Performance Evaluation of
Entry Doors

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This Presentation

We will discuss:

- **Why doors continue to leak**
- **Hidden causes of water penetration**
- **Development of evaluation method**
- **Performance criteria**

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Why doors continue to leak?

Door failures in the field are attributed to:

- **Limitation of current test methods**
- **Environmental loading**
- **Fighting nature the hard way**
- **Improper use of materials**

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Limitations of Current Test Methods (Lab)

*Doors are tested under ideal lab conditions, and in **isolation** for:*

- **Air Tightness**
- **Water Tightness**
- **Thermal Performance**

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Limitations of Current Test Methods (Field)

No standard method, No performance criteria -Tied in with lab test methods:

- **Air Tightness**
- **Water Tightness**

Here's a typical water penetration test carried out for five minutes at 0 Pa:

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Environmental Loading

*The following environmental loads are imposed **simultaneously**:*

- **Rain and Snow**
- **Wind Pressure**
- **Temperature Difference**
- **Indoor Humidity**

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Fighting Nature the Hard Way

Accommodate the elements. Face sealing does not ensure long term performance:

- **Do not rely on face sealing**
- **Pressure equalize the door perimeter**
- **Promote drainage at the right locations**
- **Do not rely on exposed sealants**

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Improper Use of Materials

Either select the material to withstand its service conditions, or modify the conditions to suit the material:

- **Water absorption and freeze/thaw resistance**
- **Temperature differences**
- **Mechanical stresses and wear and tear**
- **UV exposure**

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Development of Evaluation Method

To evaluate the door under the following superimposed environmental conditions:

- **Rain**
- **Wind Pressure**
- **Temperature Difference**
- **Indoor Humidity**

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Test Setup

The evaluation is carried out in a weather-side and room-side environmental chambre capable of:

- **Outdoor thermal cycling (low/high)**
- **Outdoor radiant heat**
- **Controlled wind pressure differential**
- **Controlled indoor humidity**

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Evaluation Procedure

*Air leakage and water penetration tests are performed **prior to and following conditioning** at:*

- **Outdoor temperature cycling -18º/+45º C**
- **Indoor RH of 40% at +21º C**
- **+15 Pa pressure differential**

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Test 1- Air Leakage (Initial)

Air infiltration and exfiltration *(room temperature both sides) at 75 Pa pressure difference (ASTM E283)*

- Rate of air leakage less than 1.65 m^3/hr per meter of crack length

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Test 2 - Water Test (Initial)

Water penetration *at 150 Pa pressure differential (ASTM E547)*

- No leakage to the interior or under the doorsill
- No leakage into hardware assembly or striker plate
- No water absorption into the foam-filled weatherstrips

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Test 3 - Conditioning

Air leakage and water penetration tests are performed prior to and following exposure to outdoor temperature cycling:

- **Three temperature cycles -18º/+45º C**
- **Indoor RH of 40% at +21º C**
- **+15 Pa pressure differential**

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Test 4 - Air Infiltration (Final)

***Air infiltration at -18º C** at 75 Pa pressure difference (ASTM E1244)*

- Rate of air leakage less than 1.65 m^3/hr per meter of crack length

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Test 5 - Water Test (Final)

Water penetration *at 150 Pa pressure differential (ASTM E547)*

- No leakage to the interior or under the doorsill
- No leakage into hardware assembly or striker plate
- No water absorption into the foam-filled weatherstrips

