

# THERMAL EXPANSION

When planning and installing distribution pipe lines, along with the structural requirements, thermally caused linear expansions must be considered.

Pipes may not be installed rigidly between two fixed points. You must always compensate for the length variation of the pipes. Open laid pipes that are fully exposed to thermal expansion must be provided with suitable compensation for expansion and contraction. For this you need to know the location of all fixed points. Compensation is always provided between two fixed points and changes of direction.

Typical installations can be classified as:

- Installations that allow thermal expansion.
- Installations that do not allow thermal expansion.

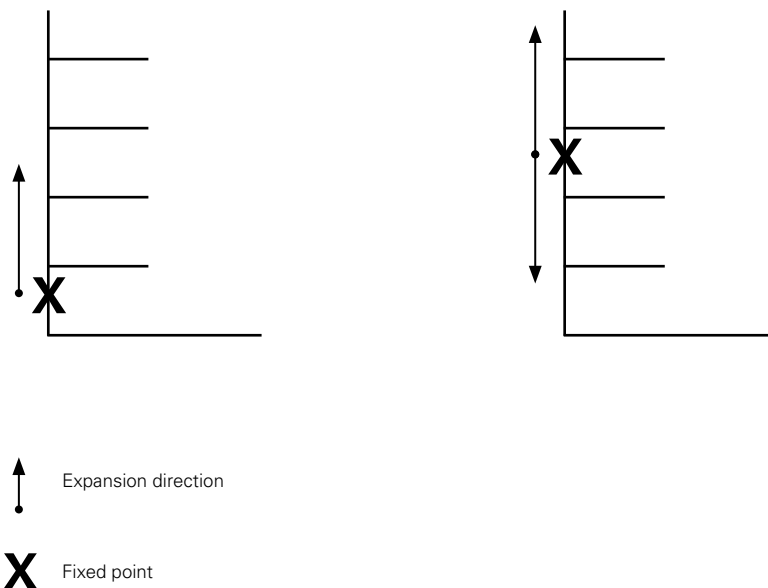
And the following specifications apply to each of them:

## Installations that allow thermal expansion.

### 1. Fixed points

A fixed point exists when the pipe run is fixed to a place without the possibility to move. Pipe supports with clamps which hold the pipe are not considered as fixed points, since they allow movements. Only in the event of a change of direction, support clamps can be regarded as fixed points. Fixed points location must be determined in such a way that pipe expansion may be limited or allowed in a direction not causing problems.

The following drawing graphically shows what is explained above:



## 2. Expansion by means of a flexible arm

The flexible arm should be long enough to prevent damage, and support clamps should be placed sufficient far from the wall to allow for longitudinal thermal expansion.

Since the support clamp is located on a change of direction, this point can be considered a fixed point. Then, from this point on, the thermal length variation shall be compensated.

