



Community Development & Neighborhood Services

281 North College Avenue

Fort Collins, CO 80524

970.416.2740

**2012 Fort Collins Residential Energy Code and Green Code
*COMPLIANCE GUIDE***

Revised 11-6-12

Residential



Planning, Development & Transportation Services

Community Development & Neighborhood Services
 281 North College Avenue
 P.O. Box 580
 Fort Collins, CO 80522.0580
 970.416.2740
 970.224.6134- fax
 fcgov.com

Residential

Green Code Amendments IRC

Plan Submittal Requirements

(Items to be provided on plans or with application)

	IRC
R324.1	<i>Construction Waste Management.</i> Plan to manage and recycle wood, concrete, steel, and cardboard waste. Identify waste company and how controlled on-site.
N1102.5	<i>Maximum Fenestration U Value</i> (average) on plans for basement windows. All fenestration U-Values identified.
N1103.6	<i>Heating/cooling Designs</i> on plans detailing system per ACCA Manuals S, J, and D.
I1401	<i>Heating/cooling Systems</i> to be sized per ACCA Manuals S, J, and D.
M1507.4	<i>Whole Dwelling Unit Ventilation</i> system identified, system type, exhaust termination w/dampers, controls and ducts, sound ratings.
G2406.2	<i>Natural Draft Appliances</i> identified on plans. Details to show that equipment is outside building envelope.
G2406.2	<i>Natural Draft Fireplaces</i> identified on plans.
P2903.2	<i>Maximum Flow of Fixtures.</i> Plans to indicate flow rates for fixtures per table P2903.2

Inspection Requirements

(Items to be inspected by City or Approved Agency)

R303.3	<i>Mechanical Ventilation.</i> Systems to be vented to the outside: bathrooms per M1507.3, kitchens w/gas ovens per M1503, whole dwelling unit per M1507.4. Inspected by City.
R324.1	<i>Construction Waste Management.</i> Plan document and site control of the collection of wood, concrete, cardboard, and steel. Inspected by City.
R324.3	<i>Certified Hardwoods.</i> Tropical Hardwoods in use to be certified by Forest Stewardship Council. Inspected by City.

Residential Requirements Green Codes

R325	<i>Low VOC's.</i> materials used, inspectors to ask for Low VOC literature on paints, stains, sealers etc.
R326	<i>Outdoor Lighting.</i> (<u>New buildings</u>) verify use of dark sky fixtures. Inspected by City.
R327	<i>Owners Operation Manual.</i> (<u>New buildings</u>) verify owner's manual is present at finals. Manual should provide owner with information to maintain and operate installed equipment. Inspected by City.
R703.8.1	<i>Fenestration Installation.</i> (<u>New windows, not replacements</u>) Verify that installation conforms to AAMA Standard A or A1 in regards to water plane. Spot check by City, final document by approved agency.
N1102.2.12	<i>Insulation Installation.</i> Verify installation to RESNET I standards, RESNET II at rims. Inspected by City.
N1102.4.2	<i>Air Barrier Sealing.</i> Spot inspected by the City verifying air sealing details on plans for new construction. Final blower door performed by approved agency. Full inspection by the City of air sealing details per IRC. N1102.4.2.2 for additions and alterations to existing buildings. Attached garages require differential-pressure test by approved agency.
N1102.5	<i>Maximum Fenestration U Value</i> (average) on plans for basement windows. All fenestration U-Values identified inspected by City.
N1103.6	<i>Heating/cooling Design</i> verify installed per plans including duct size inspected by the City. Final approval and testing by approved agency.
M1401	<i>Heating/cooling</i> verify equipment size per plans and compatibility of equipment. Inspected by the City. Final approval and testing by approved agency.
M1507.3	<i>Exhaust Ventilation System</i> Check equipment installed same as approved plans, Inspected by the City. Final approval and testing by approved agency.
M1507.4	<i>Whole Dwelling Unit Ventilation</i> Verify system identified, system type, exhaust termination w/dampers, controls and ducts, sound ratings. Inspected by the City. Final approval and testing by approved agency.
G2406.2	<i>Natural Draft Appliances</i> Identified on plans. Verify enclosure of natural draft equipment. Inspected by the City. Final approval and combustion safety testing by approved agency.
G2406.2	<i>Natural Draft Fireplaces</i> Identified on plans. Inspected by the City. Final approval and combustion safety testing by approved agency.
P2903.2	<i>Maximum Flow of Fixtures.</i> Verify maximum flow rates for fixtures per table P2903.2. Inspected by the City.

Certificate of Occupancy Requirements
(Items to be provided prior to project approval)

R703.8.1	<i>Fenestration</i> Installation certificate submitted by approved agency.
N1102.4.2.1	<i>Air Sealing Verification</i> form (blower door) (new buildings). Submitted by approved agency. Blower door test not required on additions or alterations.
M1309	<i>HVAC Performance</i> Tested, results documentation submitted by approved agency.
M1507.3	<i>Exhaust</i> ventilation performance tested results submitted by approved agency.
M1507.4.4	<i>Whole Dwelling Unit Ventilation</i> performance tested results submitted by approved agency.
G2406.2	<i>Natural Draft Appliances</i> with draft hoods requires combustion safety test, when identified by plan check. Submitted by approved agency.
G2406.2	<i>Natural Draft Fireplaces</i> Identified on plans. Inspected by the City. Final approval and combustion safety testing by approved agency.

