

# Design - Guidelines

## Forces, movements and expansion types

### EXPANSION

When a buried pipeline is exposed to temperature increase, this will lead to an expansion of the pipe.

The expansion is counteracted by friction that occurs between the moving pipe and the surrounding sand (soil).

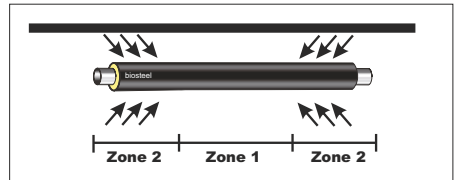


### FRICTIONS

The frictions build up an axial stress in the pipe and counteracts free expansion.

You get two different zones of the district heating pipes

1. The part that is fixed (may be in the middle of a straight length) (zone 1).
2. The part of the pipe that moves (in both ends of a straight length) (zone 2).



The stress in the fixed part depends only on the difference of the temperature when the trench was filled.

The force in the pipe can be calculated, as the stress multiplied by the steel pipes' cross section.

The part of the pipe that moves is called "Friction Length". It acts as a fixative for the fixed part.

$$F = E \cdot A \cdot \Delta T$$

$F$  = Stress

$E$  = Modulus of elasticity

$A$  = Coefficient of thermal expansion

$\Delta T$  = Temperature Change

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