Johns Manville
A Berkshire Hathaway Company

INDUSTRIAL INSULATION

CROSS-FLO® JACKETING TESTING SUMMARY

TECHNICAL BULLETIN

INTRODUCTION

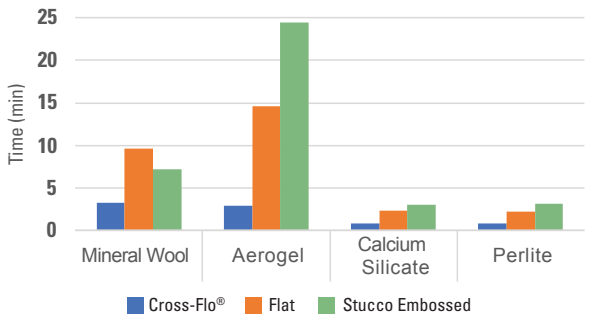
Johns Manville's innovative Cross-Flo® metal jacketing is designed to deter corrosion under insulation (CUI) by promoting the efficient drainage of moisture that enters a piping system. One of the primary functions of metal jacketing in an industrial insulation system is to prevent moisture ingress, which is a top contributor to CUI. However, even the most robust system designs are prone to damage, improper installation, extreme weather events, and more. When water is retained under metal jacketing for an extended period of time, it can reach the pipe surface through seams and potentially be absorbed into the insulation itself. It is therefore prudent to consider water intrusion inevitable and take preventative measures against CUI by minimizing the time moisture remains in a system.

Cross-Flo jacketing is an effective product for removing water from a system quickly. Unlike other jacketing patterns, it provides a pathway between industrial insulation and metal jacketing for water to drain to a low point and escape when a weep hole or drainage port is present. The pattern promotes cross-directional flow (CDF), a mechanism whereby liquid can travel both horizontally and vertically, reducing "dead spots" where moisture can pool throughout a length of pipe. JM has performed extensive testing on Cross-Flo jacketing to support its efficacy in this regard.

SMALL-SCALE DRAINAGE TESTING

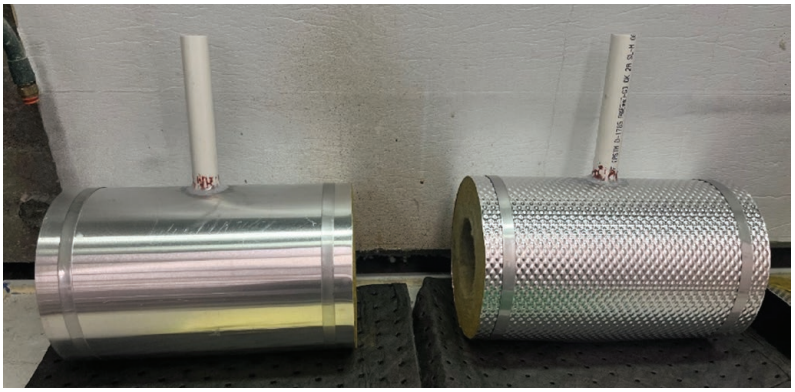
To compare the drainage performance of different jacketing patterns over common high-temperature insulation products, JM designed a test capable of measuring the rate of water drainage in a controlled, consistent manner. Representative 3" nominal diameter pipe sections were insulated with 2" thick calcium silicate, perlite, mineral wool, and aerogel insulations and covered with flat, stucco embossed, and Cross-Flo jacketing. A 1" hole was drilled into the top of the jacketing with a PVC tube sealed around it to drain 100mL of water underneath the jacketing. The jacketing was cut so that it did not cover the entire circumference of the insulated pipe, leaving a 2" gap open at the bottom to expedite water drainage. The time it took for water to stop dripping out of the egress area was recorded.

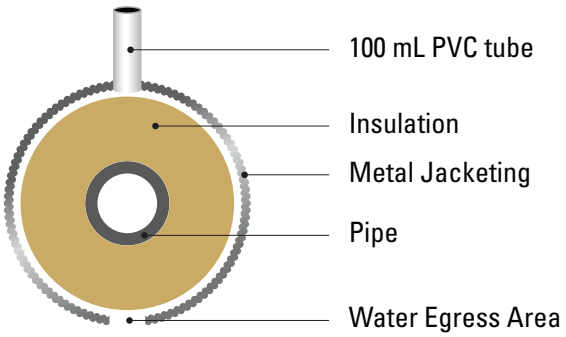
Small Scale Test – Drain Time



Full Drain Time (minutes)	Mineral Wool	Aerogel	Calcium Silicate	Perlite
Cross-Flo®	3.2	2.9	0.8	0.9
Flat	9.6	14.7	2.4	2.2
Improvement Over Flat	*67%*	*80%*	*67%*	*59%*
Stucco Embossed	7.2	24.5	3.0	3.2
Improvement Over Stucco	*56%*	*88%*	*73%*	*72%*

Cross-Flo performed better than flat and stucco embossed jacketing with every insulation type tested, reducing time to drain by 55% to 88%. Calcium silicate and perlite insulations, which have a rigid surface, both took less than a minute to drain using Cross-Flo jacketing, while flat and stucco embossed samples took over two and three minutes, respectively. The impact was similarly positive with mineral wool and aerogel, with time improvements of four to twenty one minutes. Since these insulation types are non-rigid, jacketing can compress the insulation, leaving minimal interstitial space for water to drain. However, our testing showed Cross-Flo created sufficient drainage channels, even when the jacketing is tightly fitted over the insulation. Water therefore spends less time in the system, reducing the risk of it reaching the pipe surface and leading to CUI.





