

## Terminal Unit Liners

We receive many inquiries regarding terminal unit liners, so it might be worthwhile to explain the various liner choices, applications and how they comply with various industry standards including LEED.

Terminal unit liners primarily provide thermal protection but the choice of lining material can also impact the acoustical performance of a terminal unit. Choosing the right liner is critical because it affects the cost, performance and suitability of the final product selection.

### THERMAL PROTECTION

The thermal resistance of a liner is defined in terms of an R-value that describes the ratio of the temperature difference across an insulator and the heat flux through it. The R-value for homogeneous materials is directly proportional to the thickness, but if a material is compressible, the R-value is usually reduced as it is compressed. The R-values for non-homogenous or composite wall assemblies are more difficult to determine. Regardless of the liner type, the higher the R-value, the more thermal protection you're getting.

Specifying an R-value is the simplest way to insure that a liner will provide the necessary thermal protection as determined by the system designer. Unfortunately, many specifications do not include an R-value but rather provide a liner thickness and/or density. While these properties can be applied to a specific material from a specific manufacturer, they don't provide a clear minimum R-value that must be met by an equipment manufacturer.

Sometimes customers spot an exposed screw shank or a bare steel edge inside a terminal unit and express concern that condensation may occur on an adjoining exterior surface. In actuality, the reason why condensation doesn't form is due to thermal mass. If a relatively small cold

surface like an exposed panel edge or a screw head is in direct contact with a much larger warm surface, the larger surface will tend warm the smaller surface and prevent condensation.

### ACOUSTICAL EFFECTS

The acoustical performance of a terminal unit is also affected by the properties of the lining material. Liners with soft facings tend to absorb sound energy especially at higher frequencies, typically resulting in lower discharge sound levels. Liners with hard facings tend to block or reflect sound energy, typically resulting in higher discharge sound levels and sometimes lower radiated sound levels.

It is absolutely critical that product selections in TEAMS are made with the correct liner type selected. TEAMS automatically corrects the sound calculations for each unit and liner type based upon the liner selected. This feature also allows users to easily switch liners to see the acoustical impact of the liner selection. No further corrections are required if TEAMS selections are made with the desired liner type.

### LINER TYPES

#### Fiberglass (0.500", R=1.9)

This is and has been the industry standard for at least 30 years. This material is dual density fiberglass. It has a soft low-density core and a hard high-density skin to resist air erosion up to a recommended maximum velocity of 3600 FPM. This material is actually tested to withstand 2.5 times the recommended velocity to 9000 FPM. The outer skin consists of compressed fiberglass bonded by an acrylic additive. It is often referred to in specifications as "matte-faced lining". It is secured by water-soluble hot melt spray adhesive. This is a general purpose liner that is suitable for use in all but critical environment applications. Although

# FIBRE-FREE

## 1/2" FIBERGLASS

some engineers are hesitant to allow fiberglass in new construction, there is no scientific evidence proving that this material contributes to a hazardous environment.

### Fiberglass (1.000", R=3.9)

This material is exactly the same as the previous selection, but it's twice as thick, so it provides roughly twice the thermal protection and slightly improved acoustically performance in certain products. This is a good choice for customers who desire extra protection from condensation or slightly lower sound levels.

### Steri-Loc (1.000", R=3.5)

This is high density fiberglass covered with a rigid permanently affixed scrim-reinforced foil covering. The lining is glued in place and all cut edges are covered or captured by either galvanized Z-brackets or foil tape. This has been the standard lining used in critical environment spaces like hospital operating room and clean room applications for over 20 years. The Office of Statewide Health Planning and Development (OSHPD) in Sacramento, California has approved Steri-Loc for use in all areas of California hospitals. OSHPD is one of very few agencies that approve products for healthcare applications.

### Foil Face (0.500", R=1.5)

This material is low density fiberglass with a soft permanently affixed foil covering. This liner is only offered on certain low profile fan-powered products that cannot accommodate our SteriLoc lining. It is secured by water-soluble hot melt spray adhesive. This liner is required when low profile units are used to serve critical environments.

### Fibre-Free (0.375", R=1.5)

This is an engineered polymer foam insulation (EPFI) that has several interesting properties. Although its surface is textured, Fibre-Free can be easily cleaned if necessary. This material absorbs no moisture and contains an anti-microbial

agent to prevent the growth of mold and fungi. Because it absorbs no moisture, it must be secured using both glue and mechanical fasteners called blind rivets. OSHPD has approved Fibre-Free for use less critical areas of California hospitals and it sometimes used for the most critical areas if air filtering requirements are met. With its modest cost and positive attributes, Fibre-Free can also be used as a general purpose liner for any projects where a non-fiberglass liner is desired.

