

# Fire & Cabin Safety Research Conference

Lamart Corporation

Clifton, NJ

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October 25, 2001



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# Evaluating Pressure Sensitive Tapes for Insulation Blankets

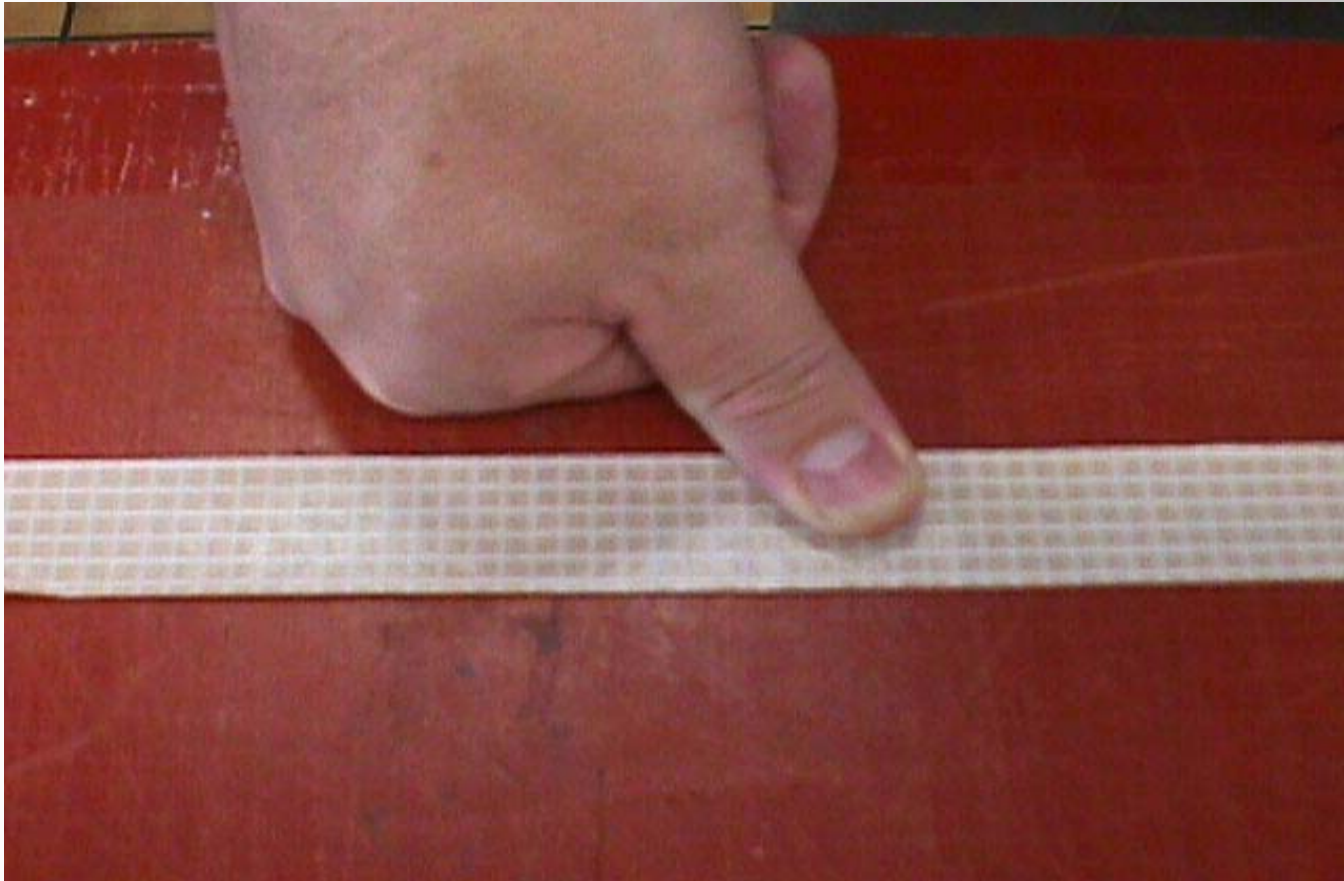
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# Reasons For Testing

- Comparison (product qualification)
- Control (quality processes)