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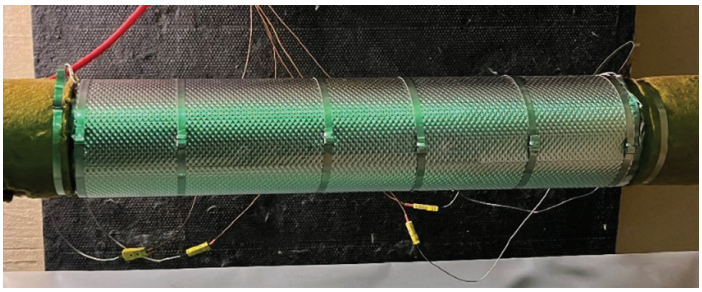
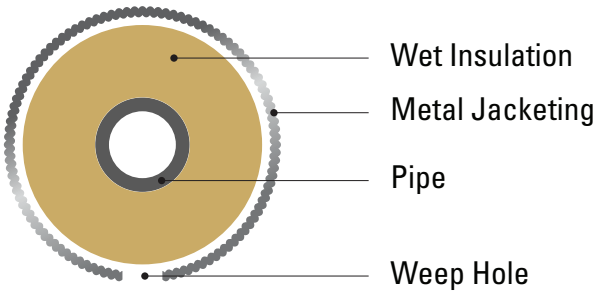
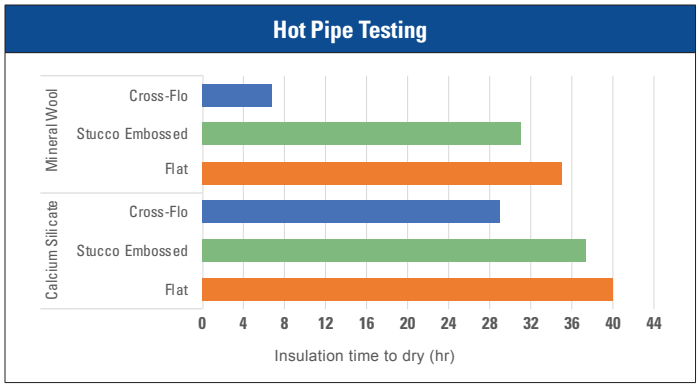
TIME TO DRY WET INSULATION

Protecting insulation from moisture is one of the primary functions of metal jacketing. But what if the insulation does get wet? To determine the impact of Cross-Flo jacketing's drainage capabilities on drying wet insulation, JM performed testing on a pipe insulated with calcium silicate and mineral wool that had been submerged in water to reach full saturation, representing an extreme case. The test method compared Cross-Flo jacketing to flat and stucco embossed patterns, and all metal jackets were installed with one ¾" weep hole in the center of the 3' tested pipe section. The pipe was heated from ambient to a target process temperature of 600°F after the wet insulation had been installed and jacketed. During the test, moisture steamed through the insulation cross-section and out the weep hole as the pipe heated up from ambient. To determine when the insulation had dried, the time when the insulation temperature and pipe surface temperature stabilized was recorded.







For both mineral wool and calcium silicate, systems with Cross-Flo jacketing took less time for the insulation to dry compared to flat and stucco embossed. The cross-directional flow characteristics allowed moisture steaming off across the 3' long pipe section to more readily travel over the surface of the insulation and out of the centralized weep hole. It took less than eight hours for the mineral wool to dry with Cross-Flo jacketing, whereas stucco and flat both took over thirty hours. Over calcium silicate insulation, Cross-Flo jacketing reduced drying time by more than eight hours compared to stucco embossed and flat patterns.

Insulation should always be removed and replaced when subjected to significant amounts of moisture. This testing was completed using extreme conditions to demonstrate how Cross-Flo jacketing helps to prevent CUI by promoting water egress in a system. In a real-life situation, this buys time between the wetting event and when insulation replacement can be performed.

CONCLUSION

In applications where CUI is a concern, proactive measures must be taken to protect the metal pipe from contact with water. Minimizing the time that moisture remains in an industrial insulation system is critical. Cross-Flo metal jacketing is an excellent choice due to its superior tested drainage performance compared to typical jacketing patterns. Whether rigid, non-rigid, hydrophobic, or non-hydrophobic insulation is used, Cross-Flo jacketing demonstrates significant improvement in removing water from insulation systems, helping to prevent CUI.

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