

Bonded system - Z-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	2.5	m
Insulation class	Series 1	

Steel

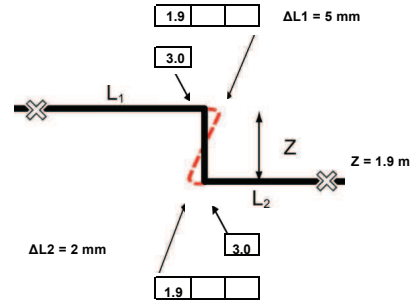
Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	3.9	m
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	1.5	m
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			



Multiple calculations

Input					Output											
Node no.	L1 m	L2 m	Nominal size	d mm	D mm	ΔL1 mm	ΔL2 mm	Z m	Layers for ΔL1	Foam pads for ΔL1			Layers for ΔL2	Foam pads for ΔL2		
										1	2	3		1	2	3
zp1 zp2	3.9	1.5	DN 400	406.4	560	5	2	1.9	1	1	2	3	1	1.9	2	3
2	3.9	3	DN 400	406.4	560	5	4	2.2	1	2.2			1	2.2		
3	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
4	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
5	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
6	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
7	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
8	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
9	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		
10	50	100	DN 65	76.1	140	17	17	2.1	1	2.1			1	2.1		

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.2 Sprawdzenie Z-tki odcinek zp1 - zp2.

Bonded system - 80-90° L-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	1.08	m
Insulation class	Series 1	

Steel material properties

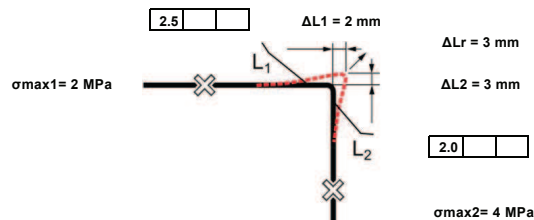
Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	1.5	
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	2.4	
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			



Multiple calculations

Input				Output													
Node no.	L1	L2	Nominal size	d	D	ΔL1	F1 min	Foam pads for ΔL1			ΔL2	F2 min	Foam pads for ΔL2			ΔLr	Number of layers
	m	m		mm	mm	mm	m	1	2	3	mm	m	1	2	3	mm	
z1	1.5	2.4	DN 400	406.4	560	1.8	1.8	2			3	2.1	2.5			3	1
2	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
3	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
4	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
5	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
6	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
7	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
8	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
9	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
10	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.3 Sprawdzenie L-ki kolano z1.

Bonded system - 80-90° L-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	1.09	m
Insulation class	Series 1	

Steel material properties

Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	2.4	
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	6.6	
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			

Multiple calculations

Input				Output													
Node no.	L1	L2	Nominal size	d	D	ΔL1	F1 min	Foam pads for ΔL1			ΔL2	F2 min	Foam pads for ΔL2			ΔLr	Number of layers
m	m	m		mm	mm	mm	m	1	2	3	mm	m	1	2	3	mm	
z2	2.4	6.6	DN 400	406.4	560	2.9	2.1	2.5			8	3.0	3			8	1
2	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
3	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
4	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
5	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
6	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
7	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
8	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
9	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2
10	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		37	2.8	3	1.5		38	2

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.4 Sprawdzenie L-ki kolano z2.

Bonded system - Z-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	1.3	m
Insulation class	Series 1	

Steel

Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	6.6	m
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	53.15	m
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			

Multiple calculations

Input					Output												
Node no.	L1 m	L2 m	Nominal size	d mm	D mm	ΔL1 mm	ΔL2 mm	Z m	Layers for ΔL1	Foam pads for ΔL1			Layers for ΔL2	Foam pads for ΔL2			
										1	2	3		1	2	3	
z3 z4	6.6	53.15	DN 400	406.4	560	8	53	3.9	1	3.9			2				
2	3.9	3	DN 400	406.4	560	5	4	2.2	1	2.2			1	3.9	2.0		
3	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
4	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
5	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
6	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
7	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
8	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
9	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		
10	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5		

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.5 Sprawdzenie Z-tki odcinek z3 - z4.

