14.5	15.7	10.4	12	6	8.5
7	71.1	71.4	35.2	35.9	16.9	18.3	12.1	14	7	9.9
8	81.2	81.6	40.2	41.0	19.3	20.9	13.9	16	8	11.3
9	91.4	91.8	45.2	46.1	21.7	23.5	15.6	18	9	12.7
10	101.5	102.0	50.3	51.3	24.1	26.1	17.3	20	10	14.1
20	203.1	204.0	100.5	102.5	48.3	52.3	34.6	40	20	28.3
30	304.6	306.1	150.8	153.8	72.4	78.4	52.0	60	30	42.4
40	406.1	408.1	201.1	205.0	96.6	104.5	69.3	80	40	56.6
50	507.7	510.1	251.4	256.3	120.7	130.7	86.6	100	50	70.7
60	609.2	612.1	301.6	307.5	144.9	156.8	103.9	120	60	84.9
70	710.7	714.2	351.9	358.8	169.0	182.9	121.2	140	70	99.0
80	812.3	816.2	402.2	410.1	193.1	209.1	138.6	160	80	113.1
90	913.8	918.2	452.5	461.3	217.3	235.2	155.9	180	90	127.3
100	1015.3	1020.2	502.7	512.6	241.4	261.3	173.2	200	100	141.4
200	2030.6	2040.5	1005.5	1025.2	482.8	522.6	346.4	400	200	282.8
300	3046.0	3060.7	1508.2	1537.7	724.3	783.9	519.6	600	300	424.3
400	4061.3	4080.9	2010.9	2050.3	965.7	1045.3	692.8	800	400	565.7
500	5076.6	5101.1	2513.7	2562.9	1207.1	1306.6	866.0	1000	500	707.1
600	6091.9	6121.4	3016.4	3075.5	1448.5	1567.9	1039.2	1200	600	848.5
700	7107.2	7141.6	3519.1	3588.1	1689.9	1829.2	1212.4	1400	700	989.9
800	8122.5	8161.8	4021.9	4100.7	1931.4	2090.5	1385.6	1600	800	1131.4
900	9137.9	9182.1	4524.6	4613.2	2172.8	2351.8	1558.8	1800	900	1272.8
1000	10153.2	10202.3	5027.3	5125.8	2414.2	2613.1	1732.1	2000	1000	1414.2

Calculation example for H = 1312 (the dimension is put together from the individual part-dimensions).

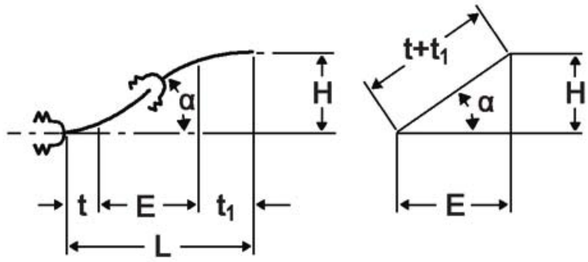
		α = 5 ⅝°		α = 11 ¼°		α = 22 ½°		α = 30°		α = 45°	
	H mm	E mm	L_1 mm	E mm	L_1 mm	E mm	L_1 mm	E mm	L_1 mm	E mm	L_1 mm
	2	20.3	20.4	10.1	10.3	4.8	5.2	3.5	4	2	2.8
+	10	101.5	102.0	50.3	51.3	24.1	26.1	17.3	20	10	14.1
+	300	3046.0	3060.7	1508.2	1537.7	724.3	783.9	519.6	600	300	424.3
+	1000	10153.2	10202.3	5027.3	5125.8	2414.2	2613.1	1732.1	2000	1000	1414.2
=	**1312**	**13321.0**	**13385.4**	**6595.9**	**6725.1**	**3167.4**	**3428.3**	**2272.5**	**2624**	**1312**	**1855.4**

5.2 Dimensions for two spigot/socket or threaded bends each with one socket

$E = (t+t_1) \cdot \cos \alpha$

$H = (t+t_1) \cdot \sin \alpha$

$L = t+t_1+E$

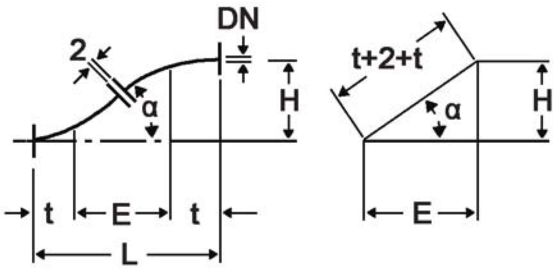


5.3 Dimensions for two connected flanged bends

$E = 2(t+1) \cdot \cos \alpha$

$H = 2(t+1) \cdot \sin \alpha$

$L = 2t+E$



6. Pressure tests

Guidelines for carrying out pressure tests can be found under:

W4/d
Guidelines for the planning, design, construction, operation and maintenance of drinking water supply systems outside buildings.

