Energy Savings…..Noise Reduction…..Safety…..Sustainability

Shannon
GLOBAL ENERGY SOLUTIONS

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

IDEA2019
The Energy for More Resilient Cities

Mechanical Insulation

Best Practices For District Energy

Objectives:

1.) Best Approach

2.) Best Practices

3.) Standards Applied

4.) Standards Compliance

5.) Maintenance Program

6.) Life Cycle Costing

Application is the Key

Recommendations for Specific Areas

Boiler Rooms – Steam & Hot Water

Fiberglass Pipe Covering

(Aluminum/Stainless Steel Jacketing)

Low Labor Cost / Low Material Cost / Easy to Install

Easy to Damage / Must Be Protected with Robust Jacketing

Mineral Wool Pipe Covering

(Aluminum/Stainless Steel Jacketing)

Low Labor Cost / Low Material Cost / Easy to Install

Easy to Damage / Must Be Protected with Robust Jacketing

Calcium Silicate

(Aluminum/Stainless Steel Jacketing)

High Labor Cost / Low Material Cost / Hard to Install

Very Robust Density/ Must be Jacketed / Dusty / Thermal Cracks with Time

Recommendations for Specific Areas

Boiler Rooms *– Steam & Hot Water*

Fiberglass Pipe Covering

(The Most Cost Effective / The Most Vulnerable)

(Aluminum/Stainless Steel Jacketing)

Low Labor Cost / Low Material Cost / Easy to Install

Easy to Damage / Must Be Protected with Robust Jacketing

Recommendations for Specific Areas

Boiler Rooms *– Steam & Hot Water*

Mineral Wool Pipe Covering

(Aluminum/Stainless Steel Jacketing)

Low Labor Cost / Low Material Cost / Easy to Install

Easy to Damage / High Dust-Free Floating Fibers / Must Be Protected with Robust Jacketing

Recommendations for Specific Areas

Boiler Rooms *– Steam & Hot Water*

Calcium Silicate

(Aluminum/Stainless Steel Jacketing)

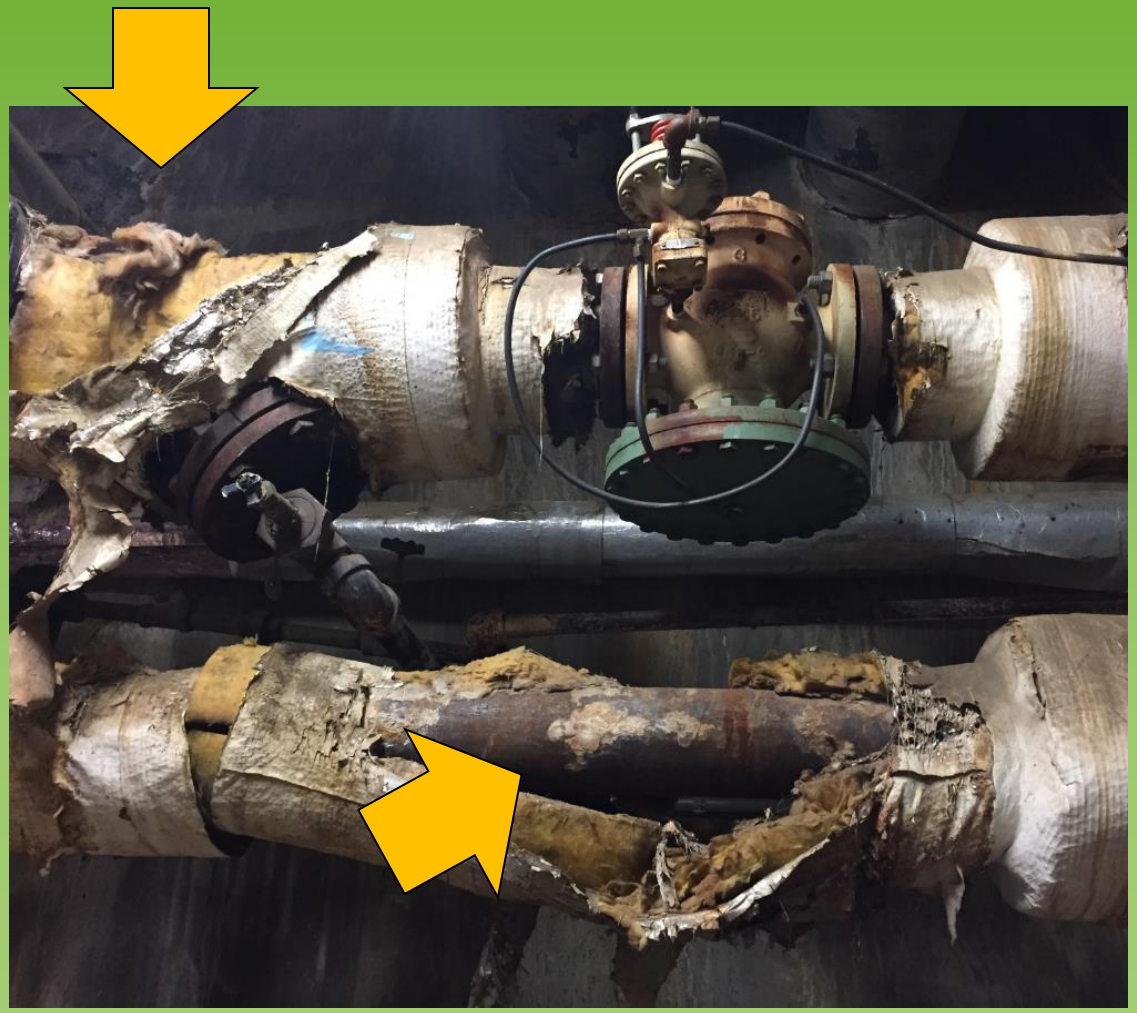
High Labor Cost / Low Material Cost / Hard to Install & Field Fabricate (Saw)
Very Robust Density/ Must be Jacketed / Dusty / Thermal Cracks develop with Time

Advantages & Disadvantages

Product	K Factor	R Factor	Temp Range	Installation	Thermal Performance	Barrier	Durability
Fiberglass	.23	4.35	+850F	Easy	Good	Required	**Poor**
Mineral Wool	.25	4.00	+1200	Messy	Good	Required	**Poor**
Calcium Silicate	.38	2.63	+1200	Difficult Dusty	Good	Required	**Great**
Elastomeric Foam (Armaflex)	.28	3.57	+300	Easy	Poor	Required	**Good**

