

Introduction:

Shannon Acoustic Blankets are a CAD designed, CNC produced, high-quality pre-engineered insulation system designed to reduce noise levels, minimize insulation maintenance and improve the surrounding work environment. Shannon Acoustic Blankets are weather and chemical resistant. Shannon Acoustic Blankets are flexible, easy to install, remove and reinstall, allowing quick and easy access for serviceability. The key benefit is "Re-Usability".

Applications: Shannon Acoustic Blanket Applications include; Engine Manifolds, Steam Turbines, Mufflers, Expansion Joints, Exhaust Piping, Fittings, By-Pass Piping and Turbo Charger Cases.

Markets: Oil & Gas Industry, Private/Public Utility, Commercial.

Service Temperature: This design is a Thermal/Acoustic Noise Reduction Barrier with a service temperature to 1100°F (593°C).

Acoustic Performance: 4 – 15 DBA Reduction Overall

Finished Surface Mass: 1.7lb/ft² (8.3 kg/m²) to 3.7lb/ft² (18.1 kg/m²)

Blanket Components: The Outer Jacketing consists of a layer of Stainless Steel Type 304 Knitted Wire Mesh .011" Dia. @ 16SF/LB (0.28 mm Dia. @ 3.3 m²/kg) and a layer of 17.0oz/yd² (577g/m²) Silicone Impregnated Fiberglass Cloth. A layer of "Mass Loaded Vinyl 1lb/sf to 2lb/sf Surface Mass (4.9-9.8 kg/m²) is placed under the Silicone Cloth to act as a "Reflector" of noise energy. The inner jacketing consists of a layer of Stainless Steel Knitted Wire Mesh (same as above) on the outside, encasing a layer of 18.0 oz/yd² (611g/m²) Plain Fiberglass Cloth. The Insulation Core Material is a 176.2 11 lb/ft³ (kg/m³) Fiberglass Needled Mat-Type "E" Fiber and will act as an "Absorber" of noise energy. The Fiberglass Mat is encapsulated by the Knitted SS Mesh, Silicone Cloth, Plain Fiberglass Cloth and SS Mesh, then stapled together, producing a "Self Contained Blanket System". The Blanket System includes an Integral Fastener for install & removal. The combination of reflection and absorption will generate given expectations of noise reduction with varying surface mass and varying blanket thickness.

Blanket Construction: Blanket construction shall be a "Stapled Construction". Outer jacket materials will be drawn down, to match at the inner or outer jacket edge. Jacketing will be folded under and stapled with 3/8" (0.95CM) Monel bevel point staples at the outer edge seam. Staples are to follow the inner or outer jacket edge with at most 1" (2.5CM) spacing between staples.

Leak Accommodations: To accommodate a leak and detect its origin, blankets will have a low point stainless steel drain grommet or the design will incorporate a mating seam at the lowest point of the blanket.



Steam Inlet T&T Valve to Steam Turbine

Blanket Insulation Weight: When designing blanket insulation for large equipment where a multi-piece construction is necessary, the total number of pieces will be minimized. Any one piece will not exceed 40lbs (18 kg) in weight.

I.D. Plate: For easy identification and location, a stainless steel or aluminum I.D. Plate tag is riveted to each blanket piece. 1/8" (0.32CM) embossed lettering shows location, description, size, pressure rating, Work Order, Manufacturing Date and Tag Number Sequence. Each blanket will include an ID Plate.

Quilting Pins: To maintain uniform thickness, stainless steel quilting pins @ 14 Gauge (2.5 mm²) will be placed at random locations no greater than 12" (30 CM) apart. Quilting Pins will prevent shifting of the insulation core. Stainless speed washers will secure the quilting pin stem.

Minimized Air Void: Some equipment and equipment heads are a multi-piece design and are installed in tag number sequence. Turbo-Charger Housings, Mufflers, Silencers & Expansion Joints will be designed in sections. Blanket design will conform to the surface with minimized air void.

Blanket Overlap: Blanket will extend beyond mating flanges onto existing insulation for a minimum of 2" (5CM). Where blanket cannot fit over existing oversized insulation, blanket will butt up to existing insulation with a friction fit seam. All surfaces will be insulated, open gaps are not acceptable. Blanket diameters which are 1" (2.5CM) or larger than existing insulation must be end capped to eliminate open air void.