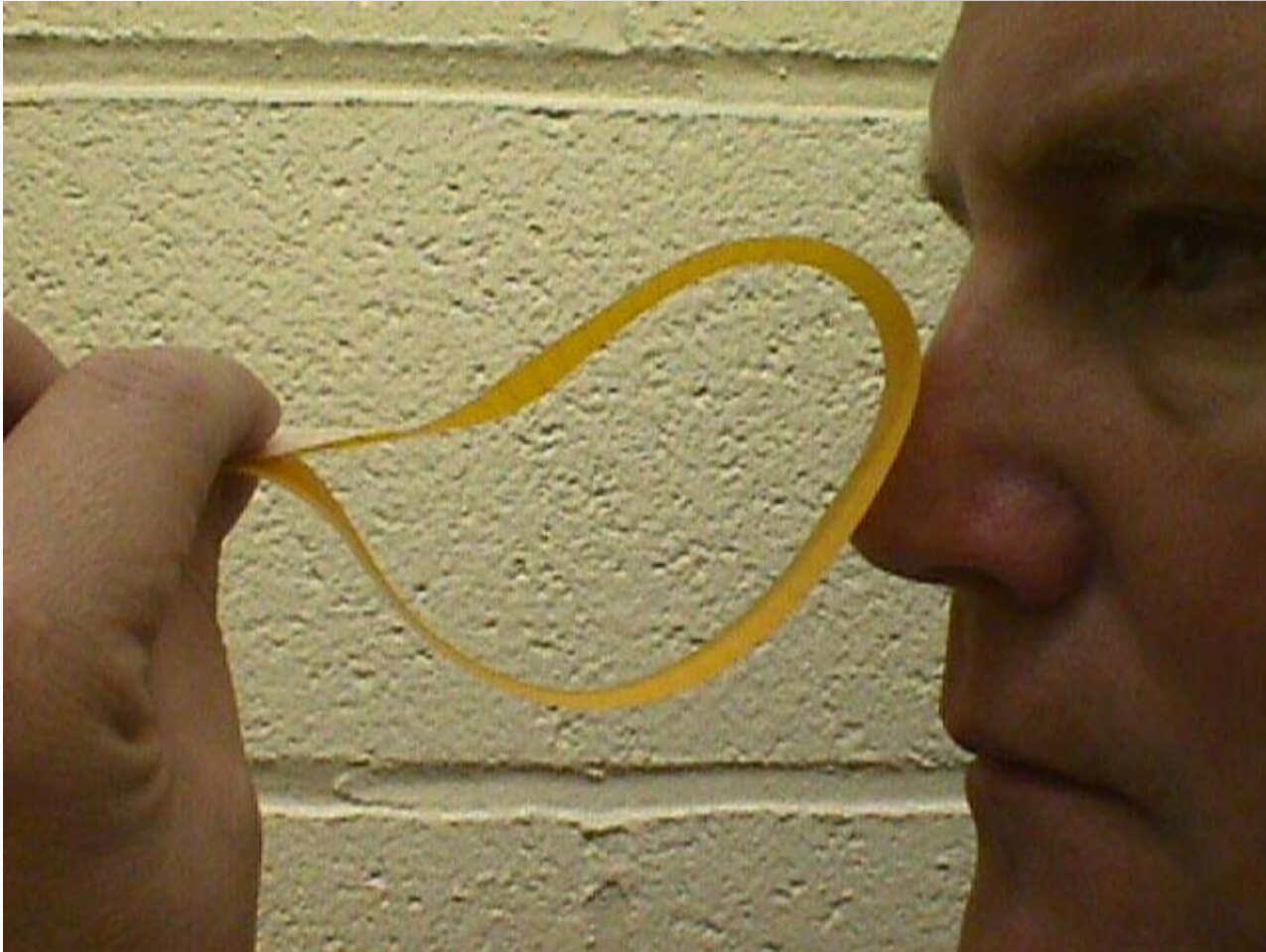
“Test Methods for Pressure Sensitive Adhesive Tapes, 13th Edition,”  
Pressure Sensitive Tape Council (PSTC)

# Misconceptions



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# Misconceptions



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# Relevant Test Methods

Peel

Tack

Shear (holding power)

Tensile

Elongation

Environmental conditioning (aging)

# Acrylic Adhesives

Blends of copolymers determine peel, tack & shear values

- Higher molecular weight increases shear
- Lower molecular weight increases tack
- Blending high MW & low MW gives desired balance of peel tack & shear

# Rubber Adhesives

- Peel
  - Resins
  - Plasticizers
  - Antioxidants
- Tack
  - Resins
  - Plasticizers
  - Polymer
- Shear
  - Polymer
  - Fillers ( $\text{tio}_2$ )



# Peel Adhesion

- DEFINITION: “The force per unit width required to break the bond between a pressure sensitive adhesive tape and the surface to which it has been applied when the tape is peeled back at a controlled angle at a standard rate and condition.”