Residential Building Code Green Building Amendments (Prescriptive) Applicable to Single-family Detached Housing, Duplexes, Townhomes



Item	GB Practice	Description *	Intent	Applicability**	Code	Ordinance -Ref Section
RESOURCE EFFICIENCY						
1	Construction waste recycling	<ul style="list-style-type: none"> Submit recycling plan (who, what, where, how) before project begins Implement recycling (non-landfill) for wood, metal, concrete and cardboard 	Divert construction waste from landfill	New: Yes Addition: No Alteration: No	IRC	R324.1
2	Certified wood	Sustainable forestry certification required for all tropical hardwoods	Support sustainable forestry practices	New: Yes Addition: Yes Alteration: Yes	IRC	R324.3
3	Windows, skylights, doors: installation	Increased detailing regarding integration of fenestration with exterior drainage plane	Reduce potential for exterior moisture damage	New: Yes Addition: Yes Alteration: No	IRC	R703.8.1
ENERGY EFFICIENCY						
4	Building envelope: thermal specifications for electric-heat buildings	More rigorous insulation envelope specifications for electric-heat buildings (beyond 2009 International Residential Code requirements)	Save energy and reduce peak electrical demand	New: Yes Addition: Yes Alteration: Yes	IRC IECC	Table N1102.1 Table N1102.1.2 N1102.4.2.1 Table 402.1.1 Table 402.1.3 402.4.2.1
5	Basement windows: thermal specifications	Basement windows with comparable performance to windows on main living levels	Set stage for energy-efficient, comfortable living space when basement is finished	New: Yes Addition: Yes Alteration: No	IRC IECC	N1102.5 402.5
6	Air sealing: tight construction	<ul style="list-style-type: none"> Whole-building air leakage: 3.0 ACH50 maximum (electric heat) 4.0 ACH50 maximum (non-electric heat) Increased focus on effective sealing between living space + attached garage Performance testing required 	Capture energy, comfort, durability and health benefits	New: Yes Addition: Part Alteration: Part	IRC IECC	N1102.4.2 202 402.4.2
7	Insulation: installation	<ul style="list-style-type: none"> Insulation installed to the Residential Energy Services Network (RESNET) Grade I standard Exceptions for which RESNET Grade II is acceptable: <ul style="list-style-type: none"> Rim joists Cavity insulation in exterior walls with continuous rigid insulating sheathing, R-5 minimum 	Install insulation so it delivers rated energy performance	New: Yes Addition: Yes Alteration: Yes	IRC IECC	N1102.2.12 402.2.12
8	Heating + cooling systems: design	<ul style="list-style-type: none"> Added requirements for permit application: <ul style="list-style-type: none"> Heating + cooling design load calculations include room-by-room loads Air-Conditioning, Heating, and Refrigeration Institute (AHRI) matched evaporators, condensing units and furnaces (AHRI certificate required) Document key design parameters 	Design systems that satisfy comfort needs and perform in accordance with manufacturer specifications	New: Yes Addition: Yes Alteration: Part	IRC IECC	N1103.6 M1401.3 403.6 (refs IRC M1401.3)

9	Heating, ventilation, air conditioning (HVAC) systems: performance testing	Performance testing of heating, cooling and ventilation systems, aligned with Air Conditioning Contractors of America (ACCA) 5 "Quality Installation" procedures. Systems operating out of tolerance compared with design specifications will be adjusted and re-tested until they pass.	Verify that HVAC systems perform as designed	New: Yes Addition: Yes Alteration: Part	IRC IECC IMC	M1309 403.6 (refs IRC M1309) 107.3
WATER EFFICIENCY						
10	Water-efficient fixtures	Toilets, showerheads and faucets must meet Environmental Protection Agency (EPA) WaterSense® standards for maximum flow rate or consumption.	Save water and energy	New: Yes Addition: Yes Alteration: Yes	IRC	P2903.2
INDOOR ENVIRONMENTAL QUALITY (IEQ)						
11	Safer combustion appliances: new construction	Natural-draft combustion appliances (furnaces, boilers and water heaters) must be placed outside the building's pressure boundary and pass combustion safety test. Natural-draft fireplaces must pass combustion safety test. (This requirement may also be met with safer combustion appliances: power-vented, sealed-combustion or direct-vent.)	Eliminate potential health and safety hazard of combustion products spilling into building	New: Yes Addition: Yes Alteration: No	IRC IFGC	G2406.2 303.3
12	Safer combustion appliances: existing buildings	When combustion appliances are replaced, all natural-draft combustion appliances must pass combustion safety test under "natural conditions."	Reduce potential health and safety hazard of combustion products spilling into building	New: No Addition: No Alteration: Yes	IRC IFGC	G2408.1 305.1
13	Low-Volatile Organic Compound (VOC) materials	Interior materials meet maximum VOC emissions standards	Improve indoor air quality for construction workers and occupants	New: Yes Addition: Yes Alteration: Part	IRC	R325.1
14	Whole-building ventilation	<ul style="list-style-type: none"> Provide whole-building, controlled, mechanical ventilation system, designed to meet ASHRAE 62.2 airflow requirements. Air handlers used to move ventilation air must be equipped with efficient blower motors. 	Improve indoor air quality	New: Yes Addition: No Alteration: No	IRC IMC	R303.3.3 M1507.4 407
OUTDOOR ENVIRONMENTAL QUALITY (OEQ)						
15	Exterior lighting: fixture design	Install "dark-sky friendly" exterior lighting fixtures	Increase security Reduce light pollution and light trespass	New: Yes Addition: No Alteration: No	IRC	R326 R326.1
OPERATIONS + MAINTENANCE + EDUCATION						
16	Building owner education	Provide operations and maintenance manual for building owner	Educate owners about their home and other "green" choices they can make	New: Yes Addition: Part Alteration: Part	IRC	R327 R327.1