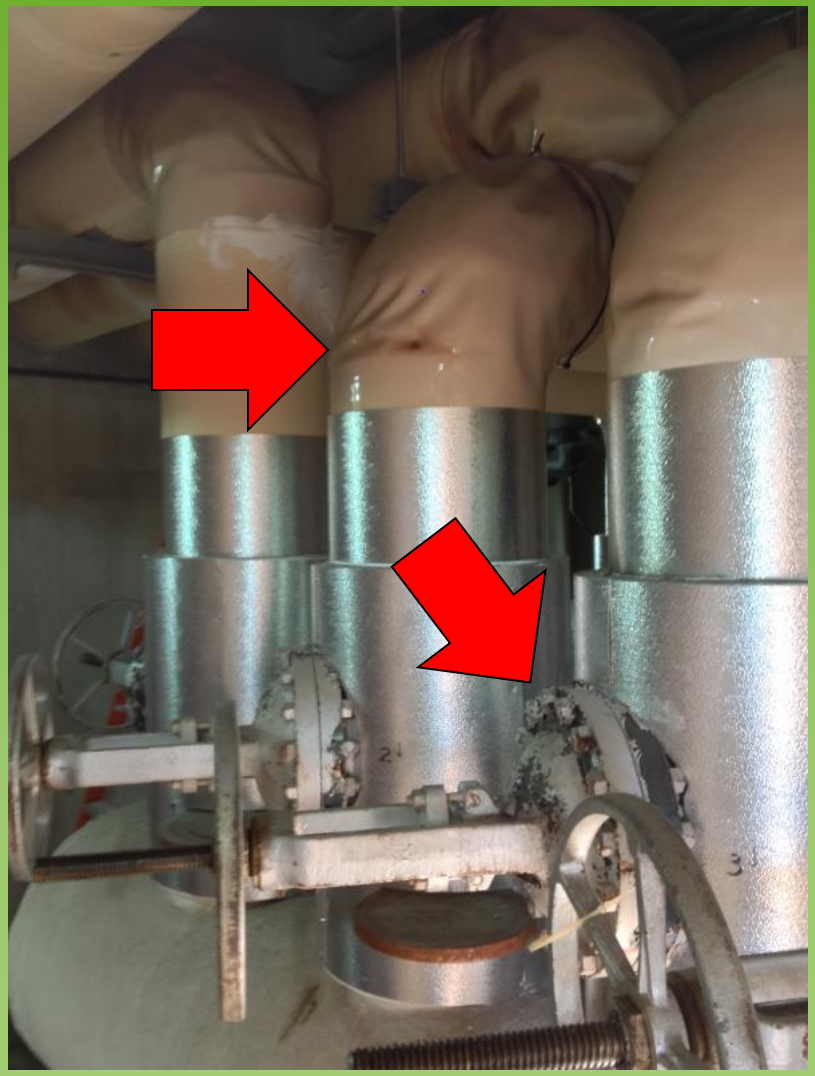
All materials require skilled labor for install & repair.
All materials require jacketing/barrier for protection.
All materials are vulnerable to flooding/saturation.
"Only" Calcium Silicate can be walked on.
Once removed……the repairs are costly!

How Do We Manage the System?



Inspection
Service
Repair
Tear It Out
Step on It
Ignore the Repair

PVC Jacketing/Barrier Materials are Vulnerable to Heat



This Mechanical Room experienced elevated temperature, Gate Valve Bonnets left uninsulated, created source heat enough to “Melt” the PVC

Fiberglass Pipe Covering & Aluminum Jacketing – Design: LT650-CONV-FG-ALJ

Introduction
INSULTECH® Thermal Systems incorporate multiple component insulation materials on a steam or process piping system. The system components are a conventional applied insulation material for all stationary components in the steam system which will not require any need for removal. The complex applications, namely areas requiring inspection or easy access and removal will have an INULTECH® Blanket. The multiple material approach will allow for maximum thermal efficiency, easy access and long term durability.

Common Applications
INSULTECH® Thermal Blanket Applications include; Steam Process Gate & Globe Valves, Pressure Reducing Valves, Strainers, Flanged Fittings, Pressure Reducing Stations and Complex Surface Geometry Equipment. All flange connections will include INSULTECH® Blanket. INSULTECH® Thermal Systems Conventional Material will be applied to all in-line welded Piping, equipment, Fittings and Elbows.

Markets
Include; Institutional and Industrial Steam Systems, Boiler Rooms and District Heating, Cogeneration Power Plants & Steam Utility users.

Maximum Service Temperature
This design is to act as a Thermal Barrier with a maximum service temperature of 650°F (343°C).

INSULTECH® Thermal Systems Components
Fiberglass Pipe Insulation
- One piece, 36" long hinged sections open to fit pipe.
- Heavy density resin bonded inorganic glass fibers.
- Fiberglass SSL II pipe insulation is jacketed with all-service (ASJ) vapor retarder and comes with factory applied Doublesure, double pressure sensitive longitudinal adhesive closure system and butt strip seals for a positive closure.
- UL Classified for Surface Burning Characteristic (FHC 25/50).
- Thermal Conductivity – 300 F = 0.35 btu in / hr F
- 1.5" & 2" Thickness

Aluminum Corrogated Roll Jacketing
- Aluminum Sheet @ 0.016" Thickness.
- Complys to ASTM B-209 Standards
- Specify: Smooth, Stucco Embossed or Corrugated Finish.
- Jacketing has a Polysurlyn Moisture Retarder. The retarder prevents galvanic or chemical corrosion at the metal-insulation interface.
-

Form LT650-CONV-FG-ALJ
Effective 5-2011

Aluminum Elbow & Fitting Covers
- ITW Insulation Systems Aluminum Sure Fit or Ell-Jac® Insulation Covers made in two each half sections.
- Smooth Finish @ 0.16" Thickness.
- 7/16" circumferential overlap at closing joints.
- Conforms to ASTM C-450 & ASTM C-585.

Banding
½" Wide x 0.20" Thickness Type 304 Stainless Steel Banding applied along all pipe covering at most 10" O.C. Banding will be "Blue" Color Coded to identify as "Non-Asbestos"

Caulking
All exposed joints are to be caulked using DuPont Manufactured Silicone / Aluminum Caulk.

Screws
Self Tapping – Type 410 - #8 x ¼" Stainless Steel Screws Whitney Punched Outer Cover to Inner Cover. All screws will use a ¼" nut driver for installation.

Aluminum Endcaps
All Terminal Ends of Pipe Covering & Aluminum Jacketing will have Aluminum Metal Endcaps. Using a 0.016" Thickness Aluminum matched in 2 each ½ Sections.

Overlapping & Matchups
Conventional Material Overlaps
All Aluminum Pipe Covering Jacketing will have a circumference overlap of 2". All end to end seams will include a 3" overlap of jacketing.

Blanket Insulation Matchups
Pipe insulation terminal ends will allow for proper blanket insulation transitions. Blankets will overlap onto pipe insulation a minimum of 2"-5". Butt seams are acceptable if the pipe insulation O.D. is larger than the blanket insulation O.D.