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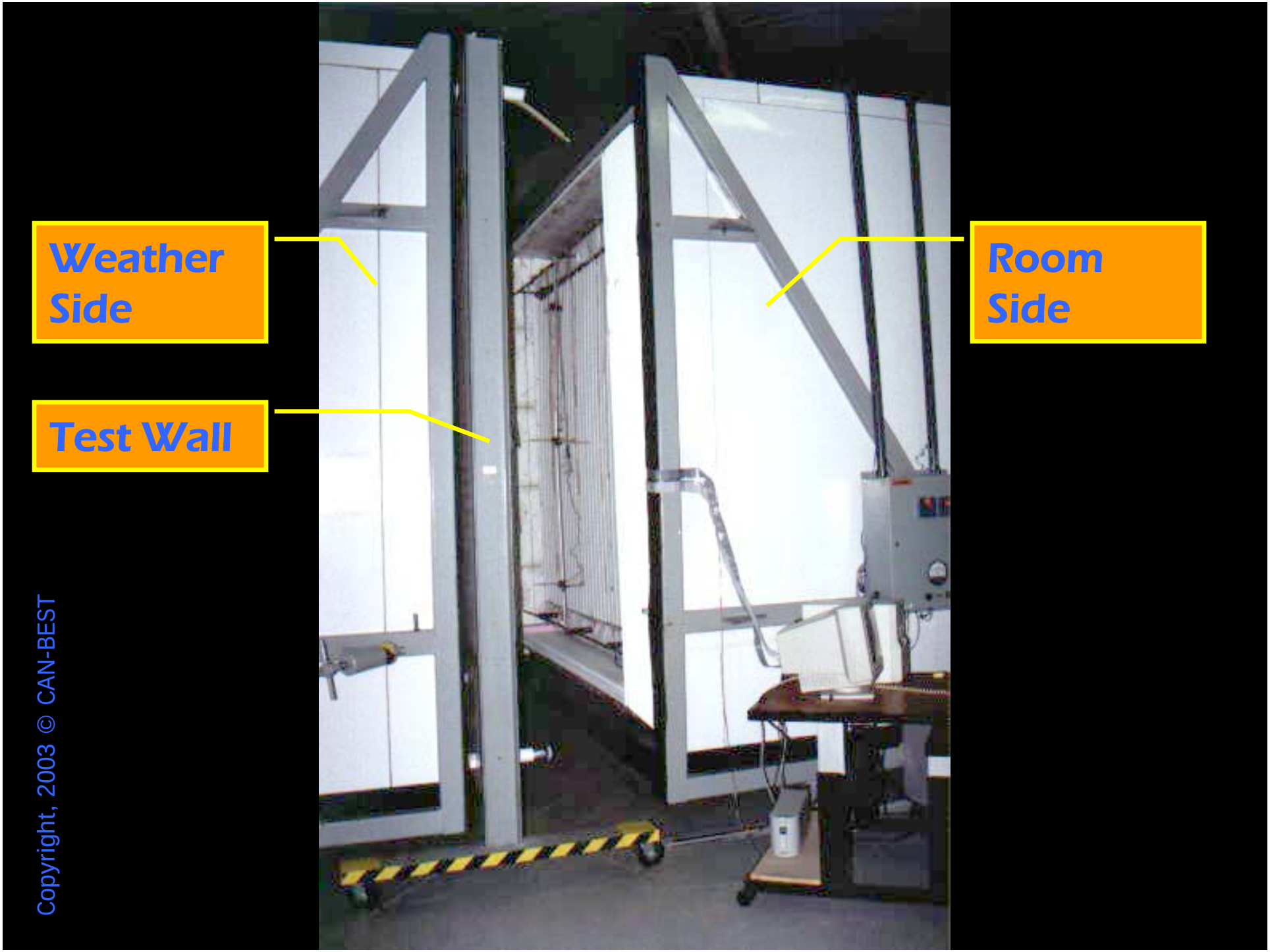

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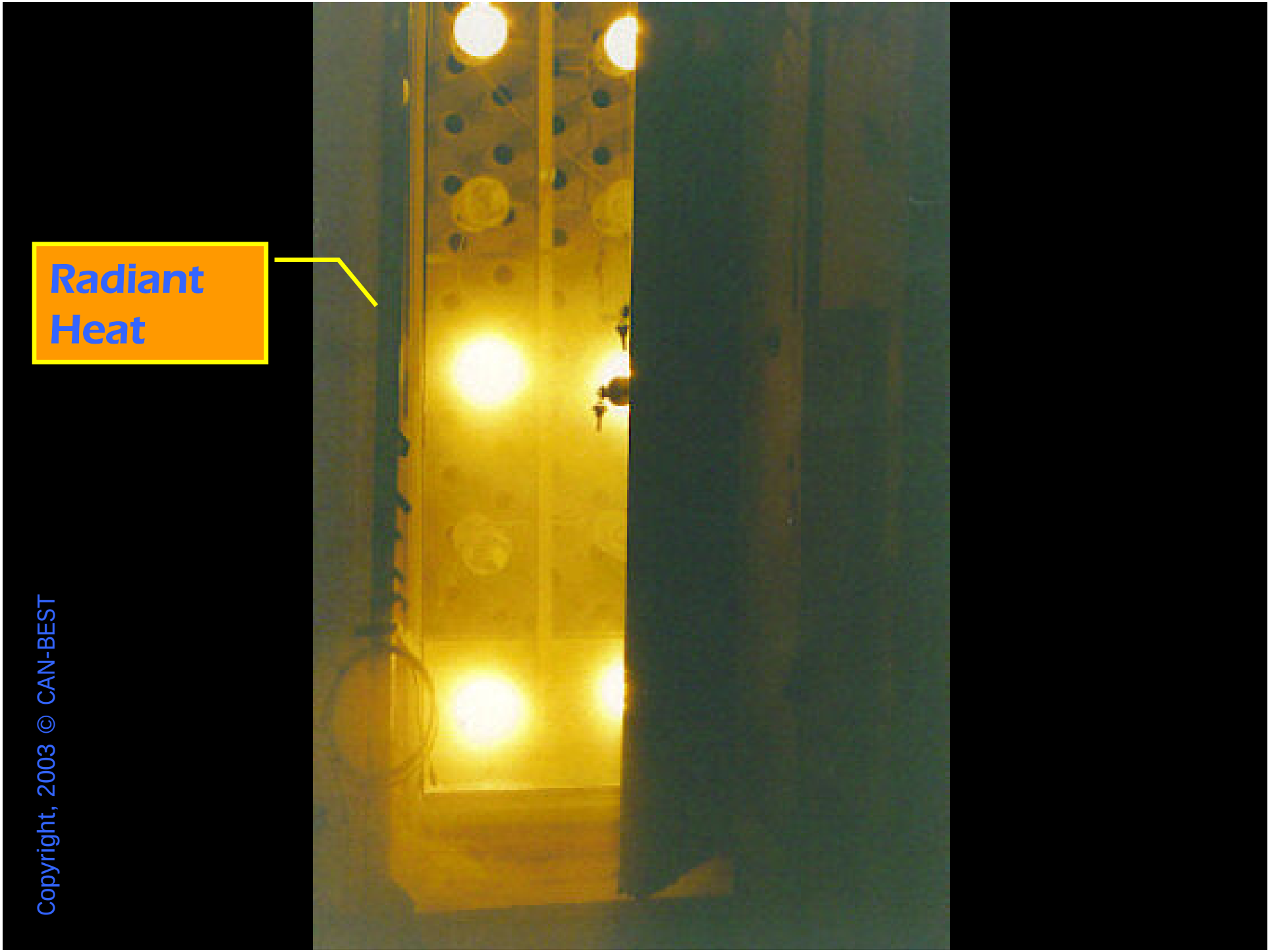