* Amended code language is posted at www.fcgov.com/building/codes.php

** Indication of how amendment applies to new buildings, additions and alterations to existing buildings. In general, amendments apply in same manner as any code provision, when a building permit is required.

10/04/2011



**Planning, Development & Transportation Services
Community Development & Neighborhood Services**

2012 FORT COLLINS RESIDENTIAL ENERGY CODE COMPLIANCE FORM

FORM 1 - NON-ELECTRIC HEAT (If using elec heat form 3 must be used), use this form for single family houses, duplex, townhouses, or multi-family up to 3 stories.

Permit Number:
Address:

DIRECTIONS: Place a check next to Prescriptive, UA, or SPA indicating the path chosen. An air tightness Blower Door Test is required and must pass a 4 ACH leakage max.

<input type="checkbox"/>	(A) PRESCRIPTIVE compliance for house, 2009 IRC, section N1102.1, climate zone 5.
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BUILDING ENVELOPE	INSULATION R-VALUE
Wood frame wall insul r-value	R-20 or 13+5ci
Metal frame wall insul r-value	R-13+9ci or R-19+8
Crawl space wall	R-13 or R-10ci
Roof insulation in attic	R-38
Roof rafter insulation	R-30
Walls below grade	R-13 / R-10ci
Wood floor over un-cond	R-30
Slab on grade floor, unheat	R-10, 24" DEEP
Windows	U-.35

<input type="checkbox"/>	(B) TOTAL UA ALTERNATIVE (ResCheck), 2009 IRC, SECTION N1102.1.3
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Submit a passing UA calculation (i.e. ResCheck) using 2009 IRC/IECC. The rating must be submitted at time of application and must include address of residence; name of individual completing the rating form; name & version of software tool (i.e. ResCheck).

<input type="checkbox"/>	(C) SIMULATED PERFORMANCE ALTERNATIVE, 2009 IECC, SECTION 405
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An energy rating system must be utilized using approved computer software tool such as the new modified Fort Collins version of RemRate. A preliminary rating passing the 2009 IECC must be submitted at time of application. Rating must include Address, Name of individual completing the rating, & Name & version of software tool. Final rating requires a blower door test. Final passing rating must be submitted for certificate of occupancy.

SIGN:	DATE:
CONTRACTOR:	PHONE:



Planning, Development & Transportation Services
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FORM

FORM 3- ELECTRIC HEAT, for buildings whose primary heat source is electric.

Permit Number:

Address:

DIRECTIONS: Place a check next to method A or B indicating the path chosen. Also choose between an Air sealing checklist or Blower Door Test.

(A) PRESCRIPTIVE, 2009 IRC & IECC local amendment, climate zone 5.

	RESIDENTIAL	COMMERCIAL
BUILDING ENVELOPE	INSULATION R-VALUE	INSULATION R-VALUE
Wood frame wall insul r-value	R-20+5ci	R-13+7.5ci
Metal frame wall insul r-value		R-13+R-10ci
Mass wall (concrete, cmu)	R-15 ci or R-19	R-13.3 ci
Roof insulation in attic	R-49	R-49
Roof insulation cont. above deck		R-25ci
Walls below grade (bsmt or crawl)	R-15 ci or R-19	R-10ci
Wood floor over un-cond	R-30	R-30+7.5ci
Slab on grade floor, unheat	R-10, 48" DEEP	R-10, 24" DEEP
Windows	U-.30	U-.35

(B) TOTAL UA ALTERNATIVE / TOTAL BLDG PERFORMANCE (ResCheck/ComCheck) 2009 IECC chap 4 and 5.

This path is only allowed when 2 calculations (ResCheck or ComCheck) are submitted. One form showing all prescriptive values above inserted into the calculation thus establishing specific passing score. The second form can then be submitted using trade-offs but must pass to the same score as the first calculation. Passing forms must be submitted at time of application showing address of residence; name of individual completing the rating form; name & version of software tool. Air Sealing Checklist or Blower Door Test is required.

Circle one for either method above: Air Sealing Checklist Blower Door Test

(C) SIMULATED PERFORMANCE ALTERNATIVE, 2009 IECC, SECTION 405

An energy rating system must be utilized using approved computer software tool but must show that modifiers can be inputted into such programs to allow for upgraded requirements in the prescriptive method above. A preliminary rating must be submitted at time of application and include Address, Name, & software tool & version. Final passing rating must be submitted for certificate of occupancy.

SIGN:

DATE:

CONTRACTOR:

PHONE:



Construction Waste Management Plan

This fact sheet describes a Fort Collins building code change effective January 1, 2012. The requirements apply to all new residential and non-residential construction.

