

Aircraft Thermal Acoustical Insulation Systems

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**Federal Aviation
Administration**



Background of Thermal/Acoustical Insulation Flammability Testing

- Requests from industry (via Int'l Aircraft Materials Fire Test Working Group)
- Swiss Air MD-11 Accident (Sept. 1998)
- Prior incidents in China, Italy, Copenhagen, US, and others

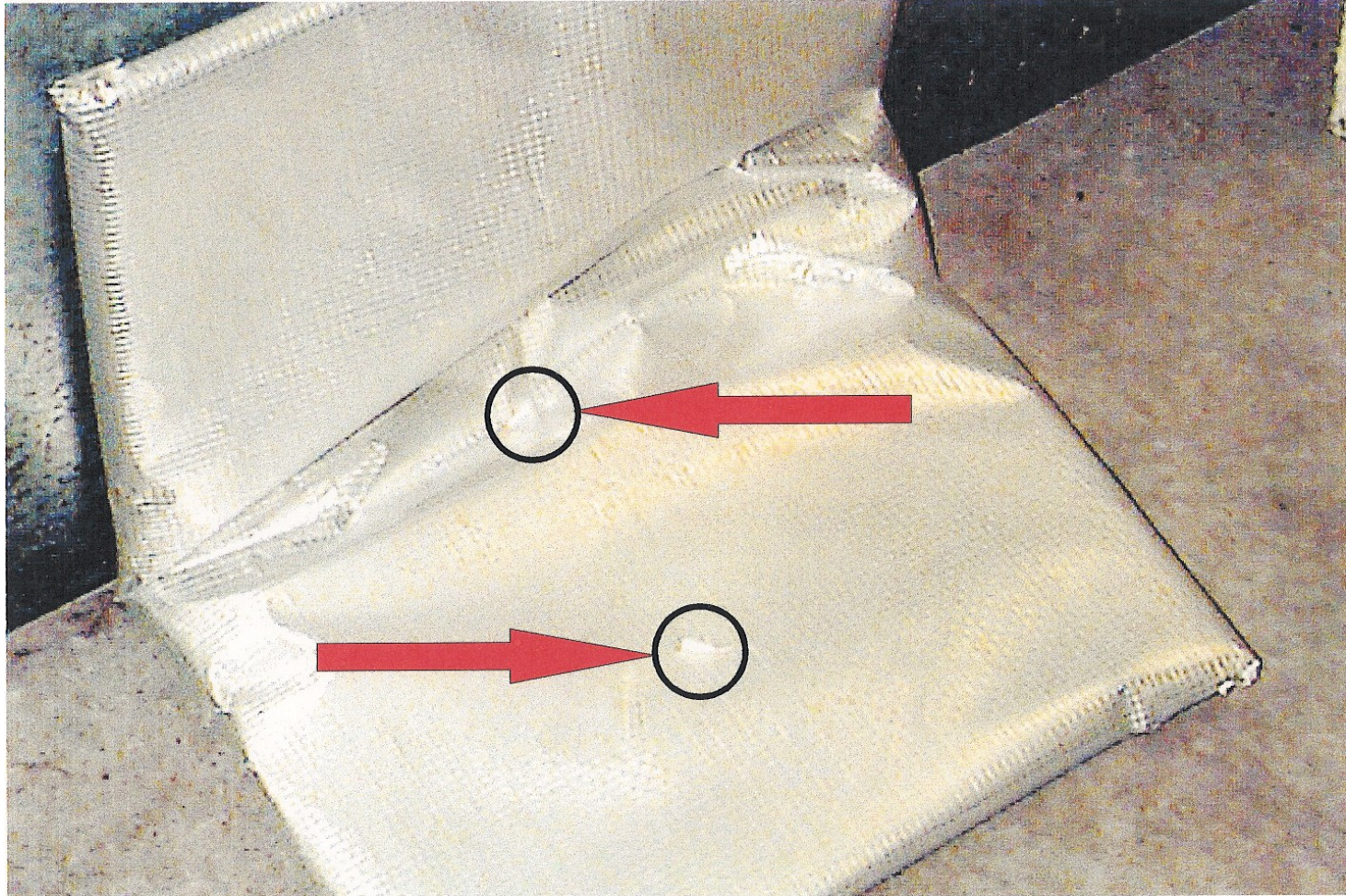


Flammability Testing

- Round Robin Testing included:
 - Vertical Bunsen Burner Testing
 - Cotton Swab Testing (developed internally by Boeing) ... *picture to follow ...*
 - DOT/FAA/AR-97/58 summarizes the results of these tests.
- Electrical Testing: 115-208 Volts, 400 Cycle; performed at FAA Tech. Center