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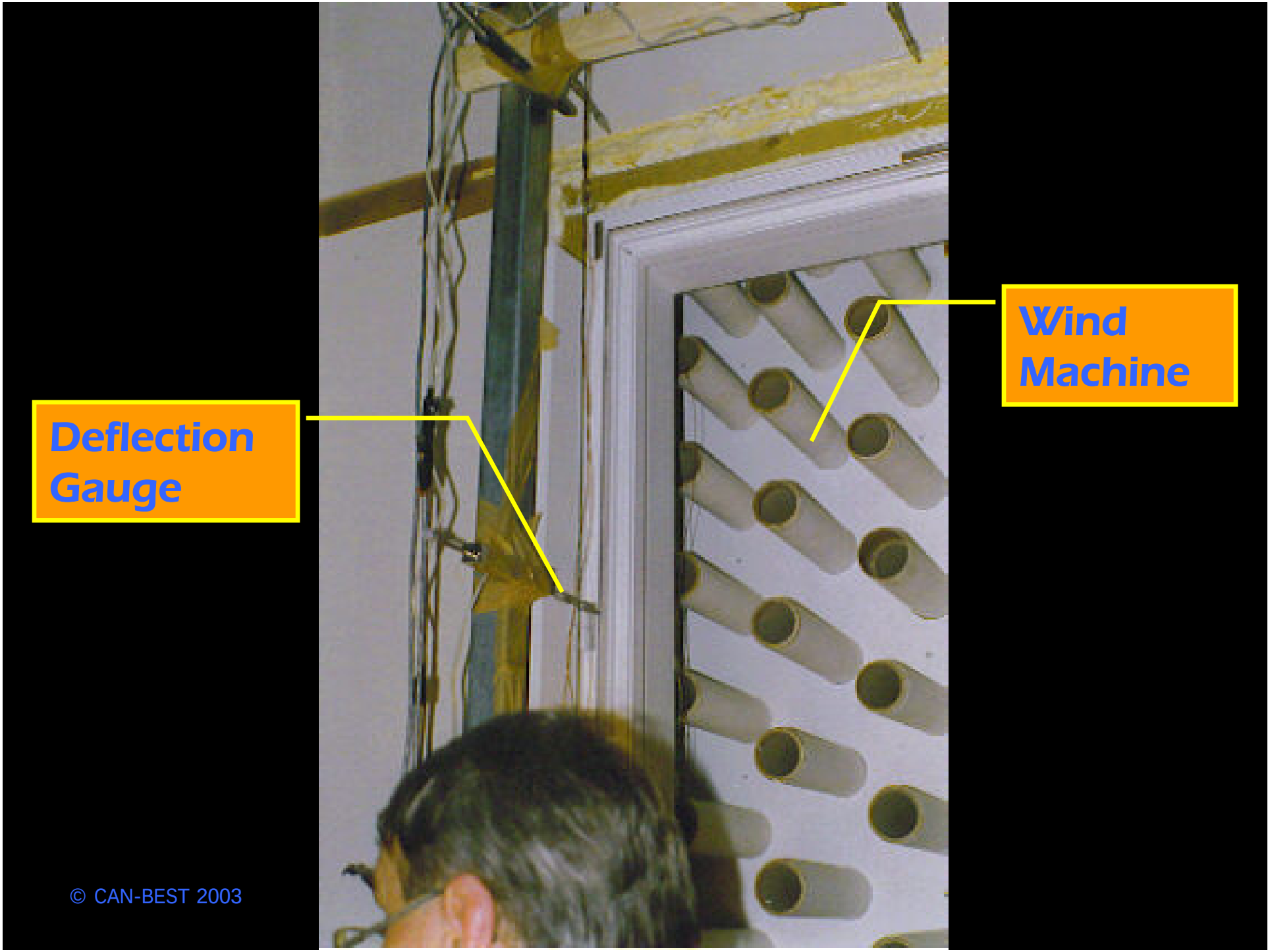