Follow **"Best Practices"**

Apply **Specification Standards**

Use a "Universal Standard"

Manage the System !

Pay Attention to the “Un-Insulated”

Treat All surfaces !

Manage the system, regardless of what materials are applied

Recommendations for Specific Areas

Manholes

Steam Vapor, Carbonic Acid Corrosion, Flooding

These Materials are Vulnerable to Flooding

Fiberglass Pipe Covering
Mineral Wool Pipe Covering
Calcium Silicate

These Materials are NOT

Foamglass (Cellular Glass)
PTFE Thermal Blanket Insulation

Recommendations for Specific Areas

Manholes (Option 1)

Foam Glass Cellular Glass

(Aluminum/Stainless Steel/Pittwrap Jacketing)

High Labor Cost / High Material Cost / Hard to Install & Field Fabricate

Robust Density/ Must be Jacketed / Thermal Cracks develop with Temperature

Recommendations for Specific Areas

Manholes (Option 2)

PTFE Thermal Blanket

Low Labor Cost / High Material Cost / Easy to Install (Integral Fasteners)
Robust Density/ Robust Jacketing/ Accommodates “Carbonic Acid & Flooding”

Follow **"Best Practices"**
Apply **Specification Standards**
Use a "Universal Standard" throughout your facility
Demand a Warranty & Manage the System !

Simple Spec® (Copy Paste Format)

Thermal Blanket Design: LT550LFP-M (LT288C-LFP-M)

Applications: Shannon Thermal Blanket Applications include; Valves, Flanges, Pumps, Expansion Joints, Drip Legs, Piping, Equipment and Complex Surfaces that otherwise are left untreated. "Confined Space" applications with high temperature, steam vapor & flooding.

Service: **Service:** Steam & Hot Water Systems subjected to Carbonic Acid "Non-Vented" Atmospheres. **Manhole Applications**

Maximum Service Temperature: 288˚C (550˚F)

Purpose: Shannon Thermal Blankets are a CAD designed /CNC produced, high quality pre-engineered insulation system designed to save energy, retain radiant heat, minimize insulation maintenance and improve the surrounding work environment. Shannon Thermal Blankets are weather and chemical resistant. Shannon Thermal Blankets are flexible and easy to install, remove and reinstall allowing quick access and easy equipment serviceability. The key benefit is "Re-Usability".

Blanket Components: The Outer and Inner Non-Porous Jacketing is a 459 g/m² (13.5 oz/yd²) 100 percent PTFE Laminate. The Insulation Core Material is a 176.2 kg/m³ (11 lb/CF) **Fiberglass Needled Mat** - Type "E" Fiber. The Fiberglass Mat is encapsulated by the PTFE Jacketing and sewn together, producing a "Self-Contained Blanket System", highly corrosive resistant. The Shannon Blanket System includes Integral Fasteners for install & removal.

Blanket Construction: Blanket construction shall be a **"Double Sewn"** lock stitch with a minimum 5 stitches per inch (2 stitches per CM). All raw jacket edges will have a tri-fold PTFE Teflon® Laminate binding. No raw cut jacket edge will be exposed. Stitching will be pure Teflon® 3-Ply thread. **No "On-Site Fabrication" to assure high quality.**

ID Plate: For easy identification and location, a stainless steel or aluminum name plate tag is riveted to each blanket piece.

Design Approach: Thermal Blankets will be custom fit to match each specific component geometry. "Generic Designs" are not acceptable. Thermal Blankets will be a self-contained insulation system with an integral fastener to allow for easy access, removal and re-installation.

Blanket Weight: Any one piece will not exceed 40lbs (18 KG) in weight.

Blanket Overlap: Thermal blanket will extend beyond the mating flange onto existing insulation for a minimum of 2" (5CM). Fitting sizes 6" or more must have a minimum 4" (10CM) overlap. Open gaps are not acceptable.

Leak Accommodations: To accommodate a leak and detect its origin, blankets will have a low point stainless steel or brass drain grommet or the design will include a low point blanket seam.

CAD / CNC Requirement: Thermal Blanket Insulation will require CAD Drawing Submittals to assure accuracy of design. Upon receipt of project contract, each item must be field measured, tagged and "Custom Fitted" to assure a quality fit and finish. All blankets are to be CAD designed / CNC produced to assure the highest quality, precise fit and electronic CAD filing retrieval for future replacement.

Manufacture Origin: Blanket & Blanket Components must be made in the U.S.A.

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/inch (3-4 twists/CM). Wiretwist length will be 16" (40CM) 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.

FASTENING OPTIONS:

FASTENING OPTIONS:

2.) Stainless Steel Double "D" Ring Strap

A 1.5"(3.8CM) wide LFP composite 20 mil thick Strap 4-3/4" (12CM) overall long stationary strap is folded with two 1.5"(3.8CM) in width stainless steel "D" rings heat sealed to the outer surface of the jacket. This is placed ½" (1CM) from the closing seam edge. The pull down strap, minimally 14" (36CM) long, of the same material is heat sealed to the outer jacket 3" (4.8CM) in from the closing seam edge. Both matching straps are spaced along the closing seam edge no greater than 8" (20CM) apart. All closing seams have a 1.5"(3.8CM) extended LFP flap, which is placed along the stationary strap side of the closing seam.

3.) Non-Metallic Side Release Buckle and Strap

The blanket fasteners will be 1 1/2" Delrin Side Release Buckles with 1.5"wide LFP composite 20 mil thick Straps. The Buckle strap will be a minimum of 5-1/2" long and will be heat sealed to the outer surface for a minimum of 5" in length. A matching pull strap will also be heat sealed on the outer jacket surface and will match up to the Buckle Strap. The pull strap will be a minimum of 14".

Blanket Thickness Surface Temperature Reference:

Operating Temperature	Thickness	Surface Temperature	Thickness	Surface Temperature	Thickness	Surface Temperature
121˚ C (250˚ F)	25 mm(1")	37.9˚ C (100.2˚ F)	40 mm(1.5")	33.3˚ C (92.0˚ F)	50 mm (2")	30.8˚ C (87.4˚ F)
149˚ C (300˚ F)	25 mm(1")	42.6˚ C (108.6˚ F)	40 mm (1.5")	36.8˚ C (98.2˚ F)	50 mm (2")	33.5˚ C (92.3˚ F)
177˚ C (350˚ F)	25 mm(1")	47.3 ˚C (117.2˚ F)	40 mm (1.5")	40.3˚ C (104.6˚ F)	50 mm (2")	36.3˚ C (97.4˚ F)
204˚ C (400˚ F)	25 mm(1")	52.2˚ C (126.0˚ F)	40 mm (1.5")	44.0 ˚C (111.2˚ F)	50 mm (2")	39.3 ˚C (102.7˚ F)
232˚ C (450˚ F)	25 mm(1")	57.2 ˚ C (135.1˚ F)	40 mm (1.5")	47.8 ˚C (118.0˚ F)	50 mm (2")	42.3 ˚C (108.2˚ F)
260˚ C (500˚ F)	25 mm(1")	62.5˚ C (144.5˚ F)	40 mm (1.5")	51.7 ˚C (125.1˚ F)	50 mm (2")	45.5 ˚C (113.9˚ F)
287.8˚ C (550˚ F)	25 mm(1")	67.9˚ C (154.2˚ F)	40 mm (1.5")	55.8 ˚C (132.4˚ F)	50 mm (2")	48.9 ˚C (119.9˚ 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.

