Introduction to Building Envelope Commissioning

Presented by:

Kevin Perri, CCP, CEM, LEED AP
Takeaways

• Explain what is building envelope commissioning

• Describe some benefits of building envelope commissioning

• Point out common areas that are overlooked during construction

• Describe in detail how to functionally test a buildings envelope
What is Commissioning?

When a building is initially commissioned it undergoes an intensive quality assurance process that begins during design and continues through construction, occupancy, and operations. Commissioning ensures that the new building operates initially as the owner intended and that building staff are prepared to operate and maintain its systems and equipment.

–Lawrence Berkley National Laboratory
Benefits of Commissioning
Building Envelope Commissioning

- United States Army Corps of Engineers (USACE)
- United State Green Building Council (USGBC)
- American Society for Testing and Materials (ASTM)
- International Energy Conservation Code (ICEE)
- Association of Architects (AIA)
- American Society of Heating, Air-Conditioning, and Refrigeration (ASHRAE)
- National Institute for Building Science (NIBS)
What is the Envelope?

• Building Envelope
  – Physical separator between conditioned and unconditioned spaces
    • Weather barrier
    • Air barrier
    • Thermal barrier
    • Vapor barrier
Stages of Envelope Commissioning

- Pre-Design
- Design
- Construction
Design Review
Design Review

BRICK VENEER

PRE-MANUF. ALUM. COVER PLATE INTEGRAL TO CANOPY SYSTEM

PRE-MANUF. GALV MALLEABLE IRON INTEGRAL TO CANOPY SYSTEM

HANGER ROD BY CANOPY MANUF.

1" RIGID INSULATION
FLUID APPLIED AIR BARRIER

5/8" EXTERIOR SHEATHING

STRUCTURAL STEEL BY P.E.M.B. MANUF.

5 1/2" BATT INSULATION

5/8" GWB ON 6" COLD-FORMED META FRAMING; SEE STRUCTURAL

CANOPY DETAIL

A-324 SCALE: 3" = 1'-0"
Design Review

Ensure The Two Touch and sealed to each other
Design Review

WRAP MEMBRANE ROOF TO COVER PARAPET

2" MIN

MEMBRANE ROOF

RIGID INSULATION
MTL DECK, SEE STRUCT
STEEL BEAM & JOIST, SEE STRUCT

MECHANICAL ROOF LEVEL
45'-4 5/8"

ACM WALL PARAPET CAP
SEALANT & BACKER ROD, TYP
ACM WALL PANEL SYSTEM (B)

RIGID INSULATION, TYP
WEATHER BARRIER, TYP
SHEATHING, TYP
METAL STUDS @ 16" O.C. W/ BATT INSULATION, TYP

Associated Builders and Contractors, Inc.
Design Review

PREFINISHED MTL. FLASHING W/ BLOCKING
ROOFING MEMBRANE
ROOF CANT
LIGHTWEIGHT INSULATING CONCRETE SYSTEM
SLOPE

1'-10"

ROCKCAST WT-675
ROCKCAST BA-100
STEEL BEAM
SEE STRUCTURAL
BUILDING WRAP ON 3/8 RIGID INSULATION ON 3/8 SHEATHING
ROCKCAST AMV SERIES ST-001; I FLUSH W/ F.O.B.
Design Review

Aluminum gutter and downspout

1'-10"

Prefinished metal fascia

2 1/2" soffit framing

Prefinished metal soffit

Cont. brick soldier course, typ.
Design Review
Design Review
Design Review
Design Review
Design Review

Window Flashing Sequence

SCALE 1:12

NOTE:
1. Apply flash to finish any area and 6 in. minimum up to finish.
2. Maximum flash spacing 12 in. minimum of finish.
3. When temperatures are below 40 degrees F, use appropriate flashing - SEE SPEC.
Contractor Training

- Envelope Commissioning
- Test plan
- Design review
Site Visits

• What to look for?

• How to address issues?

• Follow-up
Site Visits
Site Visits
Site visits
Site Visits
Site Visits
Site visits
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Site Visits
Site Visits
Site Visits
Functional Testing

- Building prep
  - Seal all “intentional” openings
  - Plumbing traps filled
  - HVAC shutdown
  - Combustion equipment turned off or pilot
  - Interior doors open, exterior doors closed
  - If ceiling tiles have been dropped, some will need to be removed
  - Weather conditions
  - Power requirements
  - Door Closer
Building Prep
Functional Testing

- Blower door
- Communication cables
- Pressure tubes
- Power
- Weather
Functional Testing
Functional Testing

- Pressurize
- Depressurization
### Depressional set

<table>
<thead>
<tr>
<th>Test Fan</th>
<th>2</th>
<th>Open (225)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6</td>
<td>62.2</td>
<td>64</td>
</tr>
<tr>
<td>P7</td>
<td>55.6</td>
<td>58.5</td>
</tr>
<tr>
<td>P8</td>
<td>222.2</td>
<td>229.2</td>
</tr>
<tr>
<td>P9</td>
<td>246</td>
<td>250.5</td>
</tr>
<tr>
<td>P10</td>
<td>232.6</td>
<td>243.5</td>
</tr>
</tbody>
</table>

- **Test Fan 2**: Open (225)
- **Test Fan 3**: Open (225)
- **Test Fan 4**: Open (225)

### Baseline data

<table>
<thead>
<tr>
<th>Temperature, initial</th>
<th>Indoors</th>
<th>Outdoors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline, Initial [Pa]</td>
<td>0.69</td>
<td>0.52</td>
</tr>
</tbody>
</table>

- **Greatest Initial Baseline**: 3.63 Pa
- **Time per Baseline Pressure**: 0 s

### Corrected airflow (CFM)

<table>
<thead>
<tr>
<th>Corrected airflow (CFM)</th>
<th>12950</th>
<th>12950</th>
<th>11860</th>
<th>15320</th>
<th>15770</th>
<th>13500</th>
<th>14550</th>
<th>14550</th>
<th>14010</th>
<th>14550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (%)</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>-0.5%</td>
<td>0.5%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>-0.7%</td>
</tr>
</tbody>
</table>

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**CFM/1000 ft²**: 0.4900

**CFM/1000 ft²**: 0.9987

**CFM/1000 ft²**: 11.23

**CFM**: 15950

**95% Confidence Interval**: 95%
Functional Testing
Functional Testing

- Thermal Images
- Tracer Smoke
Smoke Testing
Thermal Images
Thermal Images
Thermal Images

[Image of thermal scan with a temperature reading of 77.6 degrees]
Thermal Images
Thermal Images
Thermal Images
Thermal Images
Questions?

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