# 180<sup>0</sup> Peel Adhesion

- **SIGNIFICANCE:** Allows for the comparative measurements of the adhesion of PS tape systems using a standard test method. Also measures the uniformity of quality of a given PS tape system.

# 180° Peel



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# 180<sup>0</sup> Peel

- Reporting results: oz./Inch of width; n/mm of width

# Peel

- Useful conversions

- Force

- Newtons

$$N = \text{oz} \times 0.2780$$

- lbs

$$\text{oz} = N \times 3.5969$$

- oz

$$N = \text{lb} \times 4.4472$$

$$\text{lbs.} = N \times 0.2249$$

- gm

$$\text{gm} = 0.0353 \text{ oz}$$

- Width

- mm

$$\text{mm} = \text{in} \times 25.40$$

- inches

$$\text{in} = \text{mm} \times .0394$$

# Peel - Variations

- $90^{\circ}$  peel
- $180^{\circ}$  peel for double coated PS tapes
- Test panel composition

# Peel - Variations

- Weight of roller & number of roller passes
- Dwell time
- Environmental conditioning
  - Temperature
    - -60 °F to 160°F
  - High humidity

# Peel

- Depends on WET OUT: The amount a pressure sensitive adhesive (PSA) flows after tape application.



# Peel

- If a PSA tends to flow too much, it may lead to EDGE OOZE: When the sides of a roll of PS tape become tacky because of excessive adhesive flow or when the tape is wound too tightly.

# Tack

- **DEFINITION:** “The property of a pressure sensitive adhesive that allows it to adhere to a surface under very slight pressure. It is determined by the ability of the adhesive to quickly wet the surface it contacts.”

# Rolling Ball Tack

- **SIGNIFICANCE:** “The rolling ball tack test is one method of attempting to quantify the ability of an adhesive to adhere quickly to another surface.”

# Rolling Ball Tack



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# Rolling Ball Tack



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# Rolling Ball Tack

- Reporting results: inches; millimeters
  - Report average of 5 (minimum) tests
  - Use fresh test specimen for each test
  - Clean ball after each use
- When comparing results with other labs, make sure test apparatus is identical

# Tack - Variations

- Quick stick
- Polyken probe
- Rolling ball with lighter ball

# Tack

- Tack is not a predictor of peel adhesion
- As tack increases, shear *can* decrease



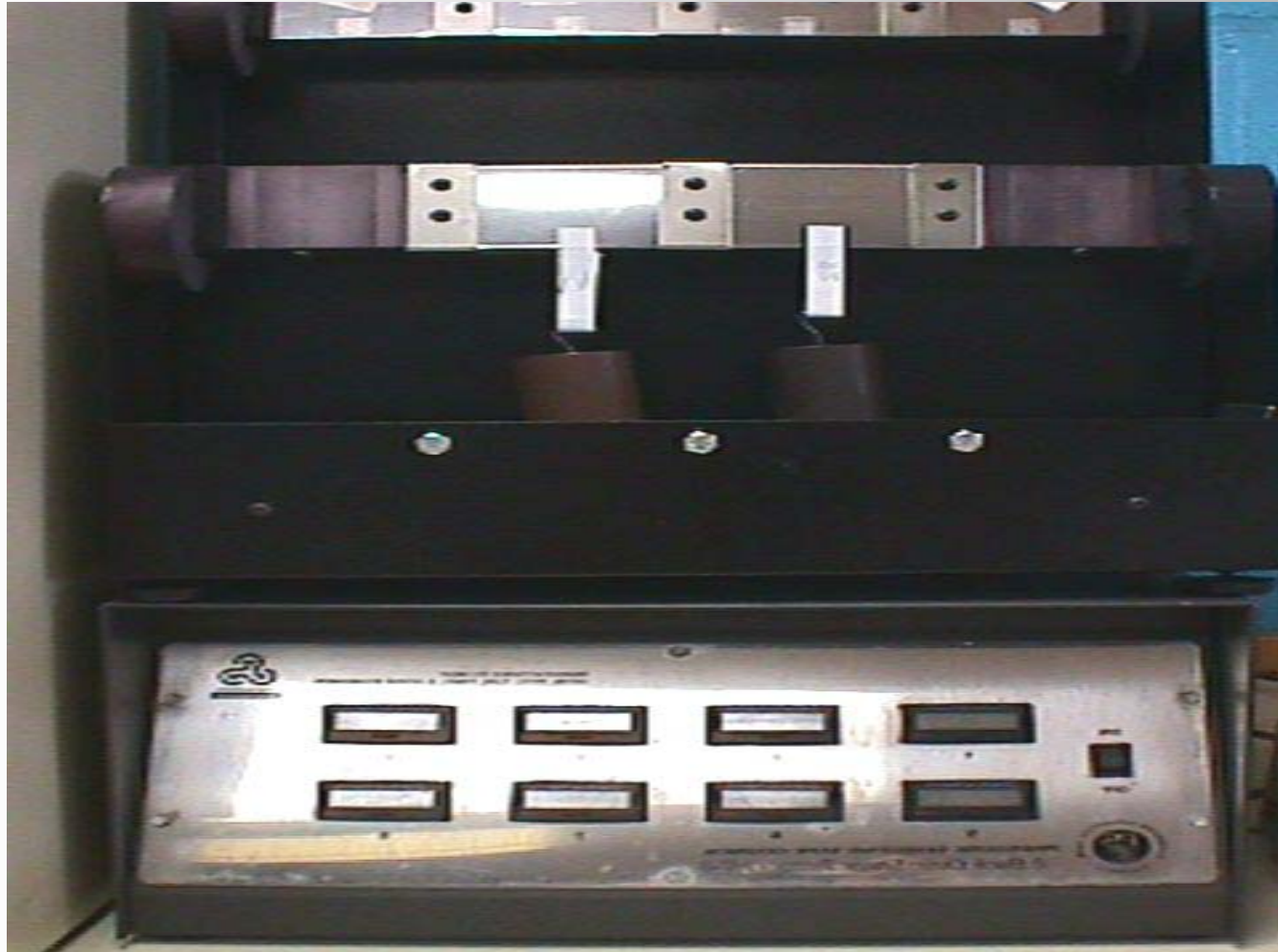
# Shear (Holding Power)

