Leaders in Chilled Water Pipe and Vessel Insulation

EAGLE & STORK PLUMBING

Why Insulate?

The principal reasons pipework is insulated are:

- *To minimise heat (energy) gains to the chilled water and thus operating costs and carbon footprint.*
- *Comply with Statutory National Building Code (NBC) regulations.*
- *Manage and minimise the risk of condensation formation (sweating) on the surface of chilled water pipes/vessels.*

Whilst the reduction of heat gains to the cooling media, be it chilled water or refrigerant, is very important, the over-riding reason, particularly in tropical regions, is the management of condensation formation on the insulation surface.

Poorly applied or insufficient insulation can lead to severe water damage to building construction such as plaster ceilings, inaccessible wall cavities and the like. This usually ends up in mold growth, smells and eventual costly replacement of building components.

Maximise Efficiency Optimise Costs Minimise Risks

Traditional Insulation Materials

Over the past 40 years or so, most pipe insulation materials have been preformed sectional (split) fiberglass, preformed sectional polystyrene or closed cell elastomeric (black foam) types.

In the case of ***fiberglass***, its hygroscopic (ability to absorb moisture) nature meant it had to be sealed with a vapour resistant membrane (vapour barrier), usually reinforced aluminum foil. This is a time consuming and costly process.

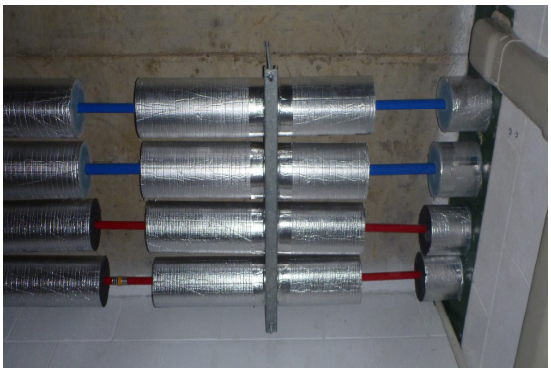
Polystyrene has good moisture resistance but has to be glued to the pipework as do all the joints to ensure moisture does not track along and through small gaps. It is normally wrapped and sealed with reinforced aluminum foil as for fiberglass. If the vapour barrier is not properly applied, in time (about 5 years) the polystyrene becomes water logged and all insulation value is lost.

Elastomeric foam has been the favoured insulating material for many years due to its advertised resistance to moisture penetration (permeability), ease of installation due to its flexibility and thus lower installed cost.

The experiences of Eagle and Stork over our time in the tropics has shown that elastomeric foam begins to lose its vapour permeability after a few years on systems that operate 24/7 and can result in very costly water damage to ceilings etc. as well as insulation replacement costs.

Recent Insulation Product

Over the past 10 years or so, a new insulation product comprising **cross-linked closed cell polyolefin foam** has become available to the industry. Originally it was only available in sheet form, but was soon followed by preformed single split sectional pipe insulation to suit all standard pipe diameters.



This product employs a factory applied vapour barrier, is reasonably flexible and relatively easy to install. It is generically known by its product name of Thermobreak.

Eagle and Stork experiences are that Thermobreak has a much higher resistance to sweating and as such has been adopted as our first choice of insulation material on chilled water and direct refrigerant systems.

Interestingly, all the above insulation products have very similar thermal conductivity properties (heat loss/gain resistance) but none match the long-term vapour permeability of Thermobreak.

Insulating the Tropics since 1996

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Energy Considerations

In recent years, the strong environmental focus on energy and carbon footprint reduction has seen the implementation of mandatory thermal insulation requirements within the National Building Code (NBC). The requirements for insulation thickness vary across Australia depending on climatic considerations.

The tropics have one of the most demanding requirements and as such insulation thicknesses have generally risen from the industry standard of 5 years ago from 19 mm to between 40 and 50 mm and in some cases up to 75mm.

Eagle and Stork offer only Code complying systems and in some cases even the Code requirements cannot successfully control condensation formation.

