

Building Science Institute, Ltd. Co. Procedure A-2023 Field Conformity Assessment

These procedures apply to Building Science Institute, Ltd. Co. True North Quality Management Services Quality Assessors and Verification Organization Quality Assessment Designees. The performance of these assessments is recorded in HouseRater.

Related policies:

- Building Science Institute, Ltd. Co. Policy 08-2022 Terminology

Referenced Documents

BSI Policy 14 Referenced Standards, Codes, and Programs

Information Required for All Field Conformity Assessments

Identifying Data & Weather Conditions

The Quality Assessor or Quality Assessment Designee must record the Verification Organization; name of Verifier or Software Analyst being assessed; the type of verification/software analysis work being performed, whether energy code compliance (Prescriptive, UA, Cost Performance, R406 ERI); or ERI; or ENERGY STAR®, Indoor airPLUS, Zero Energy Ready Home; street address of dwelling unit; name of the Quality Assessor or Quality Assessment Designee performing the assessment; the date of the assessment; type of assessment, whether remote observation or in-person site observation; outdoor temperature at dwelling unit at time of assessment, indoor temperature, windspeed, and elevation above sea level.

Assessment Criteria

The criteria the Verifier or Analyst are assessed against are the requirements of the relevant Referenced Standards, Codes, or Program Certification Protocols, as applicable to the type of verification performed by the assessed Verifier or Software Analyst.

Observations

Observations are recorded as "Non-Conform" (NC) if the person observed does not conform with the requirements of the criteria they are assessed against.

Observations are recorded as "Conform" (C) if the person observed conforms with the requirements of the assessment criteria.

Observations are recorded as "Not Applicable" (NA) if the element is not present or the person being assessed cannot perform the verification.

The Quality Assessor or Quality Assessment Designee must record comments on non-conformance and not applicable items. Comments should be recorded on conforming items to ensure positive feedback or to collect additional information on the item.

Pre-drywall/Post-insulation Field Conformity Assessment

Building Elements

- Foundation type(s) documented & recorded
 - Photograph of foundation type
 - Floor/foundation dimensions measured & recorded
 - Framing type & sizes documented & recorded
 - Photograph of each unique floor/foundation assembly framing type, size, and spacing
- Exterior walls measured & recorded
 - Photograph of each elevation view
 - Wall structural type documented & recorded
 - Framing type & sizes documented & recorded
 - Photograph of each unique wall assembly framing type, size, and spacing

- Thermal mass documented & recorded
- Roof/ceiling structural type documented & recorded
 - Roof/ceiling dimensions measured & recorded
 - Framing type & sizes documented & recorded
 - Photograph of each unique roof/ceiling assembly framing type, size, and spacing
 - Ceiling exposure documented & recorded
 - Roof covering type documented & recorded
- Rim/Band joist insulation R-value documented & recorded
 - Photograph of each unique Rim/Band joist assembly framing type, size, and spacing
- Windows measured
 - Window orientation recorded
 - Window performance data recorded
 - Window shading documented
 - Photograph of representative window
- Skylight measured
 - Skylight orientation recorded
 - Skylight tilt recorded
 - Skylight performance data recorded
 - Skylight shading documented
 - Photograph of representative skylight
- Insulation R-value & installation quality recorded
 - Floors/foundation
 - Photograph of each unique floor/foundation insulation type, depth, and installation quality
 - Walls
 - Photograph of each wall insulation type, depth, and installation quality
 - Cathedral ceilings
 - Photograph of each cathedral ceiling insulation type, depth, and installation quality
- DHW pipe distribution length documented
 - DHW pipe R-value documented
- Solar DHW system pipe R-value documented
- Recirculation system type, control strategy, & branch length documented
 - Photograph of each recirculation system
- Drain Water Heat Recovery model number, efficiency, & # of connected showers recorded
 - Photograph of each Drain Water Heat Recovery system

Final Field Conformity Assessment

Insulation R-value & installation quality recorded

- Ceilings
 - Photograph of each unique ceiling/roof insulation type, depth, and installation quality
- Doors measured
 - Type of door documented
 - R-value & SHGC of door documented
 - Door weatherstripping presence, installation quality, & condition recorded
 - Photograph of each unique exterior door type, weatherstripping, and installation quality