Flammability Testing

Cotton Swab Testing



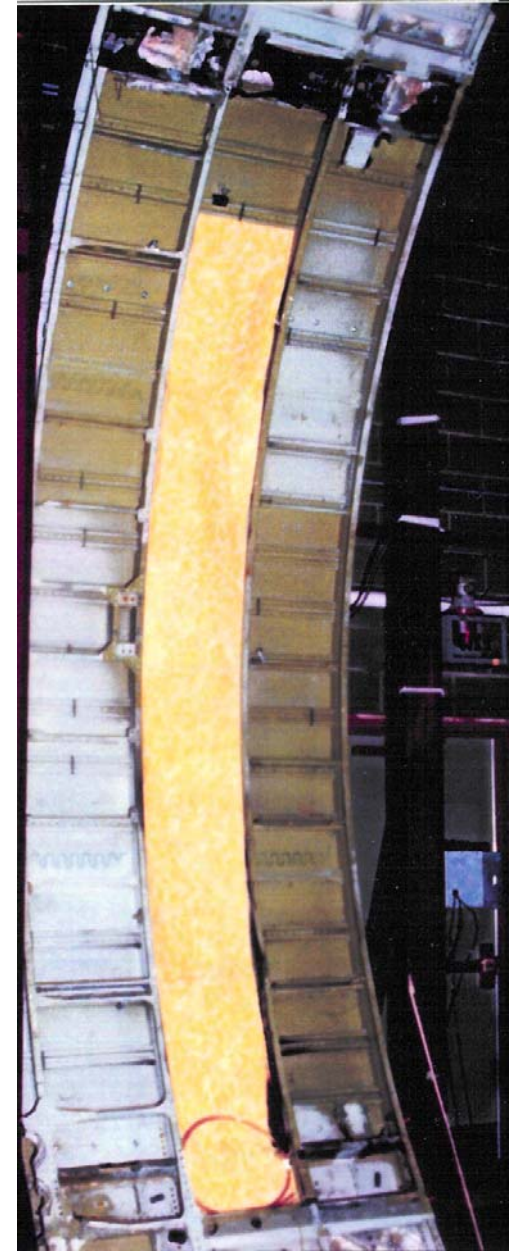
Electrical Testing

- Electrical Testing: 208 Volts, 400 Cycle, 3-Phase
- DC-10 Test Shell – Test Article
- Short circuit (hard faults) resulting in circuit breakers tripping and intermittent (ticking faults) no tripped breakers.
- Current overloads (excessive heating) beyond rated temperature of the wire insulation.
- Test new samples and contaminated (dirty) samples.