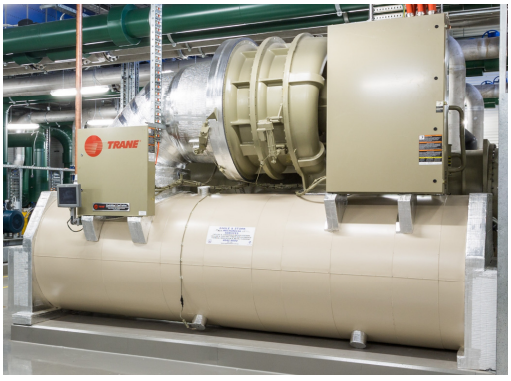
Apart from the mandatory requirements, the ever-increasing cost of electricity is a strong incentive to minimise thermal losses/gains to chilled water and refrigerant operating costs.

Condensation Control

The importance of controlling the formation of condensation (sweating) on the surface of the insulation cannot be overstated.

Condensation formation occurs on any

surface having dry bulb temperature (DBT) lower than the dew point temperature (DPT) of the air in contact with that surface. DPT is conditional on the relative humidity (RH) and DBT of the air around the pipe.



Case Studies

Eagle and Stork have been involved in numerous new and retrofit installations of chilled water pipe and chiller vessels insulation and cladding. The following is a list of just a few successfully completed projects within the tropics:

*Stages 1 and 2 of the 6 star Green Star **William McCormack Qld** Gov't buildings at Sheridan St, Cairns, completed 2002 and 2010 respectively.*
***James Cook University, Cairns** – 11,000 kW central chilled water and energy plant, completed 2012.*
***James Cook University, Cairns – Dental School** - 2010, Oral Health - 2011 and the Cairns Institute Facility - 2013.*
***Holiday Inn Hotel** chiller replacement and new evaporator vessel insulation and cladding – 2013*
***Pacific International Hotel** chiller vessel re-insulation and cladding – 2013*
***Telstra telephone exchanges** throughout Qld and NT – 2005 – 2013*

The definition of DPT is the temperature at which air can no longer "hold" all of the water vapour, which is mixed with it, and some of the water vapour must then condense into liquid water.

Typically, the temperature of chilled water in the carrier pipe is about 6 deg C. The function of insulation is to resist that 6 deg C from reaching the surface of the insulation.

Depending on the thickness of the insulation and its thermal conductivity, the surface temperature of the insulation will stabilize to a condition just below (2-3deg C) the air temperature around it. For example, a pipe in a ceiling space at night time might be subject to say 26 deg C. at a RH of 95-98% and the pipe surface temperature will be say 23 deg C. At these air conditions the DPT is 25.7 deg C. Because the pipe surface temperature is lower than the DPT, condensation will form. Increasing the insulation wall thickness will raise the surface temperature and may be sufficient to at least match the DPT

The above depends entirely on the insulation being dry all the way through its wall thickness and this is achieved through the use of a high performance vapour barrier. If the vapour barrier is degraded and/or the insulation has become damp, the surface temperature can be many degrees lower than the DPT and condensation formation will be exaggerated to the point that significant quantities of water will drip onto building components under it. Left unattended, the insulation will soon become useless and sweating will be prolific with obvious consequences.

Eagle & Stork thoroughly understand the mechanisms behind condensation formation and as such are very aware of the importance of ensuring that all pipes are properly insulated and vapour sealed.

Cladding

Eagle & Stork supply, fabricate and install cladding to all insulated pipework, chiller vessels, buffer / stratification tanks and boilers.

Steam
Heating Hot Water (HHW)
Other Insulation Services
Exhaust - Marine/Genset

A range of metals from Colorbond, Stainless Steel and Aluminium etc… can be used depending on the application.

Ask us about
No Clad Pipe Insulation!!!
An economical option
Puncture & UV resistant, rust proof & paintable aluminium foiled scrim coating. Installed at Cooktown Hospital & Nhulunbuy High chiller

All metal is fabricated in-house and installed by experienced personal from a simple straight section of pipe right through to large lobster back elbows, tanks and vessels.

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