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Expansion of pipes

Moveable fixings

White paper

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Expansion of pipes

The calculation for the expansion of a heating pipe and the resulting construction is well known. However, there is less information about the requirements and consequences for the moving (non-fixed) point mountings of the pipe. In this paper we will discuss these requirements and consequences for the moving (non-fixed) point fixings.

When pipes in a heating system warm up, the pipes will expand in length and in diameter. The exact amount of expansion is a result of the temperature change and the pipe material and is easy to calculate. Small length changes can be absorbed by the flexibility of the pipe itself. The resulting force caused by the expansion, is lower at smaller diameters. For small diameters a regular clip is usually enough to contain the movement and thus to control the expansion in the length direction. Greater length changes, especially in heavy, rigid pipes, can result in high tension in the pipes and or undesired movement of the pipe.

For this reason the pipes must be equipped with either expansion joints or an expansion bend or loop. In order to direct the movement in the planned direction, so called ‘fixed point’ constructions will be used to secure the pipe without allowance of movement.

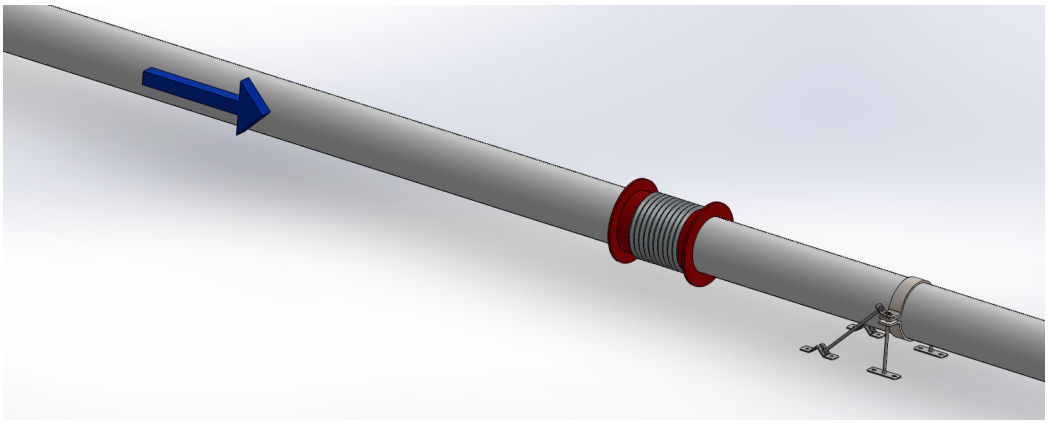


Figure 1.

To discuss the effects of the several fixing solutions we will look into the movement of the pipe in detail. For pipes equipped with expansion joints (Figure 1.) the movement will be in the direction of the expansion joint during heating up, and away from the joint during cooling down. This is one dimensional (axial) movement.

Expansion loops and bends

For pipes with expansion loops or bends the pipe will move in two dimensions (axial and lateral) as can be seen in figure 2. The red line represents the direction of the pipe's movement when it expands.

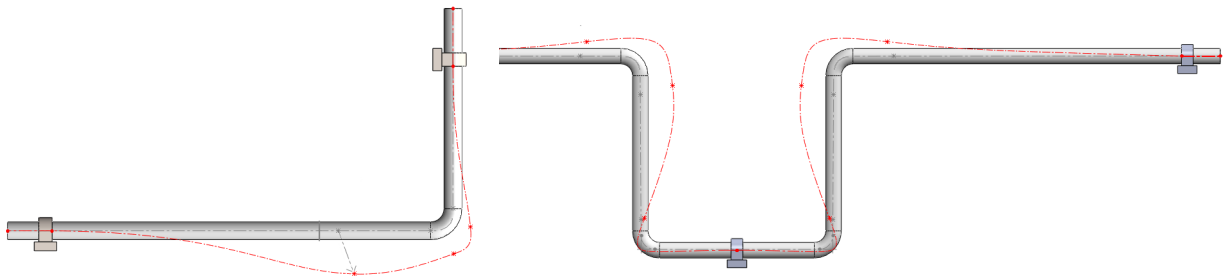


Figure 2.

Main mounting solutions between fixed points

Sliding clips

These clips will allow one dimensional (axial) movement of the pipe through the clip. This can be achieved by means of a rubber lining that allows sliding movement through the clip, or by means of a rolling device (figure 3.1 and 3.3). Because of the relative heavy weight of a pipe for central heating systems, the frictional sliding resistance is quite high. Therefore the use of rubber lined clips is more often paired with platic drainage pipes. For central heating pipes clips are used with build-in shallow ribbing and removable spacers, like the BSK clip (figure 3.2).

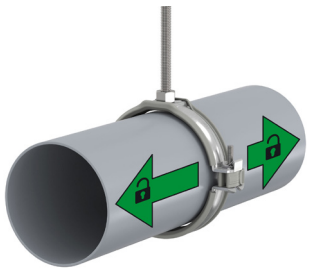


Figure 3.1

Figure 3.2

Figure 3.3

Because of this one dimensional movement allowance, the sliding clip solution is only advisable in combination with pipes using expansion joints.

Expansion units

These expansion units will allow a one dimensional (axial) movement of the pipe as well. However the clip will move with the pipe, and the clip will be guided by means of the expansion unit.