- **DEFINITION:** “The ability of a tape to resist static forces applied in the same plane as the backing. Usually expressed in a time required for a given weight to cause a given width of tape to shear free from a vertical panel.”

# Shear (Holding Power)

- **SIGNIFICANCE:** measures a PS tape's ability to resist “creeping” on a vertical surface.

# Shear



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# Shear



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# Shear



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# Shear

- Reporting results
  - Length of creep
  - Time to failure

# Shear - Variations

- Elevated temperature
- Dynamic shear
- Combination of elevated temperature and dynamic shear

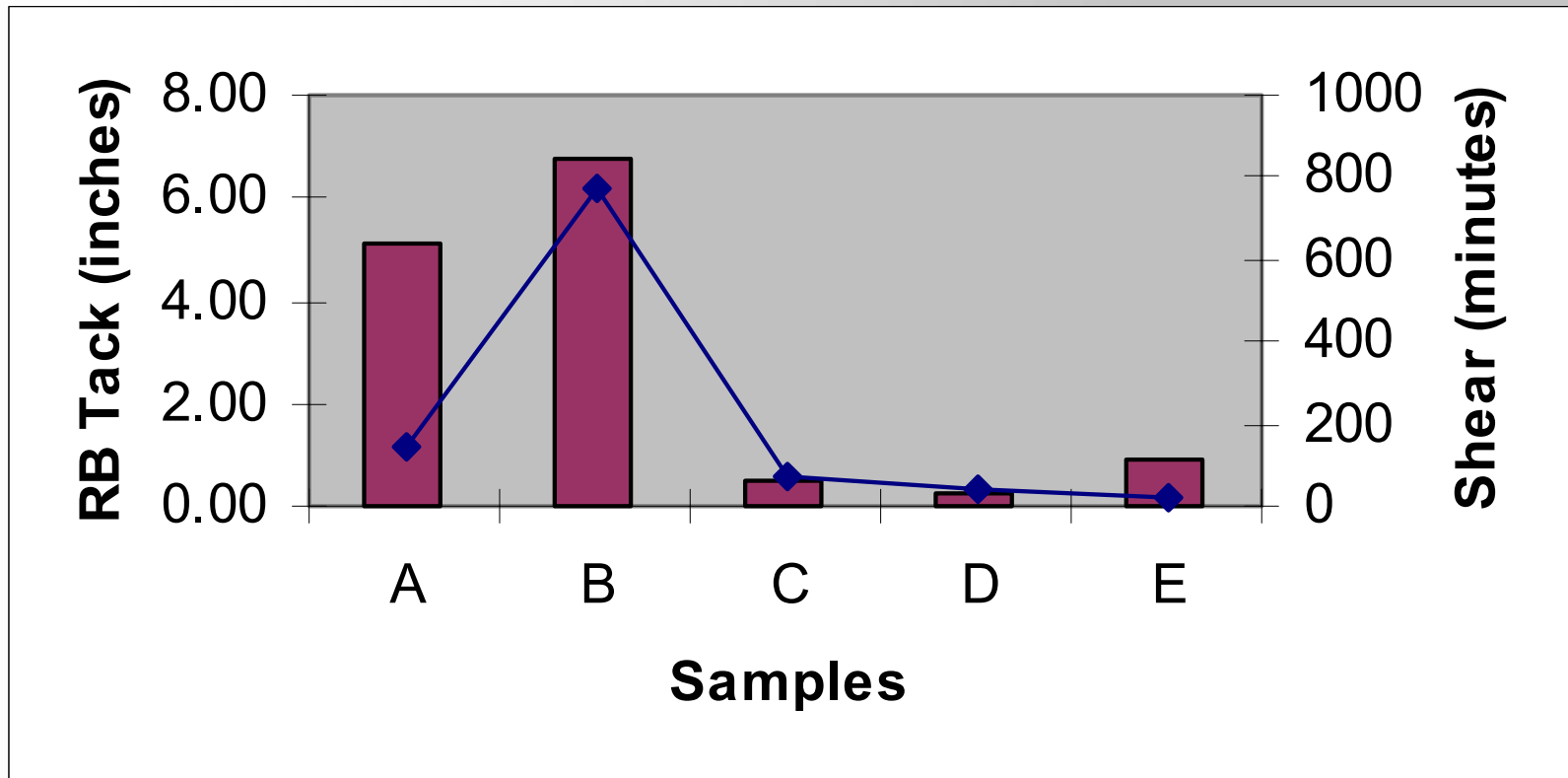
# Peel, Tack & Shear Comparisons

	<b>180° Peel</b>	<b>RB Tack</b>	<b>Shear</b>
	<b><u>oz./in.</u></b>	<b><u>inches</u></b>	<b><u>minutes</u></b>
• <b>A (PI)</b>	61	5.10	140
• <b>B (PI)</b>	51	6.75	778
• <b>C (PVF)</b>	74	0.50	76
• <b>D (PVF)</b>	79	0.25	45
• <b>E (PET)</b>	42	0.92	16



# Tack/Shear Trend

(Lines = Tack      Bars = Shear)



# Tensile (Breaking Strength)

- **DEFINITION:** “The force required to break a unit width of tape by controlled pulling on opposite ends of the piece.”
  - Machine direction
  - Cross machine direction

# Tensile (Breaking Strength)

- **SIGNIFICANCE:** Measurement of the ability of a tape backing “to withstand stress in application and service.”

# Tensile



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# Tensile