Available from:
Swiss Association of Gas and Water Professionals SVGW
Grütlistrasse 44
P.O. Box 658
CH-8027 Zurich

7. Pressure losses in water mains

7.1 Introduction

The Hydraulics Laboratory at the Swiss Federal Institute of Technology in Lausanne was commissioned by us to develop pressure-loss charts for water mains made of ductile cast iron with polyurethane (PUR) linings.

Measured roughness of the PUR surface in the pipes k ≥ 0,01 mm (i.e. hydraulically smooth surface).

The pressure-loss calculations are based on COLEBROOK's formula.

The pressure-loss chart on the following page is valid for class K9 ducpur push-in joint pipes that are new or as good as new.

It is also applicable to ecopur push-in joint pipes of the same pipe class. The altogether 1.8 mm smaller inside diameter DI must be taken account of.

The use of the pressure-loss chart is illustrated by the following examples.

Abbreviations used in the examples:

DN	=	nominal diameter of the pipe
DI	=	effective calculated inside diamater of the pipe in mm
Q	=	flow rate in l/s
v	=	average flow-speed in m/s
h	=	pressure-loss in m water head 1)
J	=	$\frac{h}{L}$ = pressure-loss in m water head 1) / 1000 m or slope in ‰
1)	=	1 m water head = 0,981 bar

Application example for ducpur pipes

Example 1

Given: DN 200, J = 4 m/1000 m

Find: Q,v

From the pressure-loss chart for ducpur push-in joint pipes, pipe class K9:

Q = 34 l/s, v= 1 m/s

Example 2

Given: DN 200, J = 4m / 1000 m

Find: DN, v

From the pressure-loss chart for ducpur push-in joint pipes, pipe class K9:

DI = 286,0 mm v = 1,56 m/s

Selected for use DN 300: Q= 121,8 l/s, v=1,63 m/s

Example 3

Given: Q = 100 l/s, J= 4 m/1000 m

Find: DN, v

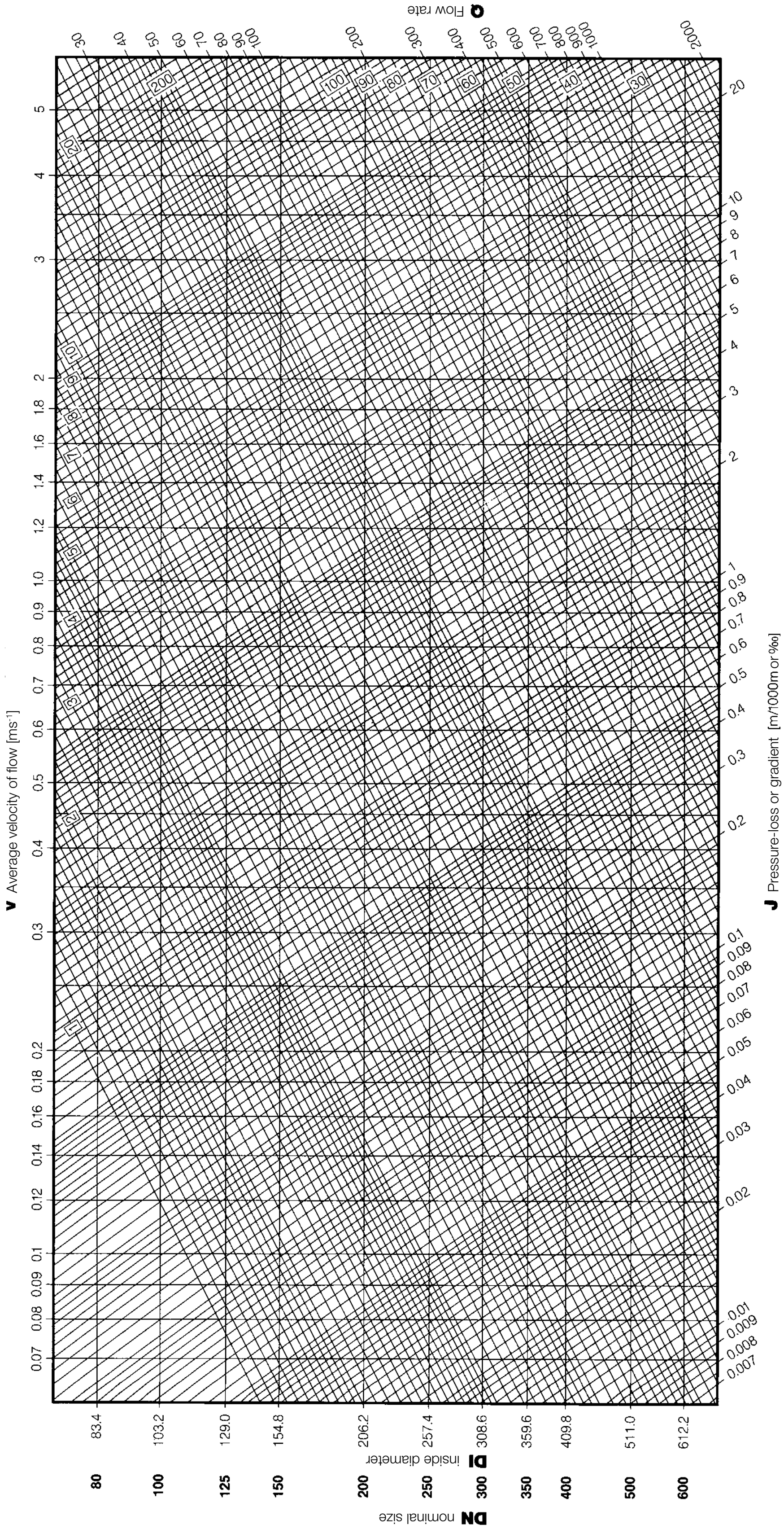
From the pressure-loss chart for ducpur push-in joint pipes, pipe class K9:

