**Building Division** **Department of Community Development**

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# Energy Conservation Design, Submittal, Inspection, and Compliance *International Residential Code®* and *International Energy Conservation Code®*

The City and County of Broomfield Building Division has adopted the 2006 *International Residential Code®* and the 2006 *International Energy Conservation Code®*, effective February 28, 2008. This handout will summarize the new submittal requirements for energy code compliance. This applies to building permits for all new residential projects, including detached one and two family homes, townhomes, and multi-family projects.

There are three design paths that the designer can take to show compliance with these codes. Option #1 is the Prescriptive Path per IRC Chapter 11; Option #2 is the Total UA Alternative Path per IRC Section N1102,1,3 and IECC 402.1.4; and Option #3 is the Simulated Performance Alternative Path per IECC Section 404.

## OPTION #1 - PRESCRIPTIVE PATH

IRC Chapter 11 has the requirements for the prescriptive path. The plans need to show the following information. All information shall be per tables within Chapter 11, using zone 5 Dry.

1. **Insulation.** Provide all insulation "R" values, materials, and locations to be installed (walls, ceilings, cantilever floors, floors over garage, crawl space, basement walls, etc.) per Section N1102.2 and Table N1102.1. The exact location of the building thermal envelope that corresponds with this information shall be delineated on the plans, details, and section views.

   Please note that the cavity insulation shall be completely in direct contact with the floor sheathing at cantilevers or in floors located above garages.

2. **Fenestration.** Provide all fenestration U factors per Section N1102.3 and Table N1102.1. This will apply for all glazing in windows and doors. If the U-values differ from window to window, please be clear which unit is intended for each location.

3. **Air Leakage.** Provide details on how all areas listed in Section N1102.4.1 will be protected against air leakage. Please pay attention to the areas behind fire places and knee walls in attics. Verify that all windows, skylights, swinging doors, and sliding glass doors will meet the maximum air infiltration rate per Section N1102.4.2. Verify that all recessed lighting will meet the requirements of Section N1102.4.3.

4. **Moisture Control.** Show all moisture control details per Section N1102.5. Provide details for locations of vapor retarders. See also requirements for the location of the thermal envelope.

5. **Duct Insulation.** Indicate duct insulation per Section N1103.2.1. Provide details to show R-8 for supply and return ducts in attics or R-6 for ducts in floor trusses – please note the exception for ducts located completely inside the building thermal envelope.

6. **Duct Sealing.** Indicate duct sealing methods per Section N1103.2.2. Provide details for method of duct sealing to be used. Note that the Code requires that "duct joints shall be made substantially air tight." The definition for substantially air tight is maximum duct leakage of 10% for ducts within the building envelope and 5% for ducts outside the building envelope.

7. **HVAC Equipment Sizing.** ACCA Manual J 8th edition calculation package shall be based on the orientation of the home on the building lot for custom homes. We will allow the builder to do calculations based on worst case scenario for master plans. These calculations need to be done for all of the options if these options add or change room layout scenarios or fenestration details. Calculations shall show the size of the appliances: furnace and air conditioner condenser – make and model for both. Include the performance data for the equipment used. ACCA Manual J requires that ACCA Manual S be used for the equipment selection.

   These calculations shall be based on the design parameters shown on the last page of this handout. These design parameters will not be allowed to be changed for any reason. Currently there are only these 3 approved software choices: Wrightsoft, Nitec, and Elite.

8. **Duct Sizing.** ACCA Manual D calculations are required for each house and will be allowed to be a deferred submittal. They will need to be submitted to the plan checker after ductwork has been installed to be checked against the approved Manual J calculations. These will then be stamped by plan checker and sent back to the field. These calculations and layout sheets will need to be on site at time of mechanical rough inspection. The layout sheets will need to show all take-off locations and sizes, register sizes, return air opening sizes, duct run length, and duct size. Limited changes to this plan will be allowed in the field but approval of these field changes will be solely at the discretion of the field inspector. **See comments at end of handout for duct leakage testing at time of rough inspections.** Note that ACCA Manual D recommends that ductwork NOT be located within any exterior walls of the building envelope.

## OPTION #2 - TOTAL UA ALTERNATIVE PATH

IRC Section N1102.1.3 and IECC Section 402.1.4 have the requirements for the total UA alternative path. This allows the builder to show compliance by providing a copy of the REScheck calculations. The applicant shall show compliance with the 2006 IECC when using this option.

The submitted REScheck printout shall show all of the following specific information:

- orientation of each individual wall;
- insulation types, R-values, and whether continuous or cavity;
- accurate square footage; and
- accurate window and door sizes and the specific wall in which they are located, along with the U factor and SHGC factor (solar heat gain coefficient) for this glazing.

Builders who have master plans shall provide the “best case” and the “worst case” orientation for the REScheck (based on the orientation of the exterior walls). The plans examiner will check the differences and verify if the builder can just submit the “worst case” orientation when submitting future master plan permits. With this total UA option, the performance piece of the 2006 REScheck software cannot be used because: the 2006 REScheck provides a performance simulation, not how the house actually performs; the simulation does not include HVAC duct leakage or design; and the 2006 IRC does not have a performance option to show compliance with Chapter 11. If a performance option is desired, the builder may use 2006 IECC Section 404 (see option #3).

In addition to the REScheck the builder shall also supply the following information:

1. Air leakage details per Section N1102.4. See required details listed in Option #1 above.
2. Moisture control details per Section N1102.5. See required details listed in Option #1 above.
3. Duct sealing methods per Section N1103.2.2. See required details listed in Option #1 above.
4. Manual J and Manual D calculations as listed in Option #1 above.

