

# Bonded system - 10-80° L-bends with foam pads

calculations according to Design Manual chapter 4

Version: 1.0.4

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## Conditions

Flow temperature, T <sub>f</sub>	130	°C
Installation temperature, T <sub>ins</sub>	10	°C
Soil cover, H	0.6	m

Insulation class

Series 1

## Soil parameters

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

## Important

The calculation only apply when L<sub>2</sub> ≥ 0,2\*L<sub>1</sub>

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

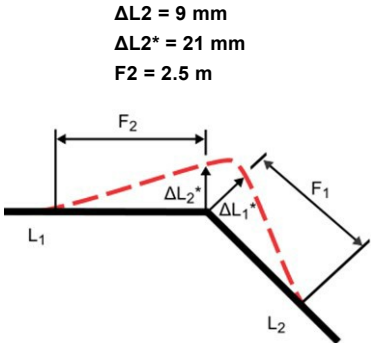
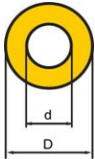
T<sub>ins</sub> = installation temperature before preheating

T<sub>f</sub> = max operating temperature

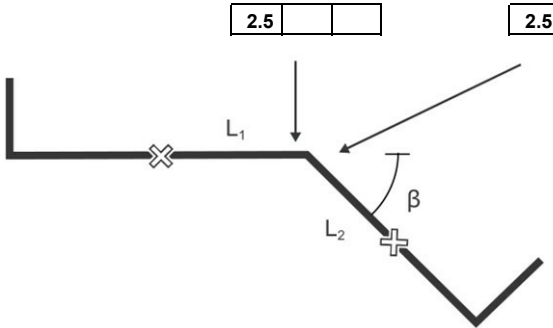
## Example

Nominal size	DN 50	
Steel pipe diameter, d	60.3	mm
Wall thickness, s	2.9	mm
Casing diameter, D	125	mm

Dist. to anchor point, L <sub>1</sub>	6	m
Dist. to anchor point, L <sub>2</sub>	6	m
Bend angle, β	45	°
Max allowed ΔL <sub>1</sub> +ΔL <sub>2</sub>	49	mm



ΔL<sub>1</sub> = 9 mm  
ΔL<sub>1</sub>\* = 21 mm  
F<sub>1</sub> = 2.5 m



## Multiple calculations

Input					Output														
Node no.	β	L1	L2	Nominal size	d	D	Max allowed ΔL1+ΔL2	ΔL1	ΔL1*	ΔL2	ΔL2*	F1 min	Foam pads for ΔL1			F2 min	Foam pads forΔL2		
	°	m	m			1							2	3	m		1	2	3
1	39	40	10	DN 65	76.1	140	38	51	98	14	85	NA	NA	NA	NA	NA	NA	NA	
2	40	40	10	DN 65	76.1	140	40	51	96	14	83	NA	NA	NA	NA	NA	NA	NA	
3	41	40	10	DN 65	76.1	140	41	51	94	14	80	NA	NA	NA	NA	NA	NA	NA	
4	42	40	10	DN 65	76.1	140	43	51	91	14	78	NA	NA	NA	NA	NA	NA	NA	
5	43	40	10	DN 65	76.1	140	45	51	89	14	75	NA	NA	NA	NA	NA	NA	NA	
6	60	40	10	DN 65	76.1	140	80	51	67	14	46	3.2	3.5	2.0	1.0	3.0	3.0	1.5	1.0
7	50	40	10	DN 65	76.1	140	58	51	78	14	61	NA	NA	NA	NA	NA	NA	NA	NA
8	50	40	10	DN 65	76.1	140	58	51	78	14	61	NA	NA	NA	NA	NA	NA	NA	NA
9	50	40	10	DN 65	76.1	140	58	51	78	14	61	NA	NA	NA	NA	NA	NA	NA	NA
10	50	40	10	DN 65	76.1	140	58	51	78	14	61	NA	NA	NA	NA	NA	NA	NA	NA