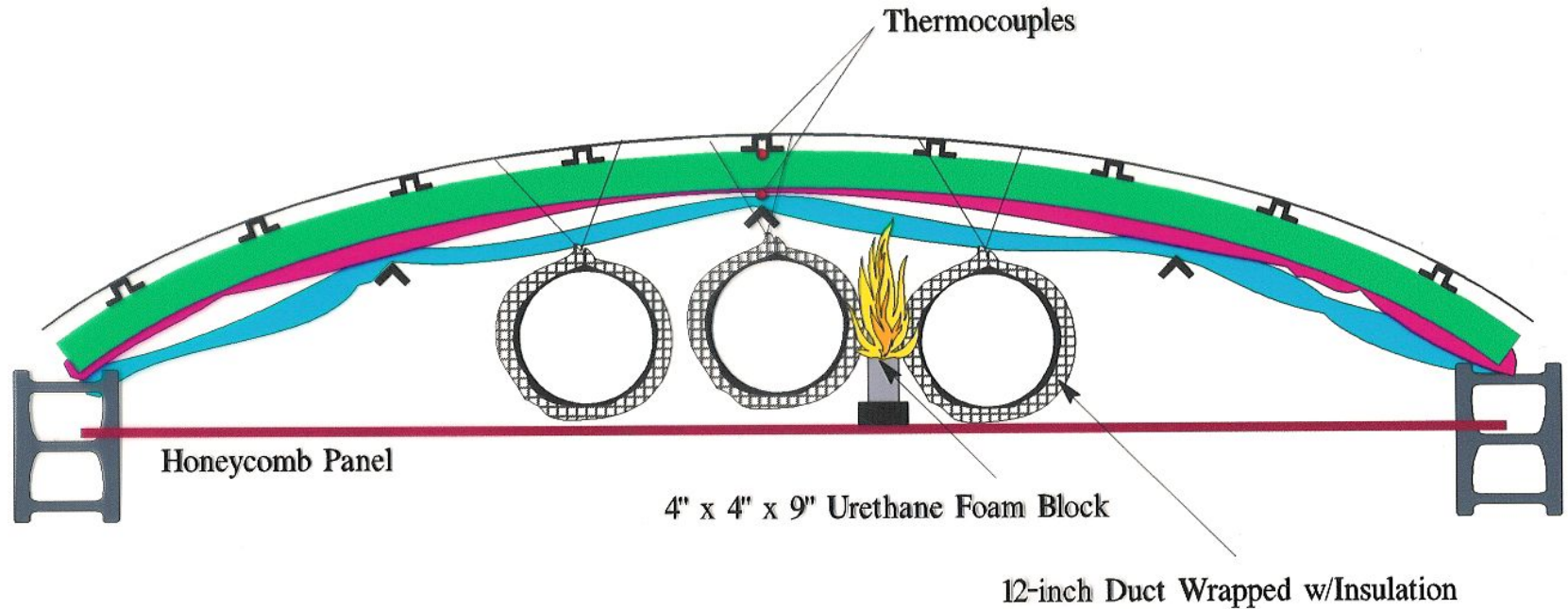
Electrical Testing

Test Rig



Intermediate Scale Test

Attic Mock-Up Tests



 Between Frame Blanket

 Over Frame Blanket

New Standard

- The new standard, Test Method to Determine the Flammability and Flame Propagation Characteristics of Thermal/Acoustical Insulation Materials.
- This standard utilizes a radiant heat source and a small pilot flame ignition source.



New Standard



Thermal Acoustical Insulation Materials

- An example of four materials that must meet the rule:
 - Tapes
 - Hook and Loop
 - Damping Systems
 - Blanket Heaters

Thermal Acoustical Insulation Tapes

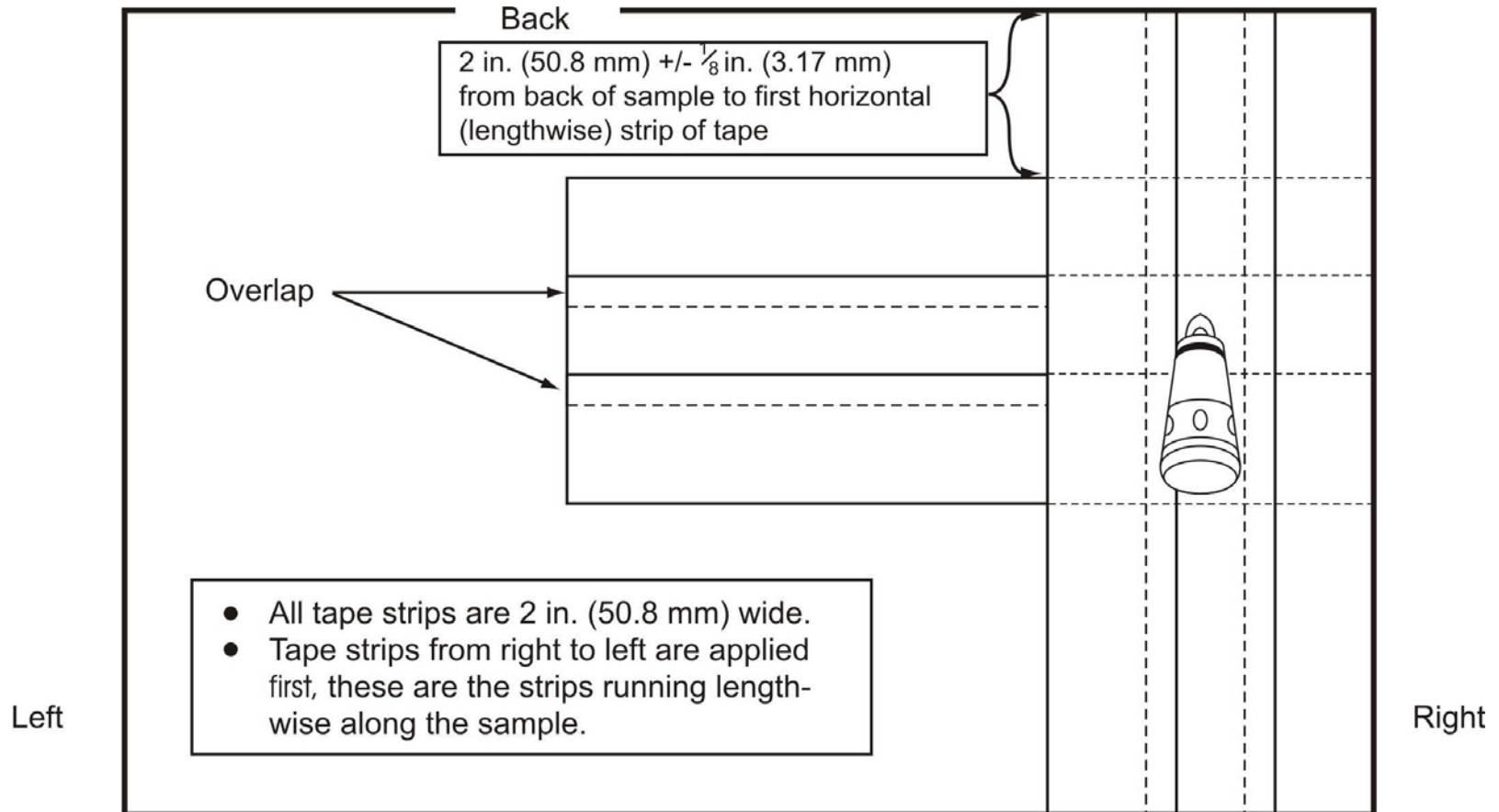
- Widespread use.
- Applications:
 - Fabrication and installation of new blankets.
 - Tape and film cover are the same.
 - Repair in the after market.
 - Tape and film cover combination may differ.