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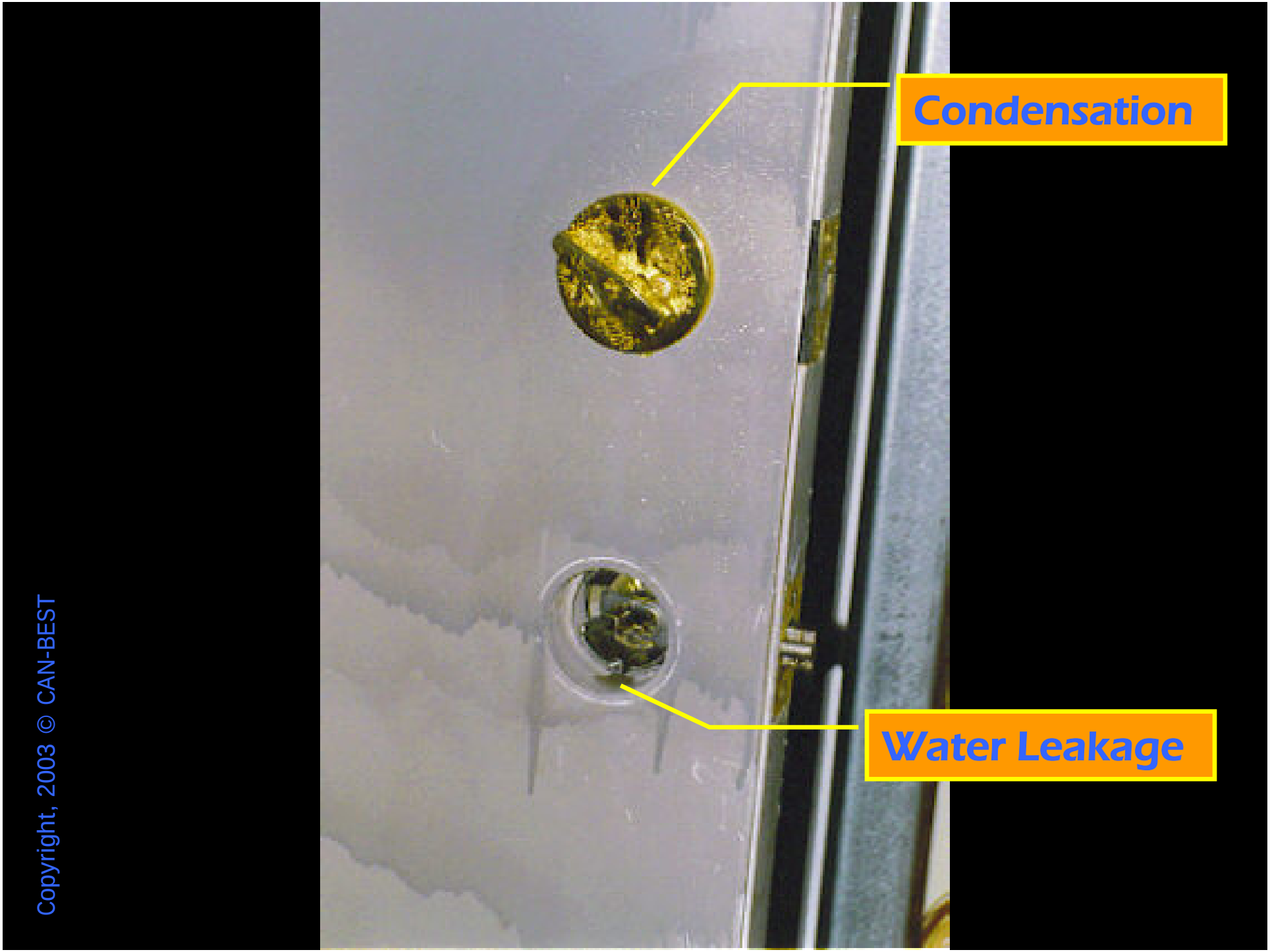

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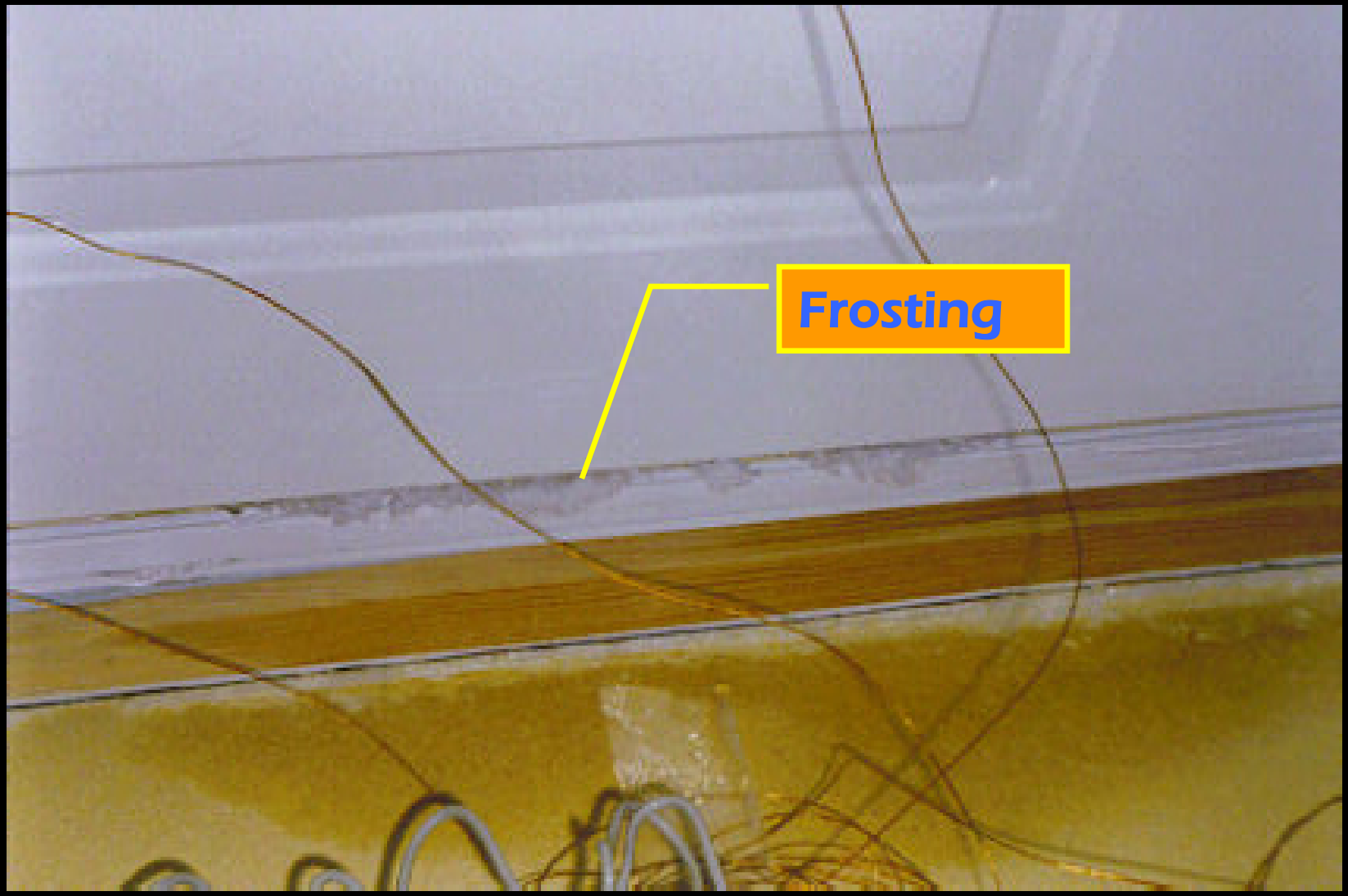