Code reference

International Building Code—(IBC) 3602.1 Commercial and all multifamily housing

International Residential Code—(IRC)R 324.1 Single-family detached housing, duplexes, townhomes

“For new residential and non-residential buildings, a construction waste management plan acceptable to the Building Official that includes recycling of concrete, wood, metals and cardboard, is required at time of application for a building permit. The plan shall be implemented and conspicuously posted on the construction site. Substantive changes to the plan shall be subject to prior approval by the Building Official.”

What is construction waste management and why is it important?

Construction waste management is applying management practices that result in less waste going to the landfill. At least 16% of the waste buried in the Larimer County landfill is directly attributed to construction and demolition (C & D) activities. Diverting construction and demolition waste extends the life of landfills, while contributing to the community's waste diversion and carbon emissions reduction goals. Waste management techniques also save natural resources and can reduce a project's overall disposal costs.

Techniques fall into “reduce, reuse, recycle” categories:

- **Waste prevention:** generating less waste to begin with. Plan efficient use of materials during the design and specification process, use scrap materials from one process for another process on the same job site.
- **Reuse:** set aside surplus or off-spec materials for use on other projects, or donate them to architectural materials retailers such as the non-profit organizations (ReSource Fort Collins or Habitat for Humanity).
- **Deconstruction:** disassemble a structure instead of demolishing it, to salvage materials such as cabinetry and porcelain appliances, lumber, landscaping elements, windows, doors.
- **On-site recycling:** use waste materials from the project by reprocessing them for other applications on the same site. One example for large projects is to grind waste materials to use as a soil amendment.
- **Off-site recycling:** collect materials on site for recycling at other facilities.

How do I comply with the code requirement?

The code outlines a three-step process:

1. **Develop a construction waste management plan.** This helps you get organized on the front end. The plan must address, at minimum, recycling of four materials: concrete, wood, metals and cardboard. The plan must address how these materials will be collected and recycled. For example, for each material, will a recycling service provider pick it up? Or, will the contractor haul the material to a designated location? A template for a simple plan is provided below. The plan is submitted with the building permit application and it is reviewed.
2. **Post the plan on the job site.** Be sure everyone on the project understands the CWM plan and commits to following through with it.
3. **Implement the plan.** To help ensure the designated materials are separated from other construction waste, post signage. Monitor receptacles to ensure materials aren't ending up in the wrong place. Building inspectors will be spot checking during site visits for other inspections.

Are there local providers who can help with construction waste management?

- Yes. There are a mix of specialty providers and conventional waste haulers who also provide recycling services. City of Fort Collins provides a current list of local hauling, salvage and recycling facilities found on the City's website at <http://www.fcgov.com/recycling/centers.php>

For more information

- City of Fort Collins Natural Resources Department, 221-6600, www.fcgov.com/naturalresources/recycling.
- Construction Materials Recycling Association: www.cdrecycling.org
- U.S. Environmental Protection Agency: www.epa.gov/osw/conservation/rrr/imr/cdm



Community Development & Neighborhood Services
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 FAX: 970-224-6134

CONSTRUCTION WASTE MANAGEMENT PLAN
Required as part of Approved Construction Plans

PROJECT INFORMATION

Address _____ DATE _____

Permit No. _____

General Contractor & Contact Info: _____

CONSTRUCTION WASTE MANAGEMENT PLAN

Complete this table or attach a more detailed plan

Material ⁽¹⁾	Vendor retrieving the material ⁽²⁾	Facility recycling the material ⁽³⁾
Concrete		
Wood/Lumber		
Metals		
Cardboard		

Notes

- (1) At minimum, the four listed materials must be recycled.
- (2) Enter vendor name and phone number. If the applicant will haul the material themselves, state such.
- (3) Where will applicant or vendor take the material for recycling? Enter facility name and address.



Certified Tropical Hardwood

This fact sheet describes a Fort Collins building code change effective January 1, 2012. The requirements apply to all new residential and non-residential construction.

Code reference

International Building Code (IBC) Sec. 3602.2 – applies to nonresidential and all multifamily housing.

International Residential Code (IRC) Sec. R324.3 – applies to single-family houses, duplexes, townhomes.

"All tropical hardwoods used in new construction, additions and alterations requiring a building permit, shall be certified by the Forest Stewardship Council or other approved agency.

Certification demonstrating compliance shall be required with delivery of such materials and shall be available for inspection".

What is "certified wood?" and why is it important?

Many wood product users have little information about the source of their lumber. Some forest management practices cause environmental damage such as habitat loss, increased erosion and stream sedimentation. Some wood products begin with illegal logging operations.

Programs have been developed to certify wood that comes from forests that are responsibly managed and harvested. For example, the Forest Stewardship Council is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. FSC-certified forest products are verified from the forest of origin through the supply/custody chain. FSC officials maintain theirs is the most rigorous forestry certification system to ensure responsible forest practices are maintained, including environmental protection, social equity & economic viability. The FSC and other certification programs based on recognized responsible forest management practices cover an array of wood products, from construction-grade framing lumber, custom cabinetry and interior finish wall paneling, to applications such as durable interior flooring and weather-resistant outdoor decking.

How do I comply with the code requirement?