STANDARD FASTENER "WIRETWISTS": A stainless steel wire (0.50 mm²) 20 Gauge, will be doubled up and twisted in a spiral fashion, with a minimum of 5-7 twists per inch (2-3 twists per CM). Wiretwist length will be 16" (40 CM) or longer. The Wiretwist will be secured to the lacing pin at the pin stem. Pin stems will be 2.5 mm² (14 gauge). Wiretwists will be spaced 6" (15CM) on center along closing seams with matching lacing pins to lace and secure to.

Drawing Requirements:

Each blanket insulation project will include an instruction package shipped with the blanket material. This package will include Assembly Drawings identifying piece location, a Material List of all pieces and Instructions for Installation on how Shannon-INSULTECH® will be installed. All blankets are to be CAD designed / CNC produced to assure the highest quality and precise fit.

Drawing Record Keeping:

The correlating Project Production Drawings must be kept on file with the blanket manufacturer. The latest revisions, if any after installation, will be recorded on the CAD file drawing system. This file will be kept for a minimum of ten years to assure accuracy in the ordering of replacement parts.

Project Qualifications:

All items insulated will require a site visit prior to bid submittal. Upon receipt of project contract, each item must be field measured for "Custom Fitting" to existing field conditions. Each item must be tagged and or marked for installation reference. At the time of installation, blankets must have a corresponding tag on the blanket and must match to an existing tag on the fitting. No generic standard blanket designs will be accepted. This will assure a "Custom Fit" design with maximum thermal efficiency.

Project Accuracy & Effectiveness:

Demonstrate the efficacy of precision, through the use of State-Of-The Art CAD Design. The efficacy of precision markings with the ability to maintain a high degree of repetitiveness and control of manufacturing tolerances for locations of I.D. tags, stitch lines, cut lines for stuffing, cutting of jacketing materials and cutting of insulation through the use of State-Of-The-Art CNC cutting systems & software.

Warranty:

We guarantee that all custom manufactured blankets will accommodate vibration probes, gauges, tubing, piping, brackets, etc. and fit correctly for optimum performance as per the design specification provided in the quotation process. In addition, for 18 months we will cover the cost of replacing the blanket should the failure be due to premature degradation of any component utilized in the blanket construction, as well as any defects due to poor workmanship.

Sample Submittal:

Upon bid submittal a blanket design sample must be presented for review and product approval. A 7"x9" (18CMx23CM) Sample will be required and must identify all characteristics mentioned in the above fabrication requirements. Any deviations from the above stated requirements may result in a bid rejection.

Installation Guidelines:

Shannon Acoustic Blankets will follow these guidelines:

- Once material is received, open boxes with care. DO NOT "cut" deep into container to avoid damaging blankets.
- Locate the Instructions for Installation.
- Follow the Material List to determine blanket part number.
- Refer to the Assembly Drawing for orientation of each blanket part number and installation details of each part.
- Locate the Identification Tag on each blanket, for correct description and sequence of blankets.
- Material is installed in tag number sequence.
- Use leather gloves to install material.
- A physical effort is required for proper placement and fit.

Storage:

Once shipment is received, protect Shannon Acoustic Blankets from water damage and/or other abuses prior to installation. Shannon Acoustic Blankets will be shipped in cardboard boxes or crated for export shipping. Packaging is not designed for outdoor storage, thus a tarp or covering of some type is necessary if stored outdoors until installation is completed.

Site Preparation:

Apply Shannon Acoustic Blankets on clean, dry surfaces and avoid trapping oils, greases or combustible materials. Surfaces must be stripped of existing materials.

Blanket Thickness Surface Temperature Reference:

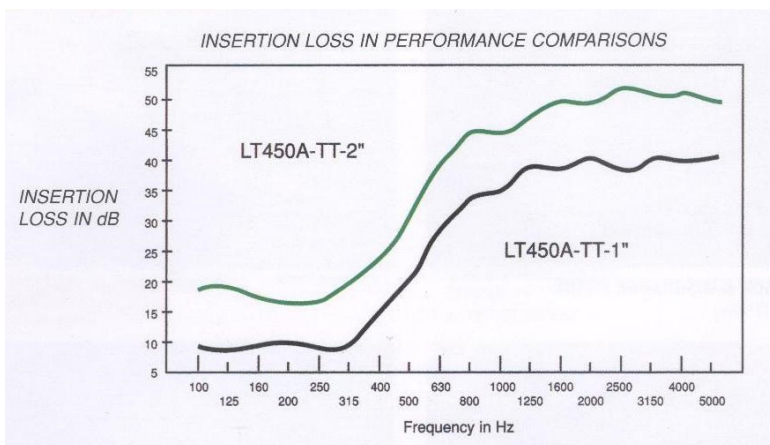
| Operating Temp | Thickness | Surface Temp | Thickness | Surface Temp | Thickness | Surface Temp |
|------------------|--------------|--------------------|--------------|--------------------|--------------|--------------------|
| 371° C (700° F) | 40 mm (1.5") | 69.2° C (156.5° F) | 50 mm (2") | 59.8° C (139.6° F) | 65 mm (2.5") | 53.6° C (128.4° F) |
| 427° C (800° F) | 40 mm (1.5") | 79.2° C (174.6° F) | 50 mm (2") | 68.1° C (154.5° F) | 65 mm (2.5") | 60.7° C (141.2° F) |
| 482° C (900° F) | 40 mm (1.5") | 90.3° C (194.5° F) | 50 mm (2") | 77.2° C (171.0° F) | 65 mm (2.5") | 68.6° C (155.4° F) |
| 538° C (1000° F) | 50 mm (2") | 87.4° C (189.4° F) | 65 mm (2.5") | 77.3° C (171.2° F) | 80 mm (3") | 70.1° C (158.1° F) |
| 593° C (1100° F) | 50 mm (2") | 98.7° C (209.7° F) | 65 mm (2.5") | 87.1° C (188.8° F) | 80 mm (3") | 78.7° C (173.7° F) |

- * The above referenced Cold Face Surface Temperatures should be used as guidelines for blanket insulation thickness design.
- * The Cold Face Surface Temperature of the blanket should approach surrounding ambient temperature conditions.
- * The economic thickness of the blanket should consider blanket cost, thermal performance and blanket design constraints.
- * Heat Loss Calculations are based on a 21.1° C (70° F) ambient temperature using a flat surface condition.

Blanket Thickness to Acoustic Performance:

| Thickness | Surface Mass | Noise Reduction Range |
|--------------|--|----------------------------|
| 1" (2.5CM) | 1.8 lb/ft ² to 2.8 lb/ft ² (8.8-13.7kg/m ²) | 1.5 DBA to 6 DBA Reduction |
| 1 ½" (3.8CM) | 2.2 lb/ft ² to 3.2 lb/ft ² (10.7-15.6kg/m ²) | 4 DBA to 8 DBA Reduction |
| 2" (5CM) | 2.6 lb/ft ² to 3.6 lb/ft ² (12.7-17.6kg/m ²) | 5 DBA to 10 DBA Reduction |
| 2 ½" (6.4CM) | 3.0 lb/ft ² to 4.0 lb/ft ² (14.7-19.5kg/m ²) | 7 DBA to 13 DBA Reduction |

- * The above referenced Acoustic Performance should be used as a guideline for blanket insulation thickness design.
- * The Acoustic Performance of the blanket should be bench marked against the ambient noise condition.
- * The economic thickness of the blanket should be considered in selection of a target reduction with consideration to blanket design constraints.
- * Contact Shannon Enterprises for guidance in selection, as the historical performance of each application varies significantly.



| 107dBA SOURCE | A-WEIGHTED MEASUREMENTS | | LINEAR WEIGHTED MEASUREMENTS | |
|------------------------|--|--|--------------------------------------|--------------------------------------|
| | LT 450A-TT-1" Noise Reduction (in dBA) | LT 450A-TT-2" Noise Reduction (in dBA) | LT 450A-TT-1" Insertion Loss (in dB) | LT 450A-TT-2" Insertion Loss (in dB) |
| Test Frequency (in Hz) | | | | |
| 100 | 8 | 19 | 8 | 18 |
| 125 | 8 | 20 | 7 | 19 |
| 160 | 9 | 17 | 9 | 17 |
| 200 | 9 | 16 | 9 | 16 |
| 250 | 8 | 17 | 8 | 16 |
| 315 | 10 | 20 | 9 | 20 |
| 400 | 14 | 24 | 14 | 23 |
| 500 | 21 | 30 | 20 | 30 |
| 630 | 28 | 39 | 27 | 39 |
| 800 | 34 | 44 | 33 | 44 |
| 1000 | 35 | 44 | 34 | 43 |
| 1250 | 38 | 46 | 37 | 46 |
| 1600 | 37 | 49 | 36 | 49 |
| 2000 | 38 | 48 | 38 | 48 |
| 2500 | 37 | 51 | 36 | 51 |
| 3150 | 40 | 50 | 39 | 50 |
| 4000 | 39 | 49 | 38 | 50 |
| 5000 | 41 | 49 | 40 | 49 |

With the following listed Noise Reductions measured in the A-Weighting, the total Noise Reduction from the 107 dBA loudspeaker level over a 100-5000Hz frequency band would be: 20.8 dBA for design LT 450A- TT-1" Thickness and 29.5 dBA for design LT 450A- TT-2" Thickness.