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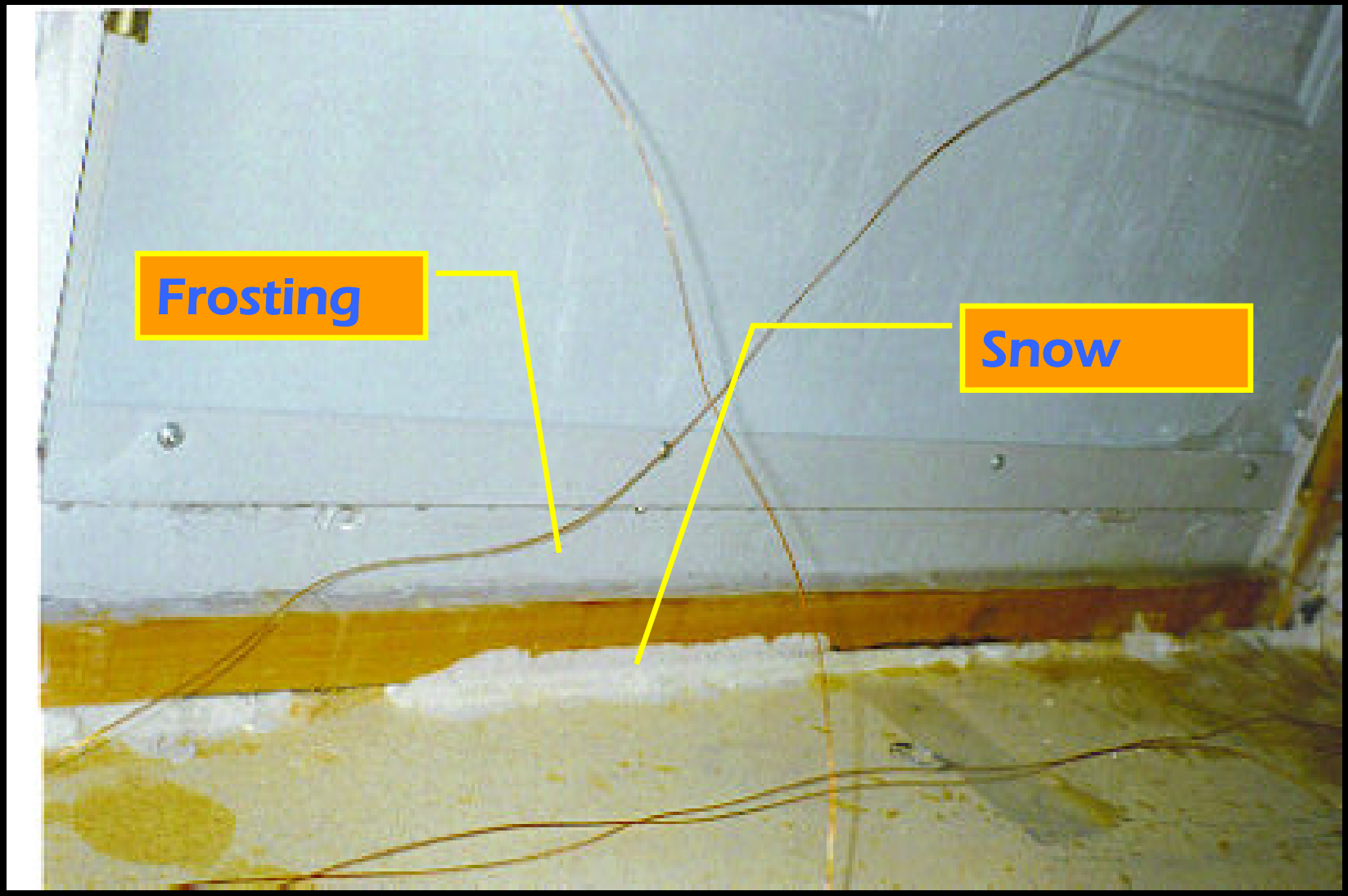

