air barrier abaa association of america CONFERENCE & TRADE SHOW MAY 8-9 2018 SALT LAKE CITY
AIR BARRIER EDUCATION TRACKS FOR THE CONSTRUCTION INDUSTRY

Building Enclosure Commissioning

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fail·ure
/ˈfālyər/

noun

1. lack of success.
   "an economic policy that is doomed to failure"
   synonyms: lack of success, nonfulfillment, defeat, collapse, foundering More
2. the omission of expected or required action.
   "their failure to comply with the basic rules"
   synonyms: negligence, dereliction; More

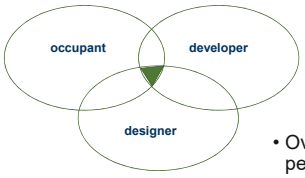
- less **resistance** to exterior environment
- less ability to **manage** infiltration
- greater **susceptibility** to problems

- What are the **drivers** of failure?

Drivers – Performance

- Occupant
  - Decrease **energy** use
  - Critical facilities require **continuous operation**
- Developer
  - Whole building **integration**
  - **Schedule**
  - Adverse to **litigation**
  - **Prevention** of failure (had failure in past & not wanting to repeat)
- Designer
  - **Complex** designs and design tools

Practice Pushing Industry

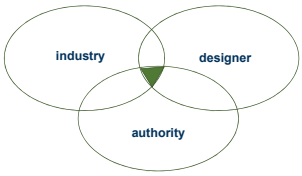


- Overlap in increased performance demands

Drivers – Materials

- Industry
  - **Competitive** environment
  - **Financial** benefit of getting product to market
  - **Proven** materials?
- Designer
  - **Misunderstanding** of material performance criteria
  - Desire to use latest **"cool"** materials
- Authority
  - More **stringent** codes

Industry Pushing Practice



- Overlap in material options and compliance with Code criteria

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Drivers – Welfare & Durability

- Occupants / Owners
  - Want **healthy environment**, without disruptions
  - Want **durability** and long service
- Designer
  - Require **knowledge**
  - Challenged to stay current with **multiple** facets of buildings
- Authority
  - Lax **enforcement** of codes

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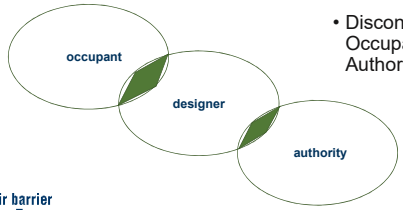
Lack of Knowledge



- Disconnect between Occupants/Owners and Authorities

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Drivers – Liability

- Designer
  - Pushing responsibility to Contractors (**delegation** of design)
- Developer / Owner
  - Cost **constraints**
  - **Alternative** project delivery methods
- Contractor
  - **Value engineering** of designs
  - Pushing **responsibility** to Sub-Contractors
    - Purchasing building enclosure design from **one** Sub-Contractor
    - Sub is responsible for design, coordination, quality, schedule, installation
    - **The rise of the specialty subcontractor, engineer of record, design assist and consultant**

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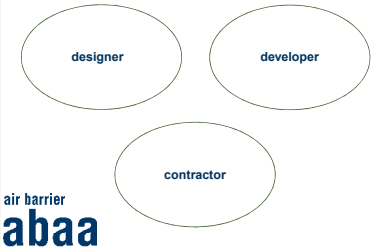
Delegated Responsibility



- Total disconnect

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ex·pe·ri·ence

/ˌikˈspirēəns/

noun

1. practical contact with and observation of facts or events.
   "he had already learned his lesson by painful experience"
   synonyms: involvement in, participation in, contact with, acquaintance with, exposure to, observation of, awareness of, insight into
   "his first **experience of** business"

verb

1. encounter or undergo (an event or occurrence).
   "the company is experiencing difficulties"
   synonyms: undergo, encounter, meet, come into contact with, come across, come up against, face, be faced with
   "some policemen experience harassment"

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Cause & Effect

- Slack building codes
- Low energy costs
- Budget constraints
- Performance demands
- Sustainability goals
- Knowledge, education or training
- Errors and omissions
- Reduce responsibility to reduce liability
- The rise of the **specialist and programs** to mitigate failure

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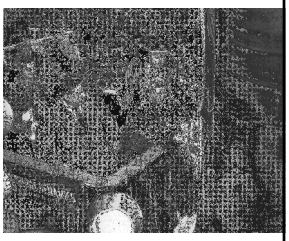
Commissioning (Cx)



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Cx History

US Navy

- The systems and equipment required to transform the new hull into an **operating and habitable warship are installed and tested**.
- The commanding officer and crew report for **training** of new ship.

Manufacturing

- A good manufacturing practice (GMP) is a **production and testing practice that helps to ensure a quality product**.
- GMP guidelines are **not prescriptive instructions.**
- It is the company's responsibility to determine the most **effective and efficient quality process**.