Thermal Acoustical Insulation Tapes

- Various widths of tapes are used; i.e., 2 inch, 3 inch, 4 inch, etc.
- No standard applies to the tape used in aftermarket repair applications.



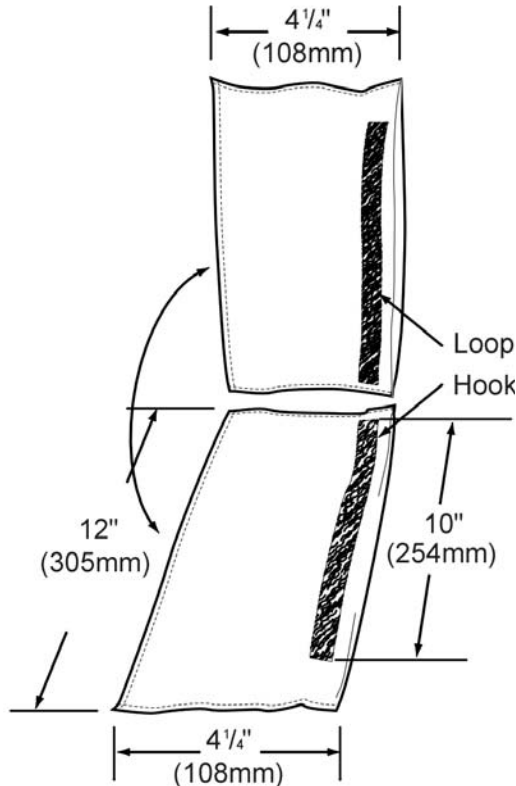
Thermal Acoustical Insulation Tapes



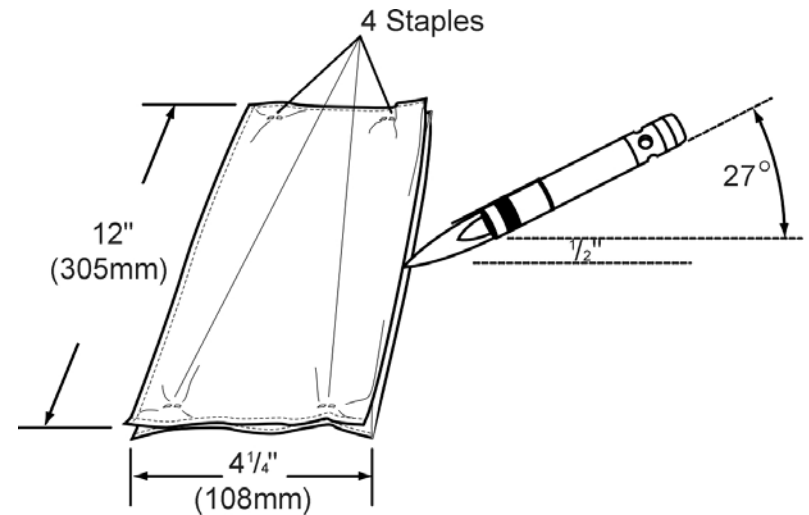
Hook and Loop

- Hook and loop strips are generally designed into a thermal acoustical insulation blanket rather than added during installation.
- Precludes the use of other attachment means such as clips or tapes at installation.
- Preferred fastener for parts that need to be accessed regularly.

Hook and Loop Configurations



Open Test Sample



Closed Test Sample

Hook and Loop

- The small test blankets with the hook and loop strips attached are an acceptable sample configuration that can characterize the flammability of the hook and loop strips.