Bonded system - Z-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	1.3	m
Insulation class	Series 1	

Steel

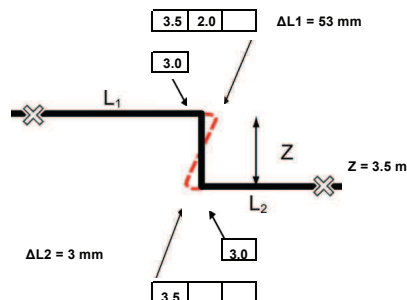
Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	53.15	m
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	2.45	m
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			



Multiple calculations

Input					Output											
Node no.	L1 m	L2 m	Nominal size	d mm	D mm	ΔL1 mm	ΔL2 mm	Z m	Layers for ΔL1	Foam pads for ΔL1			Layers for ΔL2	Foam pads for ΔL2		
										1	2	3		1	2	3
z5 z6	53.15	2.45	DN 400	406.4	560	53	3	3.5	2	3.5	2.0		1	3.5		
2	3.9	3	DN 400	406.4	560	5	4	2.2	1	2.2			1	2.2		
3	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
4	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
5	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
6	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
7	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
8	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
9	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	
10	50	100	DN 65	76.1	140	32	32	2.5	2	2.5	1.5		2	2.5	1.5	

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.6 Sprawdzenie Z-łki odcinek z5 - z6.

Bonded system - Z-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	1.45	m
Insulation class	Series 1	

Steel

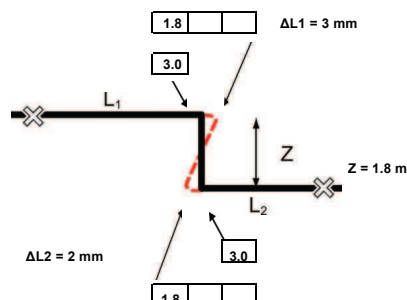
Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, ϕ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 400		Dist. to anchor point, L ₁	2.45	m
Steel pipe diameter, d	406.4	mm	Dist. to anchor point, L ₂	1.5	m
Wall thickness, s	6.3	mm			
Casing diameter, D	560	mm			



Multiple calculations

Input					Output												
Node no.	L1 m	L2 m	Nominal size	d mm	D mm	ΔL1 mm	ΔL2 mm	Z m	Layers for ΔL1	Foam pads for ΔL1			Layers for ΔL2	Foam pads for ΔL2			
										1	2	3		1	2	3	
z7 z8	2.45	1.5	DN 400	406.4	560	3	2	1.8	1	1.8				1	1.8		
2	3.9	3	DN 400	406.4	560	5	4	2.2	1	2.2				1	2.2		
3	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
4	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
5	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
6	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
7	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
8	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
9	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		
10	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5		

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.7 Sprawdzenie Z-łki odcinek z8 -z9.

Bonded system - Z-bends with foam pads

calculations according to Design Manual chapter 4

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T_f 110 °C
 Installation temperature, T_{ins} 10 °C
 Soil cover, H 1.45 m

Insulation class

Series 1

Steel

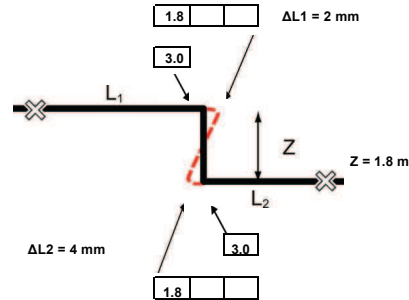
Expansion coefficient, α 0.0000123 °K⁻¹
 Modulus of elasticity, E 207,714 MPa

Soil parameters

Soil density, ρ 19 kN/m³
 Soil friction angle, ϕ 32.5 °
 Friction coefficient, μ 0.40

Example

Nominal size DN 400
 Steel pipe diameter, d 406.4 mm
 Wall thickness, s 6.3 mm
 Casing diameter, D 560 mm
 Dist. to anchor point, L_1 1.5 m
 Dist. to anchor point, L_2 3 m



Multiple calculations

Input					Output											
Node no.	L1 m	L2 m	Nominal size	d mm	D mm	ΔL1 mm	ΔL2 mm	Z m	Layers for ΔL1	Foam pads for ΔL1			Layers for ΔL2	Foam pads for ΔL2		
										1	2	3		1	2	3
zp3 zp4	1.5	2	DN 400	406.4	560	2	2	1.7	1	1.7			1	1.7		
2	3.9	3	DN 400	406.4	560	5	4	2.2	1	2.2			1	2.2		
3	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
4	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
5	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
6	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
7	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
8	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
9	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	
10	50	100	DN 65	76.1	140	29	29	2.4	2	2.4	1.5		2	2.4	1.5	

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.8 Sprawdzenie Z-tki odcinek zp3 - zp4.

