

Chilled Water Pipe Insulation Guide

Pipes that carry chilled water must be insulated not only to prevent unwanted heat gain but to also prevent condensation forming and potentially damaging the building and/or causing mould growth.

This document provides the recommended minimum insulation levels for pipe and fittings for different system applications and environmental conditions.

General Recommendation:

It is generally recommended that all pipes, fittings, and valves that carry chiller water are insulated with at least 13mm thick insulation. This not only ensures condensation is not formed but significantly limits the heat gain of the pipes increasing the efficiency of the system.

The tables below show that the risk of condensation forming with 13mm thick insulation is very low, even with flow temperatures as low as 7°C:

Insulation Thickness	13mm								
Flow Temperature	7°C								
Space Temperature	22.0° C	23.0° C	24.0° C	25.0° C	26.0° C	27.0° C	28.0° C	29.0° C	30.0° C
Surface Temperature	19.0° C	19.9° C	20.7° C	21.5° C	22.4° C	23.2° C	24.0° C	24.9° C	25.7° C
Dew point @ 50% RH	12.0° C	13.0° C	14.0° C	15.0° C	16.0° C	17.0° C	18.0° C	19.0° C	20.0° C
Dew point @ 60% RH	14.0° C	15.0° C	16.0° C	17.0° C	18.0° C	19.0° C	20.0° C	21.0° C	22.0° C
Dew point @ 70% RH	16.0° C	17.0° C	18.0° C	19.0° C	20.0° C	21.0° C	22.0° C	23.0° C	24.0° C
Dew point @ 80% RH	18.0° C	19.0° C	20.0° C	21.0° C	22.0° C	23.0° C	24.0° C	25.0° C	26.0° C
Dew point @ 90% RH	20.0° C	21.0° C	22.0° C	23.0° C	24.0° C	25.0° C	26.0° C	27.0° C	28.0° C

Green = dew point lower than pipe surface temperature.

Red = dew point at or above pipe surface temperature.

Best practice is to ensure all elements of the system are insulated with at least 13mm thick insulation but particular care must be taken with any pipes, fittings, and

valves that are run within the building structure where condensation and the subsequent building damage would not be noticed for a long period.

Structural Penetrations:

Pipes that carry chilled water should generally remain insulated even when passing through structural members. If pipes were to pass through these elements without insulation, they may have excessive heat gain through conduction with these structural elements and cause condensation to form on the structural member or within the penetration.

To assist with retaining the structural integrity of the elements it may be possible to reduce the thickness of the insulation by up to half, but a minimum insulation thickness of at least 9mm is recommended. The table below shows that even with flow temperatures as low as 7°C the risk of condensation forming is still quite low with 9mm thick insulation:

Insulation Thickness	9mm								
Flow Temperature	7°C								
Space Temperature	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C	29.0°C	30.0°C
Surface Temperature	18.0°C	18.8°C	19.5°C	20.3°C	21.1°C	21.9°C	22.6°C	23.4°C	24.2°C
Dew point @ 50% RH	12.0°C	13.0°C	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C
Dew point @ 60% RH	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C
Dew point @ 70% RH	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C
Dew point @ 80% RH	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C
Dew point @ 90% RH	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C

Green = dew point lower than pipe surface temperature.

Red = dew point at or above pipe surface temperature.

Where pipes do cross through structural elements without insulation the penetration should be filled with a suitable sealant and the pipe insulated tightly up to each side of the penetration.

Exposed Pipes, Fittings, & Valves:

Where pipes, fittings, and valves are exposed inside or outside they should also generally be insulated with at least 13mm thick insulation. In some situations, to allow the correct functionality of a valve or sufficient access for maintenance this is not possible. In these situations, it is suitable to reduce the insulation thickness to 9mm and as per the table in the structural penetrations section above. The risk of condensation is still generally quite low.

Where even less insulation is possible then a layer of at least 3mm thick insulation should be used. But as per the table below, it is very likely that condensation will form on the surface of this insulation layer:

Insulation Thickness	3mm								
Flow Temperature	7°C								
Space Temperature	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C	29.0°C	30.0°C
Surface Temperature	14.2°C	14.8°C	15.3°C	15.8°C	16.4°C	16.9°C	17.5°C	18.0°C	18.6°C
Dew point @ 50% RH	12.0°C	13.0°C	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C
Dew point @ 60% RH	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C
Dew point @ 70% RH	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C
Dew point @ 80% RH	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C
Dew point @ 90% RH	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C

Green = dew point lower than pipe surface temperature.
Red = dew point at or above pipe surface temperature.

Any valves or fittings with 3mm insulation must be installed in a way where condensation forming and dripping will cause limited damage to the building, for example now installed tight up against a building element. As part of the annual maintenance of the system the service agent should pay particular attention to inspecting and maintaining the insulation integrity of these areas.

Radiant Cooling Systems:

Radiant cooling systems generally operate with higher chilled water flow temperatures than other types of cooling systems. For radiant cooling systems with flow temperatures no less than 10°C the insulation thickness of 9mm provides a good level of protection against condensation, so generally it is acceptable to reduce the insulation thickness for these systems as shown in the table below:

Insulation Thickness	9mm								
Flow Temperature	10°C								
Space Temperature	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C	29.0°C	30.0°C
Surface Temperature	18.8°C	19.5°C	20.3°C	21.0°C	21.8°C	22.6°C	23.4°C	24.1°C	24.9°C
Dew point @ 50% RH	12.0°C	13.0°C	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C
Dew point @ 60% RH	14.0°C	15.0°C	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C
Dew point @ 70% RH	16.0°C	17.0°C	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C
Dew point @ 80% RH	18.0°C	19.0°C	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C
Dew point @ 90% RH	20.0°C	21.0°C	22.0°C	23.0°C	24.0°C	25.0°C	26.0°C	27.0°C	28.0°C

Green = dew point lower than pipe surface temperature.
Red = dew point at or above pipe surface temperature.

Where practical though, the 13mm insulation thickness recommended earlier in this document should be used.

Insulation Joints:

To maintain the integrity of the insulation it is critical that joints in the insulation are minimised, and any joints are taped or glued shut. This requires insulation to be applied onto pipes and fittings during the installation carefully, the following guidelines are provided for this:

1. Where possible fit insulation to pipes as they are run, and slide this out of the way to install fittings allowing the insulation to then naturally rebound to its nominal length.
2. Do not stretch the insulation. If it is too short fit another section or re-cut the current section to the correct length.
3. When cutting the insulation use a sharp serrated blade and hold this at a low angle to create a clean cut for jointing later. For best results when cutting use a new blade and rough the edge over a fine file.
4. Where insulation joints are required, these should be glued with a suitable insulation glue (F2 Ados, K-Flex, etc) and if desired, then taped once the glue has cured. Taping only of joints is not permitted (note: Multitubo Pre-Insulated pipe insulation is suitable to be glued also).
5. When using 13mm thick insulation this can be slid around joints, the reduction in thickness on the inside of the bend will not risk condensation being produced. When using 9mm thick insulation sharp bends must be insulated with segmented sections of insulation to maintain the 9mm minimum thickness.
6. For any reason the insulation becomes sodden from normal use or from external environmental factors, the insulation should be removed and replaced.