TECHNICAL BULLETIN

CORROSION
Under Insulation

1. What is corrosion and what causes it?

Corrosion Under Insulation (CUI) is defined as an insidious damage mechanism that occurs beneath the surface of the insulation and targets the external face of the structure it protects. Despite being well documented within the Oil and Gas (Industrial) industry, it is much less frequently observed or openly discussed within the building services sector.

Corrosion does occur on building services pipework too and copper piping has been found to be susceptible. Although CUI can be found on many different substrates this document will focus on copper.

Firstly, it is important to recognise that corrosion is a general problem in the construction industry. It is also often a complex issue – but there are simple steps that can be taken to mitigate it.

Corrosion needs a number of elements to be present. It can be represented as:

Moisture + Oxygen + Contamination of Some Sort = Corrosion

The problem on any construction site is that all factors needed to cause corrosion are present in significant quantities. So great care and attention is needed to prevent it becoming an issue.

2. Why Do We Insulate Building Services Piping and Ductwork?

There are many functions performed by thermal insulation which include:

- **Conservation of energy – i.e. to prevent heat loss or gain.**
- **To maintain the efficiency of Hot, Heating, Cold and Chilled water services.**
- **On Cold and Chilled water services in particular, reducing moisture vapour flow towards the cold surface is a vital component of preventing condensation and maintaining insulation performance. Condensation can result in a more general degradation of materials used in our buildings e.g. ceiling tiles etc.**
- **To limit the effects of the building services systems on building temperatures.**

3. Corrosion in Building Services

Copper possesses a resistance to corrosion that is unrivalled by many metals, therefore giving copper pipes a lengthy service life. However, this metal has been widely mischaracterised as being corrosion-proof. It is known that variance in water chemistry, water quality and other factors including service environments and building materials have caused water / moisture vapour to become increasingly aggressive towards copper piping.

Corrosion can and does happen under all types of insulation and also if there is no insulation present at all. So a simple statement that the insulation causes corrosion cannot be true.

The catalyst for the process is moisture. Moisture will reduce insulation performance as well as being the major contributory factor in corrosion. So we must take steps to eliminate moisture getting into insulation systems and onto metallic surfaces. Moisture can also result in more general damage to buildings.

Often when installing insulation on building services systems, there will be a moisture laden atmosphere, little or no ventilation or air flow, and cold surfaces to which the insulation is being applied.

What is true however is that the vast majority of projects are completed without a corrosion problem arising. Therefore, it is certainly possible that regardless of insulation type, corrosion can be avoided.

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4. Risks to Consider

Pipe supports: On cold and chilled water service lines, pipe supports should always be insulated. If support clips are applied directly to the pipes, then a cold bridge will be created. This is clearly shown on the photo with corrosion being visible on the support with the risk that this will continue on the pipework itself. BS5970 states that pipe supports of the same material as the insulation should be used and that the support itself should be external to the vapour barrier i.e. not clipped direct to the pipe.

Condition of piping to be insulated – is it clean and free of any signs of damage or degradation?

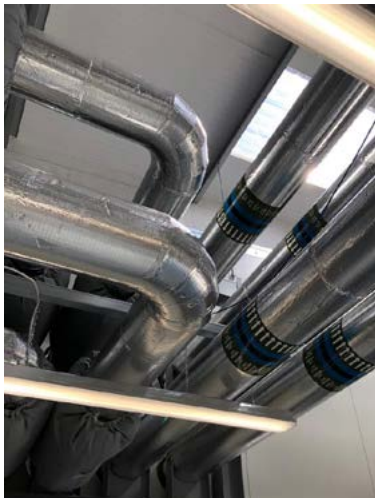
Lack of cleaning/decontamination of both surfaces and atmosphere – can lead to material being trapped between the insulation and the surface being insulated e.g. flux at joints.

Water properties and condition in the pipes themselves e.g. chemical composition of the water in the local area, issues with static water/stagnation.

It is critical that all surfaces to be insulated are dry prior to insulation/pipe support application.

Vapour barrier continuity at joints along and between pipe/duct sections and particularly at pipe supports and fittings. Moisture vapour will find its way in if the vapour barrier is not correctly sealed or is damaged at site.

5. What is Best Practice?



Adherence to specification. BS5422 provides an excellent basis for any specification.
Often more detailed specifications are used in Building Services applications such as NES Y50.

Consideration of actual site conditions especially if insulation is being installed on cold/chilled water pipes in areas of high ambient temperature, high humidity and little or no air movement.
This can have a significant impact on the required thickness of insulation to prevent condensation.

Selection of material and thickness appropriate to the service to be insulated.

Training/Understanding of Practitioners/Knowledge of risks and pitfalls.

Application in accordance with BS5970 "Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of – 100°C to +870°C – Code of practice 2012." This document has a specific section which highlights the issue of moisture/water ingress under insulation and the potential impact on building services systems including corrosion.

6. Conclusion

Corrosion under insulation can/will occur given the right set of site/ambient conditions. British Standards documents and major specifications reflect this.

Insulation alone (and more specifically phenolic) cannot be blamed as the (sole) cause of corrosion.

Mitigation is crucial and absolutely possible via specification and application. There are many millions of linear metres of insulated non-corroded copper piping systems (including phenolic which has been used for more than 30 years) in service in the UK and across the globe.

For more detailed information on this topic, contact:

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