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REPORT Reaching Design Engineers at the OEM Level

September/October 2020

VOLUME 2 > NUMBER 4

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Cutting to the Chase on Thermal Insulation Selection A Material Converter's Perspective

BY JOE BLISS

Thermal insulation... whether you're an appliance OEM or an HVAC systems designer, it can be a challenging subject. After all, knowing which thermal insulation would be best for your application out of what can seem like hundreds of options can be a time-consuming exercise.

One resource to be considered in your search for the perfect insulation is your flexible materials converter. Converters work directly with many different thermal insulation manufacturers to identify and source the raw materials needed to make die-cut and custom-engineered insulation panels and gaskets for

customers. Therefore they have a unique perspective on challenges design engineers are trying to solve and the breadth of available solutions.

And, while a material manufacturer may tend to limit their focus – and recommendations – to their own products, converters can present our customers with a much broader set of options.

Getting Started: Identifying the Factors that Impact Material Choice

The first question when asked for material recommendation is, "How and where will it be used?" With thermal insulation, this leads to follow-up questions regarding the method of heat transfer.

Environment

Asking where and how the thermal insulation is going to be used may sound like a basic question, but it is, in fact, foundational. Factors like temperature, moisture and vibration can all wreak havoc on insulation if the right material isn't chosen. And because we work in so many industries, you might be trying to solve a problem that is new to HVAC or appliances that has been seen previously in automotive and/or industrial applications.

Things you'll want to consider include:

- Intermittent vs. Continuous Temperature Requirements – When looking at temperature

ratings it is critical to distinguish between intermittent and continuous temperature exposure. While some materials will withstand consistent exposure to high temperatures (continuous), there are lower temperature rated insulations that may be appropriate for occasional exposure to higher heat levels (intermittent). The lower temperature insulations often come with a lower price tag and are more than adequate for the end use application.

- **Exposure to Moisture** –

Common insulation materials are hydrophilic, meaning they tend to absorb moisture, often leading to a loss of their form and thermal performance over time. But in some applications, where high moisture content or direct exposure to fluids is a possibility, this is not sufficient. If this is the case, consider the use of a hydrophobic or water-resistant material. Better yet, invest in an insulation that's shielded from the moisture completely by some type of physical barrier or coating.

- **Vibration** – While often overlooked, continuous, periodic and sustained movement can physically break down the fibers of an insulation over time, leading to declining performance and eventual failure. Insulation that will be subject oscillation, shaking, or other continuous movements should either be shielded or isolated from the movement or be constructed of a material able to withstand or absorb the vibration energy.

Heat Transfer

The method of heat transfer is important because different types of heat transfer require different solutions. Radiant heat, for example calls for an insulation with an emissive surface – shiny metal foil for example – that

will reflect the unwanted heat away, preventing transfer into unwanted areas. Convective and conductive heat, on the other hand, both require insulation materials capable of withstanding direct contact with heated surfaces without breaking down.

Considering this at the outset of your material selection will help avoid miscues down the line.

Common Types of Thermal Insulation

Now that we've identified the critical performance parameters for the thermal insulation application, it's time to weigh our options.

Before selecting a material first look at insulation weight and density. These two characteristics will affect the thermal conductivity of the insulation material. In general, the higher the weight and density, the better insulator it is. However, these materials typically cost more and it's not always necessary to invest in the heaviest or most dense insulation. As such, you'll want to weigh your performance needs before investing in a heavier, more dense thermal insulation.

Ceramic blankets and papers

If you're in need of high-temperature performance and resistance, ceramic insulation materials are a natural fit. Ceramic blankets are flexible, lightweight, and perform in temperatures up to 2,000F (1093C). Ceramic papers offer similar benefits while offering a thinner profile for use in areas where space is at a premium.

Fiberglass

Woven fiberglass insulation is a common thermal and acoustic insulation option. Fiberglass insulation is available in both flexible and rigid forms and can serve as a cost-effective alternative for high-heat materials like ceramic.

Needled mats

Needled mats are non-woven insulation products made of silica, fiberglass, or other fibers. These mats are a versatile insulation option, as they are soft and compressible, come in multiple thicknesses and densities, and feature options with many temperature ratings.

Synthetic blankets

These lightweight, compressible insulations are made from hydrophobic synthetic fibers such as polyester or polypropylene. In addition to providing thermal insulation, synthetic blankets can reduce noise, vibration, and harshness (NVH) to combine acoustical and thermal management in one material solution.

Working with the Right Partner Can Make All the Difference

The applications for heat management solutions can vary greatly, just as the variety of materials used to insulate their components do as well. Given the seemingly endless combinations it is not uncommon to over-spec a product, leading to unnecessary cost increases without a corresponding increase in value. Enlisting the help of a materials converter during the early design phase of your project may j save time and money. On top of this, using a rather non-traditional resource in your project planning may also open your eyes up to a much wider range of materials and applications than had previously been considered. ●



Joe Bliss Chief Executive Officer at JBC Technologies, Inc JBC Technologies is a full-service manufacturing partner that converts flexible materials into custom die cut parts for leading manufacturers around the globe. To learn more, go to www.jbc-tech.com.