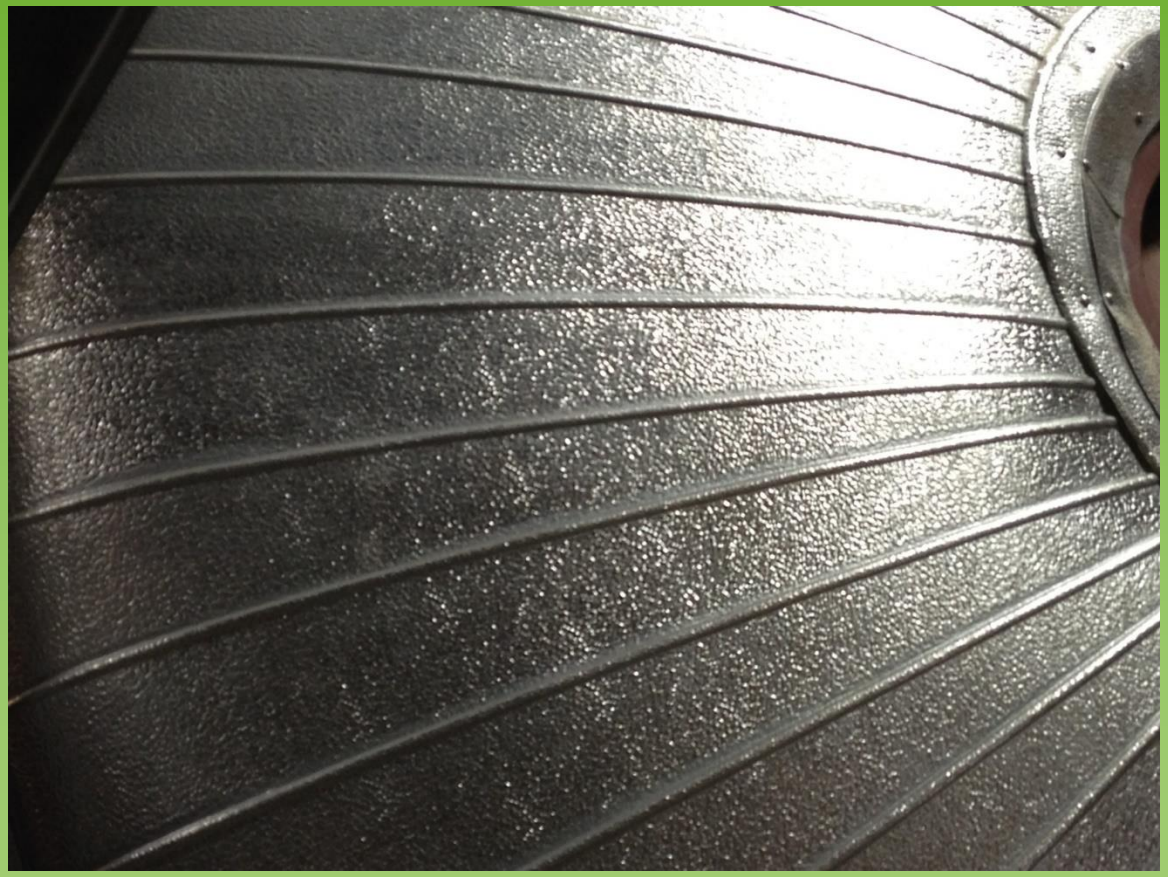
* The economic thickness of the blanket should consider blanket cost, thermal performance and blanket design constraints.

* Heat Loss Calculations are based on a 21.1˚ C (70˚ F) ambient temperature using a flat surface condition.

Formats: CSI – 3 Part, CSI – 10 Part (Submittal), Simple Spec

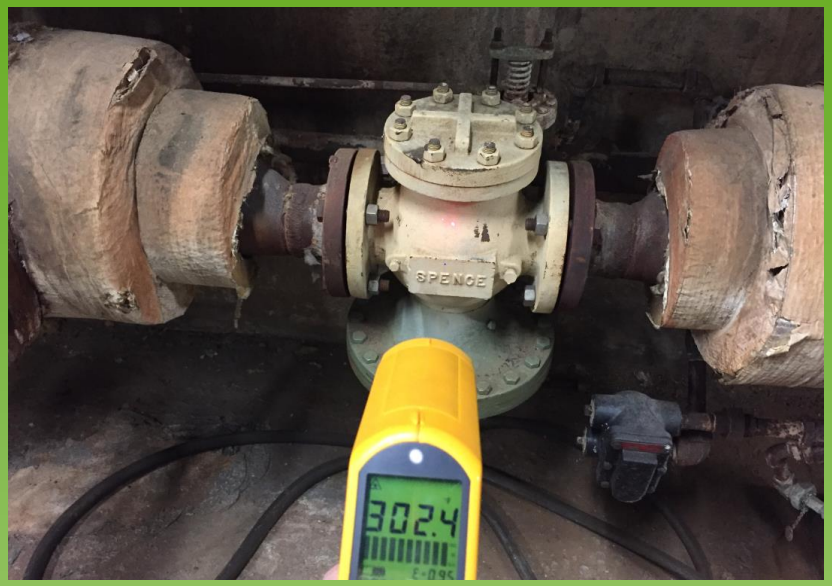
Sourcing “Does Not Work” without design standards

Conventional Insulation & Jacketing Material Applied Correct, will last for many years



The New Opportunity:

Areas where Conventional Insulation cannot be used



Most Systems are a History of Neglect

- Conventional Insulation is applied.
- Insulation is removed (Inspection, Service, Repair)
- Insulation is never “Re-Installed”.
- Flanged Fittings, Complex Surfaces remain untreated.
- The result is a large radiant surface area.
- The result is WASTED ENERGY !
- Most WASTED ENERGY is fittings, not pipe.
- Gate Valves, Control Valves, Strainers, Flanges

Conventional Insulation - Challenges

- Complex Surface Conditions.
- Quick Access is Needed.
- Each removal requires re-insulation.
- Conventional may not hold up to the field condition (Flooding, Steam Leaks).
- Re-insulating is not cost effective over time.
- Logistics with hiring a contractor with each reinstall is too difficult.