Definition of Damping Systems

“The dissipation of vibratory energy to suppress structure-borne radiated noise.”



Damping Systems

- Various thicknesses of materials used (sandwich constructions)
- Weakest link appears to be the PSA (adhesion to the aircraft skin)
- Led to decision to test at interface of the damping system adhesive layer and piece of sheet metal (simulate aircraft skin) in Radiant Panel Test Apparatus
- Sample size and sample placement is similar to mated hook and loop samples
- Requires build up to achieve correct height for flame impingement (using Kaowool™ M boards)

Damping Systems

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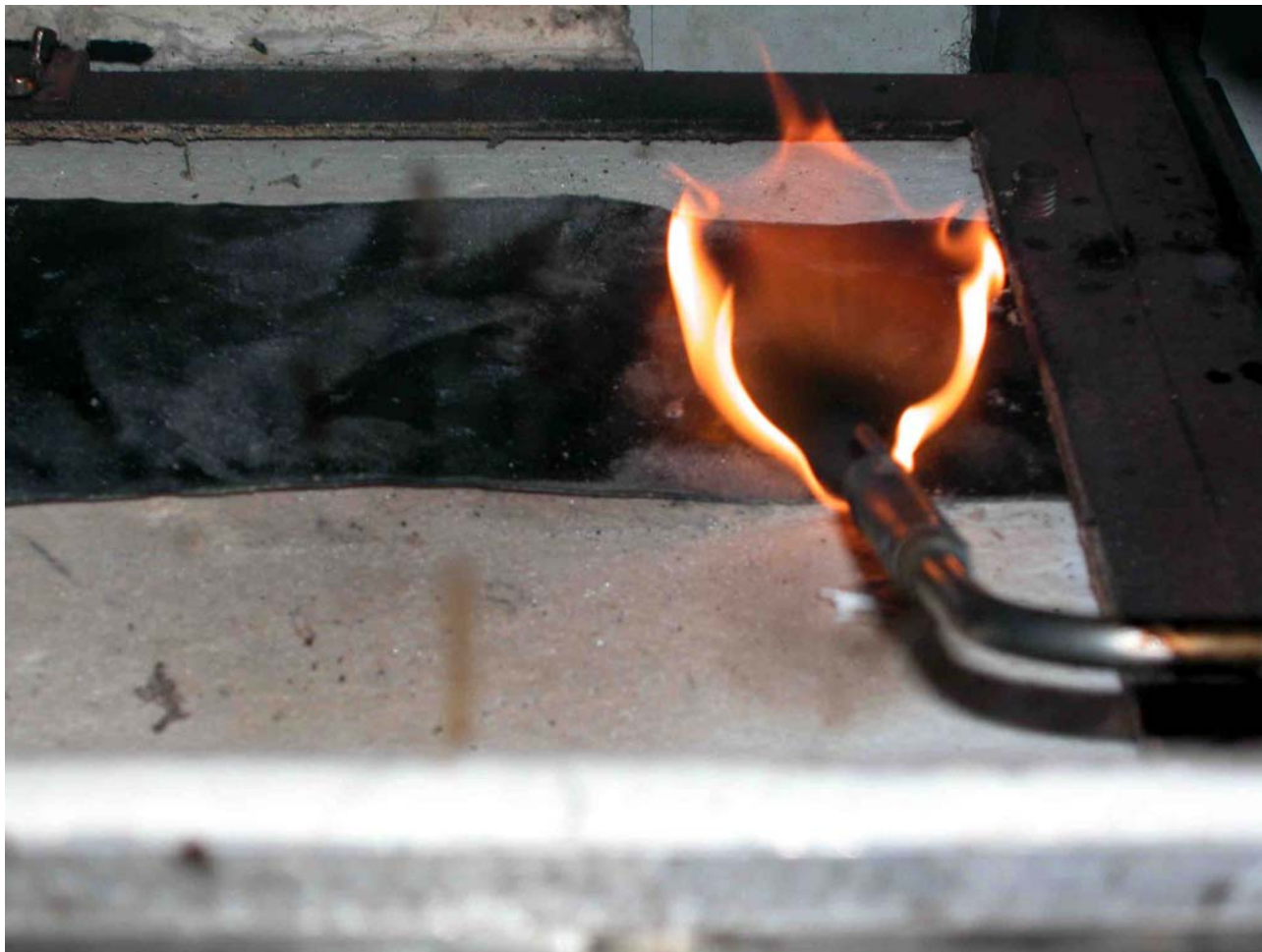
Damping Systems