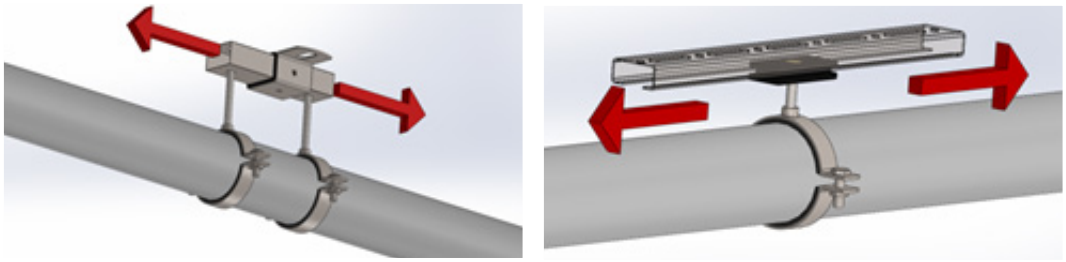
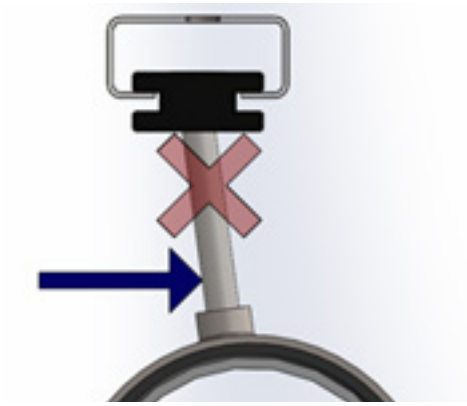


Figure 4: GK 150 and the GK 50



Because these expansion units cannot handle cross directed / lateral forces, it is preferred to use them in combination with expansion joints (figure 5).
If not properly applied, and the pipe experiences lateral force and the rod will be pushed out of the expansion unit, and the pipe could fall down.

Figure 5.

Hinge points

The construction with hinge points will allow movement in two dimensions (figure 6) and are therefore especially recommended in combination with expansion bends or loops. It is important to note that two hinges are employed by using two ball hangers or a ball hanger and a hinge type clips, for example.

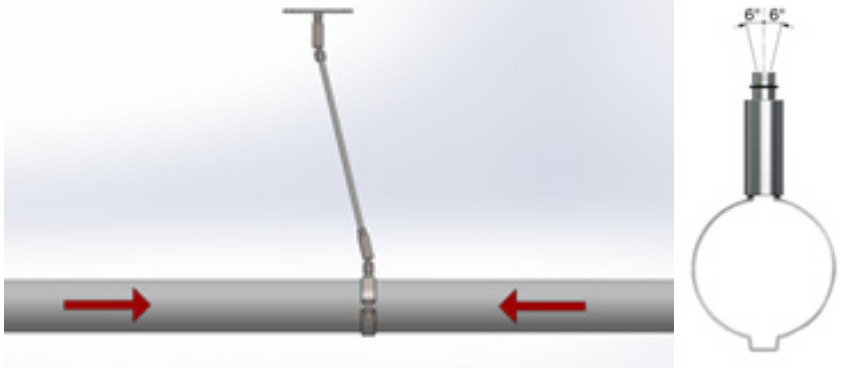


Figure 6.

We often see the use of only one single hinge point, like with one ball hanger as in figure 7. But a construction with only one hinge point will not work because the clip is fixed around the pipe and cannot move, so the threaded rod is forced to bend.

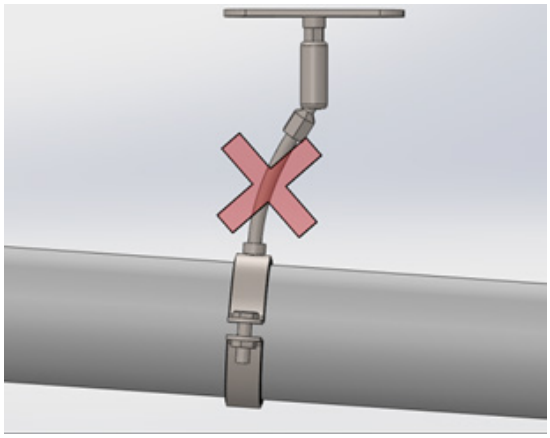


Figure 7.

Based on the required expansion length, one can calculate the height of the construction taking into account the allowed maximum angle of the hinge.
The side effect of the hinge construction is a slight movement in height (C) as well, as shown in the table in figure 8. in case of a 6 degree angle.

In the construction (e.g. with the pipe running through a hole in the wall) this height movement should be taken into account. Because of the “free” movement of this construction, this results in tension free fixing.

Threaded rod length **A** (between joints) [cm]	Max. expansion **B** (α = 6°) [cm]	Height difference **C** (α = 6°) [cm]
5	0.53	0.03
10	1.05	0.05
15	1.58	0.08
20	2.10	0.11
25	2.63	0.14
30	3.15	0.16
35	3.68	0.19
40	4.20	0.22
45	4.73	0.25
50	5.26	0.27
55	5.78	0.30
60	6.31	0.33
65	6.83	0.36
70	7.36	0.38
75	7.88	0.41
80	8.41	0.44
85	8.93	0.47
90	9.46	0.49
95	9.98	0.52
100	10.51	0.55

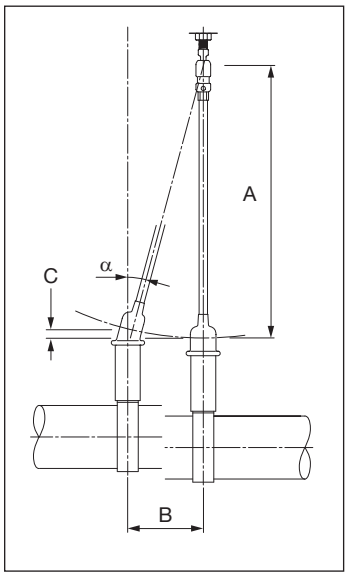


Figure 8.

In conclusion

In conclusion we can say that it is important to deliberately choose the most moveable fixing point method. In order to achieve a well functioning system, all the pros and cons of the solutions mentioned in this paper must be taken in account.

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