Exterior Walls

- Exterior wall color documented & recorded

HVAC Equipment

- HVAC system type recorded
- Types of individual HVAC system components documented
- HVAC system fuel type recorded
- HVAC system class recorded
- HVAC system location documented
- HVAC system controls documented
- HVAC system manufacturer & model number recorded

- HVAC system capacity & efficiency documented
 - Photographs of individual HVAC system components & nameplates

DHW Equipment

- DHW class of equipment identified
- DHW equipment location documented
- DHW equipment manufacturer & model number recorded
- DHW efficiency rating documented
- DHW equipment insulation documented
- DHW type documented
- DHW capacity documented
- DHW fuel source documented
 - Photographs of each DHW system & nameplate
- Flow rates of faucets & shower heads documented
- Solar DHW system type documented
 - Photograph of SRCC label or manufacturer data sheet
- Solar DHW system collector area, orientation, & tilt documented
- Solar DHW system storage tank size & location documented
- Solar DHW system storage tank R-value documented

Light Fixtures

- Percentage of Qualifying Light Fixtures documented
 - Photograph of each unique light fixture type

Ceiling Fans

- Ceiling fan quantity documented
- Ceiling fan manufacturer & model number documented

Appliances

- Refrigerator manufacturer & model number documented
 - Photograph of refrigerator nameplate
- Refrigerator location documented
- Dishwasher manufacturer & model number documented
 - Photograph of dishwasher nameplate
- Range/oven fuel type documented
- Range type documented
- Oven type documented
 - Photograph of each oven/range
- Clothes washer manufacturer & model number documented
 - Photograph of clothes washer nameplate
- Clothes washer location documented
- Clothes dryer manufacturer & model number documented
 - Photograph of clothes dryer nameplate
- Clothes dryer fuel type documented
- Clothes dryer location documented

On-Site Power Production System

- On-site power production system documented
- PV system inverter documented
 - Photograph of PV system inverter nameplate
- PV system orientation documented
- PV system tilt documented
- PV system area documented
 - Photograph of nameplate or manufacturer data sheet

Duct Leakage Test Elements

- Duct location documented
- Duct R-value documented
- Fan serial number
 - Photograph of Fan serial number
- Manometer within calibration; date last calibrated
 - Photograph of Manometer serial number
 - Photograph of Manometer within calibration; date last calibrated
- All components of HVAC design present

- Air handler fan turned off
- All fans that can change pressure in conditioned space OR space containing ducts or air handlers turned off
- All vented combustion appliances turned off IF located in space that may become depressurized during test
- All filters in duct system & air handler cabinet removed, including return grille filters
- Non-motorized dampers in ducts between conditioned space & other spaces left alone
- Motorized dampers in ducts between conditioned space & other spaces closed & not sealed by verifier
- All zone & bypass dampers open
- Balancing dampers left alone
- Non-dampered openings of intermittent mechanical ventilation systems left open
- Non-dampered ventilation openings of continuously operating ventilation systems sealed at exterior
- Supply registers & grilles temporarily sealed at face & perimeter
- Floor registers on carpet removed & face of duct boot temporarily sealed
- If registers & grilles are not present, face of duct boot temporarily sealed
- Duct leakage test device attached to largest return grille
- Single static pressure pitot tube installed at supply register closest to air handler
- Manometer & tubing connected correctly to duct leakage test device

Total Duct Leakage Test

- If ducts located in unconditioned space, access points between those spaces & exterior opened
- A door or window between dwelling unit & outside open
- Fan induced duct system pressure difference, w.r.t. outside, of 25 Pa +/- 3 Pa, measured over 10 seconds
 - Photograph of Fan induced duct system pressure difference, w.r.t. outside, of 25 Pa +/- 3 Pa, measured over 10 seconds
- Results of duct leakage test recorded
- Total duct leakage results graded