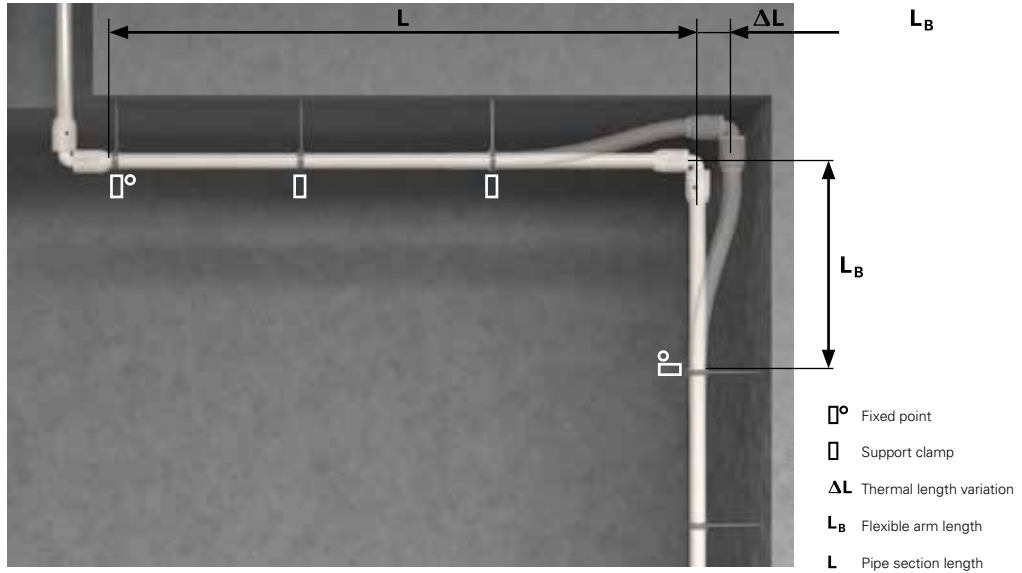


Figure 2: a flexible arm compensates thermal length variation.

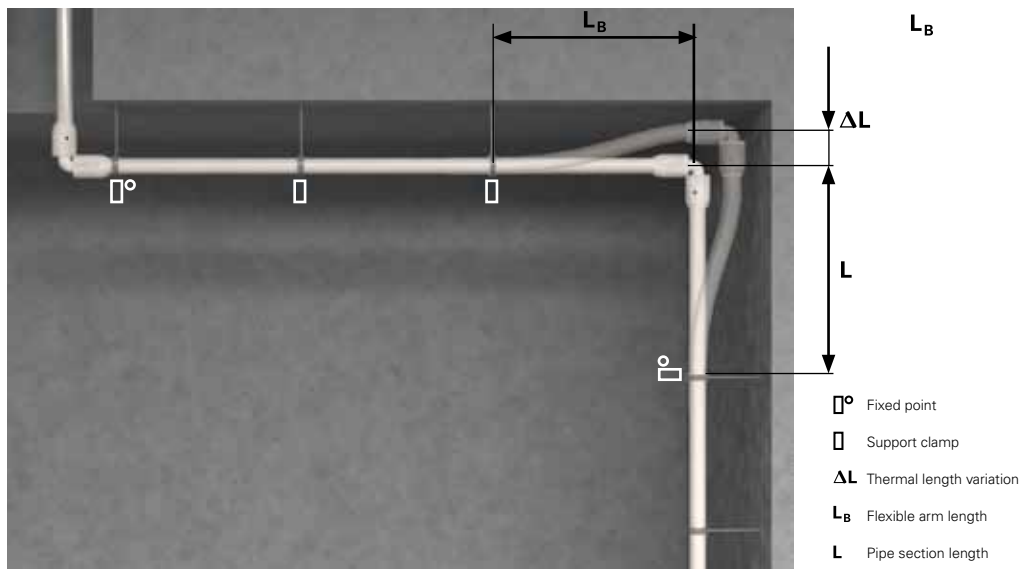


Figure 3: Thermal length variation compensated by  $\Delta L$  flexible arm.

Use the formula below to calculate the minimum length of  $L_B$ , the flexible arm:

$$L_B = c \cdot \sqrt{(d_e \cdot \Delta L)}$$

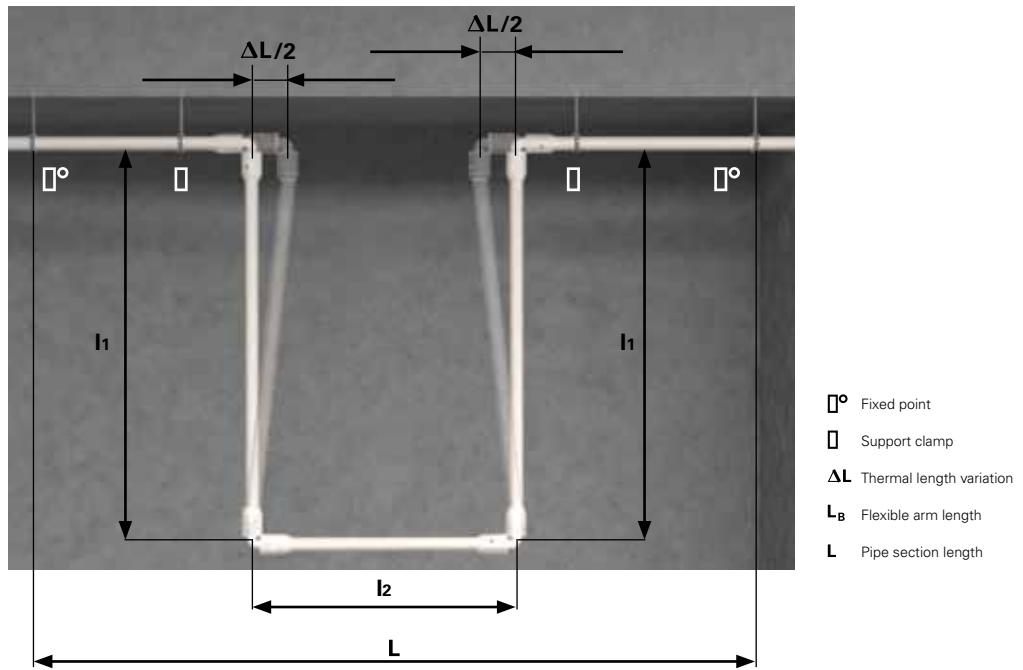
Where:

- $\Delta L$  = Thermal length variation (mm)
- $L_B$  = Flexible arm length (mm)
- $c$  = Material constant (12 for PE-X, 6 for Multilayer)
- $d_e$  = Outside diameter of the pipe (mm)

### 3. Expansion by means of an expansion loop

The following schema applies

Figure 4



When designing an expansion loop it is preferable to design it so that  $l_2 = 0.5 l_1$ . In this case, the flexible arm is calculated according to the previous equation, taking into account that  $L_B = l_1 + l_1 + l_2$

### 4. Expansion by means of trays and support clamps

This type of compensation is more commonly used for pipe diameters above 40 mm, normally aimed to main distribution installations.

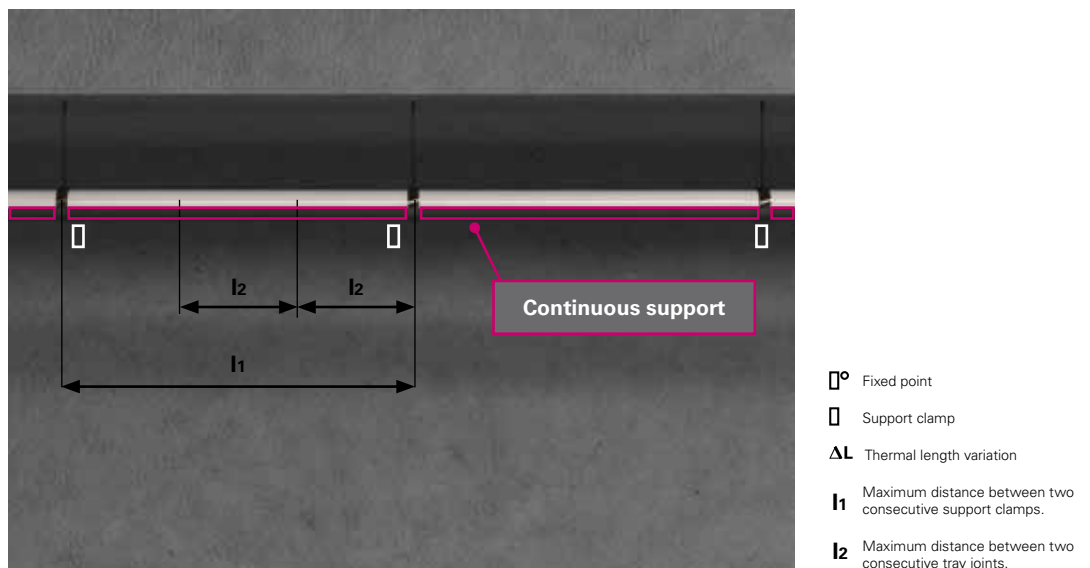
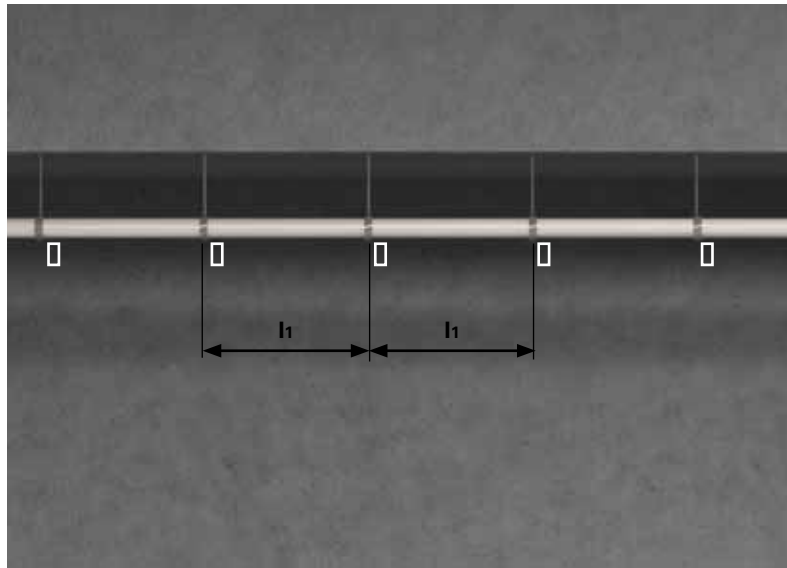


