HEAT LO$$

The Cost-Saving Benefits of Press Platen Mold Insulation

by Kurt H. Hartwig

Wherever you find two areas of different temperature, you'll find heat transfer from hot to cold. In the case of compression molding of plywood and oriented strand board (OSB), this heat transfer takes place in three primary ways. First, it occurs by heat conduction through the top and bottom platen and into the press. Second, it moves by convection by currents of air within the environment. And finally, heat leaves the platen by transferring into the final product.

Insulating materials control the heat by slowing down the transfer rate in and around the platen. Thermal conductivity (K Factor) is important in determining a material's ability to resist the flow of heat. The lower the K Factor, the higher the material's insulating power, and thus lower overall heat transfer and operating costs. Plywood and OSB manufacturers achieve maximum level of process efficiency and cost savings when mold insulation is installed between platen and press head.

In addition to conserving energy, thermal insulation also protects machinery components. When platens begin to heat toward operating temperature, other major parts and components increase in temperature as well and can cause major implications to machinery. First, it breaks down the system's hydraulic oil more quickly, which reduces the life of oil seals and rings, as well as to the pump and valves. Second, it causes thermal expansion on moving parts, which invites increased drag and wear. With time, system components will fail prematurely. Installing thermal insulation will protect machinery components from the adverse effects of heat.

Thermal insulation has the additional ability to reduce the potential for cold spots. All platens distribute heat differently and, to a certain point, unevenly. Installing a sheet of mold insulation in and around the platen will dramatically improve the ability to control and maintain temperatures. This provides an overall tighter machine tolerance as well as an increase in uniformity and stability in the final product.

The last cost-saving benefit realized from thermal insulation derives from its ability to lessen cycle and shorten start-up times. Whether it's plywood or OSB manufacturing, heat will transfer 1) from the platen into the final product, and 2) from the platen into the press itself. Platen temperature, therefore, decreases as units increase during production. Installing a sheet of mold insulation allows the platen to recover more quickly, without losing time in reheat. Heat from the platen will also transfer into the press upon initial setup, which results in longer start-up times. Again, installing a sheet of insulation will minimize the time required to reach full operating temperature.

Selecting Thermal Insulation

There are many insulation materials on the market claiming to be the most efficient. How to decide which material is best requires an understanding of five key properties.

The first property is compression strength (unit: psi), which is the maximum force required to deform a material prior to reaching its yield point. The importance of this property is for maintaining press alignments. Typically, compression strength of most insulation materials decreases as temperature increases. In fact, a small increase in temperature can result in a significant decrease in compression strength in some insulating grades. Manufacturers can provide this data through their technical bulletins.

The second key property for selecting mold insulation is service temperature (unit: °F), which is the highest temperature at which a material can perform reliably in long-term application ("long term" being inconsistently defined by the manufacturers). Depending on the product, most platens operate between 275°F and 450°F. It is recommended to select insulation 25 percent above operating temperature of mold.

The third and most important key property is thermal conductivity (unit: Btu/hr/ft sq/in/°F), which is defined as the quantity of heat that flows through a unit area in a unit time under a unit temperature. The value of thermal conductivity is used for three purposes. First, it is used as a benchmark of a material's performance during operation. Second, it is used to determine a utility's savings (e.g., steam or oil). Last, it is used to measure the return on investment. Understanding these three purposes for thermal conductivity aids in making a good buying decision of insulation material.

The fourth property for selecting thermal insulation is water absorption (unit %), which is defined as the amount of water absorbed by a material when immersed in water for a period of time. The common measure is the percent swell. The disadvantage of water absorption to insulation is that swelling can cause misalignment and cracking. Therefore, the lower the value the better a material is at resisting the absorption of water.

The fifth key property is thickness tolerance (unit: inch), which is the material's ability to maintain parallelism across flats. On most press applications, tolerance is extremely important for achieving alignments and product quality. The value of thermal expansion at operating temperatures is so low that operations are unaffected. Parallelism, therefore, is important only during initial purchase of thermal insulation.

The last yet least discussed property is a material's resistance to lubricants and hydraulic/thermal oils. When hydraulic fluid leaks through components, the oil runs down the machine and contacts the insulation. Again, this gives rise to potential swelling and cracking. This condition is seen more on vertical presses where a hydraulic cylinder and components are mounted above the press.

Conclusion

These five key performance properties are important because life expectancies differ in thermal mold insulation materials. The life of any insulation is dependent upon three factors: time in actual operation, operating temperature, and actual compression. As mentioned above, the most important property is thermal conductivity. Tied for second in importance are temperature and compression. The third is thickness tolerance; and the fourth is water and oil absorption.

The pressure on panel manufacturers to increase quality and efficiency in order to remain competitive can only be expected to intensify. As one manager states, "If there is another method that I can reduce costs for profit-maximization, I'm going to focus my energies learning how." Thermal mold insulation is one way to reduce costs associated with poor product quality and excessive utility usage, and thereby improve overall competitiveness.

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