Technical Insulation

Heat Networks - Secondary Insulation Systems

Improving Heat Network Performance

At the start of the year, CIBSE published a revised version of CP1 Heat networks: Code of Practice for the UK. Building on knowledge gained on schemes across the country, CP1 (2020) has been developed to support best practice in this developing area, helping to tackle issues such as oversizing as well as providing a clear golden thread of audited information about the design and installation to support operation and maintenance.

Heat networks can, of course, vary considerably in both size and complexity - from a system serving a single building (defined in CP1 (2020) as Communal Heating) to one providing for whole communities or cities (District Heating). In recognition of this, CP1 does not try to provide a set template for heat network delivery, but instead sets out 540 minimum standards across a variety of areas. The project team is then given the freedom to develop the specifics based on the particular requirements or performance targets for the network.

A good example of how this process works is the guidance around pipework insulation on secondary systems (pipework within buildings). CP1 (2020) recognises that effectively insulating this pipework is essential, both to maintain system performance and guard against overheating, and sets out basic minimum insulation standards. The Code also highlights, however, that by going beyond these, it may be possible to significantly raise overall system efficiency.

CP1 and Pipe Insulation

The minimum requirements for secondary pipework insulation are provided in table 8 of Objective 3.9. Minimum pipe insulation thicknesses are given for both phenolic and mineral fibre materials across a range of steel pipe diameters. These are typically set at 50 mm for both insulation options.

It's worth noting the decision to use pipework insulation thickness as the key metric rather than a heat loss parameter (such as those found in BS 5422: 2009 (Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C) and the Energy Technology List (ETL)). This reflects a desire to keep the minimum requirements simple and clearly defined. At the same time, project teams need to be aware of how use of this specification may impact overall system performance, particularly as phenolic insulation is considerably more thermally efficient than mineral fibre insulation. For example, modelling suggests that heat losses from a secondary system fitted with the minimum specification of mineral fibre insulation may actually be between 30-39% higher than for the phenolic specification, see Figure 1.

Rather than defaulting to this table, CP1 (2020) therefore encourages project teams to consider pipe insulation specification from an early planning stage and in the context of the overall system performance. It requires calculations for heat losses to be carried out at the Feasibility Stage (Stage 2) and suggests that losses of less than 50 W/dwelling should be possible for a well-designed system. This performance is only likely to be achievable through enhanced specifications of pipe insulation such as those provided in the ETL.

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Objective 3.9 also provides best practice guidance for installations. This includes highlighting the need to maintain continuous vapour barriers and insulation across valves, flanges, fittings and pipe supports where it recommends the use of "rigid low-conductivity inserts". Detailing in this area is key to the overall system performance with calculations showing that even a single, uninsulated 4" valve could allow 2240 kWh of heat loss per year on a system operating at 75 °C for 8760 hours. In comparison, by insulating this valve to an ETL specification, heat losses can be cut to just 153 kWh heat loss.

As part of the new process within CP1 (2020), members of the project team overseeing the design and installation of the secondary pipework will need to complete checklists, evidencing aspects including the full specification of pipework insulation, expected heat losses and photography of the completed installation. These are all fed into Evidence Packs, along with similar checklist processes for all other areas of the design, providing a comprehensive golden thread for the network.

The Future of Heat Networks

The fuel agnostic nature of heat networks, which has seen them powered by everything from combined heat and power (CHP) plants to waste heat from the London Underground, means they are seen as an important tool as we look to decarbonise our built environment as part of the country's net zero carbon commitments. This is particularly true in dense urban areas where use of low carbon technologies such as heat pumps is less viable for individual dwellings.

For this reason, whilst CP1 (2020) is currently a voluntary document, the Department for Business Energy and Industrial Strategy (BEIS) is already discussing legislating around its recommendations. By engaging with the document, and understanding the benefits of going beyond its minimum recommendations, project teams should be able to deliver heat network.

		75°C				Comparison	
NB	OD	Phenolic Insulation		Mineral Fibre			
(mm)	(mm)	Int	(W/m)	Int	(W/m)	Difference (W/m)	% Increase
15	21.3	50	4.63	50	6.34	1.71	36.93
20	26.9	50	5.17	50	7.07	1.9	36.75
25	33.7	50	5.78	50	7.91	2.13	36.85
32	42.4	50	6.55	50	8.93	2.38	36.34
40	48.3	50	7.05	50	9.61	2.56	36.31
50	60.3	50	8.04	50	9.95	1.81	23.76
65	76.1	50	9.32	50	11.44	2.12	22.75
80	88.9	50	10.33	50	12.61	2.28	22/07

Figure 1: CP1 Code of Practice, Table 8 of Objective 9, showing the minimum requirements for secondary pipework insulation.

Ambient Air Temperature: 20°C
Relative Humidity: 80%
Surface emissivity: 0.05ε
Assumed Thermal Conductivity:
Kooltherm® Phenolic Pipe Insulation: 0.025 W/mk
Mineral Fibre Insulation: 0.035 W/mk

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