- **End Result is a neglected surface condition !**

Compare the Cost/Benefits

(Remove & Re-Install just 1 time)

Conventional Insulation Vs. INSULTECH Thermal Blankets

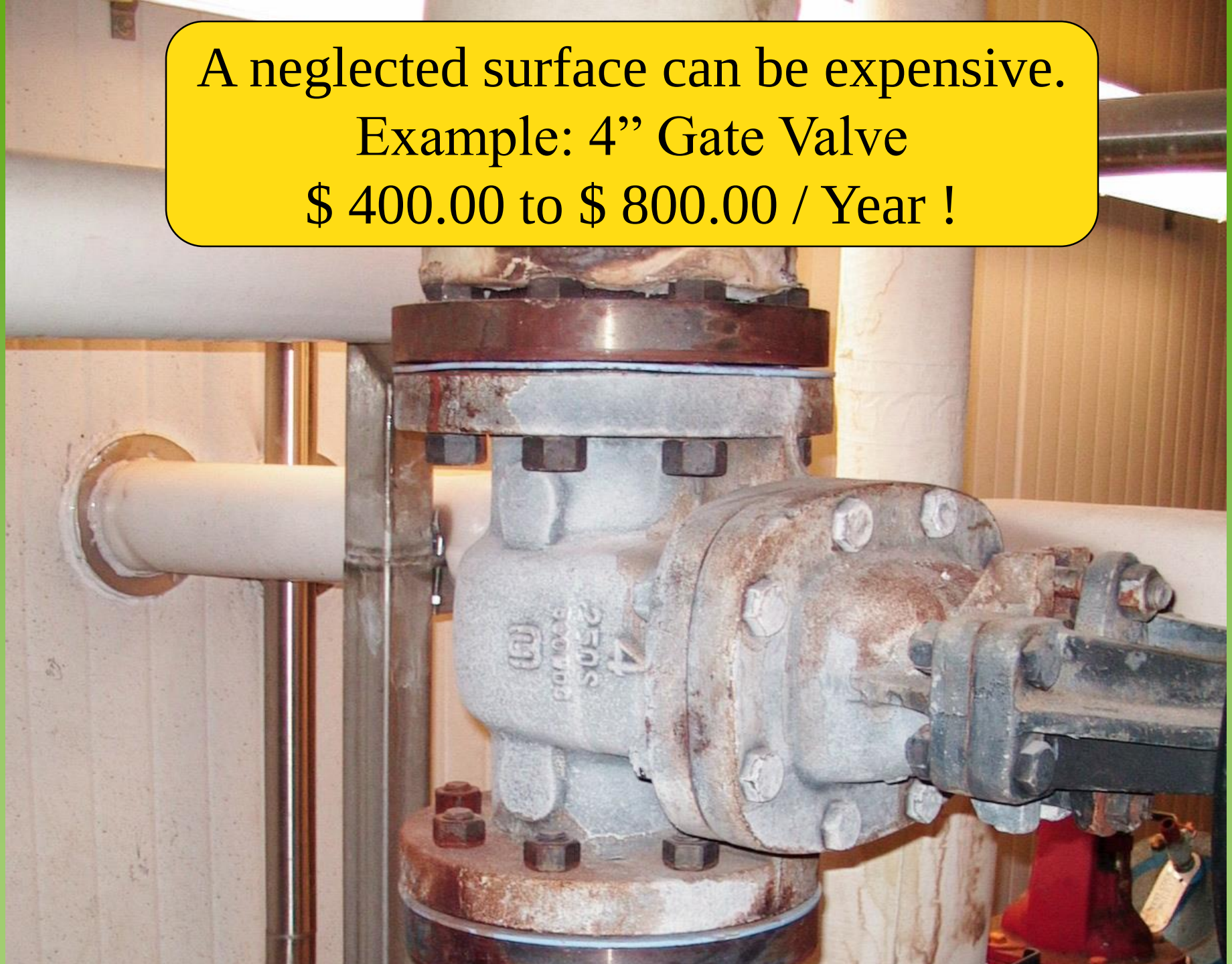
Components	Conventional Insulation		INSULTECH Thermal Blanket
Outer Jacketing	0.016" Corrugated Aluminum		Silicone Fiberglass Cloth
Insulation	3" Thick Calcium Silicate		2" thick Fiberglass Mat
Inner Jacketing	NONE		Plain Fiberglass Cloth Stainless Steel Wire Mesh
Material Cost	Jacketing Calcium Silicate (6 linear feet) TIW Wool (Packing) Fibrous Adhesive Misc. (screws, wires, etc.)	$144.00 $119.00 $5.00 $11.00 $15.00	
Total Material Cost		$294.00	$485.00
Labor Cost	1 each man day @ $35.00/hr.		1 each man day @ $35.00/hr.
Total Labor Cost		$280.00	$35.00
Total Install Cost		**$574.00**	**$520.00**

Life Cycle Costing

Insulation Approach	Timeline	Removal # Times Removed	Cost	Cost of Removal	Re-Installed?	Cost Outcome Net Present Value
Conventional Insulation	15 Years	1 Time Then Left Bare	$ 576.00	$ 27.00	No	($10,849)
Conventional Insulation	15 Years	Removed & Re-Insulated Each Year	$ 576.00	$ 27.00	Yes	$ 8,506
Conventional Insulation	15 Years	Removed & Replaced w/Blanket	$ 576.00	$ 27.00	Yes	$ 10,253
Blanket Insulation	15 Years	Removed & Re-Installed Each Year	$ 576.00	$ 27.00	Yes	$ 10,335

* Most Cost Effective to Use a Blanket if Removal & Access is Necessary

If There is a Flange Break or Valve…Apply Blanket


A neglected surface can be expensive.
Example: 4” Gate Valve
$ 400.00 to $ 800.00 / Year !

Sample Savings – Bare Valves

Fuel Cost $ 17.63 / 1000# Steam / 350 F Temp.

Valve Size	Cost Bare	Cost Insulated	Annual Savings
10” 150# Gate Valve	$ 2,121.00 / Year	$ 148.00 / Year	$ 1,973.00 / Year
8” 150# Gate Valve	$ 1,574.00 / Year	$ 109.00 / Year	$ 1,465.00 / Year
6” 150# Gate Valve	$ 1,174.00 / Year	$ 82.00 / Year	$ 1,092.00 / Year
4” 150# Gate Valve	$ 813.00 / Year	$ 57.00 / Year	$ 756.00 / Year
2 ½” 150# Gate Valve	$ 547.00 / Year	$ 39.00 / Year	$ 508.00 / Year

Compare Valve SF to Pipe SF

Gate Valve Size	Gate Valve SF	Pipe Size (IPS)	Equal LF of Pipe
10” 150# Gate Valve	15.9 SF	10” IPS - Pipe	5.9 LF Piping
6” 150# Gate Valve	8.8 SF	6” IPS - Pipe	5.2 LF Piping
2 ½” 150# Gate Valve	4.1 SF	2 ½” IPS Pipe	5.7 LF Piping

The Surface Area is Compelling !

