

**INSULATION UPGRADE  
SAVES \$250,000**



## **Dow Corning avoided the expense of purchasing new refrigeration equipment by upgrading its glycol system.**

The new insulation system that Dow Corning® installed on its glycol line in Building 505 improved the efficiency of the line to the extent that the company was able to avoid spending the \$250,000 already earmarked for new refrigeration equipment. Building 505 is one of approximately 70 buildings on the 100+ acre site in Midland, Michigan involved in the manufacture and production of high-performance silicon-based materials for a wide range of products.

### **Old System Could Not Keep Up With Process Demand**

Building 505 specifically manufactures silicone resins and coatings. Several processes occur there that depend on a chilled system for vent control. The glycol in the system's lines must be kept cold (-20°F) to maintain the efficiency of the process. Although the refrigeration system was sufficient when installed over 15 years ago, numerous productivity improvements and expansions to the building rendered the system unable to keep up with process demand. The chiller ran at full capacity 24 hours a day, 7 days a week, 365 days a year, and still the system had difficulty maintaining the ideal process temperature.

### **An Upgrade Was Scheduled in Two Phases**

In September 1999, Dow Corning made the decision to upgrade the glycol system in two phases. The upgrade required the following steps:

- Replace the insulation on the 525 linear feet of outdoor piping. An inspection of the high lines had found frozen insulation with exposed frost as well as mildew

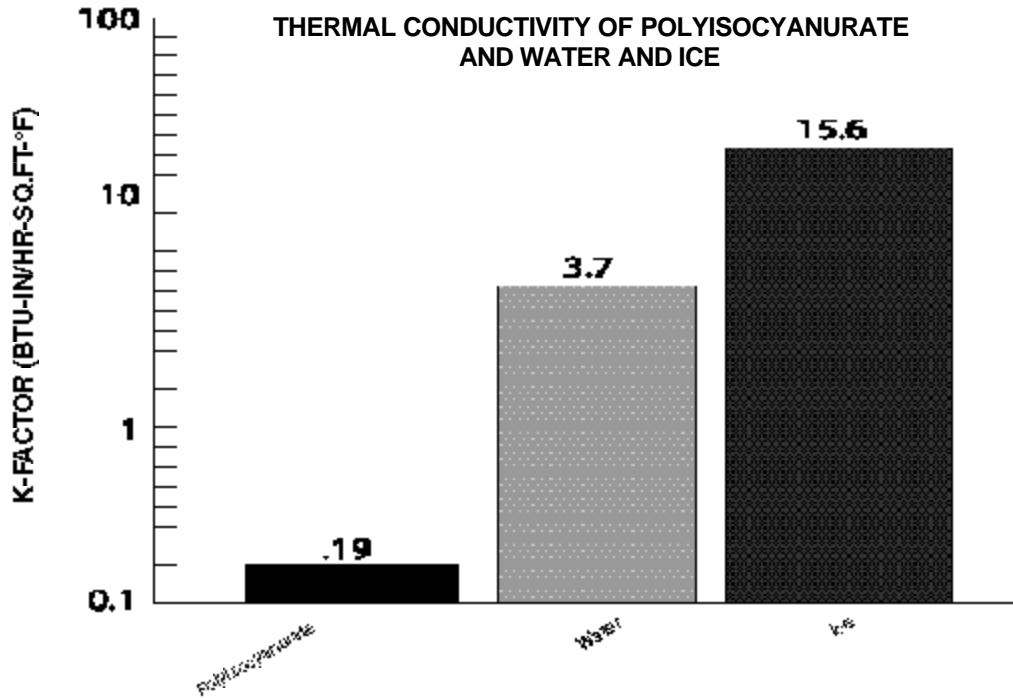
forming on the outside of the jacketing—all clear indications that a breach in the insulation system had serious detrimental effects on process performance.

- Upgrade the chiller system at a cost of \$250,000. Because it was initially thought that the unit itself was at capacity, the money was earmarked for a larger capacity unit to handle additional loads.

### **Insulation Upgrade**

During Building 505's annual two-week shutdown, a team of Dow Corning pipe coverers began the job of replacing the insulation. "Once we stripped off the wet, iced up, old glass fiber insulation, we did a thorough NDT (non-destructive testing) inspection to ensure that the integrity of the pipe line was still intact," says Rick Jones, Project Estimator in Central Plant Engineering. "Once this was determined, we sand blasted the pipe and repainted it. We then covered it with a TRYMER 2000, 2-1/2" thick with shiplap joints. We applied a 30 mil R-30 Polyguard vapor retarder over the insulation, and installed SpeedLine PVC jacketing over the vapor retarder. The PVC jacketing system was held in place with stainless-steel bands on 9" centers."

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### Thermal Load on Chiller Greatly Reduced

The new insulation greatly reduced the demand on the chiller unit by providing a far better insulation system than was originally designed and installed. “With the new insulation, the chiller is now running about 50 percent of the time even during the summer months,” says Jones. “In addition, before the chiller was reset after startup, the glycol temperature was found to be running approximately 25° colder than before. The thermal load on the chiller unit has been greatly reduced to the point that we now have excess capacity to support the building for several more years.”

Another benefit of the new insulation system is that the PVC jacketing, combined with the underlying support from the rigid polyisocyanurate insulation, not only provides thermal protection but also physical damage protection for the vapor retarder. “This is especially important when sandblasting nearby piping or even having operators working in the pipe racks where the insulation system can get damaged,” says Jones. “It protects against bumps and bangs, but most importantly, it extends the life of the insulation system.”