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Damping Systems

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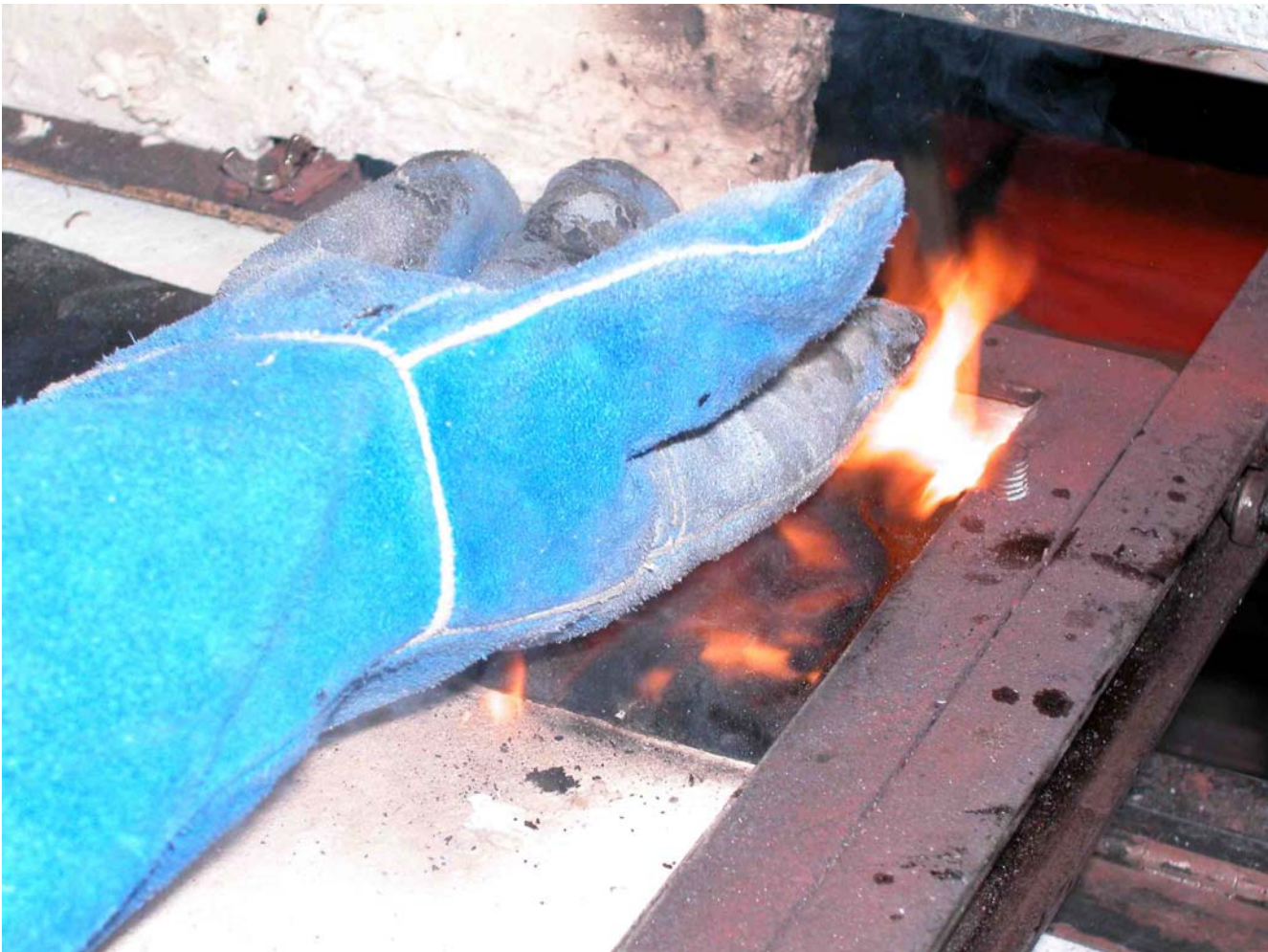
Damping Systems