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# Tensile

- Reporting results: lb/inch; newtons/mm
- Useful conversions:
  - Newtons/100 mm     $N/100 = lb/in \times 17.5127$
  - Lb/in                 $lb/in = N/100 \text{ mm} \times 5.72$

# Elongation

- **DEFINITION:** “The distance a tape will stretch in a machine or cross direction before breaking under controlled conditions, expressed as a percentage of original length.”

# Elongation

- **SIGNIFICANCE:** Indication of how much a tape will stretch, and therefore how much “relaxation” force a tape may experience immediately after tape application.



# Elongation

- Scrim decreases elongation

# Key Issues

- Conditions That Can Affect the Performance of a PS Tape
  - During Application
  - In Service

# Key Issues

- Clean surfaces
- Sufficient pressure
- Limited elongation (especially an issue w/ non-reinforced tapes)

# Key Issues

- No Si contamination on PS surface
- Storage @ 70<sup>0</sup> F & 50% RH
  - Acrylic adhesives generally more forgiving than rubber adhesives
- Eliminate extreme temperature changes just before application

# Key Issues

- Applying tape under tension, then exposing taped structure to temperature extremes may cause tape failure
- Too much tack can cause shear problems
- Tack is no indication of peel adhesion

# Test Methods

- PSTC
  - PSTC 101
  - PSTC 6
  - PSTC 107
  - PSTC 31
- ASTM
  - ASTM D3330/D3330M
  - ASTM D 3121
  - ASTM D3654/D3654M
  - ASTM D3759

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