7.6 Provision for thermal expansion

7.6.1 Calculating thermal length changes

The thermal change in length is calculated with the following equation:

$$\Delta L = \alpha \cdot L \cdot \Delta T$$

ΔL	=	Length change in mm
α	=	Coefficient of linear thermal expansion in $\frac{mm}{m \cdot °C}$
L	=	Length of piping in m
ΔT	=	Temperature difference in °C

The coefficient of linear thermal expansion must be selected according to the installed pipe type and if pipe support channel is installed.

Determining the pipe length
The pipe length L is the actual installed pipe length on site between anchor points, expansion bends or loops. Sometimes it may be necessary to divide the pipe run into several sections by adding anchor points or expansion bends and loops to limit the change in length per section.

Determining the temperature ΔT
To determine the temperature difference ΔT, the following shall be taken into consideration:
- Installation temperature or minimum operationg temperature (e.g. when the system is out of service)
- Maximum operating temperature (e.g. thermal disinfection)

Pipe type	Pipe size	Coefficient of linear thermal expansion α $[\frac{mm}{m \cdot °C}]$	Material constant C
		$\Delta L = \alpha \cdot L \cdot \Delta T$	$L_{DL} = C \cdot \sqrt{d_a \cdot \Delta L}$
RAUTITAN stabil RAUTITAN gas stabil	16–40	0.026	33
RAUTITAN platinum	16–63 without REHAU support channel	0.15	12
RAUTITAN red	16–40 with REHAU support channel	0.04	–
RAUTITAN green			
RAUTITAN lilac	50–63 with REHAU support channel	0.1	–

Tab. 7-6 Coefficient of linear thermal expansion (approximate values) and material constants for deflection leg calculation (approximate values

7.6.2 Deflection legs

Thermal length changes can be accommodated by deflection legs. RAUTITAN PE-Xa pipes are particularly suitable for this due to their flexibility.
A deflection leg is the freely moveable pipe length, which can take up the required thermal length changes. The length of the deflection leg is influenced mainly by the material (material constant C).
Deflection legs result mostly from changes in direction of the piping. For long piping lengths, additional deflection legs must be installed in the piping to compensate the thermal length changes.

Do not fit pipe support channels or pipe brackets on deflection legs as this would restrict their flexibility.