The Fort Collins building code requires that all **tropical hardwoods** used in new construction be certified by the FSC or other agency approved by the Building Official. The main uses of tropical hardwood in Colorado are for decks (examples: Garapa, Ipe, Mayan Mahogany, Santa Maria) and hardwood flooring (examples: eucalyptus, tigerwood, bamboo, Brazilian cherrywood). All of these varieties can all be obtained as certified products.

The building permit holder must provide appropriate certification documentation available upon request by the **Building Inspection Division**. FSC-certified products are sometimes clearly identified with the FSC logo. The retailer can ask their supplier to stamp the material with the FSC label. To ensure the product is FSC certified, verify that the invoice from the certified retailer states their FSC CoC code and FSC claim (ie: FSC-Mix)

Where are complying materials available?

Most Fort Collins area building-supply centers and local lumber dealers can provide certified tropical hardwood products from wholesale outlets across the country. Check to see whether products are stocked or special order. Additional sources are located in the Denver metro area.

Search for FSC-certified products and species and certificate holders on-line. Note: the only web site with up-to-date information on the validity of a FSC certificate is <http://info.fsc.org/>.

For more information

- [Forest Stewardship Council – United States: www.fscus.org](http://www.fscus.org)
- [Sustainable Forestry Initiative: www.sfiprogram.org](http://www.sfiprogram.org)
- [American Tree Farm System: www.treefarmssystem.org](http://www.treefarmssystem.org)
- [Program for the Endorsement of Forest Certification Systems: www.pefc.org](http://www.pefc.org)
- [Sustainable Forest Management Program, Canadian Standards Association \(CSA\): www.csa-international.org/product_areas/forest_products_marking/](http://www.csa-international.org/product_areas/forest_products_marking/)



Fenestration Installation Fact Sheet

This fact sheet describes a Fort Collins building code change effective January 1, 2012.

Code reference: 2009 International Residential Code (IRC) Section R703.8.1 Fenestration Installation, and International Building Code (IBC) Section 1405.13.3, Fenestration Installation, are both amended by the City of Fort Collins as follows:

R703.8.1 Fenestration installation. For all new construction, all fenestration installations shall be in accordance with American Architectural Manufacturers Association (AAMA) Standards/ Specifications for Windows, Doors and Skylights and shall be supervised and inspected by an individual certified as an Installation Master by Architectural Testing, Inc. (ATI), or other approved agency.

What is fenestration installation, and what is the new requirement?

The requirement pertains to the installation of residential and light commercial manufactured windows and doors. The InstallationMasters training and certification program was developed to improve the installation of fenestration products. It was developed by the American Architectural Manufacturers Association (AAMA) and the American Society for Testing and Materials (ASTM), to create consistent installation practices. These installation practices are general guidelines; the manufacturer' installation instructions should always be followed, and in most cases are very similar to these guidelines. This requirement does not apply to built-in-place "store-front" windows. The City of Fort Collins Green Building Code (GBC) Amendment utilizes the InstallationMasters installation techniques, plus incorporates an important sill flashing requirement, based on building science best practice (see the EEBA Water Management guide referenced below).

Fenestration sill and perimeter flashing and how they're integrated into the building drainage plane are critical for a properly functioning building shell. Improper fenestration installation can lead to building component degradation and failure, and is one of the leading causes of potentially costly building repairs and lawsuits. Many installers are already using these best practices, but because of the lack of a standard, there are also many incorrect installations occurring.

The City of Fort Collins Fenestration Installation training class partially illustrates the Installation Master's techniques and sill flashing required to meet the City's GBC amendments. Attending this class qualifies an individual to be an "Approved Agency". This individual will then be able to install, supervise, or inspect a fenestration installation, and fill out and sign the Fenestration Installation Checklist. Any individual who is an InstallationMasters certified installer can also fill out and submit the checklist form.

How do I comply with the code requirement?

Any fenestration installation requiring permit must be performed, supervised, or inspected by an individual who is InstallationMasters certified, or who is a City of Fort Collins Fenestration Installation "Approved Agency". This individual must sign, date and submit the Fenestration Installation Checklist to Building Services prior to receiving approval.

For more information

Reference: InstallationMasters Chapter 16, New Construction Installation Method "A" or "A1".
Best practice sill and perimeter flashing integration into various drainage planes can be found in the Energy and Environmental Building Association (EEBA) Water Management guide, by Joseph W. Lstiburek, PhD, P.Eng.

(Revised 11-6-2012)

Residential HVAC design requirements for permit submittal

Requirements for HVAC design submittal vary for three different types of residential buildings. References below are to 2009 IRC and IBC, which have been locally amended. Submittals are reviewed to check that design conditions are correct, building data (design conditions, R-values, U-values, equipment specifications, duct parameters, etc) matches the plans, and that the allowable methods have been reasonably followed.

1. Single-family (detached, attached)

- IRC M1401.3 outlines requirements for heating and cooling design load calculations, equipment sizing, room load calculation and matched equipment.
- IRC M1601.1 outlines duct design and sizing requirements.
- IRC M1507.4 outlines requirements for whole-dwelling unit ventilation.

Design heating and cooling loads must be calculated in accordance with ACCA Manual J, using an ACCA-accredited software program (currently accredited programs are Elite Software RHVAC, Wrightsoft Right-J8, Nitek HVAC Wizard).