Duct Leakage to Outside Test

- If ducts located outside infiltration volume, access points between those spaces & exterior opened
- All exterior doors & windows between infiltration volume & outside closed
- Blower door installed
- Blower door fan sealed & duct leakage test device fan sealed & turned off, 10 second baseline taken at blower door
- Blower door fan unsealed, turned on, adjusted to induce 25 Pa +/- 3 Pa pressure difference across enclosure w.r.t. outside
- Duct leakage test device unsealed, turned on, adjusted to induce 0.0 Pa +/- 0.5 Pa duct system pressure difference w.r.t. dwelling unit
- Enclosure pressure difference w.r.t outside re-checked & confirmed at 25 Pa +/- 3 Pa
- Duct system pressure difference w.r.t. dwelling unit re-checked & confirmed at 0.0 Pa +/- 0.5 Pa
 - Photograph of Duct system pressure difference w.r.t. dwelling unit re-checked & confirmed at 0.0 Pa +/- 0.5 Pa
- Results of duct leakage test recorded

Infiltration Test Elements

- Infiltration volume documented
- Compartmentalization boundary documented
- Fan serial number
 - Photograph of Fan serial number
- Manometer serial number
 - Photograph of Manometer serial number
- Manometer within calibration; date last calibrated
 - Photograph of Manometer within calibration; date last calibrated
- Exterior doors & windows closed & latched
- Exterior garage doors & windows closed & latched
- If vented crawlspace, interior access points closed
- If unvented crawlspace, all interior access points open & exterior access points closed
- If floor above crawlspace is air sealed & insulated, interior access points closed

- If attic is NOT air sealed & insulated at roof deck, interior access points closed
- If attic is air sealed & insulated at roof deck, interior access points open & exterior access points closed
- If floor above basement is air sealed & insulated, interior access points closed
- If floor above basement is NOT air sealed & insulated, interior access points open & exterior access points closed
- All interior doors open
- Chimney dampers & combustion air inlets on solid-fuel appliances closed
- Fans that can move air across the dwelling unit enclosure turned off
- Non-motorized dampers between conditioned space & other spaces left alone
- Motorized dampers between conditioned space & other spaces placed in closed position
- Non-dampered openings of intermittent local exhaust systems between conditioned space & other spaces left open
- Non-dampered openings of intermittent mechanical ventilation systems left open
- Non-dampered ventilation openings of continuously operating ventilation systems sealed at exterior
- Whole house fan louvers & shutters closed
- Window trickle vents & through the wall vents closed
- HVAC registers & grilles uncovered
- Plumbing drains with empty p-traps sealed or filled with water
- Vented combustion appliances off or in pilot mode
- Blower door installed in exterior door or window with unrestricted air pathway to dwelling unit & no obstructions within 5' of fan inlet and 2' of fan outlet (detached dwelling unit)
- Tubing installed to measure pressure difference between enclosure & outside (detached dwelling unit)
 - Blower door installed in doorway to enclosed space (corridor) OR exterior door or window with unrestricted air pathway to dwelling unit & no obstructions within 5' of fan inlet and 2' of fan outlet (attached dwelling unit)
 - Tubing installed to measure pressure difference between enclosure & enclosed space (attached dwelling unit)
 - Unrestricted air pathway > 20 square feet opened between enclosed space and outside (attached dwelling unit)
 - Adjacent dwelling unit doors to enclosed space open, if possible (attached dwelling unit)
- 10 second baseline with fan sealed
 - Photograph of 10 second baseline
- Fan induced enclosure pressure difference of 50 Pa +/- 3 Pa, measured over 10 seconds (single point test)
 - Photograph of Fan induced enclosure pressure difference of 50 Pa +/- 3 Pa, measured over 10 seconds (single point test)
- Fan induced enclosure pressure difference measured 5 equally spaced points between 10 Pa & 60 Pa, measured over 10 seconds at each point (multi-point test)
 - Photograph of each Fan induced enclosure pressure difference measured 5 equally spaced points between 10 Pa & 60 Pa, measured over 10 seconds at each point (multi-point test)
- Airflow corrected for altitude & temperature
 - Photograph of altitude
 - Photograph of indoor temperature
 - Photograph of outdoor temperature
- If single point test, add 10% of airflow to corrected result
- Infiltration test results recorded

Mechanical Ventilation Airflow Test Elements

- Mechanical ventilation system type documented
- Mechanical ventilation system manufacturer & model number documented
 - Photograph of mechanical ventilation system nameplate
- Mechanical ventilation run-time documented
 - Photograph of mechanical ventilation control run-time
- Gauge serial number
 - Photograph of Gauge serial number
- Gauge within calibration; date last calibrated