Figure 5: support trays and support clamps.

## 5. Expansion by means of support clamps

This is, probably, the most common fixing method in plumbing installations.




-  Support clamp
- h1** Maximum distance between two consecutive support clamps

Figure 6: Installation with support clamps.

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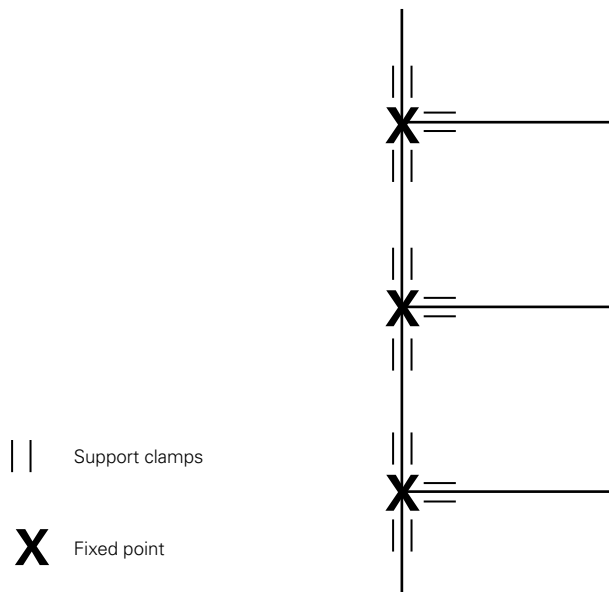
## Installations that do not allow thermal expansion

In many occasions, it is necessary to install the pipe between two fixed points. Then, thermal expansion and contraction forces are transferred to the building structure thanks to the pipe supports. It is important to mention that this circumstance does not consist of any inconvenience due to the minimum thermal expansion and contraction forces pertaining to these pipes. Some examples shall be described on figures 7, 8, 9 and 10.

### 1. Fixed points

Fixed points are laid out in such a way that no contractions or dilatations may occur. The maximum distance between two consecutive fixed points shall not be in excess of 6 m.

The following drawing graphically shows what is explained above.



 Support clamps

**X** Fixed point

Figure 7: Fixed points lay out in a branch-type installation.

## 2. Expansion by means of fixed points and support trays

The maximum distance between two consecutive fixed points, support clamps or support tray joints must meet the requirements specified before.