MEP System Cx

- Quality oriented process for **achieving** and **verifying performance**

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2005 - 2011

- ASHRAE Guideline 0 – 2005: The Commissioning Process
  - The purpose of this guideline is to describe the Commissioning Process capable of verifying that the facility and its systems meet the Owner's Project Requirements.
- NIBS Guideline 3 – 2006 Exterior Enclosure Technical Requirements for the Commissioning Process
- CSA Z320-11 Building Commissioning

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2012 - 2018

- NIBS Guideline 3 – 2012 Building Enclosure Commissioning Process
- ASTM E2813-12e1 (2012) Standard Practice for Building Enclosure Commissioning
- ANSI/ASHRAE/IES Standard 202-2013 Published Standard: Commissioning Process for Buildings and Systems
- ASTM E2947-2016a Standard Guide for BECx
- WORKING DRAFT - ISO 21105 Building enclosure thermal performance verification and commissioning

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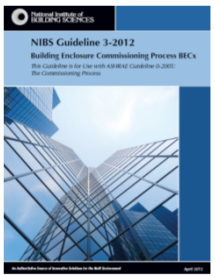
NIBS Guideline 3 2012 - BECx

"… the process by which the design and constructed performance of building enclosure materials, components, assemblies and systems are validated to meet defined objectives and requirements of the project, as established by the Owner."

The Guideline 3-2012 Building Enclosure Commissioning Process available at:
https://www.wbdg.org/ccb/NIBS/nibs_gl3.pdf



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BECx – what it is … and is not

- Not a party responsible for design or construction
- Not a guarantee
- Not expensive relatively speaking (Approx. 0.1% of project cost!)
- The Owner's advocate

- Is independent (not part of the design or construction team)
- Is an advisor
- Is engaged directly to Owner or through Cx Provider

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BECx Process

… focus is on defining project expectations
- BECx Pre-Design Phase

… focus is on quality assurance
- BECx Design Phase

… focus switch to quality control & verification
- BECx Pre-Construction Phase
- BECx Construction Phase

… focus switch to Owner training & maintenance
- BECx Occupancy and Operation Phase

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Owner Project Requirements (OPR)

The OPR produces a list **documenting the requirements** against which the Pre-Design, Design and Construction phases are executed.

Basis of Design (BOD)

A narrative and analytical document prepared by the design A-E along with design submissions to explain **how** the Owner's Project Requirements (OPR) are met by the proposed design.

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BECx Plan

The Commissioning Plan helps the owner understand the requirements and risks associated with each enclosure system in delivering the anticipated level of performance and the cost and schedule impact of the Commissioning activities.

-NIBS Guideline 03-2012

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Design Review

- Technical review, refine details
- Review interactions between systems
- Review specifications
- Finalize project commissioning plan
- Draft / Finalize BECx specification
- Document
- Back check

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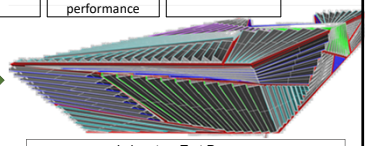
Building Enclosure Test Program

Design:	Enclosure Assembly:	Building Function and IAQ Requirements:	Location:
Complex / unique forms; building height	Barrier; drainage/rainscreen; combination of assemblies	Performance critical facility; multi-family high-rise; high performance	coastal/high wind zone, defined by ASCE -7; contaminated ground



Field Test Program

Laboratory Test Program
Field Test Program

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BECx Specification 01 91 19

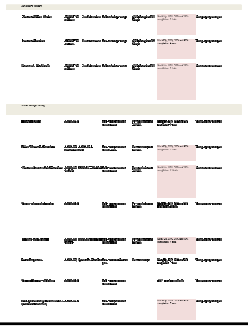
1.1 WORK INCLUDED
Commissioning requirements common to all Building Enclosure-Related Sections.
Verification of proper and thorough installation of Building Enclosure components.
Documentation of tests, procedures, and installations.
Coordination and requirements for field mock-up, trial installation and Performance Testing events.

1.2 GENERAL DESCRIPTION

A. Statement of Building Enclosure Design Intent (BEDI):

B. Building Enclosure Commissioning (BECx) is the process of ensuring that all building enclosure components are installed and **perform** collectively according to the BEDI and that the installation is adequately tested and that the specified performance is verified and documented.

It serves as a **tool to identify deficiencies** in the building enclosure during the preconstruction and construction phases in an effort to advance the building enclosure components from mock-up installations, through installation of the separate components on the structure, to a fully integrated, weather-tight assembly prior to occupancy, thereby **reducing impact on the building end user**.



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Pre-Construction Phase

- Purchasing
- Review of exclusions and/or substitutions
- Performance Mock-Up
  - Lab
  - Field

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Construction Phase

- Safety
- BECx Kick-off meeting
- Submittal Reviews
- Mock-Ups
- Development & Refinement of Installation check lists with assistance of trades
- Individual Trade Pre-con Meetings
- Ongoing BECx meetings
- Construction Observation
- Performance Tests
- Documentation

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Performance Testing

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Keep testing real!

No testing for the sake of testing!