### Major Savings

With the new insulation, the need for additional capital to replace the existing unit with a larger chiller was eliminated. “Once the insulation upgrade was complete,” says Jones, “the chiller system ran so efficiently that we decided to cancel the request for the \$250,000 chiller upgrade. When we first got the system back on line we realized immediately

that we had gained 30° in temperature. What was running at 0° and -10° was now at -25° and -30°. The chiller that used to run 100 percent of the time was now running at about 50 to 75 percent of the time. And, there is plenty of room for future expansion with the existing system. This is all due to just the insulation upgrade.”

### Added Environmental Benefit

With the insulation upgrade, Dow Corning realized an additional benefit—excess capacity. “Now that we have excess capacity,” explains Brian Klump, 505 Building Maintenance and Reliability Engineer, “we’ve been able to tie in additional process vents to the chilled glycol system. We were unable to do this before because we didn’t have enough capacity. The new insulation system has reduced the loadings on the chiller unit and we’ve been able to add additional vent loadings to the condensers.”

### Additional Savings

While the major benefit of the insulation upgrade was the elimination of a \$250,000 expenditure on new equipment for a larger refrigeration system, other benefits included increased energy savings and reduced wear and tear on the chiller. “Prior to the upgrade we were running at capacity whereas now we are running at 50 percent of capacity,” says Darren Cammin, 505 Building Team Leader. “This translates into a savings of approximately \$3,600 per year in electricity costs.

“It is important to point out,” says Cammin, “that the \$250,000 savings was many times the cost of the insulation. Upgrading the insulation system saved us \$250,000 in capital.”



## Shiplap Joints Now Part of Dow Corning Standard

The 2-1/2" thick rigid cellular insulation used on the 2" pipe was supplied by 3i Supply. "We work hand in hand with 3i Supply on a day-to-day basis," explains Jones. "They looked at the line with us and suggested we use the insulation with shiplap joints."

## Insulation System Designed to Prevent Ice Buildup and Pipe Corrosion

The TRYMER 2000 has a closed cell, non-fibrous structure. It has low water absorption and low water vapor permeability so it resists water and water vapor drive to help reduce moisture intrusion, ice buildup, and pipe corrosion. And, because it is a rigid product, it offers good support to the vapor retarder and outer protective jacketing.

"For this particular application, we recommended fabricating the insulation with shiplap joints," says Peter Finn, 3i Supply contact. "Shiplap joints provide additional joint integrity and reduce moisture intrusion in a single layer system."

Shiplap joints were a first for Dow Corning. "Now that we've seen how successful they are," says Dow Corning's Jones, "we've written them into our global

Dow Corning insulation standard specification which now states that the insulation used on cold lines will be low temperature polyisocyanurate with shiplap joints for 2.5" insulation thickness and below."

## Vapor Retarder Is an Integral Part of the Insulation System

The vapor retarder must be completely sealed throughout the entire installation to keep moisture out of the insulation system. "Any penetration of the vapor retarder can lead to icing and eventual system failure," says Peter Finn. "We used a laminated membrane on the glycol line because of its low water vapor permeance. It resists the vapor drive of warm, moist air to the cold surface of the pipe."

## Conclusion

While the energy savings resulting from the new insulation system were expected, Dow Corning achieved an additional, pleasantly surprising result. In addition to energy savings, Dow Corning also realized reduced operating costs, improved equipment efficiency, reduced wear and tear on equipment and the ability to add other vents to a previously overburdened system.



## Why Is It More Difficult to Keep Pipes Colder Than It Is to Keep Them Hot?

According to Jim Young who works in the area of insulation technical service and development at Dow Chemical Company, there are two main reasons why it is more difficult to keep pipes cold than it is to keep them hot.

### Water Intrusion into the Insulation System

Water intrusion into an insulation system on outdoor piping can reduce the thermal efficiency of the insulation as well as become a safety issue due to falling chunks of ice and difficulty gaining access through the ice to valves and flanges in the piping. Great care is necessary in system design and material selection in order to minimize the amount of water that enters the insulation system.

Low permeance vapor retarders should always be used in cold piping systems. Insulation should always be closed cell, non-wicking and resistant to water and water vapor absorption and permeability. There are other design concepts such as vapor stops, jacketing types and multi-layering used to help minimize water vapor migration into the insulation system.

### Refrigeration Inefficiencies

Refrigeration processes in general are LESS energy efficient than heating processes. Another way of stating this is that it costs more to lower the temperature of a liquid one degree than it does to heat it one degree. Still another way of looking at it, says Young, "is that the cost of one Btu of heat gained into a cold pipe is greater than the cost of one Btu of heat lost from a hot pipe. There are several reasons for this. The equipment used to cool is more expensive than equipment used to heat. Think about a simple window mounted room air conditioner versus a small quartz heater. Both can keep one or two rooms at a comfortable temperature but the air conditioner costs many times more than the small heater. This same concept is true of industrial refrigeration versus heating equipment. Even if the equipment cost is the same, there is still a great deal more inefficiency in the refrigeration system than in the heating process. Much of this inefficiency derives from the frictional energy losses incurred in the refrigeration process compressor and from the movement of refrigeration fluids."