### UltraLoc (1.000", R=3.9)

This dual wall construction that puts a 22-gauge solid galvanized inner wall over 1.000" dual density fiberglass. Unlike at least one of our competitors, we do not actively promote this liner option. Dual wall construction is costly and has few advantages over other choices. We offer this liner option simply to comply with dual wall requirements.

## FREQUENTLY ASKED QUESTIONS

### Q: What liner meets current LEED requirements?

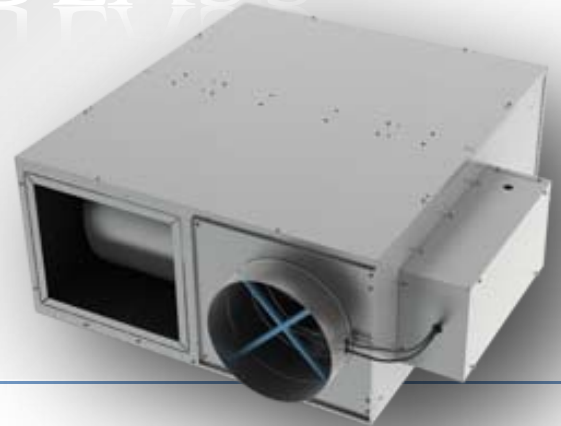
A: All Titus liners are suitable for LEED projects. 'LEED 2009 for New Construction and Major Renovations' includes Indoor Environmental Quality (IEQ) Prerequisite 1 that requires compliance with ASHRAE Standard 62.1-2007 'Ventilation for Acceptable Indoor Air Quality'. This standard states under 'Systems and Equipment' that all airstream surfaces shall meet UL Standard 181 'Standard for Factory-Made Air Ducts and Air Connectors' with regard to resistance to air erosion and mold growth. All Titus liners meet this requirement.

### Q: If I order a DESV with integral attenuator and UltraLoc, what type of liner will I get in the attenuator?

A: The integral attenuator option simply extends the unit casing by 24", so you will get the same UltraLoc liner in the attenuator. UltraLoc lining will prevent the attenuator from providing any sound attenuation, so it will simply add length

# 1" FIBERGLASS

## STERI-LOC



to the unit with no sound reduction.

**Q: What liner would you recommend for low temperature applications?**

**A:** Low temperature systems provide supply air as low as 38°F. Our standard 0.500" fiberglass liner has been independently tested in an environmental chamber and found adequate to prevent condensation with 40°F supply air, 80°F ambient air and 50% relative humidity. It's generally advisable to provide a high R-value lining like 1.000" fiberglass or SteriLoc for extra protection. Other important precautions include designing a ceiling plenum return, limiting outdoor air infiltration and using a 'soft start' on the building to gradually reduce the supply temperature. Experience has shown that when these precautions are taken, low temperature buildings are no more prone to condensation issues than standard buildings.

**Q: Do you still offer Tedlar® linings?**

**A:** DuPont™ Tedlar® is a polyvinyl fluoride (PVF) widely used in the aerospace industry. It is a slow-burning material that offers protection from many types of chemicals. It was used for a short time in the 1980's by many terminal unit manufacturers to cover fiberglass for critical environment applications. Unfortunately, this material was found to breakdown over time when exposed to air velocity. It would eventually delaminate and shred, exposing fiberglass to the air stream. Due to this problem and the fact that it cannot meet current smoke/fire standards, it should never be used inside ductwork.

**Q: We've just started up the equipment in a new building and have observed condensation forming on some of the boxes. Do we have a liner problem?**

**A:** Probably not. New buildings may hold moisture or even have a few doors propped open by movers or construction crews. If the humidity level is higher than normal and any surface temperatures drop below the dew point

temperature, condensation will result. This should stop when the building is sealed tight and begins to dry out.

**Q: Which non-fiberglass liner meets ASTM C1071?**

**A:** Non-fiberglass liners cannot meet ASTM C1071 'Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)' because this is a material-specific standard. This doesn't mean that a given non-fiberglass material isn't suitable for a use as a duct liner. It simply means that the specification needs to be corrected because it contradicts itself.

**Q: With a better understanding of the lining materials, terminology and industry standards it should be easier to decide what liner will meet your customers' requirements.**

**A:** The most important thing to remember is that all Titus liners are suitable for use in LEED projects and meet all applicable industry standards because they comply with UL Standard 181.

I hope you find this information helpful.

**RANDY ZIMMERMAN**