- Photograph of gauge's last calibration date
- All components of mechanical ventilation design present
- All interior doors open
- Operable window-trickle vents & through-wall vents open
- Ventilation openings unsealed
- Supply registers & return grilles open & unsealed
- Balancing dampers left alone
- Zone & bypass dampers in open position
- Vented combustion appliances off or in pilot mode
- Fans that can change pressure in conditioned space or spaces containing mechanical ventilation system ducts turned off
- IF mechanical ventilation system to be tested uses air handler fan, HVAC control set to "Fan"
 - IF mechanical ventilation system to be tested does NOT use air handler fan, HVAC controls set to "Off"
- Fan of mechanical ventilation system to be tested turned on
 - Powered flow hood @ inlet
 - Airflow resistance device @ inlet
 - Passive flow hood @ inlet
 - Powered flow hood @ outlet
 - Bag inflation device @ outlet
 - Mid-stream in ventilation duct
 - Integrated diagnostic tool
- Photograph of mechanical ventilation system test results
- Mechanical ventilation system test results recorded

Other Test Elements

- Kitchen range hood exhaust flow test
 - Photograph of Kitchen range hood exhaust flow test result
- Bath exhaust fan flow test
 - Photograph of Bath exhaust fan flow test results
- Bedroom zonal pressure difference test
 - Photograph of Bedroom zonal pressure difference test results

ANSI/RESNET/ACCA Std 310 Air Handler Fan Flow

- Prerequisites for air handler unit airflow test met
- Forced-air HVAC System manufacturer & model number in design documents match installed equipment
- On-board diagnostic system airflow values used
- Independent Verification Report values used
- Test performed by Verifier
 - Correct test method chosen
- Supply registers left as-found
- Non-motorized dampers that connect Conditioned space to exterior or unconditioned space left as-found
- Motorized dampers that connect conditioned space to exterior or unconditioned space closed with no further sealing
- Balancing dampers left as-found
- Non-dampened ventilation openings not sealed
- Fans that can change the pressure in either conditioned space or unconditioned spaces that contain the HVAC System turned off
- Mechanical ventilation fans connected to HVAC System turned off
- If air conditioner, tested in cooling mode
- If heat pump, tested in mode with highest design flow
- If tested in cooling mode, temperature > 55 °F or compressor power disconnected
 - Thermostat set to cooling mode & set point adjusted as low as possible
- If tested in heating mode, temperature < 60 °F or compressor power disconnected
 - Thermostat set to heating mode & set point adjusted as high as possible
- If HVAC System serves multiple zones, manufacturer instructions followed to set all zones to appropriate modes and set points

Pressure matching method

- Photograph of Manometer serial number

- Manometer within calibration; date last calibrated
 - Photograph of Manometer within calibration; date last calibrated
- Static pressure pitot tube placed in supply side between equipment & first duct run
- HVAC System operated for 10 continuous minutes
- Average pressure difference between static pressure pitot tube & space with HVAC system measured over 10 seconds
- Air handler fan turned off
- Fan flowmeter connected to HVAC System
- Fan flowmeter turned on and adjusted to match previous supply side static pressure test result
- Average airflow through fan flowmeter measured over 10 second average
- Measured airflow & plenum pressure recorded
 - Photograph of airflow results
- Fan flowmeter turned off & removed
- Test hole in supply side sealed

Flow grid test

- Photograph of Manometer serial number
- Manometer within calibration; date last calibrated
 - Photograph of Manometer within calibration; date last calibrated
- Static pressure pitot tube placed in supply side between equipment & first duct run
- HVAC System operated for 10 continuous minutes
- Average pressure difference between static pressure pitot tube & space with HVAC system measured over 10 seconds
- All filters removed
- Flow plate installed so ALL Air Handler Unit airflow will flow through it
- Average airflow through flow grid measured over 10 second average
- Measured airflow & plenum pressure recorded
 - Photograph of airflow results
- Flow grid removed
- Filters replaced
- Test hole in supply side sealed

Flow hood

- Flow hood model number & serial number recorded
 - Photograph of manufacturer nameplate with model number
- Flow hood placed over each grille that fits within capture element
- Flow hood turned on & average airflow measured over 10 seconds
- Airflow test results recorded
 - Photograph of airflow test results