Fort Collins Design Conditions – Outdoor and Indoor		
Parameter	Winter	Summer
Outdoor dry bulb temp	4F	89F
Daily range	N/A	High
Outdoor moisture		
Relative humidity	70%	23%
Wet-bulb temp	3 F	62 F
Humidity ratio	6 grains moisture / lb dry air	57 grains moisture / lb dry air
Indoor dry bulb temp	72F	75F
Indoor moisture		
Relative humidity	30%	50%
Wet-bulb temp	53 F	62 F
Humidity ratio	42 grains moisture / lb dry air	78 grains moisture / lb dry air
Moisture difference	36 grains moisture / lb dry air	-21 grains moisture / lb dry air
Wind speed	15 mph	7.5 mph

Equipment must be sized in accordance with ACCA Manual S, using the design loads and expanded performance data from equipment manufacturers. NOTE: There is no approved software for this step.

Ductwork must be designed in accordance with ACCA Manual D. Design may be performed manually or by using an ACCA-accredited software program.

HVAC design must be documented using the “Residential Mechanical Systems Design Submittal” form. The “Mechanical Systems Design Submittal Guide” provides guidance on procedures and data requirements, including design conditions and special requirements for stock plans. Both documents are available from Building Services or on-line at www.fcgov.com in the Building Services web page.

HVAC submittals are accepted only from individuals who have become an “Approved Agency” by attending the City’s Residential Mechanical Systems Design” training.

2. Low-rise multi-family (up to 3 stories)

Code requirements are identical to those for single-family housing. Submittal requirements are a variation on those for single-family houses. They are based on analysis of representative unit types, e.g. 1-BR, 2-BR, etc. Model each in “worst-case” location and orientation (typically top-floor, corner location with most glass facing SW or W). Also model each as “best-case,” i.e. lowest loads (typically interior units, mid-floor, glass some other direction). If the difference in cooling load for a given unit type is 6,000 Btuh or less, only one system design and submittal is required. If the range is greater, multiple designs and submittals are required.

The ASHRAE RTS method is an approved equivalent to the ACCA procedures.

3. High-rise multi-family (4 stories and above)

This type of building is considered commercial from a code standpoint. Energy requirements are governed by IECC Chapter 5, which allows ASHRAE 90.1 as an alternate path.

Load calculations are always required:

- IECC 503.2.1 requires design load calcs in accordance with ASHRAE/ACC Standard 183. (The Building Official can approve "equivalent" methodologies.)
- ASHRAE 90.1-2007 Section 6.4.2 provides general guidance, with reference to the ASHRAE Handbook of Fundamentals.

For projects with heating and cooling systems for individual units, analyze representative unit types (e.g. 1-BR, 2-BR, etc). Model each in "worst-case" location and orientation (typically top-floor, corner location with most glass facing SW or W). Also model each as "best-case," i.e. lowest loads (typically interior units, mid-floor, glass some other direction). If the difference in cooling load for a given unit type is 6,000 Btuh or less, only one system design and submittal is required. If the range is greater, multiple designs and submittals are required.

The ASHRAE RTS method is an approved equivalent to the ACCA procedures.

Residential Mechanical Systems: Design + Testing

City of Fort Collins Building Code Green Amendments, effective January, 2012

General Information

The amendments reinforce past code requirements regarding mechanical systems design, while adding requirements for whole-dwelling-unit ventilation and performance testing of installed mechanical systems. These requirements are supported with training, submittal forms and supplemental guides.

The Building Department will accept documentation demonstrating compliance with the mechanical systems design and testing requirements **only from individuals with “Approved Agency” status** by City of Fort Collins. Contact the Building Department regarding this designation.

Most of the work related to these amendments will typically be completed by mechanical contractors. To be successful, their work must be closely coordinated with the general contractor and other design and construction professionals.

Design

Changes related to mechanical systems design affect local exhaust (bath fans, kitchen ventilation); whole-dwelling-unit ventilation; heating and cooling design load calculations, equipment selection, ductwork; controls; and combustion appliances. **Detailed submittals are required at the time of building permit application.** Resources available to help you successfully meet the code requirements include:

- Residential Mechanical Systems Design Submittal Checklist: Required cover sheet for design submittal, specifying the documents that must be turned in and information that must be highlighted. Applicant completes the checklist and assembles the design packet.
- Residential Mechanical Systems Design Submittal Guide: Reminders regarding applicable code sections and design procedures. The guide parallels the submittal checklist.
- Residential Mechanical Systems Design training: Video, slides and design handout.

The submittal checklist and guide can be downloaded at www.fcgov.com/building. Contact the Building Department regarding training opportunities.

Testing

The amendments require installed mechanical systems, in new residential buildings and additions in which new systems are installed, to be performance-tested and adjusted to operate within design specifications. Testing is a quality assurance step that helps assure that the as-built mechanical systems operate per design intent. It provides valuable feedback for design and installation. Aspects tested include local exhaust, whole-dwelling-unit ventilation; ductwork leakage; gas furnace; air conditioner; room air flow and pressure balance; combustion safety; and controls. Contractors are encouraged to perform testing at rough stage when components can be more easily accessed if modifications are needed to comply. **Documented results are required prior to issuance of a Certificate of Occupancy.** Resources available to help you successfully meet the code requirements include:

- Residential Mechanical Systems Performance Testing Submittal Form: This required form organizes the testing data and indicates Pass/Fail for each section.
- Residential Mechanical Systems Testing Guide: Descriptions of allowable testing equipment, protocols and reminders for each of the required tests.
- Residential Mechanical Systems Testing training: Video will be available in future.