- 10 each 10” 150# Gate Valves = 59 LF Pipe
- 20 each 6” 150# Gate Valves = 104 LF Pipe
- 30 each 2 ½” Gate Valves = 171 LF Pipe

- 60 each Bare Fittings = 334 LF Bare Pipe
- 600 Bare Fittings = 3,340 LF
- 1600 Fittings = 8,896 LF

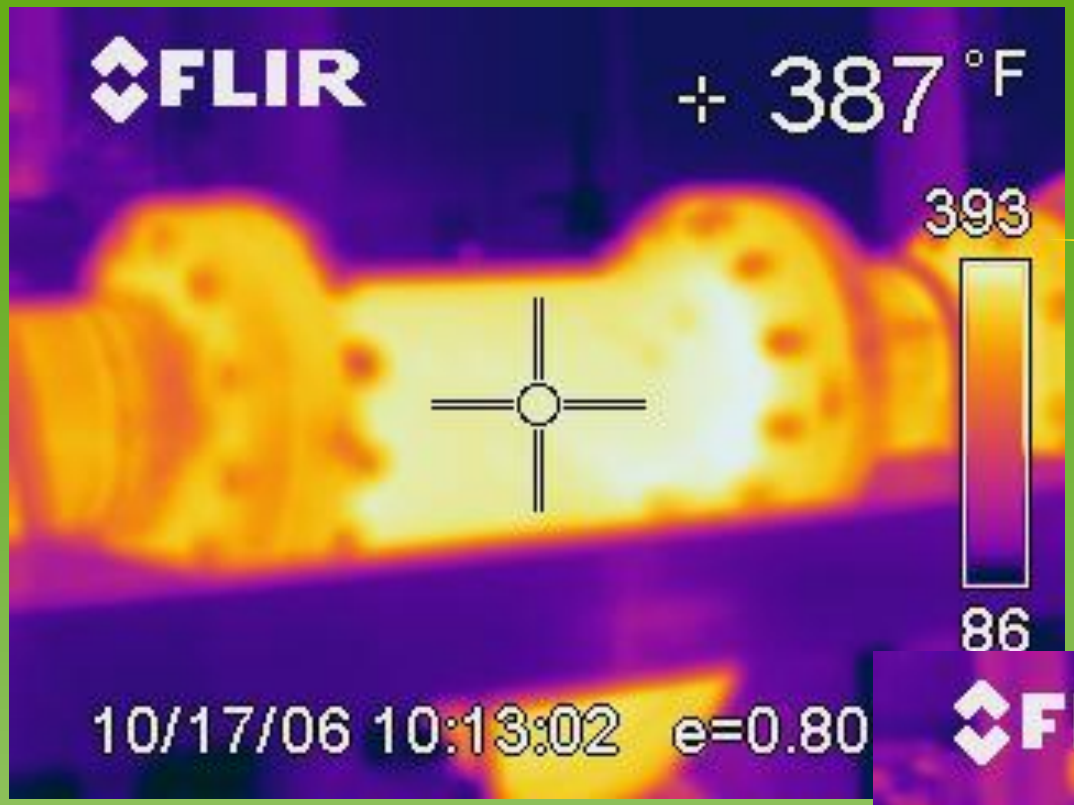
If it was bare piping, it would be insulated !

Pay Attention to the “Un-Insulated”

Treat All surfaces !

Manage the system, regardless of what materials are applied


Common Theme !



Before

After

Energy Surveys define

Performance and Savings !

Track the Steam System Capture Opportunities

The Energy Survey captures Temperature

Energy Survey Services

Valve / Fitting count of “Bare” items.

“Laundry List” is created.

“Walk Through” of the system.

Infrared Gun is used to obtain surface temperatures.

Survey includes all major “Hot Surfaces”.

Each fitting is marked or tagged for identification.

Typical Energy Survey

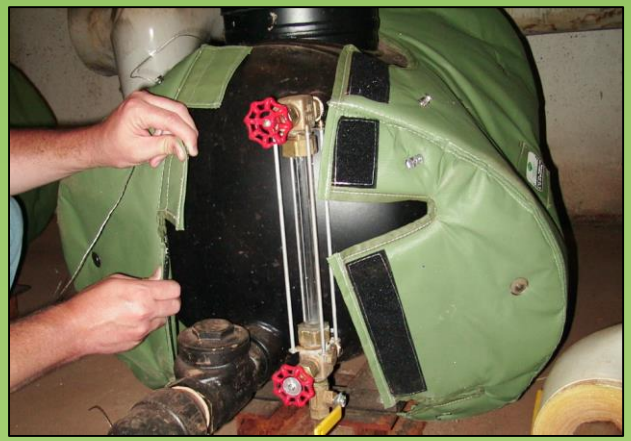
(Captures Bare Flanged & Threaded Fittings)

95% Thermal Blanket & Heat Shield Insulation

5% Conventional Insulation (Must Conventional Insulation is Mantained)

Energy Survey Summary	
Total Heatloss - Bare (BTU/Year):	8,518,801,379.73
Total Heatloss - w/ INSULTECH® (BTU/Year):	1,165,185,392.54
Heatloss Savings - w/ INSULTECH® (BTU/Year):	**7,353,615,987.20**
Total Therm Savings - w/ INSULTECH® (Therms/Year):	73,553.81
Gallons of Water Saved (Gal./Year):	882,433.92
Total Annual Operating (Steam Cost) - Bare:	$115,003.82
Total Annual Operating **(Steam Cost)** - w/ INSULTECH®:	$15,730.00
Annual (Steam Cost) Savings - w/ INSULTECH®:	**$99,273.82**
*** Lifetime (Steam Cost) Savings (15 Yrs):**	**$1,311,215.44**
Total Cost (INSULTECH® Blanket System):	$129,401.80
Installation (By Shannon) :	$48,490.00
Total Cost:	**$177,891.80**
Payback (Months):	20
Number of Fittings:	373