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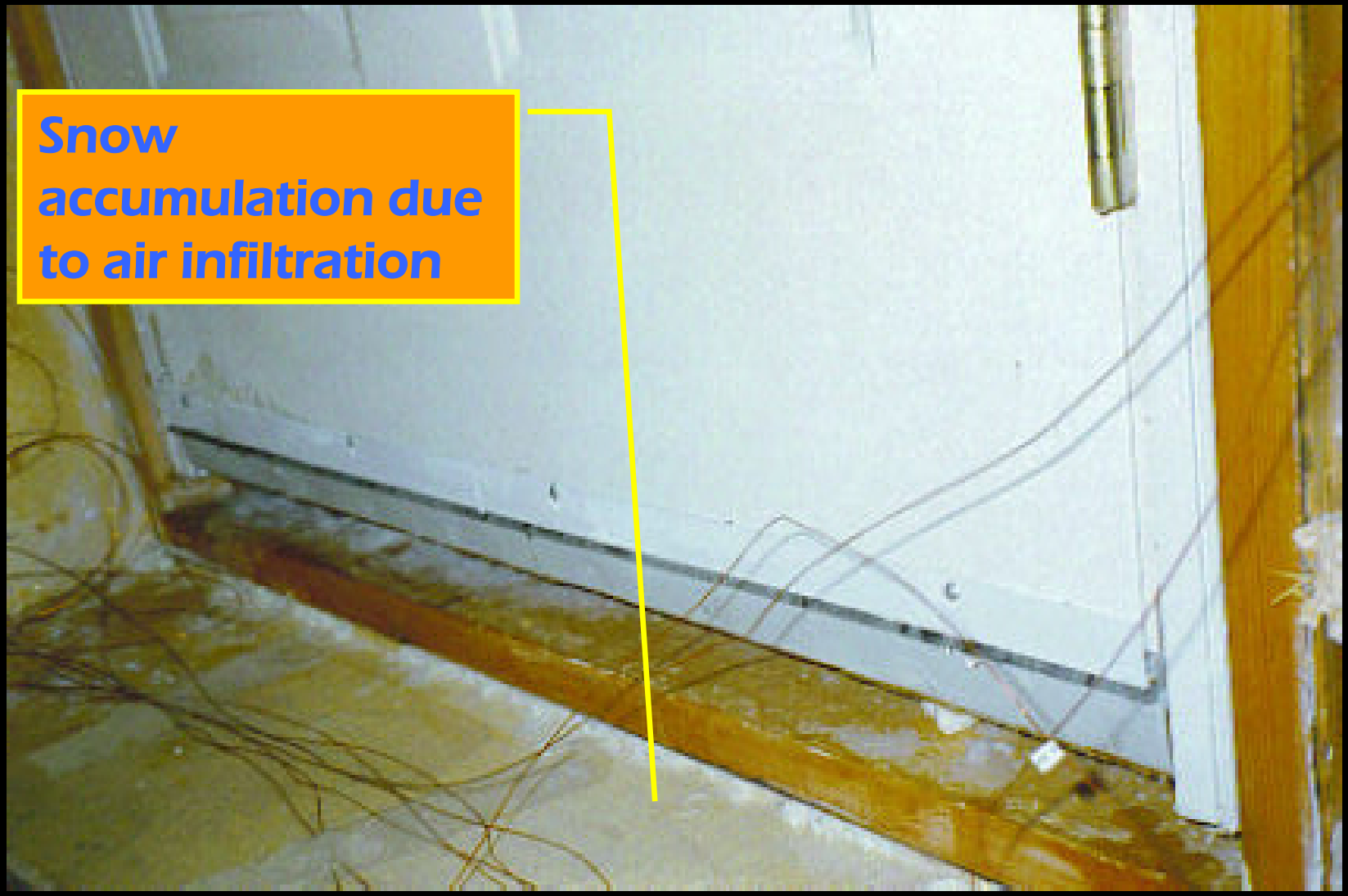