Bonded system - Parallel branches with foam pads

calculations according to Design Manual chapter 5

LOGSTOR

Version: 1.0.4

29/4-2025

Conditions

Flow temperature, T_f 110 °C
 Installation temperature, T_{ins} 10 °C
 Soil cover main, H_h 1.48 m
 Soil cover branch, H_b 0.92 m
 Insulation class Series 1

Steel material properties

Expansion coefficient, α 0.0000123 °K⁻¹
 Modulus of elasticity, E 207,714 MPa

Soil parameters

Soil density, ρ 19 kN/m³
 Soil friction angle, ϕ 32.5 °
 Friction coefficient, μ 0.40

Limitations

The calculations apply for branches under the following conditions:

Temperature
 $T_f \leq 110^\circ\text{C}$
 $\Delta T \leq 100^\circ\text{C}$

Soil cover:
 Main pipe: $0.6 \leq H \leq 1.0$ m
 Branch: $H \geq 0.5$ m

Important

For preheated systems the expansion shall be calculated for the full temperature rise from installation to max operation.

i.e.
 T_{ins} = installation temperature before preheating
 T_f = max operating temperature

Example

Main pipe

Nominal size DN 400
 Steel pipe diameter, d_1 406.4 mm
 Wall thickness, s_1 6.3 mm
 Casing diameter, D_1 560 mm

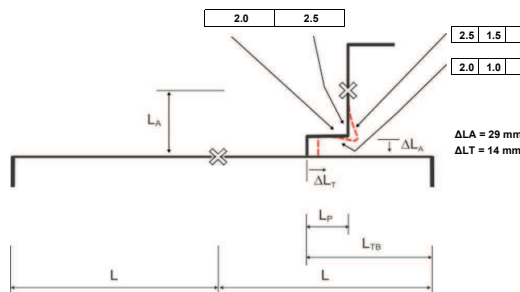
Pipe length, L 53.15 m
 Dist. branch to bend, L_{TB} 35.15 m

Axial stress at branch, σ_{aT} 71 MPa

Branch pipe

Nominal size DN 80
 Steel pipe diameter, d_2 88.9 mm
 Wall thickness, s_2 3.2 mm
 Casing diameter, D_2 160 mm

Parallel length, L_p 2 m
 Branch length, L_A 28.8 m



Multiple calculations

Input							Output														
Node no.			Branch length	Parallel length	Nominal size		Main pipe		Branch pipe		Expansion			Foam pads for ΔLT			Foam pads for ΔLA			Warnings	
	L m	LTB m	LA m	Lp m	Main	Branch	d1 mm	D1 mm	d2 mm	D2 mm	ΔLT mm	ΔLA mm	ΔLr mm	1	2	3	1	2	3		
T1	53.15	35.15	28.8	2	DN 400	DN 80	406.4	560	88.9	160	14	29	32	2.5	1.5		2.0	1.0			
2	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
3	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
4	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
5	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
6	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
7	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
8	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
9	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				
10	100	25	20	2	DN 80	DN 50	88.9	160	60.3	125	8	21	22	2.0			2.0				

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.9 Sprawdzenie trójkąta T1.

Conditions

Flow temperature, T_f 110 °C
Installation temperature, T_{ins} 10 °C
Soil cover, H 1.3 m

Insulation class Series 1

Steel material properties

Expansion coefficient, α 0.0000123 °K⁻¹
Modulus of elasticity, E 207,714 Mpa

Soil parameters

Soil density, ρ 19 kN/m³
Soil friction angle, ϕ 32.5 °
Friction coefficient, μ 0.40

Limitations

The calculations apply for branches under the following conditions:

Temperature:
 $T_f \leq 110^\circ\text{C}$
 $\Delta T \leq 100^\circ\text{C}$

Soil cover:
Main pipe: $0.6 \leq H \leq 1.0$ m
Branch: $H \geq 0.5$ m

Important

For preheated systems the expansion shall be calculated for the full temperature rise from installation to max operation.

I.e.
 T_{ins} = installation temperature before preheating
 T_f = max operating temperature

Example

Main pipe

Nominal size DN 400
Steel pipe diameter, d_1 406.4 mm
Wall thickness, s_1 6.3 mm
Casing diameter, D_1 560 mm

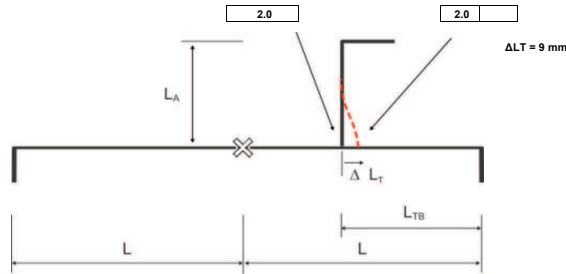
Pipe length, L 53.15 m
Dist. branch to bend, L_{TB} 42.05 m

Axial stress at branch, σ_{aT} 76 Mpa

Branch pipe

Nominal size DN 65
Steel pipe diameter, d_2 76.1 mm
Wall thickness, s_2 2.9 mm
Casing diameter, D_2 140 mm