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Damping Systems

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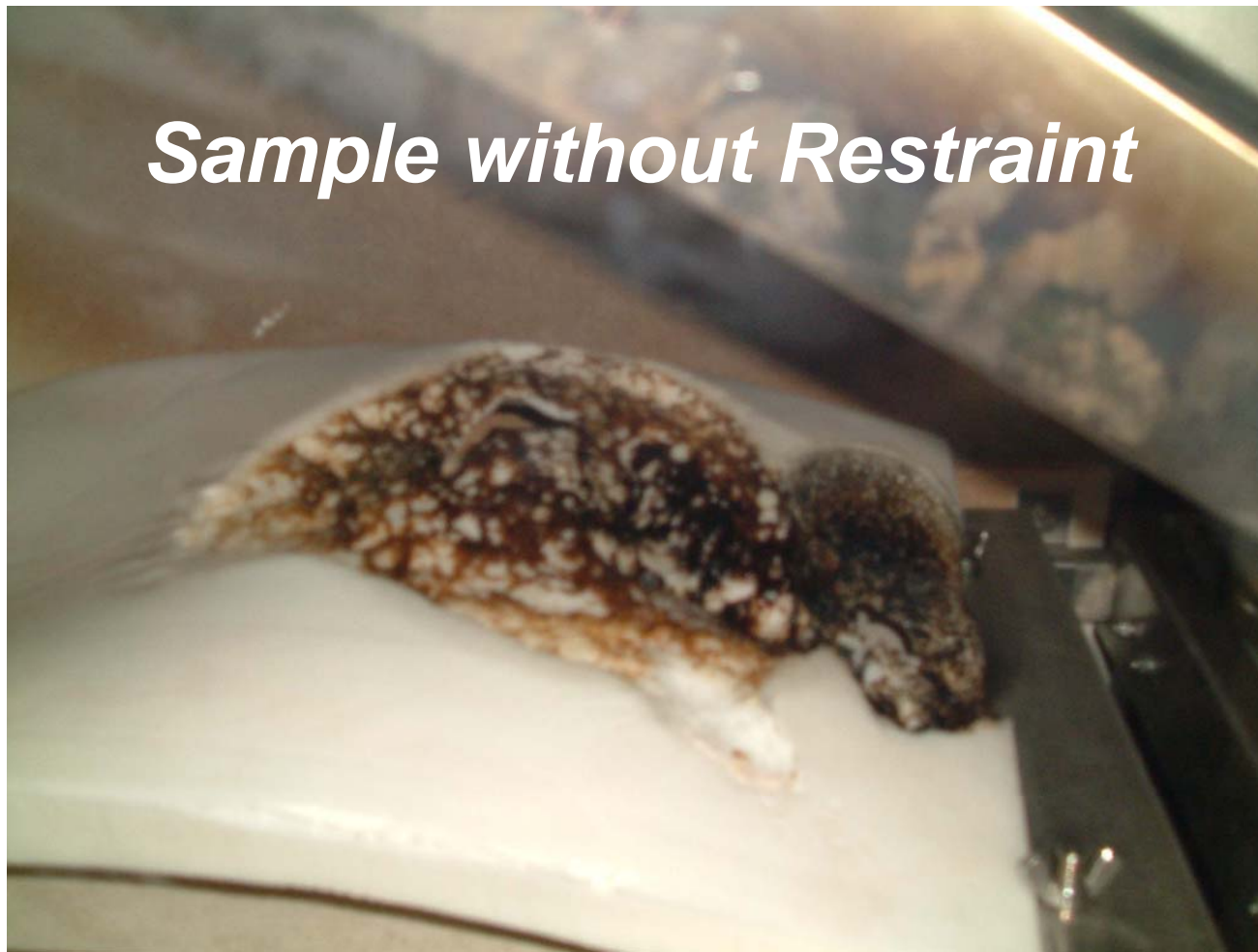
Blanket Heaters