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Occupancy Phase

- Review of Close-out report
- Training of the facility maintenance personnel.
- Educate the Owner to properly maintain the building enclosure.
- Review prior to 12 month end of warranty period.
- Lifetime persistence plan
- Review Current Facility Requirements (CFR)

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BECx success

- Reduced Risk
- Proved the system works at install
- Gained validity for energy efficiency claims
- Improved Durability

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BECx dilemma

- Why isn't every BE commissioned?
  - Perception
  - Cost prohibitive
- When do owner's embrace the Cx process?
  - When they have experienced failure
  - Proactive / experience
  - Required by LEED or government body
- Challenges BECx faces moving forward

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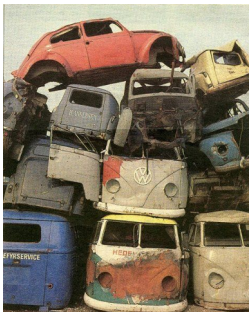
Every building enclosure is unique



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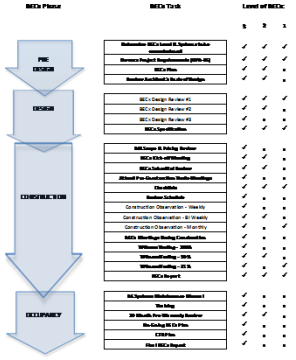
BECx process

Be adaptable to each design & situation

Levels of BECx appropriate and determined by **Owner**



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Risk

- Building Type
- Exposure
- **Design Complexity**

- Owner risk tolerance
- Cost of loss per square meter of area repaired
- Building use or function
- Area of building envelope
- Building envelope design complexity

Budget

- Team Expertise
- Certification Program
- **Code / Authority Having Jurisdiction**

- Environment
- Level of innovation and/or performance, and/or building sustainability goals

- Owner's number of prior projects and bidding requirements
- Level of owner's representatives commitment to the project throughout all phases
- Schedule
- Project delivery method
- Experience and knowledge of contractor

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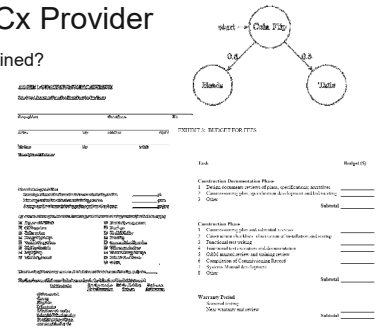
Team expertise

- Who is a BECx Provider
  - Technical knowledge
  - Free of fiduciary conflicts
  - Hands-on
  - Retained by Owner
  - Separate from Architect (may be size limitations where this is acceptable)
  - Separate from Contractor – Design/Build challenges this scenario

- The BECx Team
  - Owner, Cx Provider, Architect, Contractor, Subs, Specialty Subs, Manufacturer's, AHJ
  - Collaborative

How to retain a BECx Provider

- How are Cx Providers retained?
  - Request For Qualifications
  - Request For Proposal
  - Invitation
  - Interview
- SF330
- Cost
- Experience
- Certifications



BECx Provider Education & Certification

University of Wisconsin, Professional Development Program
- 3 day education based certification
- On-going education / experience requirements to be met, 5 years following exam
- BECxP Classes & Certification: http://continuing-engr.wisc.edu/Courses/course.lasso?myCourseChoice=N426
  - CxA + BE
  - BECxP

NEBB
- Certification for building enclosure air testing only
- Provides both firm and individual certifications
- Training & exam
- Experience & education pre-requisites

ASHRAE
Building Commissioning Association (BCA)
ACG
- Limited BE educational programs

Others in development

Challenges of certification

- Commoditization of the industry
  - Who really benefits?
  - What is the value certification brings?
  - Who is **really** "qualified"
- Adhesion to industry standards
- No controlling authority, standardization board, or accrediting agency to validate that the training and certification have value
- Vendors are biased toward their own certification and training
- Become a victim of the initial intent

For better or worse,
training and certification is not going to go away

Cx and Code / AHJ

IECC 2012 and 2015

Commissioning is a systematic process of verification and documentation that ensures the selected building systems have been designed, installed and function properly and can be maintained in accordance with the contract documents in order to satisfy the building owner's design intent and operational requirements.

IECC 2018 – will include a check list of documentation. The preliminary report will be required in order to obtain C of O

IECC 2015, Section 408 System Commissioning

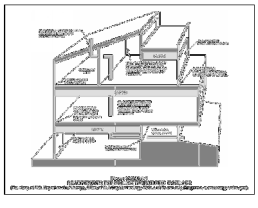
the code official. The code requirements for commissioning are: a preliminary commissioning report; drawings and manuals; a system balancing report; a final commissioning report; and verification of HVAC, lighting and electrical systems. Functional performance testing of equipment, controls, economizers and lighting control systems is necessary to ensure such systems function as designed and operate in the intended manner. The code requires the owner to receive documentation of the mechanical and lighting systems commissioning and completion requirements. The code official can obtain a copy of this documentation on request. Manuals must be provided for the overall building system so the building operator can understand the operation, maintain it as designed, and troubleshoot any future problems to keep it operating as intended.