You Can Treat…
Complex Surfaces



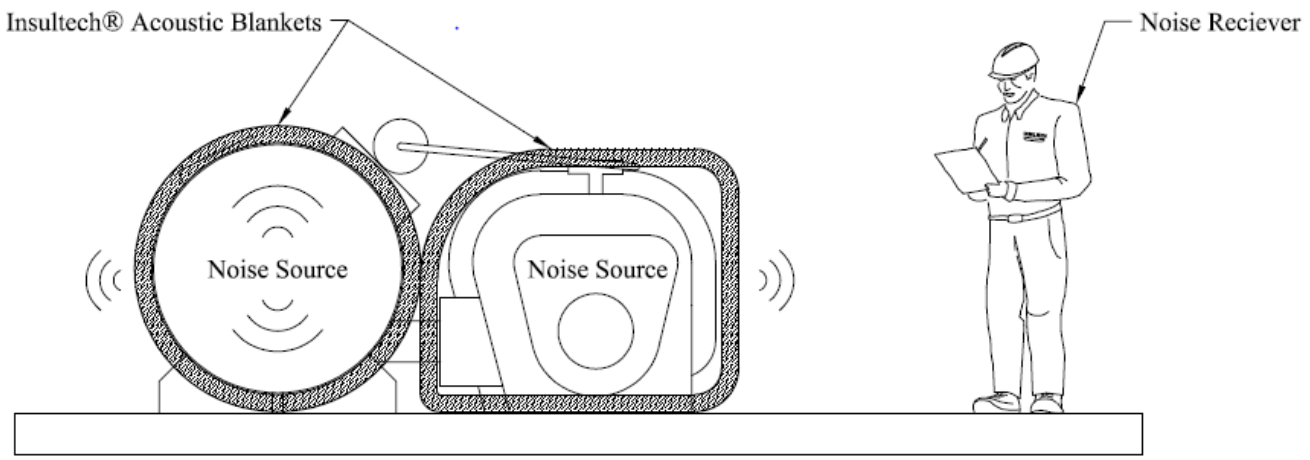
Noise Reduction

Addressing Radiant Sound Energy
Approaches
Design Options

Treat the Source

Direct Treatment - Wrap

1. Treat sound source directly on the source surface.



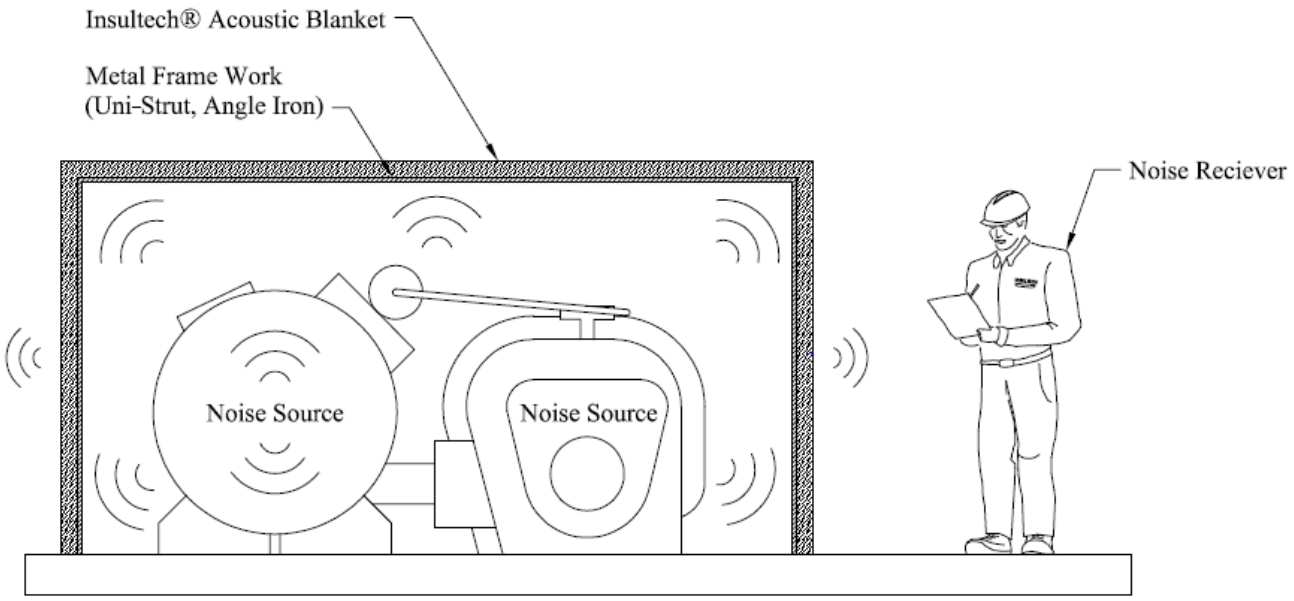
* Method most typical for an Acoustic Blanket.
* Insultech® Acoustic Blankets follow the source surface; absorbing and reflecting sound energy.
* Insultech® Acoustic Blankets are custom designed to match surface geometry.

Treat the Path

Option #2 - "Attack The Path"

Free Standing Enclosure - Panel System

2. Use an Insultech® Acoustic Blanket, custom built around supporting framework.



* The enclosure will trap sound energy by reflection and absorption & will maximize efficiency by eliminating complex geometry.
* Insultech® Acoustic Blankets are custom designed to match a self supporting frame, decoupled from the noise source.
* Design treats component source as well as overall ambient sound energy.

Recommendations for Specific Areas

Mechanical Room Noise / HVAC

Ambient Noise Challenges

Complex Surface Geometry

Clearance & Access Issues

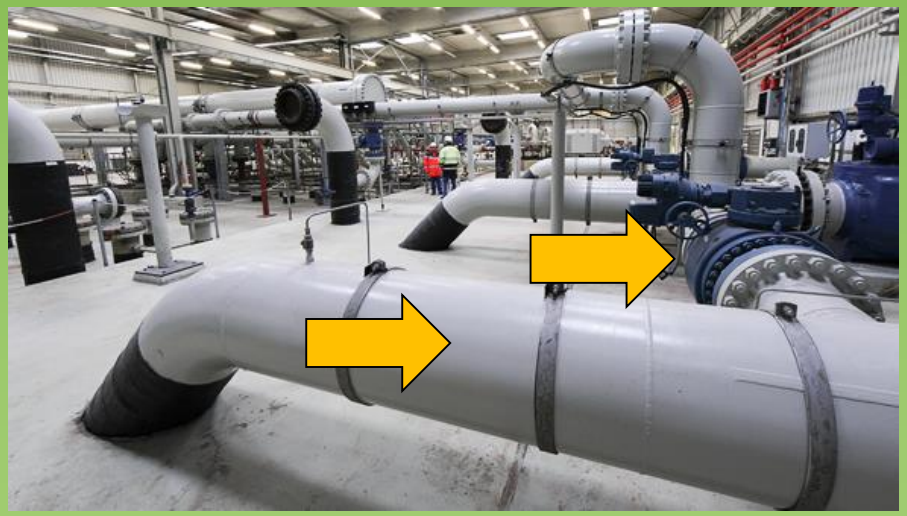
Conventional Insulation vs Acoustic Blankets

Recommendations for Specific Areas

Conventional Insulation

Difficult to apply to complex surfaces

Components: High Density Insulation/Mass Loaded Vinyl/Jacketing
(Easy for Pipe)



Best Practices

Easy Surfaces (Pipe, Flat Surfaces….Use Conventional)

Complex Surfaces (Compressors, Fans, Pumps….Use Acoustic Blanket)

Direct Surface Treatment

Enclosure Treatment

Apply Acoustic Blanket Standards…Available
Driven by: Application, Temperature, Field Condition

Simple Spec® (Copy Paste Format)

Acoustic Blanket Design: LT250A-VP (LT121C-A-VP)

Applications: Shannon Acoustic Blanket Applications include; Compressor Housings, Motors, Blowers, Rotary Chillers, Gear Boxes, Valves, Piping and Fittings, Pump Housings and Fan Housings.

