Thermal elongation

Thermal induced elongation of Polybuten (PB-H) medium pipes with Flexalen® 600

Fundamentals

According to the basic laws of physics, all pipe materials expand when heated and contract when cooled. This material behaviour must be taken into consideration when when you install none bonded pre-insulated plastic pipes in the soil.
Like all thermoplastics, polybutene (PB-H) has a higher thermal expansion coefficient than metals. The thermal expansion coefficient of polybutene (PB-H) is 35% lower than that of PE-X and is only 0.13 mm/mK.

Thermal expansion coefficients	
Material	Thermal expansion coefficient α [mm/mK]
Polybuten (PB-H)	0,13
PP	0,18
PE-X	0,20
Steel	0,012
Copper	0,017
Stainless steel	0,017

Thermal induced elongation [cm]								
Pipe length	Temperature difference Δt*) [K]							
[m]	10	20	30	40	50	60	70	80
10	1,3	2,6	3,9	5,2	6,5	7,8	9,1	10,4
20	2,6	5,2	7,8	10,4	13	15,6	18,2	20,8
30	3,9	7,8	11,7	15,6	19,5	23,4	27,3	31,2
40	5,2	10,4	15,6	20,8	26	31,2	36,4	41,6
50	6,5	13	19,5	26	32,5	39	45,5	52
60	7,8	15,8	23,4	31,2	39	46,8	54,6	62,4
70	9,1	18,2	27,3	36,4	45,5	54,6	63,7	72,8
80	10,4	20,8	31,2	41,6	52	62,4	72,8	83,2
90	11,7	23,4	35,1	46,8	58,8	70,2	81,9	93,6
100	13	26	39	52	65	78	91	104

*) is determined by ambient temperature (temperature during installation) and max. operating temperature

In comparison with steel a 10 times higher thermal expansion is measured for PB. Due to the very much lower E-modulus are the occurring forces caused by thermal expansion only approximately 2% in comparison to steel.

Elongation forces	
Medium pipe OD [mm]	Max. elongation force per medium pipe *) [N]
25	350
32	600
40	900
50	1400
63	2200
75	3200
90	4600
110	6800
125	8700

*) Temperature difference Δt = 70K

Design measures

The elasticity of the system allows the total pipe systems to self compensate, so that expansion loops, bellows and anchor points are not required. At both ends oft he pipe, at the transitions to the installation in the building and in the boiler house, the pipe ends must be secured by appropriate restraining clamps on the polybutene medium pipe (accessory item FLEXALEN 1791-xxxx-00x) and on the following system (must be provided by the customer), to exclude mutual deformation and to secure the transition fitting against shear and tensile forces.

SCHEMATIC DRAWING