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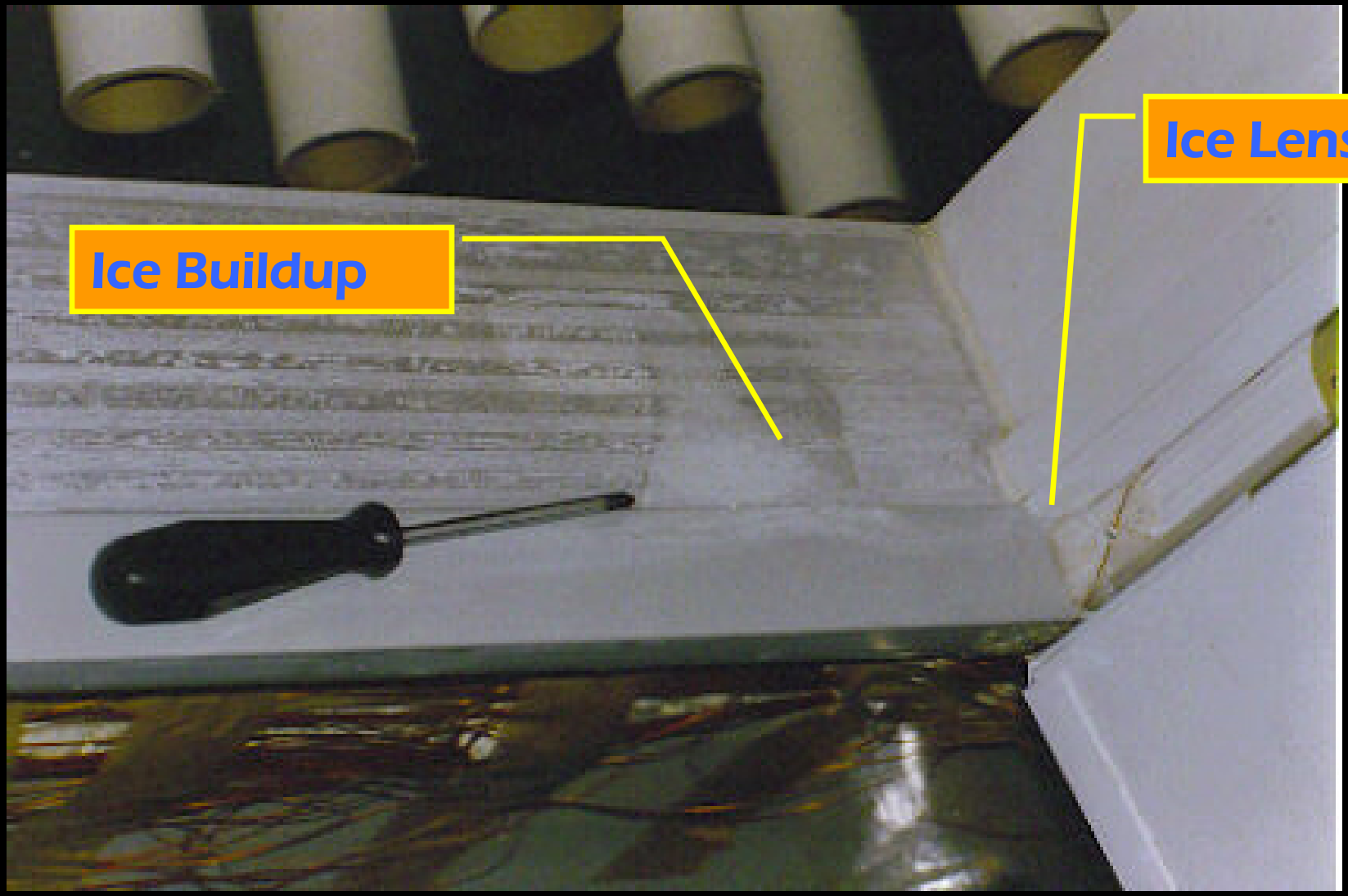

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Slab deflection due to ice lens formation at bottom end of weatherstrip

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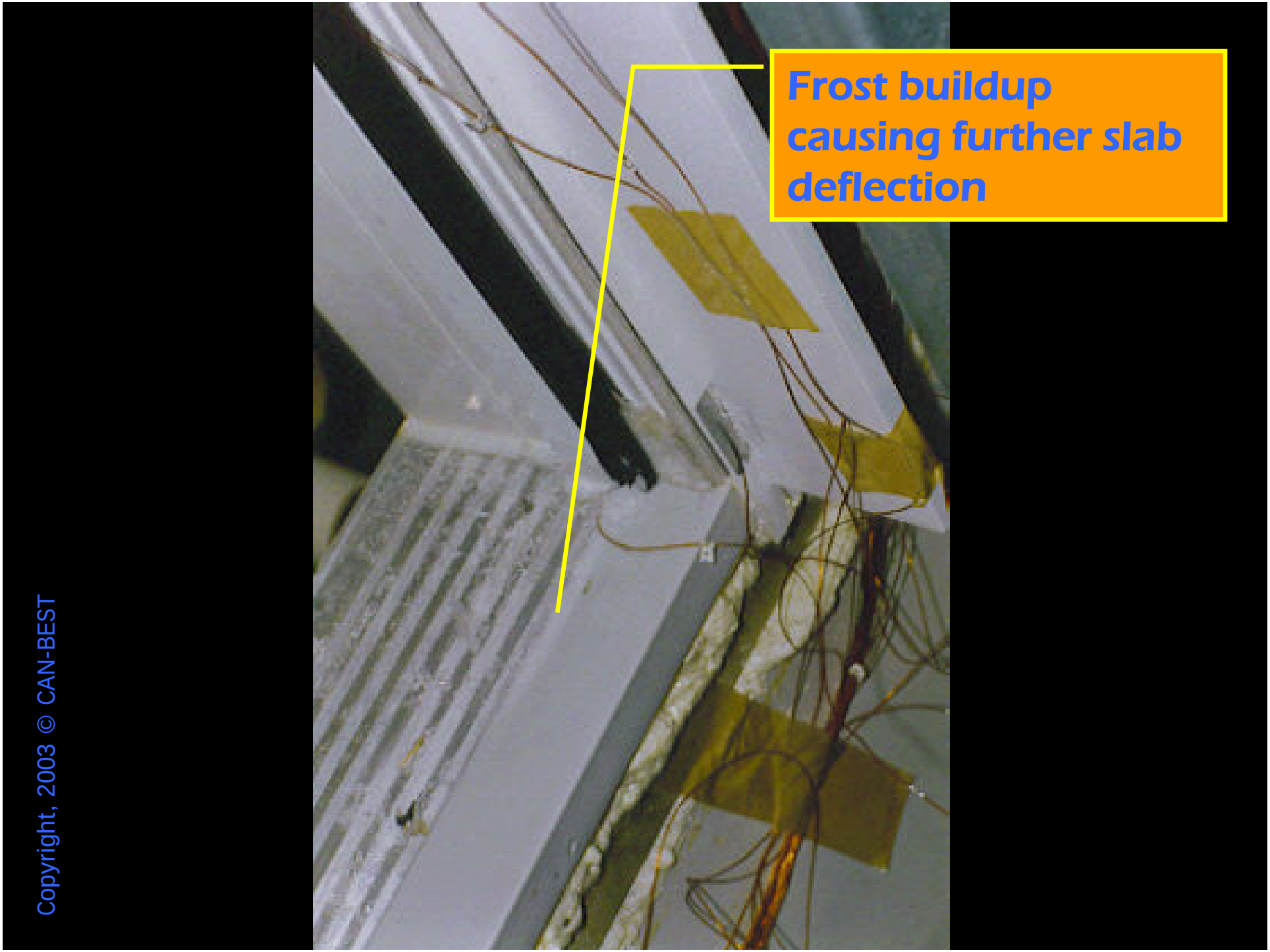