Air barrier code compliance

IECC 2015

Air leakage – thermal envelope (Mandatory)

The thermal envelope shall comply with sections C402.5.1 through .8, or the completed building shall be tested and the air leakage rate of the building envelope shall not exceed 2.0L/(s•m2) @ 75Pa (0.40 cfm/ft2 @ 1.57 psf) per ASTM E779 or equivalent.



Code compliance by design or testing

Standards

- ASHRAE/ANSI/IES Standard 202-2013 -- Commissioning Process for Buildings and Systems
  - ICC Committee 1000, Guideline – soon to be published, will aid AHJ to understand Cx requirements
- Standard 202 (rev in June '18) anticipated to be basis for new ISO Cx document

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IgCC & 189.1 (to merge in 2018)

ANSI/ASHRAE/USGBC/IES
Standard 189.1-2011

- Cx for all buildings over 5,000sf
- Systems include: HVAC, **Building Envelope Thermal, Moisture & Pressurization**, Lighting, Irrigation, Plumbing, Renewable Energy, Water & Energy Management

IGCC – 2012

- Chapter 9: Commissioning, Operation & Maintenance
- Definition of Cx: A process that verifies and documents that the selected building and the site systems have been designed, installed and function in accordance with the owner's project Requirements, construction documents and minimum code requirements.
- Section 903.1: The Registered Design Professional in responsible charge or approved agency shall perform commissioning during construction and after occupancy.
- 903.1 – Construction or system requiring verification:
  - **Vegetative Roofs**
  - **SubSoil Drainage**
  - **Foundation damp proofing**
  - **Flashings**
  - **Exterior Wall coverings**

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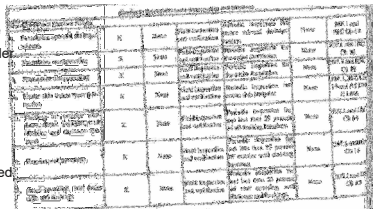
IgCC - 2015

- 605.1.2.1 Air Barriers – A continuous air barrier shall be provided for buildings in climate zones 1 through 8.
- 605.1.2.2 Testing Requirement. Test in accordance with ASTM E779. Air leakage rate of total area of building thermal envelope shall not exceed 0.25cfm/sf under pressure differential of 0.3-inch water column (1.57psf/sf)
- Section 903.1: The **Registered Design Professional** in responsible charge or **approved agency** shall perform commissioning during construction and after occupancy.
- **Experience or training** shall be considered relevant where the documented experience or training is related to the complexity of the Cx activities



903.1 – Commissioning Plan

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LEED v4 (adopted October 2016)
Energy & Atmosphere Credit

When:

- By the **end of the design development phase**, engage a commissioning authority with the following qualifications:

Who:

- The CxA must have documented commissioning process **experience** on at least two building projects with a similar scope of work. The experience must extend from early design phase through at least 10 months of occupancy;
- The CxA may be a qualified employee of the owner, an independent consultant, or a disinterested subcontractor of the design team.
  - For projects smaller than 20,000 square feet (1,860 square meters), the CxA may be a qualified member of the design or construction team. In all cases, the CxA must report his or her findings directly to the owner.

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LEED v4
Fundamental Cx - Energy & Atmosphere Credit

Who: Qualified Member of Design or Construction Team, not associated with project

- Same as NC2009, *ADDS one* Design Review of Building Enclosure
- Building Enclosure included in OPR and BOD
- References Cx to be performed per ASHRAE Guidelines 0, 1.1 and **Guideline 3, 2012**

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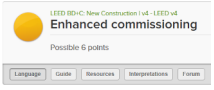
LEED v4
Enhanced Cx - Energy & Atmosphere Credit



Who: Independent CxA (may be a qualified employee of owner, or disinterested subcontractor of the design team)

- **BECx 2 points**, MBCx 1 point
- References BECx to be performed per ASHRAE Guidelines 0, 1.1 and **Guideline 3, 2012**
  - CxA prepares a CFR & O&M Plan (including training in CDs)
  - CxA develops on-going Cx Plan
  - CxA documents Operator and Occupant training delivery & effectiveness

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Challenges of BECx as viewed by LEED

- Poorly defined BECx scope in LEED V4
- Lack of understanding from Owner as to what is difference between Fundamental & Enhanced Cx, or how LEED status is achieved
- RFP's purchasing Cx services don't outline scope of work for BECx
- Heavy reliance upon industry to honestly implement G'line 3
- BECx Providers "under scoping" BECx tasks to win jobs
- No auditing by LEED to verify BECx met G'line 3
- Most Cx Providers don't know that Fundamental now includes BE – simply ignore this component or attempt to self-perform

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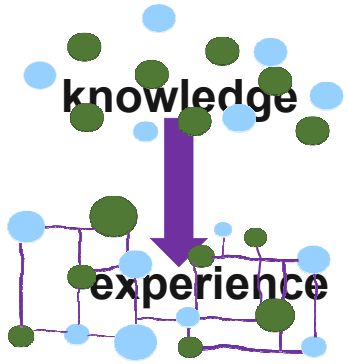
Value of BECx

- OPR
- Design review

- Construction observation
- Performance testing
- Submittal review



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Specific air barrier experience

It's not necessarily a vapor barrier
…the terms are not interchangeable!