OEM Static Pressure Table

- Photograph of Manometer serial number
- Manometer within calibration; date last calibrated
- Photograph of Manometer within calibration; date last calibrated
- Static pressure pitot tube placed in return side between filter & air handler fan
- Furnace: Static pressure pitot tube placed in supply side after furnace & before evaporator coil
- Heat Pump: Static pressure pitot tube placed in supply side after coil
- HVAC System operated for 10 continuous minutes
- Return & supply side pitot tubes connected to manometer
- Average pressure difference between static pressure pitot tube & space with HVAC system measured over 10 seconds
- Average static pressure recorded for return & supply
 - Photograph of static pressure results

ANSI/RESNET/ACCA Std 310 Air Handler Fan Watt Draw

- Prerequisites for air handler unit watt draw test met
- On-board diagnostic system airflow values used
- Independent Verification Report values used
- Test performed by Verifier
- If air conditioner, tested in cooling mode
- If heat pump, tested in mode with highest design flow
- If tested in cooling mode, temperature > 55 °F or compressor power disconnected

- Thermostat set to cooling mode & set point adjusted as low as possible
- If tested in heating mode, temperature < 60 °F or compressor power disconnected

Plug-in Watt Meter

- Air handler plugged into Plug-in Watt Meter
- Plug-in Watt meter turned on
- HVAC System operated for 10 continuous minutes
- Average watt draw measured over 10 seconds
- Average watt-draw recorded
 - Photograph of average watt-draw
- Plug-in watt meter removed and system restored to previous condition

Clamp-on Watt Meter

- Measured at service disconnect
- Measured at Air Handler Unit
- Nameplate voltage determined
- If nameplate voltage between 110 & 120 Volts, connect negative lead to ground wire & positive lead to connection between electrical power supply wire & equipment power supply wire
- If nameplate voltage between 200 & 240 Volts, connect negative lead to connection between first electrical power supply wire & equipment's power supply wire & positive lead to connection between second electrical power supply wire & equipment's power supply wire
- HVAC System operated for 10 continuous minutes
- Average watt draw measured over 10 seconds
- Average watt-draw recorded
 - Photograph of average watt-draw
- Clamp-on watt meter removed and system restored to previous condition

Analog Utility Meter

- All circuit breakers except one exclusively serving Air Handler fan turned off
- HVAC System operated for 10 continuous minutes
- Kh factor on meter recorded
- Number of full revolutions of meter counted over 90 seconds
- Number of revolutions and number of seconds recorded

Digital Utility Meter

- All circuit breakers except one exclusively serving Air Handler fan turned off
- HVAC System operated for 10 continuous minutes
- Fan wattage recorded
- Circuit breakers returned to original position

ANSI/RESNET/ACCA Std 310 Refrigerant Charge

- Prerequisites for refrigerant charge evaluation met
- On-board diagnostic system airflow values used
- Independent Verification Report values used
- Test performed by Verifier

Non-invasive (superheat) method

- HVAC System is NOT mini-split or multi-split
- IF rated cooling efficiency is < 17 SEER, outdoor dry-bulb temperature between 70-115 °F
- ALL other equipment, outdoor dry-bulb between 75-115 °F
- Thermostat set to cooling mode & set point temperature as low as possible in all zones
- Non-motorized ventilation dampers that connect Conditioned space to exterior or unconditioned space closed
- Motorized dampers that connect conditioned space to exterior or unconditioned space closed with no further sealing
- Balancing dampers left as-found
- Non-dampened ventilation openings sealed
- HVAC System ran for 15 continuous minutes
- Average return air dry-bulb & wet-bulb temperature measured at return grille closest to HVAC System for 10 seconds

- Average return air dry-bulb & wet-bulb temperatures recorded
- IF return air dry-bulb temperature between 70-80 °F AND return wet-bulb temperature > 50 °F, outdoor temperature measurements begin within 5 minutes
- Average outdoor air dry-bulb temperature measured where outdoor air stream enters condensing unit, with digital thermometer shaded from the sun, for 10 seconds
- Average outdoor air dry-bulb temperature recorded
- Average suction line temperature measured with sensor at 2 or 10 o'clock position on suction line within 6" of service valve for 10 seconds
- Average liquid line temperature measured with sensor in contact with liquid line within 6" of service valve for 10 seconds
- All outdoor temperatures taken within 5 minute period
- HVAC system returned to previous condition