## OPTION #3 - SIMULATED PERFORMANCE ALTERNATIVE PATH

This option is available per Section N1101.2 which allows design complying with IECC Section 404. Please be aware that IECC Section 404.2 also requires compliance with the mandatory requirements of Sections 401 (General), 402.4 (Air leakage), 402.5 (Moisture control), 402.6 (Maximum Fenestration U-factor and SHGC), and 403 (Systems).

We will accept software tools which have RESNET (Residential Energy Services Network) accreditation, commonly known as a HERS rating. A building plans rating, completed by an accredited RESNET rater shall be submitted at time of permit application or master plan review. This document shall be site specific for custom homes; we will allow builders to submit one for each model (with all various options) for initial review. The builder shall submit a copy of this approved building plans rating with each new permit application. Every house will be required to get a HERS rating which will be compared to the initially approved master Plan Rating. **This option requires the builder to provide on-site third party inspections by an accredited RESNET rater.**

The building plans rating document shall include the following:

1. Inspection checklist documenting the building component characteristics of the proposed design.
2. Accurate square footage.
3. Mechanical system features.
4. Name of individual completing report.
5. Name and version of the compliance software tool.
6. Name of individual who will do the field inspections and issue the final rating.

Additional information shall be submitted to verify compliance with:

1. Duct sealing methods – see details in Option #1.
2. Moisture control details – see details in Option #1.
3. Air leakage details – see details in Option #1.
4. Manual J and D calculations as shown in Option #1.

At time of final inspection, the submitted Home Energy Rating System (HERS) report shall show a passing score. Currently a HERS score of 100 is equivalent to the 2006 IECC. A certificate of occupancy will not be issued if the HERS score is greater than 100. **Please note that the City and County of Broomfield Building Division is still required to do on-site insulation and air barrier inspections with this option, see item 6 below.**

## INSPECTION AND COMPLIANCE REQUIREMENTS FOR OPTIONS #1 AND #2:

1. The builder shall call for an insulation inspection and we will also check all air leakage and moisture control details as called out on approved plans.

2. The builder shall perform a “duct blaster” test which will verify that the maximum duct leakage is 10% for ducts within building thermal envelope and 5% for ducts outside building thermal envelope. This is required on all new homes and multifamily projects. Please note that verifying the duct leakage at time of rough inspection will require all returns to be ducted and not use wall stud bays or floor joist spaces since we do not allow drywall to be installed at time of rough inspections. The builder will have to show the static pressures at rough inspection (total static should not be more than the manufacturers listing; add supply, return, AC coil, and filter for total static pressure). The builder will also have to show the total system flow on cooling speed at rough inspection. At first it would be advisable to do room to room flows at rough inspection.

3. The builder shall provide a Balance Report at time of final inspection that verifies that the air flow meets the calculations submitted at time of permit issuance. This report shall show the following: static pressure at final (total static should not be more than the manufacturers' listing and add supply, return, AC coil and filter for total static pressure; total flow and room to room flows. Room to room pressures are not to exceed 3 pa (Pascal) which is the industry standard. If outside air is introduced into the system or if the structural floor is provided with exhaust fans, these flows shall be measured to determine if they are performing as designed.

4. The builder shall post a permanent certificate in an approved location in the house. The approved location is on a wall nearest the furnace. This certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor), ducts outside conditioned spaces and U factors and solar heat gain coefficients (SHGC) for fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling and service water heating equipment.

5. The builder shall provide a copy of the REScheck if using Option #2 or fenestration list if using Option #1 on site for inspector doing rough inspection and insulation inspections. The builder shall leave the National Fenestration Rating Council (NFRC) labels on all windows and doors with glazing at time of rough inspections so inspectors can verify the glazing requirements.

6. Please note that Broomfield Building Division is also required to do an insulation and air barrier inspection if using Option #3 (Performance path – HERS Rating). The builder shall have a copy of the insulation requirements from the RESNET master plan rating calculations on site for this inspection.

| **CITY AND COUNTY OF BROOMFIELD DESIGN PARAMETERS** | |
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| **Outdoor Design Conditions per Table 1A ACCA Manual J Eighth Edition** | |
| Elevation: | 5344 feet |
| Latitude: | 40° North |
| Winter heating 99% Dry Bulb: | 1° F |
| Summer Cooling 1% Dry Bulb: | 91° F |
| Coincident Wet Bulb: | 59°F |
| Design Grains Difference at 50% RH: | -41 |
| Daily Range: | High (H) |
| Relative Humidity: | 50% winter and summer |
| Indoor Design Temperature for Heating: | 70° F |
| Indoor Design Temperature for Cooling: | 75° F |
| Heating Temperature Difference (HTD): | 69° F |
| Cooling Temperature Difference (CTD): | 16° F |
| Cooling Load Temperature Difference (CLTD): | 21.0° F |
| SHGC: | SHGC taken directly from sticker on glass. |
| *While not required per Table 402.1.1 of the IECC the SHGC is still required data for Manual J.* | *If not known, either use default per 2006 IECC Table 102.2(3) or equation SHGC= .87 x SC (shading coefficient) under A4-5 of Manual J.* |
| Altitude Correction Factor (ACF): | 0.84 |
| Moisture Content: | 68.2 |
| Air Density: | 0.063 |
| Wind Velocity Value: | 15 mph for heating |
| Wind Velocity Value: | 7.5 mph for cooling |