Air barrier will control the passage of air from/between spaces
…more than one?

standard
ASTM E2178 (CAN/ULC-S741)
ASTM E2357 (CAN/ULC-S742)

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Air infiltration & exfiltration

- major cause of rain penetration
- uncontrolled, untreated infiltrating air
- waste energy, increased condensation & envelope deterioration
- limits transfer of noise, odor, fire and smoke
- disrupts ability to control indoor humidity
- disrupts interior HVAC design pressures (comfort, infection control and IAQ problems)

Straube, High Performance Buildings

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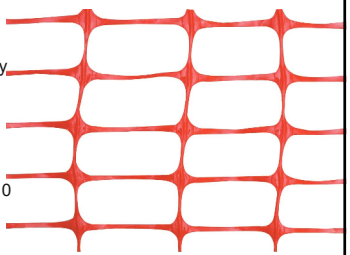
Exterior air barrier assembly

The air barrier can be located anywhere in the enclosure assembly

On the warm side, it can be a combination air and vapor barrier

If it is located on the cold side, it should have a permeance at least 10 times the permeance of the vapor barrier

Building Science Corp, Lstiburek



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Air barrier commissioning (Cx)

Achieving the owner's air barrier expectations

- ASHRAE
  - 0.1cfm/sf at 1.57psf – "tight"
  - 0.25cfm/sf at 1.57psf – "average"
  - 0.6cfm/sf at 75Pa – "leaky"
- USACE - 0.25cfm/sf at 1.57psf
- GSA – 0.4cfm/sf at 1.57psf
- IECC 2015 - 0.4cfm/sf at 1.57psf
- IgCC 2015 - 0.25cfm/sf at 1.57psf
- DOE Building America – 0.25cfm/sf at 50Pa

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Pre-Design Phase - air barrier Cx

Owners Project Requirements (OPR)
BECx Plan
Basis of Design

"Air/Moisture Barrier. Provide connections to prevent air leakage, moisture infiltration (and vapor migration as applicable) at the following locations:
o Foundation and walls, including penetrations, ties and anchors.
o Walls, windows, curtain walls, storefronts, louvers or doors.
o Different wall assemblies and fixed openings within those assemblies.
o Wall and roof connections and penetrations.
o Floors over unconditioned space.
o Walls, floor and roof across construction, control and expansion joints.
o Walls, floors and roof to utility, pipe and duct penetrations.
o Seismic and expansion joints.
o All other leakage pathways in the building enclosure."

Coordinate air barrier criteria with mechanical system design

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Design Phase - air barrier Cx

Design Review
BECx specification
- Incorporate project specific air barrier into Cx process - adapt as necessary
- Determine extent to which each task will be performed
- Testing matrix

"Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions. The assembly shall:
• be capable of withstanding combined positive and negative design wind, fan and stack pressures on the enclosure without damage or displacement, and shall transfer the load to the structure.
• not displace adjacent materials under full load.
• be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement. "

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Define

material: air leakage of the air barrier may not exceed 0.02 l/m²·s @75 Pa (0.004 cfm of air per ft² at a pressure difference of 0.3 inches of water 1.57 psf) per ASTM E2178

….which equates to the air permeance of ½ inch thick drywall

assembly: air leakage of the air barrier assembly may not exceed 0.2L/(s•m2) @ 75Pa. (0.04 cfm/ft2 @ 1.57 psf)

test combines the primary air barrier material with supporting air barrier accessories such as transition membranes and sealants to form a complete air barrier assembly per ASTM E2357

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Specify

- one air barrier section in division 1
- mock-up – perform testing
- transitions to windows responsibility of window sub
- transitions to roof and waterproofing responsibility of air barrier sub
- air barrier association of america (abaa) specifications, guidelines & test protocols
- abaa quality assurance program (qap)
- site observations
- commissioning & verification
- testing

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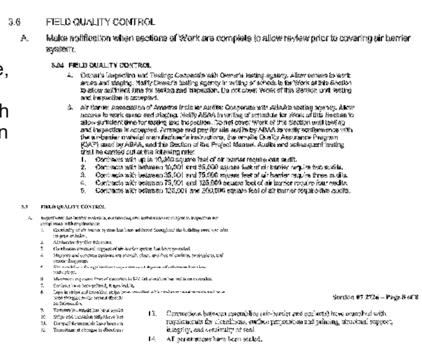
Verify

Every building is unique, however field quality control usually approach the building enclosure in the same manner.

Test!


3.6 FIELD QUALITY CONTROL
A. Make notification when sections of Work are complete to allow review prior to covering air barrier system.

3.04 FIELD QUALITY CONTROL
1. Contracts with up to 10,000 square feet of air barrier require one audit.
2. Contracts with between 10,001 and 35,000 square feet of air barrier require two audits.
3. Contracts with between 35,001 and 75,000 square feet of air barrier require three audits.
4. Contracts with between 75,001 and 125,000 square feet of air barrier require four audits.
5. Contracts with between 125,001 and 200,000 square feet of air barrier require five audits.