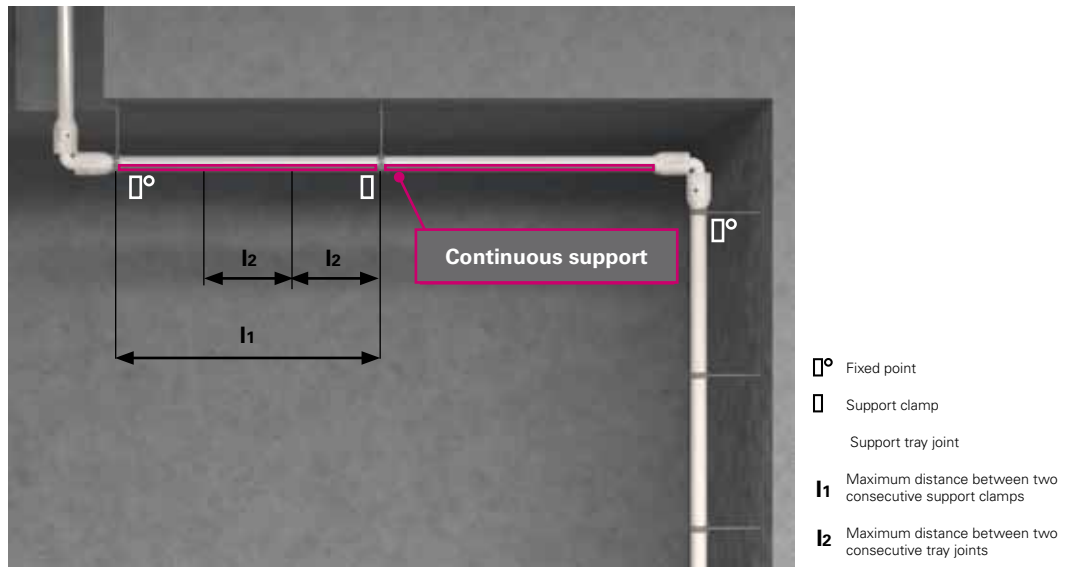


Figure 8: support trays and support clamps not allowing expansion.

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## 3. Expansion by means of trays and support clamps

The maximum distance between fixed points and support clamps, as figure 9 shows, must meet the specifications on  $L_1$  distance table.

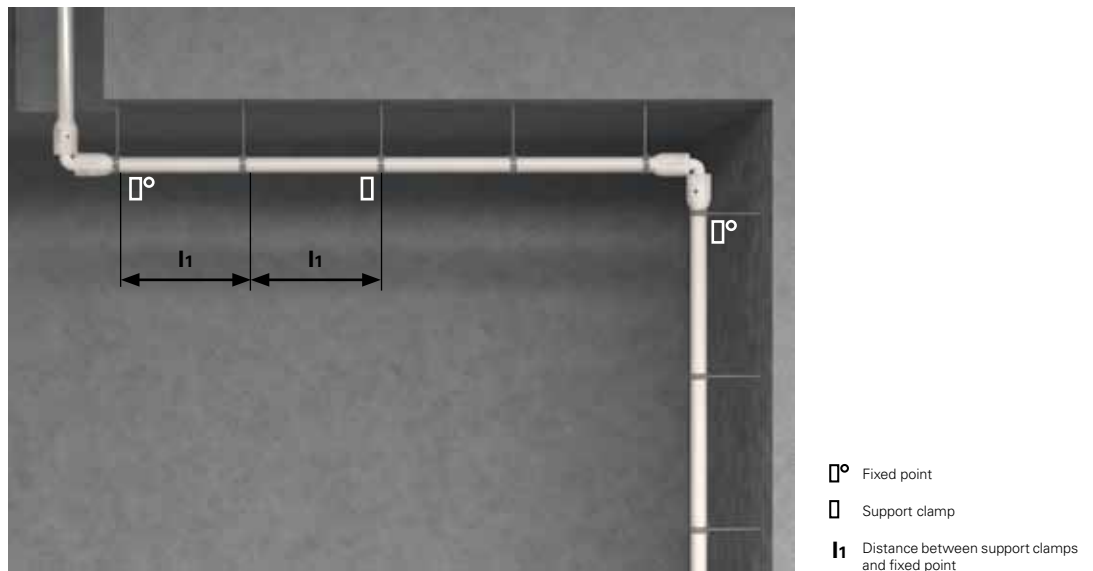


Figure 9: installation between fixed points with support clamps.

These increases are for horizontal pipe runs.