DI= 313,0 mm v = 1,30 m/s

Selectet for use DN 300 : Q= 97,5 l/s, v=1,30 m/s

7.2 Chart for pressure losses in water mains

Fig. 2817 and Fig. 2815 Push-in joint pipes, ducpur and ecopur models
Hydraulically smooth inner surfaces
Kinematic viscosity of the fluid = $1.3 \times 10^{-6}\ m^2\ s^{-1}$
ducpur / ecopur = centrifugally-cast pressure pipe in ductile cast iron with polyurethane internal lining Pipe class K9
Swiss Federal Institute of Technology, Lausanne
Hydraulics laboratory



Subject to alteration without notice

8. Planning tips for pipelines that take up longitudinal forces

8.1 General remarks

At bends, junctions, branch terminations and reduction fittings, forces can be encountered that have to be brought under control by the provision of concrete anchors or by using piping that takes up longitudinal forces and so transfers such forces to the surrounding ground. The **length of pipe that has to be secured** is dependent on its nominal size and testing pressure as well as the coefficient of friction, covering thickness and ground pressure of the compacted trench filling.
The following forces oppose the forces caused by the internal pressure:

- for bends, junctions, end caps and reductions: the frictional forces R between the pipe wall and the surrounding soil;
- for bends, the soil resistance force acting on the adjoining pipes should also be considered.

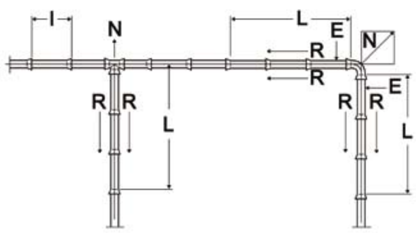
8.2 Coefficient of friction and ground pressure

The following parameters are defined:
Coefficient of friction
= 0.5 for non-binding sand and gravel in which there are no or very few bindings with loamy or clay-like material (soil type 2.23 according to DIN 18300).

= 0.25 for very loamy sand, sandy clay, marl, loess and clay (soil type 2.25 according to DIN 18300).

8.3 Dimensioning of pipelines that take up longitudinal forces

(Basis: DVGW brochure GW 368)



N = resulting thrust
E = counteracting earth restistence
R = conteracting friction
l = lenght of the pipe
L = length to be secured

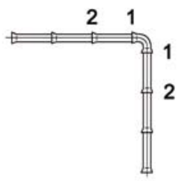
Ground pressure
= 0.05 N/mm^2 for very good compacted soil
= 0.025 N/mm^2 for good compacted soil.

Notes:

- When securing bends against “air” the length to be secured is equivalent to that of an end-cap (dummy flange).
- When ecopur pipes or pipes protected with PE-film are laid, a coefficient of friction of 0.25 should always be used because of the reduced ground friction.

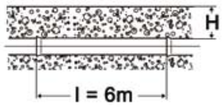
The following security measures are the minimum that must be taken:

- for bends: **2 socket joints on each side** (see illustration)
- for junctions and end-caps: **2 socket joints**
- for reductions: **2 socket joints on the side with the larger diameter.**

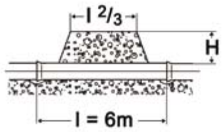


Please ask our VID for the tables showing “Pipe length to be secured“

8.1 Area of applicability



In the DVGW-GW368 rules, the general standard practice for push-in joint pipe-work is considered that involves completely filling the pipe trench even before the pressure tests. This leads to shorter pipe lengths that have to be secured against longitudinal forces.



Instead of completely filling the pipe trench before carrying out pressure tests, the pipe can be partially covered with soil over 2/3 of its length