3.5 FIELD QUALITY CONTROL

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Contract documents

- provide air barrier details
- air barrier division 1 section
- include certified and experienced installers
- coordinate air barrier with building enclosure and interior air barrier sections
- include ABAA quality assurance program
- specify mock-ups and testing of mock-up prior to cladding
- field testing (additional tests if failure occurs, who pays)
- provide for alternates (as applicable)
- GC to include dedicated building enclosure superintendent
- air barrier testing and commissioning

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Pre-Construction Phase - air barrier Cx

Scope of Work Package review
Bid review
Mock-Up and testing

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Mock-Up test of Opaque Wall Air Tightness

0.04 cfm / ft² at 1.57psf when tested in accordance with **ASTM E283** *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.*

ASTM E1186 *Standard Practices for Air leakage site detection in Building Envelopes and Air Barrier Systems*

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Construction Phase - air barrier Cx

Submittal Reviews
Checklists
Construction Observation
Observation Schedule
Testing Schedule
Field Verification System tests: Level 1
Field Verification System tests: Level 2
Field Verification System tests: Level 3
BE System Maintenance Manual
BECx Report

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Construction observation

- informs the design & review process
- experience

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material

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substrate

- moisture content

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substrate

- moisture content

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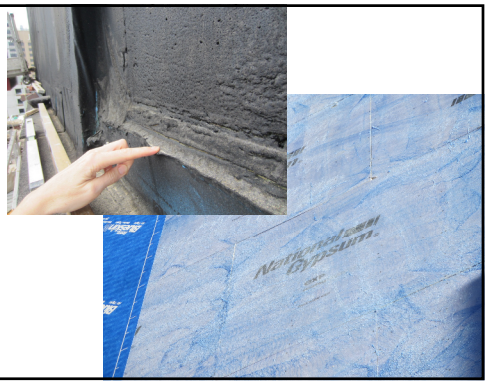
substrate

- primers
- terminations



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substrate

- termination

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substrate

- preparation

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substrate

- damage

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substrate

- compatibility

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substrate

- porosity

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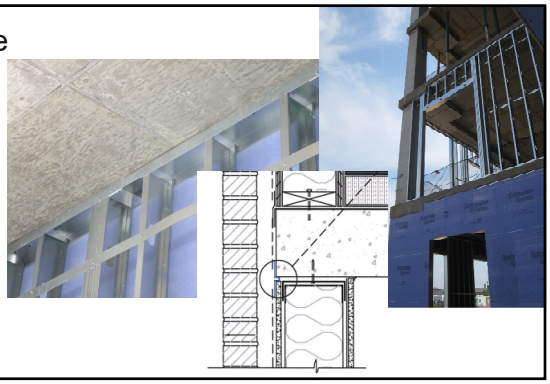
substrate

- movement



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substrate

- movement

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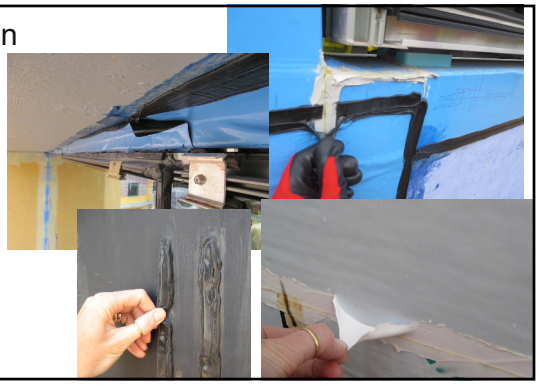
application

- adhesion



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application

- adhesion

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transition

- interruption

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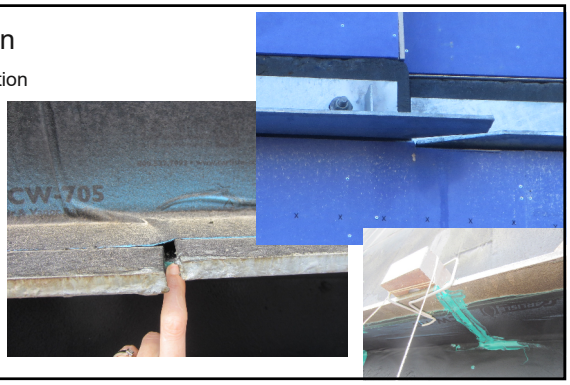
transition

- interruption



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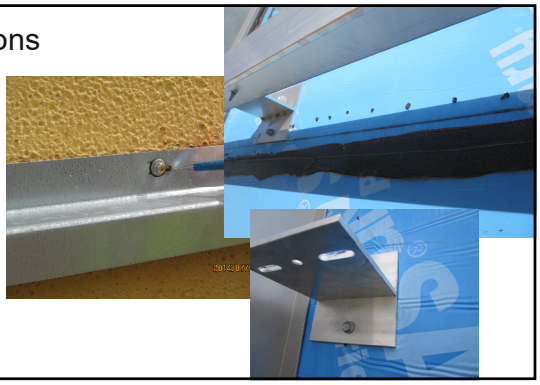
penetrations

