INSULATION FACTS #28

Facts About Lamination Process Control And Thickness Recovery After Lamination

Information from NAIMA

NAIMA
North American Insulation Manufacturers Association

In this issue we discuss several factors that greatly affect the thickness recovery of NAIMA 202-96® insulations after lamination and provide recommendations for laminators to help metal building insulation meet stated R-values after lamination.

NAIMA fiber glass metal building insulation manufacturers participate in third party testing by the National Association of Home Builders (NAHB) Research Center to substantiate out of package performance of their NAIMA 202-96® metal building insulations. This program involves regular random sampling and testing of insulation products for thickness, density, and R-value. ("R" stands for resistance to heat flow and is a measure of how effective the installed insulation will be. The higher the R-value, the greater the insulating power.) Samples must meet minimum R-value limits.

This certification program provides laminators with assurance that the products deliver specified insulating performance from the original package. Only those products bearing the NAIMA 202-96® identification on the insulation can provide this assurance to laminators and their customers.

Neither NAIMA nor the manufacturing members of NAIMA have control over each individual's laminating processes, but by following these recommendations any NAIMA 202-96® insulation product should have minimal loss in stated thermal performance after lamination.

This information was obtained from an extensive Design of Experiment by one of the NAIMA members. Through the use of this Design of Experiment, the following three major influences have been found to greatly affect thickness recovery:

- Moisture accumulation in the product from excessive adhesive application and/or inadequate ventilation.
- Excessive nip roller pressure.
- Excessive compression during windup after lamination.

Minimizing the effects of these three factors will significantly improve thickness recovery after lamination.

Use of Adhesives

Adhesives used in the lamination of NAIMA 202-96® insulation are water based adhesives. The content of water in most adhesives is around 50% by weight. Assuming an average wet application rate of 3 grams per square foot, 3.3 pounds or 4 tenths of a gallon of water per thousand square feet of insulation must escape from the laminated insulation as the adhesive cures.

The lamination process must be controlled to maintain adhesive application rates within allowed manufacturing specifications. Kiss coaters and bead applicators provide much more control over adhesive application rates than the standard Mayer bar applicators. Higher solids content laminating adhesives also introduce less water into the product.

Package ends should be pierced (about one square inch per end) to provide a ventilation path to allow the moisture in the package to escape as the adhesive cures. Rolls of finished product should be stacked on their sides to allow cross ventilation and the removal of water through evaporation.

The use of spacer blocks to limit the height of the nip roller is recommended to eliminate excessive nip pressure that compresses the insulation during lamination. Different spacer blocks should be used for each R-value. This not only improves the recovery by not breaking fibers and thus losing product integrity, it also lessens dust in the work environment. When the nip roller is not needed it should be raised clear of the blanket.

Windup Compression Ratios

NAIMA recommends that the windup compression ratio on laminated NAIMA 202-96® insulation products not exceed 5.5:1. The Design of Experiment indicates the range of optimal recovery is in the 4.5:1 to 5.0:1 range. The compression ratio is controlled mostly by the laminator and the brake tension on the facing. Caution should be used when adjusting the brake pressure so it does not adversely affect the adhesive application rate. On some lamination equipment there is an adjustable secondary compression roller that controls the amount of compression. Compression can also be controlled by pressure on the windup mandrel.

To calculate a compression ratio, follow the formula below. Prelaminated thickness (printed on the bag label in inches) multiplied by the length of the roll (in feet) multiplied by 150.8, divided by the circumference of the roll (in inches) squared. (See Figure 1.)

Metal Building Insulation Storage

Thickness recovery after lamination and repackaging under compression may also be adversely affected by long storage times in the manufacturer's facilities or on the job site. Shelf life of one month or less is recommended. The stack height of stored material should not be so high that the rolls on bottom layers are crushed by the weight of product above them.

Figure 1: Example Compression Ratio Calculation:

$$\frac{\text{Pre-laminated Thickness (in.)* x Roll Length (ft.) x 150.8}}{\text{circumference (in.) x circumference (in.)}}$$

Or

$$\frac{(6.00'' \times 75' \times 150.8)}{(120'' \times 120'')}$$

Equals

4.7:1 Compression Ratio

* Thickness refers to the prelamination thickness printed on the bag label.

Glossary of Terms

Mayer Bar
A wire wound rod used for the metering of adhesive in a lamination process.

Nip Roller
A roller that rides on top of the fiber glass blanket to provide compression and contact to the blanket and facing prior to windup.

Kiss Coater
Two adhesive rollers one on top of the other. The bottom roller picks up the adhesive and transfers it to the top roller that in turn transfers it to the facing. Application rate is adjusted by metering the distance between the two rollers.

Design of Experiment
A considered course of action aimed at answering one or more carefully framed questions in which the experimenter chooses certain factors for study, deliberately varies those factors in a controlled fashion, then observes the effect of such action.

NAIMA is a trade association of North American manufacturers of fiber glass, rock wool, and slag wool insulation products. NAIMA's role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation products and to encourage safe production and use of these insulation products.

NAIMA metal building committee members manufacture fiber glass insulations for metal building roof and wall applications. They initiate product performance standards and industry testing programs, and publish technical papers and promotional literature.

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