$L_{A,max}$ 12 m
Branch length, L_A 2 m



Multiple calculations

Input					Output											
Node no.	L		Branch length	Nominal size	Main pipe		Branch pipe		Main pipe stress at Tee	ΔLT	Fmin	Foam pads for ΔLT		Max branch length	Warnings	
	L	LTB			Main	Branch	d1	D1				1	2		Main	Branch
T2	53.15	42.05	2	DN 400	DN 65		406.4	560	76	9	2.0	2.0		12		
2	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
3	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
4	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
5	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
6	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
7	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
8	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
9	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		
10	100	25	20	DN 80	DN 50		88.9	160	60.3	125	108	1.8	2.0	20		

3.10 Sprawdzenie trójkąta T2.

Conditions

Flow temperature, T_f 110 °C
Installation temperature, T_{ins} 10 °C
Soil cover, H 1.1 m

Insulation class Series 1

Steel material properties

Expansion coefficient, α 0.0000123 °K⁻¹
Modulus of elasticity, E 207,714 Mpa

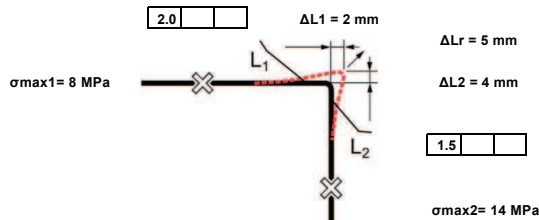
Soil parameters

Soil density, ρ 19 kN/m³
Soil friction angle, ϕ 32.5 °
Friction coefficient, μ 0.40

Example

Nominal size DN 65
Steel pipe diameter, d 76.1 mm
Wall thickness, s 2.9 mm
Casing diameter, D 140 mm

Dist. to anchor point, L_1 2
Dist. to anchor point, L_2 3.35



Multiple calculations

Input				Output													
Node no.	L1	L2	Nominal size	d	D	ΔL1	F1 min	Foam pads for ΔL1			ΔL2	F2 min	Foam pads for ΔL2			ΔLr	Number of layers
	m	m		mm	mm	mm	m	1	2	3	mm	m	1	2	3	mm	
z1.1	2	3.35	DN 65	76.1	140	2.4	1.5	1.5			4	1.7	2			5	1
2	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
3	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
4	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
5	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
6	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
7	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
8	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
9	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2
10	10	50	DN 65	76.1	140	11.3	2.1	2.5	1.5		36	2.8	3	1.5		38	2

3.11 Sprawdzenie L-ki kolano z2.1.

Conditions

Flow temperature, T _f	110	°C
Installation temperature, T _{ins}	10	°C
Soil cover, H	0.4	m
Insulation class	Series 1	

Steel material properties

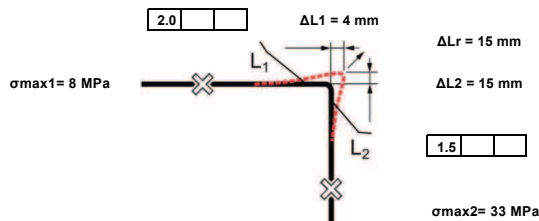
Expansion coefficient, α	0.0000123	°K ⁻¹
Modulus of elasticity, E	207,714	MPa

Soil parameters

Soil density, ρ	19	kN/m ³
Soil friction angle, φ	32.5	°
Friction coefficient, μ	0.40	

Example

Nominal size	DN 32		Dist. to anchor point, L ₁	3.35
Steel pipe diameter, d	42.4	mm	Dist. to anchor point, L ₂	13
Wall thickness, s	2.6	mm		
Casing diameter, D	110	mm		



Multiple calculations

Input				Output													
Node no.	L1	L2	Nominal size	d	D	ΔL_1	F1 min	Foam pads for ΔL_1			ΔL_2	F2 min	Foam pads for ΔL_2			ΔL_r	Number of layers
	m	m		mm	mm			1	2	3			1	2	3		
z2.2	3.35	13	DN 32	42.4	110	4.0	1.3	1.5			15	1.7	2			15	1
z2.2	3.35	13	DN 25	33.7	90	4.0	1.2	1.5			15	1.6	2			15	1
3	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
4	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
5	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
6	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
7	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
8	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
9	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2
10	10	50	DN 65	76.1	140	11.9	2.2	2.5	1.5		52	3.0	3	1.5		53	2

See LOGSTOR Design Manual:

<https://www.logstor.com/documentation>

3.12 Sprawdzenie L-ki kolano z2.2.