- cladding attachment
- cladding support



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penetrations

- permeability

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penetrations

- fasteners
- adhesion

penetrations

- attachment

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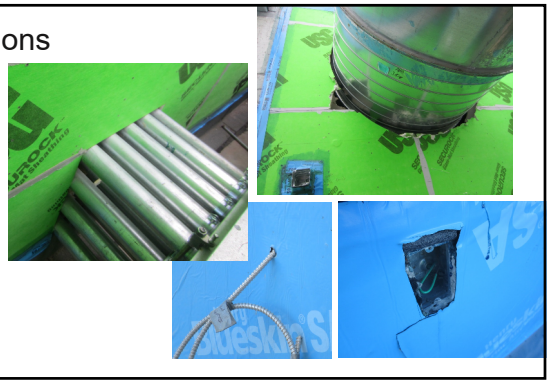
penetrations

- construct-ability



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interface

- adjacent substrates

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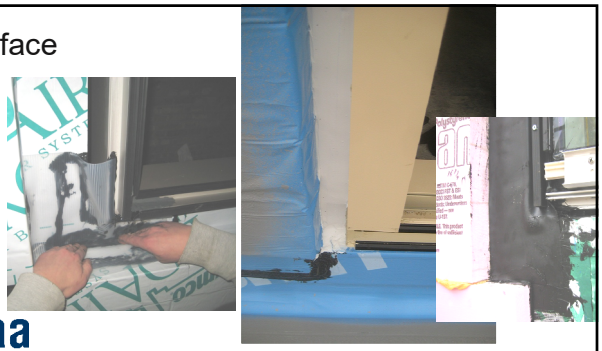
interface



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interface

- compatibility

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interface

- redundancy

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interface

- isolation

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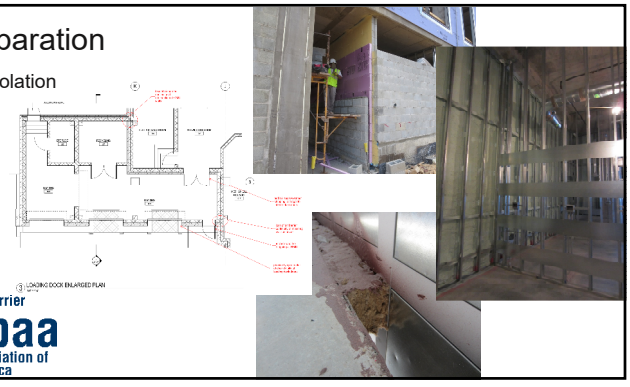
separation

- isolation



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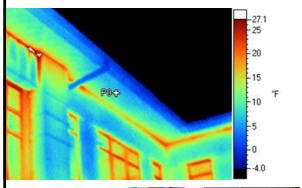
field air barrier tests



ASTM E1186-17 Standard Practices for Air leakage site detection in Building Envelopes and Air Barrier Systems (**7 practices for detecting air leakage**)

ASTM E779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

ASTM E1105-15 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference

AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems

ASTM C1060-11a(2015) Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings

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aama 501.2 / e1105

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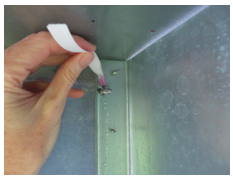

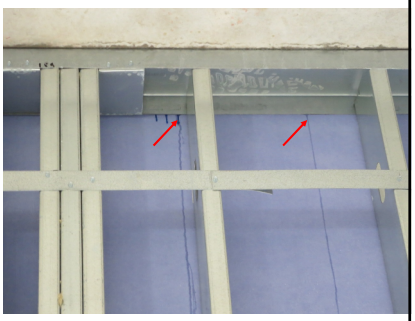

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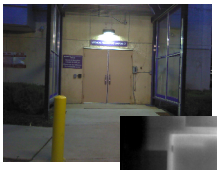
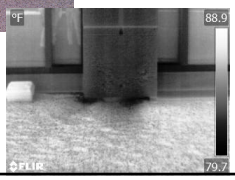
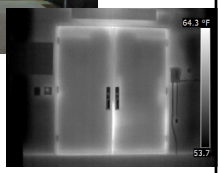
e1186 - 1 Thermographic Survey







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e1186 - 2 Smoke tracer

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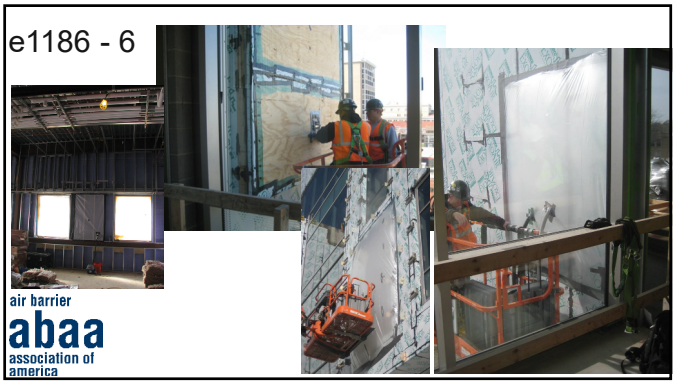
e1186 - 2 Theatrical fog

e1186 - 6



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e1186 - 7

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E1186 - 7

d4541

Typical 16psi for air barrier materials – each manufacturer may be different

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c1521

e1827 / e779

ASTM E1827 *Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door*

ASTM E779 *Determining Airtightness of Buildings Air Leakage Rate by Single Zone Air Pressurization*