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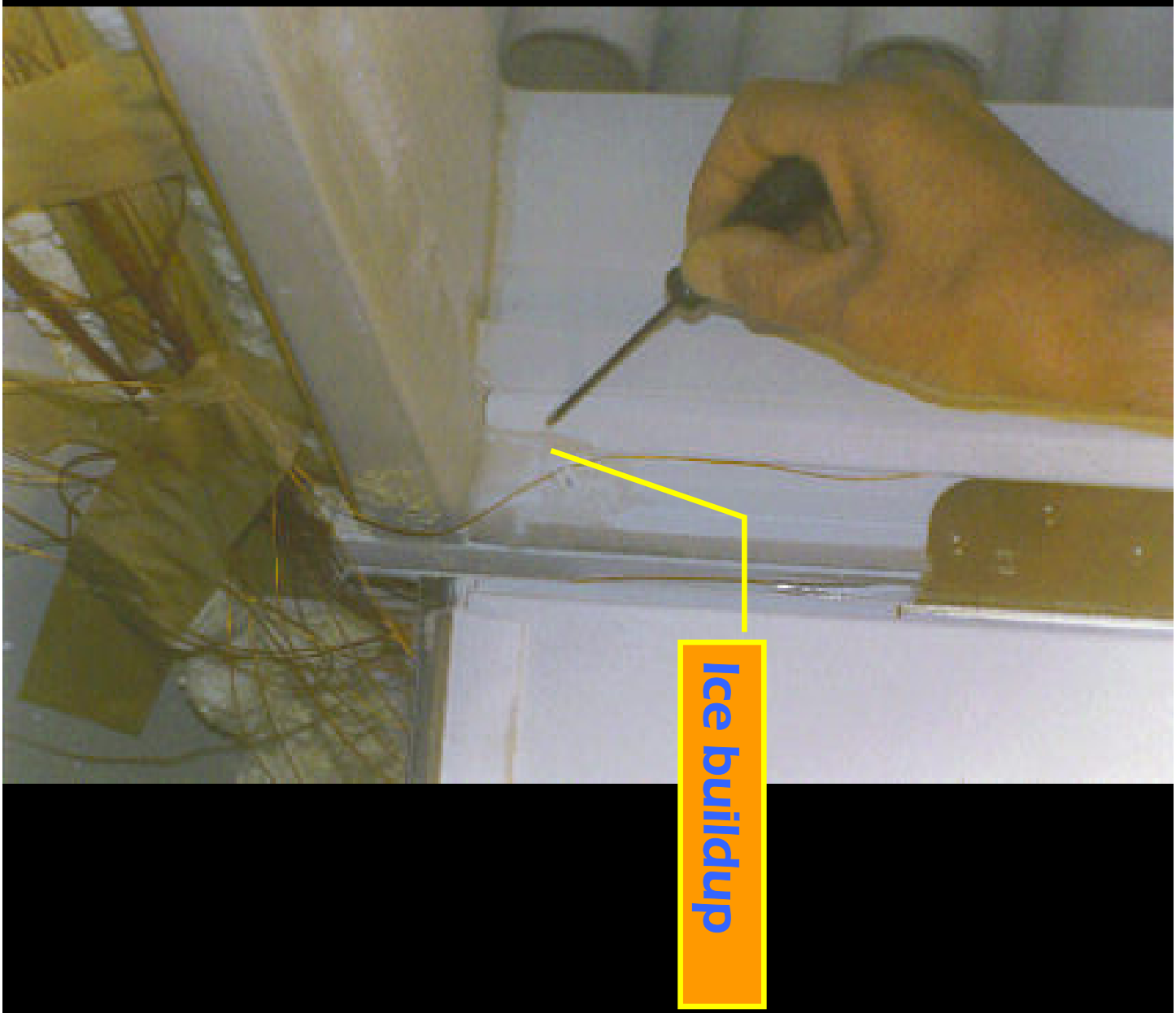

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