The submittal form can be downloaded at www.fcgov.com/building. The guide is under development; it will be available soon. Contact the Building Department regarding training opportunities.

Protocol and Submittal Requirements for Blower-Door Testing

City of Fort Collins Building Code Green Amendments (Effective January, 2012)

Approved Agency

Blower-door testing results will only be accepted from City of Fort Collins "Approved Agencies." To achieve this designation, contractors must attend City-sponsored "Residential Building Envelope" training.

Whole-house Air Leakage

Code reference: IRC N1102.4.2.1, IECC 402.4.2.1

Mandatory requirement (all residential energy code compliance paths) for new construction.

Testing protocol

Residential Energy Services Network (RESNET) Mortgage Industry National Home Energy Rating Standards, 802

PROCEDURES FOR BUILDING ENCLOSURE AIRTIGHTNESS TESTING, 2011

(available for download at www.resnet.us/standards/DRAFT_Chapter_8_July_22.pdf).

A multi-point air tightness test shall be conducted, per Section 802.6.

Compliance requirement:

- The building air change rate at 50 Pascal test pressure (ACH50) shall not exceed the following limits:
- Non-electric heat buildings: 4.0 ACH50, Electric heat buildings: 3.0 ACH50

Submittal requirement:

- Output from blower-door testing / analysis software showing, at minimum, the following information:
- Building address, date of test, technician, and company conducting the test.
- Building volume (cubic feet)
- Building leakage rate at 50 Pascal test pressure (corrected CFM50)
- Percent uncertainty in the corrected CFM50, at the 95% confidence level (+/- 5%)*
- Building air change rate at 50 Pascal test pressure (ACH50 = CFM50 x 60 / Volume)
- The person with "Approved Agency" status must also be identified on the software report, along with a signature and date. This information may be hand-written on the software output.

Attached Garage Isolation

Code reference: IRC N1102.4.2.1, IECC 402.4.2.1

Mandatory requirement for new construction, for buildings with attached garage.

Testing protocol:

- Set up the building in accordance with the protocol for whole-house air leakage, above.
- Place a pressure tap in the garage and close the door between house and garage, without crimping the sensing tube.
- Adjust blower door fan speed so that the building interior is depressurized to -50 Pascals with respect to the outdoors.
- Measure the house pressure with respect to the garage.

Compliance requirement:

- The house pressure with respect to the garage shall be in the range of -45 to -50 Pascals.

Submittal requirement:

- Provide the test result by writing "House pressure WRT garage = ___ Pa" on the software output submitted for the whole-house air leakage requirement, above.

Mechanical Room Isolation

Code reference: IRC G2406.2, Exception 6d, IFGC 303.3, Exception 1d

Mandatory requirement for new buildings with natural-draft combustion appliances located in isolated mechanical rooms.

Testing protocol:

- Set up the building in accordance with the protocol for whole-house air leakage, above.
- Place a pressure tap in the mechanical room and close the door between house and mechanical room, without crimping the sensing tube (recommendation: use rigid metal tube where it passes through doorway).
- Adjust blower door fan speed so that the building interior is depressurized to -50 Pascals with respect to the outdoors.
- Measure the house pressure with respect to the mechanical room.

Compliance requirement:

The house pressure with respect to the mechanical room shall be in the range of -45 to -50 Pascals.

Submittal requirement:

Provide the test result by writing "House pressure WRT mechanical room = ___ Pa" on the software output submitted for the whole-house air leakage requirement, above.

City of Fort Collins Building Code Green Amendments (Effective Jan 1, 2012)
Residential Mechanical Systems Design Submittal Checklist

V3B -- 1/14/2012

This checklist serves as a cover sheet for the design submittal at time of permit application
For code references and guidance on procedures and key elements, see Residential Mechanical Systems
Submittal Guide

Approved Agency

Name _____ Company _____

Signature _____ Date _____

Local Exhaust

Bath fans

- OEM specification sheet for each model of bath fan to be installed. Highlight these minimum contents:
 - Manufacturer and model number
 - Rated airflow and corresponding static pressure
 - Sone rating for any fan subject to 1.0 sone limit (part of whole-dwelling unit ventilation system)
- Include these minimum contents on electrical or mechanical plan:
 - Fan locations and model numbers
 - Specify whether any bath fan will also provide all or part of whole-dwelling unit ventilation requirement.
 - Specify intermittent or continuous operation for each fans.

Kitchen exhaust

- Specify whether oven is electric / gas / buyer option
- Specify how kitchen exhaust requirement will be met (optional if elec oven is installed & no stubbed gas line)
 - Specify intermittent or continuous operation
 - Vented range hood or other exhaust approach
- OEM specification sheet for vented range hood or other exhaust fan. Highlight these minimum contents:
 - Manufacturer and model number
 - Rated airflow and corresponding static pressure

Whole-Dwelling-Unit Ventilation

- Drawing and/or narrative describing system design. Minimum contents:
 - Minimum airflow requirement
 - Ventilation system type(s)
 - Control strategy, including dampering, duty cycling, occupant control
- OEM specification sheets for each fan. Highlight these minimum contents:
 - Manufacturer and model number
 - Fan design operating point (static pressure and airflow) on fan performance table or chart
 - Sone rating for any fan subject to 1.0 sone limit
- For fans ¼ HP or larger, documentation that fan is brushless DC or equivalent

Heating + Cooling Design Load Calculations

If more than one system is being installed, each must be separately documented.