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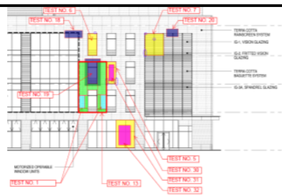
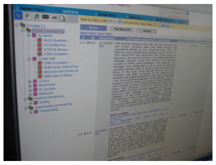
Documentation

- Report and track field action items
- Document test locations
- Building Enclosure Cx Report





Action Item No. 38
System Reviewed: Waterproofing
Date: 23 May 2008
Area Reviewed: NW Reentrant Corner (Column Line C: 1 to 3 and Column Line 3: A to C), Ground Floor
Weather: 60 Deg F / Mostly Cloudy
WJE Rep: MK
Present: GC (DB & JM)

Description:
WJE observed unprotected waterproofing membrane that included the following deficiencies: 1) large pockets of water beneath the waterproofing membrane; 2) tears at slab edge transitions along the perimeter of the first floor slab; 3) exposure to excessive debris including welding rods, miscellaneous metals (some partially melted into the waterproofing membrane), and concrete debris.

It is important to note that the large pockets of water observed beneath the waterproof membrane currently appear to be isolated to areas outboard of the precast concrete panels. WJE continues to recommend that all exposed waterproofing membrane is protected from on-going work in these and adjacent areas. GC to confirm that these deficiencies are repaired and that protection will be provided.

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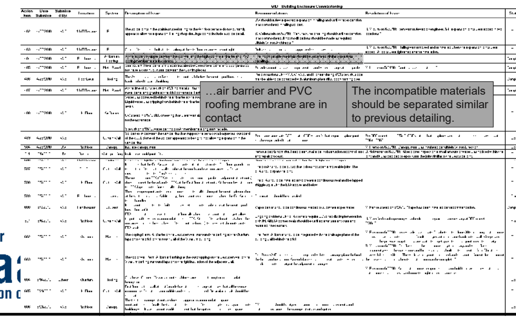
Action Item Log



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Close Out Report

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

UTSW - West Campus

EXTERIOR OPAQUE WALL ASSEMBLIES

Water and Air Control Membrane

Section 072726 - Air Barriers

Description:
A fluid applied, vapor permeable, water and air control membrane is installed over the exterior sheathing and behind the metal panel cladding systems. The purpose of the membrane is (1) to serve as the drainage plane, directing water that penetrates the metal panel rain screen cladding downward and, (2) to form an air enclosure boundary separating interior conditioned space from exterior unconditioned air.

The fluid applied membrane is integrated with metal flashings with a modified bitumen self-adhering sheet transition membrane to fulfill its water shedding function. The self-adhering transition membrane is also used at rough openings to provide a substrate for the sealant around some areas of curtain wall and door systems.

To accommodate for anticipated structural deflection of the slabs which carry through the vertical cold formed metal framing and the vertical exterior gypsum board, the air barrier must also be detailed to deflect where necessary without compromising air seal. A bellows detail was created using the transition flashing membrane at areas of deflection joints within the sheathing. Fluid-applied air barrier was then installed over the detail.

Fluid applied water and air control membrane


Bellows created using transition/flashing membrane in order to accommodate for structural deflection through the sheathing

Location(s):	Over exterior sheathing behind composite metal panels
Product(s):	Air Shield LMP Air Shield Self Adhesive Transition Membrane
Color/ Finish:	Gray (Air Shield LMP) White (Transition Membrane)
Manufacturer:	W.R. Meadows of Texas General Manager: Andy Tam, ph. 817.834.1969
Warranty Period:	5 years from substantial completion
SubContractor / Installer:	George D. Alan John Black Ph. 214-869-2075
[illegible]	[illegible]
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Occupancy Phase - air barrier Cx

Facility Engineer Training Requirements
Warranty Review
Monitoring / On-Going Commissioning
Current Facility Requirements (CFR) Plan

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Facility Engineer Training

- BECxP train facility maintenance personnel. Verify operators understand the building operation and how O&M activities affects its performance
- Implementation of on-going BECx process (measurement and verification plan)

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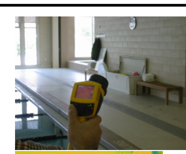
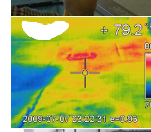
Warranty Review

- Perform pre-expiration of warranty review at approx. 10 month post completion
- Perform visual review and diagnostic testing if concerns are noted
- Evaluate operator maintenance practices
- Back check open items remaining from construction phase





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Experience is the teacher of all things.

Julius Caesar

Fiona Aldous

Principal

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