Blanket Heaters

- A typical blanket heater of one type could be comprised of silicone impregnated fiberglass and polyimide film.
- A hook and loop fastening system is sewn to the jacket.
- *Each side (top and bottom) of a blanket must be tested if the blanket is installed without an adhesive.*

Foam as Thermal Acoustic Insulation



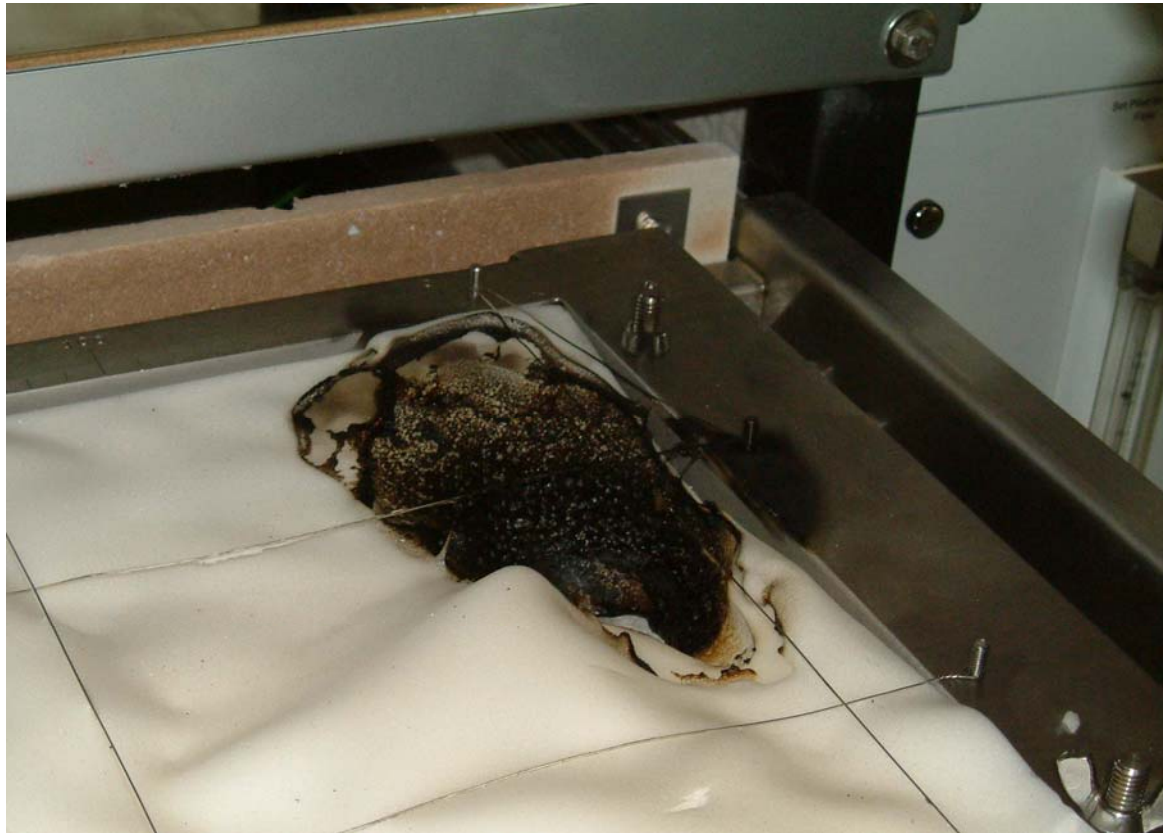
Foam as Thermal Acoustic Insulation



Restraining Wires Added to Frame

Foam as Thermal Acoustic Insulation

Sample after Testing with Wire Restraint



Lab Visit and Testing

- We will be testing:
 - Film Fiberglass Samples
 - Taped Fiberglass Samples
- Demonstrate fabrication of Hook and Loop Samples for Testing.