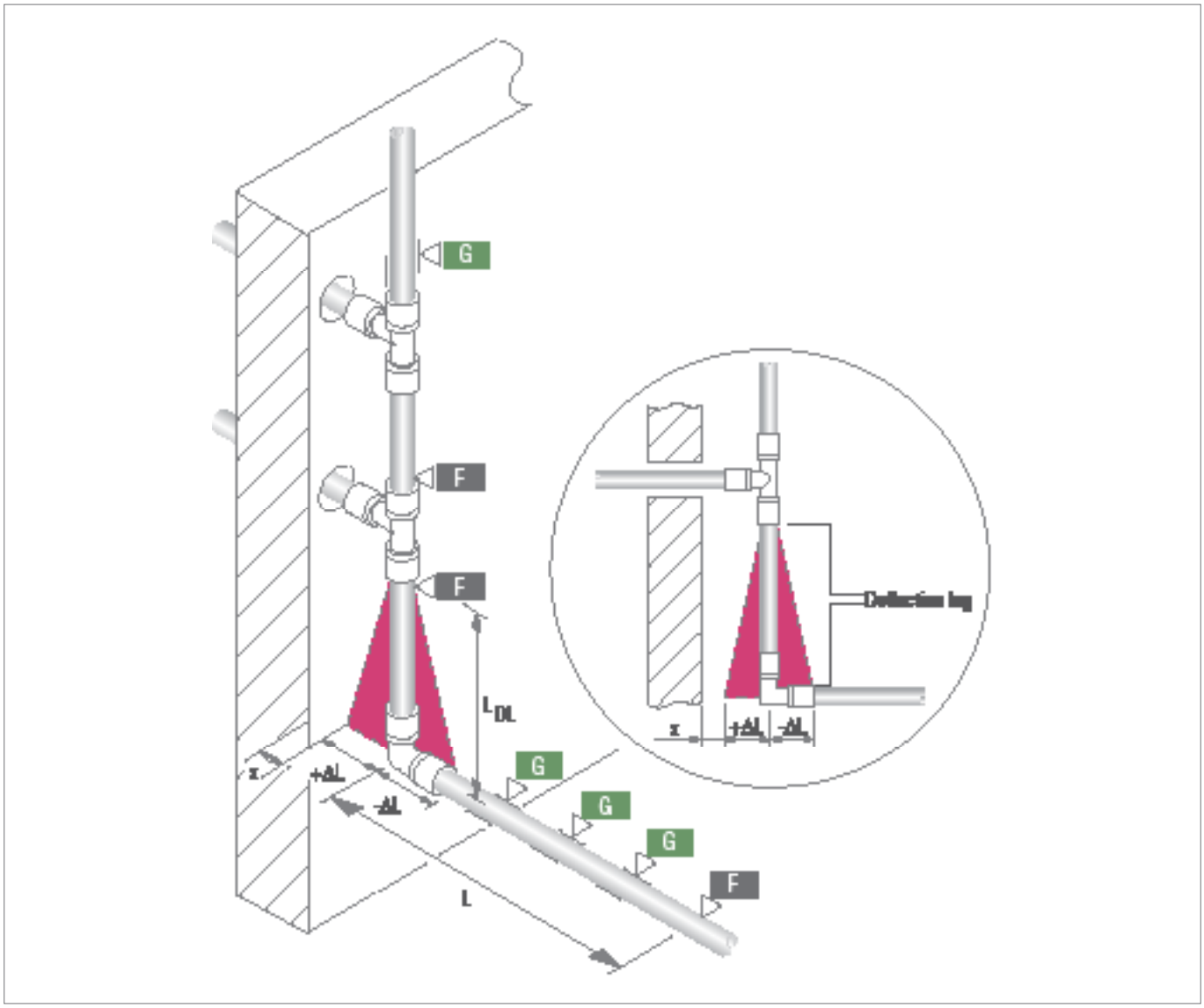

Fig. 7-17 Deflection legs

L_{DL} Length of deflection leg
ΔL Thermal length change
L Pipe length
x Minimum distance of the pipe from the wall

F Fixed/anchor point
G (tight)
Gliding point (loose)

7.6.3 Calculation of deflection leg length

The minimum length of deflection length (DL) is calculated by the following formula:

$$L_{DL} = C \cdot \sqrt{d_a \cdot \Delta L}$$

L_{DL} = Length of deflection leg
da = Outer pipe diameter in mm
ΔL = Length change in mm
C = Material contstant of piping material

For approximate values for material constant C, see Table 7-6.

Do not fit pipe support channels or pipe brackets close to the deflection legs so it will not be prevented from bending.

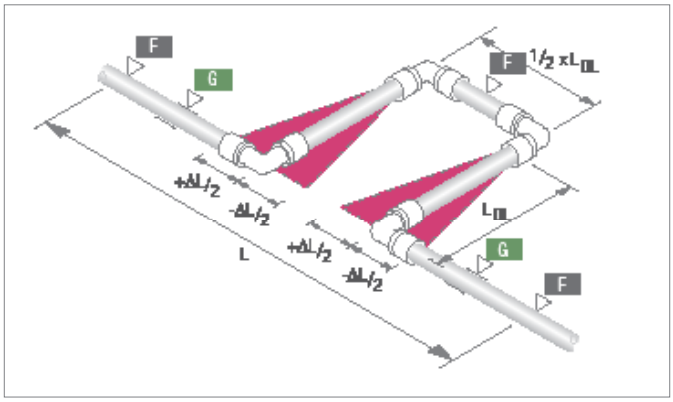

Fig. 7-18 U expansion bends.
L_{DL} Length of deflection leg
ΔL Thermal length change
L Pipe length

7.6.4 Calculation examples

The pipe length L, for which the thermal length changes is to be accommodated at a deflection length, is 7m.

The temperature difference between the minimum and maximum values (installation temperature and subsequent operating temperature) is 50 °C. The installed pipe outer diameter is 25mm.

What length of deflection leg is required according to the installed pipe type?

Calculation of deflection leg length with RAUTITAN stabil and RAUTITAN gas stabil

stabil
gas stabil

$$\Delta L = \alpha \cdot L \cdot \Delta T$$
$$\Delta L = 0.026 \ \frac{mm}{m \cdot °C} \cdot 7m \cdot 50°C$$
$$\Delta L = 9.1\,mm$$
$$L_{DL} = C \cdot \sqrt{d_a \cdot \Delta L}$$
$$L_{DL} = 33 \cdot \sqrt{25mm \cdot 9.1\,mm}$$
$$L_{DL} = 498\,mm$$

Calculation of deflection leg length with RAUTITAN PE-Xa pipes installed with REHAU support channel

platinum
red
green
lilac

$$\Delta L = \alpha \cdot L \cdot \Delta T$$
$$\Delta L = 0.04 \ \frac{mm}{m \cdot °C} \cdot 7m \cdot 50°C$$
$$\Delta L = 14\,mm$$
$$L_{DL} = C \cdot \sqrt{d_a \cdot \Delta L}$$
$$L_{DL} = 12 \cdot \sqrt{25mm \cdot 14\,mm}$$
$$L_{DL} = 224\,mm$$

Assessment of the results
RAUTITAN stabil and RAUTITAN gas stabil have lower thermal change length than RAUTITAN PE-Xa pipes due to its aluminium layer. However, the required deflection leg length for RAUTITAN PE-Xa is shorter due to the flexible pipe material.
For metallic pipe materials, a substantially larger deflection leg is required for the same operating parameters during installation, due to the significantly higher material constant (C), than for other RAUTITAN pipes system.