The above data is representative of Test Procedure ASTM E1222-87 for the Laboratory Measurement of the Insertion Loss of Pipe Lagging Systems.

Shannon makes no warranties express or implied concerning the performance results of the Shannon-INSULTECH® Acoustic Blanket Insulation and shall be held harmless by the user and its agents for any damages whether direct or consequential that may arise from use of such information.

Product Properties Specifications:

Insulation Core: "Absorber" - Standard Specification for Fiberglass Needled Fiber Felt Thermal Insulation
ASTM C 1086-88 "Absorber" - Maximum Service Temperature Up to 649°C (1200°F)
ASTM E 90-90 "Reflector" - Test Method for Measurement of Airborne Sound Data/Transmission Loss
"Reflector" - Acoustic Barrier – Barium Sulfate Loaded Vinyl (0.5 to 1.5 PSF)

Jacketing Materials: **Outer Layer:** Stainless Steel Type 304 Knitted Wire Mesh
.011" Dia. @ 16ft² /lb (.28 mm Dia. @ 3.3 m²/KG)
(Installed on the inner Jacket on the outer layer and on the outer Jacket outer layer)
Outer Layer: Silicone Fiberglass Composite Material weight 577g/m² (17.0 oz/yd²)
Silicone & Fiberglass Respective Continuous Service Temperature 249°C (480°F)
Tensile Strength of Jacketing: Warp: 3128 N/50 mm (350 lbs/in) / Fill: 2681 N/mm (300 lbs/in)
Inner Layer: Plain Fiberglass Fabric – Material Weight 18.0 oz/yd² (611g/m²)
Continuous Service Temperature 1000°F (538°C)
Inner Layer: Stainless Steel Type 304 Knitted Wire Mesh
.011" Dia. @ 16ft² /lb (.28 mm Dia. @ 3.3 m²/KG)

INSULTECH® Blanket Design Testing:

| | |
|-------------------------|---|
| ASTM C 335 | Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation. |
| ASTM E 1222 – 90 | Standard Test Method for the Laboratory Measurement of the Insertion Loss of Pipe Insulation - USA |
| ISO 15665 | Standard Test Method for the Laboratory Measurement of the Insertion Loss of Pipe Insulation – Int'l |
| ASTM C 1045 – 07 | Standard Practice for Calculating Thermal Transmission Properties under steady state conditions |
| UL 1709 | Standard Fire Test of Protection Materials for MOV / Structural Steel |
| ASTM E-84-17 | Surface Burning Characteristics of Building Materials (Flame Spread & Smoke) |
| ASTM E-136 | Combustion Characteristics of Building Materials / Fire Test Response |
| ASTM D3787 | Burst Strength Evaluation for ASTM F1138 – Spray Shield Compliance |

Caution: Typical industry handling practices should be exercised for the protection of the worker. Worker should wear long-sleeved, loose-fitted clothing, head covering, leather gloves, eye protection and appropriate respiratory protection (as required) when handling and applying INSULTECH® material. Wash with soap and cold water after handling INSULTECH® material. Wash work clothes separately and rinse washer. For specific handling practices, refer to the product MSDS sheets for the Thermal Blanket System.

Notes: The chemical and physical properties of Shannon-INSULTECH® Thermal Blanket represent typical average values determined in accordance with accepted test methods. The data is subject to normal manufacturing variations and is supplied as a technical service subject to change without notice. In addition, test data are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes. Design Guidelines are as follows: to access the true limitations of this recommended design, refer to the technical data for each product component. Following these guidelines will produce the highest achievable service life. Blanket design quality can be reduced or enhanced by changing any one component. If a question arises regarding deviations from those stated guidelines, or to insure the information is most current please contact your regional representative or call Shannon. Enterprises direct.