Service: This design is to act as a Thermal/Acoustic Noise Barrier addressing "Radiant Noise"

Maximum Service Temperature: 250˚F (121˚C)

Purpose: Shannon Acoustic Blankets are a CAD designed, CNC produced, high quality, 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".

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)

Product Components: Outer/Inner Jacketing – 18.0oz/yd² (611g/m²) **Vinyl Coated Polyester Cloth**. Mass Loaded Vinyl "Reflector" – 1.0lb/ft²-2.0lb/ft² (4.9kg/m²-9.8kg/m²). Insulation Core "Absorber" - 11lb/ft³ (176.2 kg/m³) **Fiberglass Needled Mat**-Type "E" Fiber. The Fiberglass Mat is encapsulated by the Outer/Inner Jacketing and sewn together, producing a "Self-Contained Blanket System". The Blanket System includes Integral Fasteners for install & removal.

Blanket Construction: Blanket construction shall be a **"Double Sewn"** lock stitch with a minimum 7 stitches/inch (2.8 stitches/CM). Blanket edges will have a tri-fold Vinyl Polyester cloth binding. No raw cut jacket edge will be exposed. Stitching will be Nylon or Polyester thread. **No "On-Site Fabrication" to assure high quality.**

ID Plate: For easy identification and location, a stainless steel or aluminum name plate tag is riveted to each blanket piece.

Design Approach: Blankets will be custom fit to match each specific component geometry. "Generic Designs" are not acceptable. Blankets will be a "Self-Contained" insulation system with an integral fastener to allow for easy access, removal and re-installation.

Blanket Weight: Any one piece will not exceed 40lbs (18 kg) in weight.

Blanket Overlap: Blanket will extend beyond the mating flange onto existing insulation for a minimum of 2" (5CM). Fitting sizes 6" (15cm) or more must have a minimum 4" (10CM) overlap. Open gaps are not acceptable.

Leak Accommodations: To accommodate a leak and detect its origin, blankets will have a low point stainless steel/brass drain grommet or the design will include a low point blanket seam..

CAD / CNC Requirement: Acoustic Blanket Insulation will require CAD Drawing Submittals to assure accuracy of design. Upon receipt of project contract, each item must be field measured, tagged and "Custom Fitted" to assure a quality fit and finish. All blankets are to be CAD designed / CNC produced to assure the highest quality, precise fit and electronic CAD filing retrieval for future replacement.

Manufacture Origin: Blanket & Blanket Components must be made in the U.S.A.

SELECT YOUR: FASTENER

WIRETWIST / Velcro® Vinyl Flap: Fabric Extended Jacketing Flaps with an integral Mass Loaded Vinyl are secured by the utilization of Hook/Loop (Velcro®) fasteners. A 2" (5cm) wide section of the (Velcro®) Hook will be stitched to the outer surface of the blanket. A 2" (5cm) wide section of the (Velcro®) Loop will be aligned and stitched on the mating inner surface of an extended 2"(5cm) Mating Seam or 2 ½"(6.4cm) Closure Seam Jacketing Flap.

A stainless steel wire 20 Gauge (0.5 mm Dia.) will be doubled up and twisted in a spiral fashion, with a minimum of 5-7 twists/Inch (2-3 twists/cm). Wiretwist length will be 16" (40 cm). The Wiretwist will be secured to the lacing pin at the pin stem. Pin stems will be 14 gauge (2.5 mm2). Wiretwists will be spaced at most 6" (15 cm) on center along closing seams with matching lacing pins for securement.

Optional Fasteners:

1.) Lacing Pins - Stainless Steel Type 304 Lacing Pins. These pins will be 14 gauge. Location of pins on the blanket will be 2" (5cm) or more from blanket edge and 8" (20cm) or less from centerline to centerline along the blanket edge.

2.) Optional: Metal "D" Ring Strap with Velcro Tab: A three layer fabric strap is double sewn. One strap is a 12" (30CM) long pull-down strap, the other is a 3" (8CM) long stationary strap. Both straps are stitched to the outer jacketing of the blanket. The stationary strap includes a metal "D" Ring measuring 1"-1.5" wide (2.5-3.8CM). This is placed ¼" (1.25CM) from the closing seam edge. The pull-down strap is placed 2" (5CM) in from the closing seam edge. Both matching straps are spaced along the closing seam edge no greater than 6" (15CM) apart. The pull-down strap includes hook-and-loop Velcro®, measuring at least 1" (2.5CM) wide by 5" (12.7CM) long, and is perimeter stitched to the strap surface. All closing seams have a 1.5" (3.8CM) extended fabric flap, which is placed along the stationary strap side of the closing seam.

Blanket Design Warranty: Blankets will accommodate vibration probes, gauges, tubing, piping, brackets, etc. and fit correctly for optimum performance as p… design specification provided in the quotation process. In addition, for 18 months thermal blanket manufacturer will cover the co… cing the blanket should the failure be due to premature degradation of any component utilized in the blanket construction, as w… any defects due to poor workmanship.

SELECT YOUR: Thickness, Surface Mass & Noise Reduction Range

Thickness	Surface Mass	Noise Reduction Range
1" (2.5CM)	1.8 lb/ ft² to 2.8 lb/ ft² (8.8-13.7kg/m²)	1.5 DBA to 6 DBA Reduction
1 ½" (3.8CM)	2.2 lb/ ft² to 3.2 lb/ ft² (10.7-15.6kg/m²)	4 DBA to 8 DBA Reduction
2" (5CM)	2.6 lb/ ft² to 3.6 lb/ ft² (12.7-17.6kg/m²)	5 DBA to 10 DBA Reduction
2 ½" (6.4CM)	3.0 lb/ ft² to 4.0 lb/ ft² (14.7-19.5kg/m²)	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.**

The End