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AGENDA

1. Exterior Insulation Types
   - Properties and Considerations

2. Attachment Methods
   - Girt Systems
   - Clip & Rail
   - Brick Veneer
   - Screw-through

3. Conclusion
## Typical Insulation Types

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Origin</th>
<th>Thermal Conductance W/(m K)</th>
<th>Water Vapor Diffusion Resistance Factor (µ)</th>
<th>Vapor Permeance (perm-inch)</th>
<th>Fire Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stonewool (mineral wool)</td>
<td>Mineral</td>
<td>0.032 – 0.040</td>
<td>1</td>
<td>30+</td>
<td>Incombustible, meltingpoint &gt; 1,000°C</td>
</tr>
<tr>
<td>Glasswool (mineral wool)</td>
<td>Mineral</td>
<td>0.032-0.040</td>
<td>1</td>
<td></td>
<td>Incombustible</td>
</tr>
<tr>
<td>Ultimate (mineral wool)</td>
<td>Mineral</td>
<td>0.032 – 0.040</td>
<td>1</td>
<td></td>
<td>Incombustible, meltingpoint &gt; 1,000°C</td>
</tr>
<tr>
<td>Expanded polystyrene (EPS)</td>
<td>Synthetic</td>
<td>0.035-0.040</td>
<td>20-70</td>
<td>2.7</td>
<td>Hardly inflammable</td>
</tr>
<tr>
<td>Graphit embedded EPS</td>
<td>Synthetic</td>
<td>0.032</td>
<td>30-70</td>
<td></td>
<td>Hardly inflammable</td>
</tr>
<tr>
<td>Extruded polystyrene (XPS)</td>
<td>Synthetic</td>
<td>0.030-0.040</td>
<td>x</td>
<td></td>
<td>Normally inflammable</td>
</tr>
<tr>
<td>Polyurethane (PUR)</td>
<td>Synthetic</td>
<td>0.022-0.040</td>
<td>x</td>
<td></td>
<td>Hardly inflammable</td>
</tr>
<tr>
<td>Polyisocyan-urat (PIR)</td>
<td>Synthetic</td>
<td>0.023 – 0.028</td>
<td>82 – 10,000</td>
<td></td>
<td>Hardly inflammable</td>
</tr>
<tr>
<td>Wood fibre</td>
<td>Vegetable</td>
<td>0.040-0.055</td>
<td></td>
<td></td>
<td>Normally inflammable</td>
</tr>
<tr>
<td>Hemp fibre</td>
<td>Vegetable</td>
<td>0.040-0.045</td>
<td>1-2</td>
<td></td>
<td>Normally inflammable</td>
</tr>
<tr>
<td>CL Cellulose</td>
<td>Vegetable</td>
<td>0.038-0.069</td>
<td>1-2</td>
<td></td>
<td>Normally inflammable</td>
</tr>
</tbody>
</table>
Considerations

- Building code requirements
- Effective thermal performance
- Temperature dependent thermal conductivity
- Moisture dependent thermal conductivity
- Vapour permeance and moisture movement
- Installation method
- Cladding attachments
- Fire performance
- Cost of materials, installation and labour
- Effective cost of assembly
Cladding Attachment: Masonry Ties & Shelf Angles

- **Brick ties** – 10-30% loss for galvanized ties, 5-10% loss for stainless steel
- **Continuous shelf angles** ~50% R-value loss
- **Shelf angle on stand-offs** only ~15% R-value loss
Cladding Attachment

- **Continuous Girts** – Rigid or Semi-rigid boards or spray-foam (i.e. almost anything works)

- **Intermittent Clip & Rail Systems** – Semi-rigid boards or spray-foam (i.e. flexibility & ease of installation is key)

- **Screws through Insulation** – rigid insulation boards (i.e. stiff enough to support compression load)
Cladding Attachment: Vertical Steel Z-Girts

Vertical Z-Girts

RELATIVE COST

THERMAL EFFICIENCY

20-40%

CONSTRUCTABILITY

~60-80% + loss in R-value
Cladding Attachment: Horizontal Steel Z-Girts
Cladding Attachment: Crossing Steel Z-Girts
Cladding Attachment: Clip & Rail, Steel

Galvanized Steel Clips

<table>
<thead>
<tr>
<th>RELATIVE COST</th>
<th>THERMAL EFFICIENCY</th>
<th>CONSTRUCTABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>$$$</td>
<td>50-75%</td>
<td></td>
</tr>
</tbody>
</table>
Cladding Attachment: Clip & Rail, Isolated Galvanized
Cladding Attachment: Clip & Rail, Fiberglass
Cladding Attachment: Screw through Insulation

- Longer cladding Fasteners directly through rigid insulation (up to 2” for light claddings)
- Long screws through vertical strapping and rigid insulation creates truss – short cladding fasteners into vertical strapping
- Rigid shear block type connection through insulation, short cladding fasteners into vertical strapping
Cladding Attachment: Screw through Insulation

Figure 9: Short term deflection testing results (4” thick insulation)
Cladding Attachment: Screws Through Insulation
Exterior Insulation Finish Systems
Percent Effectiveness of Exterior Insulation with Various Cladding Support Systems

- Continuous Vertical Z-Girt
- Continuous Horizontal Z-Girt
- Aluminum T-Clip
- Intermittent Galvanized Clip
- Isolated Galvanized Clip
- Stainless Steel Clip
- Fiberglass Clip
- Galvanized Screws
- Stainless Steel Screws

Percent Effectiveness of Exterior Insulation (Typical Range)
Thank You!

Questions?