Weigh-in Method

- Documentation of original refrigerant charge data collected
- Total length of liquid line measured and recorded
- Outside diameter of liquid line measured and recorded

ANSI/ACCA Std 12 QH Combustion Appliance Zone

- Outdoor CO measured before entering home
- CO measurement equipment operated continuously in CAZ during CO testing of combustion equipment & during depressurization test
- CO detection equipment monitored
 - Levels of CO > 9 ppm and < 25 ppm for 15 minutes, verifier may stop all testing
 - Levels of CO > 25 ppm, verifier must stop all testing

Atmospherically Vented Appliances

- Combustion gases measured at flue before draft diverter & around external perimeter of accessible vent pipe joints
- Appliance must operate for at least 5 minutes before sample taken
- Sample must be taken during depressurization testing

Direct Vented Appliances

- Combustion gases measured at connection and around external perimeter of accessible vent pipe joints
- Appliance must operate for at least 5 minutes before sample taken
- Sample must be taken during depressurization testing

Unvented Heating Combustion Appliances

- Measurement of combustion gases taken from area surrounding appliance
- Appliance must operate for at least 5 minutes before sample taken
- CO < 200 ppm air free

Gas Fired Ovens

- Any items not installed in oven removed
- Oven verified it is not in self-cleaning mode
- Oven turned on to highest temperature setting
- Oven door closed and CO monitored in kitchen, 5' from oven at waist height (countertop)
- IF kitchen CO > 25 ppm at any time, verifier stops testing
- CO levels measured within vent; samples taken while burner is firing; samples taken for 5 minutes

Gas Leakage Test

- All exposed fuel pipes inspected for leaks at fittings & joints with gas detector capable of measuring 20 ppm
- If odor indicates gas leak, ambient conditions tested with calibrated combustible gas meter; confirmed measured leaks with leak-detection fluid
- Location of leak identified with clearly visible mark or tag & homeowner notified
- IF levels > 10% lower explosive limit within the building, verifier notified occupants to leave & notified appropriate authorities & utilities from outside the building; no switches operated during exit; no ignition sources present

Combustion Appliance Zone (CAZ) Volume

- Volume of space providing air to fossil fuel appliances measured
- Net free area of opening which supply combustion air from adjoining room or outdoors measured

CAZ Depressurization Test

- All exterior windows, doors, & attic hatches closed
- Temporary opening to outside such as broken windows sealed
- Drain traps filled with water
- Bath exhaust fans turned on
- Kitchen range hood turned on
- Clothes dryer turned on
- Powered attic fans turned on
- Air handler fan turned on; IF pressure difference in CAZ w.r.t. outside becomes more negative, air handler left on; IF not, air handler turned off
- Interior doors to rooms with exhaust fans, other interior rooms, and interior doors to CAZ opened or closed to achieve highest pressure difference in CAZ w.r.t outside
- Make-up air, combustion air ducts, ventilation systems left as-is
- Vent or flue is at room temperature
- IF fireplace installed, damper closed; if damper cannot close, fire simulator (camping stove) operated in fire place
- Smallest Btu input appliance operated first and adjusted to operate continuously
- Spillage at draft hood tested after 5 minutes of operation with lighted match, candle, or smoke around complete circumference of draft hood relief opening
- IF smoke or flame pulled into vent, verifier recorded system pass
- IF draft not established within 5 minutes, verifier recorded system failure
- Additional fossil fuel appliances in same room turned on to full input and tested while previous appliance operates; spillage test procedures repeated on each appliance

Atmospherically Vented Combustion Appliance Venting

- Venting systems visually inspected for blockages, soot, corrosion or oxidation, improper support, slope, and/or termination, and insufficient draft
- Draft test performed and findings recorded

ENERGY STAR® Program Requirements

- All checklists completed in HouseRater

Indoor airPLUS Program Requirements

- All checklists completed in HouseRater

Zero Energy Ready Home Program Requirements

- All checklists completed in HouseRater

Approved by the Building Science Institute, Ltd. Co. Quality Council on April 24, 2023

Approve: Amber Wood, Brian Christensen, Erik Straite, Kevin Burk

Reject: None

Not Voting: Brett Dillon, Chair; Wes Davis

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