- Load calculation software output reports
 - Project Summary
 - Component Constructions
 - Right-J Worksheet
 - AED Assessment
 - Building Analysis
 - Load Short Form
 - Loads for Multiple Orientations (stock plans only)

Heating + Cooling Equipment

If more than one system is being installed, each must be separately documented.

Matched components

- AHRI reference number for the matched components. Options:
 - Software output
 - OEM table (highlight selected equipment combination)
 - AHRI certificate

AC outdoor unit and indoor coil

- OEM detailed performance data. Excerpt applicable pages; highlight these contents or write on data sheet:
 - Manufacturer and model numbers for outdoor unit and indoor coil
 - Condenser entering air temp, indoor coil entering wet-bulb temp, sea-level air flow and cooling capacity.
- Document design operating point:
 - Corrected sensible and latent cooling capacities and Sensible Heat Ratio, based on sensible/latent loads
 - Indicate whether airflow or cooling capacity was adjusted for altitude.
 - Volumetric air flow at 5000', external static pressure and blower speed, show on furnace blower table)
- Cooling equipment size ratio = (Total cooling capacity at design operating point) / (Design total cooling load)

Furnace

- OEM specifications and performance data. Highlight these minimum contents or hand-write on data sheet:
 - Manufacturer and model number
 - Air handler blower motor type (PSC / brushless-DC or equivalent)
 - Input heating capacity at sea-level
 - AFUE rating
 - Altitude de-rating factor per 1000'
 - Certified temperature rise range
 - Manifold gas pressure limits at 5000'
- Document design operating point:
 - Output heating capacity at 5000'
 - Target temperature rise
 - Volumetric air flow at 5000', external static pressure and blower speed (show on blower performance table)
- Heating equipment size ratio: (Total heating output capacity at 5000') / (Design heating load)
- If sealed-combustion furnace is specified, plans specify that a 2-pipe installation is required

Heating + Cooling Ductwork

If more than one system is being installed, each must be separately documented.

- Design parameters. Software output can be submitted.
 - Available Static Pressure (ASP)
 - Total Equivalent Length (TEL)
 - Friction Rate
- Ductwork plans. Minimum contents:
 - Duct locations
 - Duct sizes
 - Trunk reductions
 - All fittings, including turning vanes and balancing dampers
 - Materials
 - Insulation
- Picture of each duct fitting

Combustion Appliances + Depressurization Limit

Water heater

If more than one type/model water heater is being installed, each must be separately documented.

- Number of water heaters
- OEM product data (excerpt applicable pages; highlight these minimum contents or hand-write on data sheet)
 - Manufacturer and model number

- If water heater is electric, no additional information required
Water heater combustion / venting type (natural-draft open combustion, power-vented, direct-vent w/o fan assist, fan-assisted sealed-combustion)
- If natural-draft water heater is specified, provide additional information on plans:
 - Water heater location
 - If water heater will be located in mechanical room, mechanical room details

Furnace

If more than one type/model furnace is being installed, each must be separately documented.

- Number of furnaces
- OEM product data (excerpt applicable pages; highlight these minimum contents or hand-write on data sheet)
 - Manufacturer and model number
 - Furnace combustion / venting type (induced-draft, fan-assisted sealed-combustion)
- If induced-draft furnace is specified, provide additional information on plans:
 - Furnace location
 - If furnace will be located in mechanical room, mechanical room details

Fireplace

If more than one type/model fireplace is being installed, each must be separately documented.

- Number of fireplaces
- OEM product data (excerpt applicable pages; highlight these minimum contents or hand-write on data sheet)
 - Manufacturer and model number
 - Fireplace combustion / venting type (natural-draft open combustion, direct-vent)
- If natural-draft fireplace specified, show fireplace location on plans

Depressurization limit

- If natural-draft combustion appliances installed, how is local exhaust -3 Pascal depressurization limit will be met



Low-Flow Water-supplied Plumbing Fixtures

This fact sheet describes the latest Fort Collins building code amendments effective January 1, 2012-applicable to projects that involve installation of water-supplied plumbing fixtures identified in the table below.

Code Reference

International Residential Code (IRC)—Sec. P2903.2

"The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table P2903.2 below and such fixtures shall be Environmental Protection Agency (EPA) WaterSense® labeled fixtures or such fixtures and fittings that provide the equivalent maximum flow rates"

Maximum Flow Rates and Consumption for Plumbing Fixtures	
PLUMBING FIXTURE	MAXIMUM FLOW RATES
Lavatory faucet, private	1.5 gallon per minute at 60 psi
Shower head (includes hand held)	2.0 gallon per minute at 80 psi
Sink faucet	1.8 gallon per minute at 60 psi
Water closet	1.28 gallons per flushing cycle, with minimum MaP (solid-waste removal performance threshold) of 350 grams

What are low-flow fixtures and why are they important?

Low flow fixtures and low flow pre-rinse spray valves used in the food service industry use high pressure to produce sufficient flow without using nearly as much water as standard flow fixtures. Less hot water use reduces your energy bill, too. The low-flow standard for toilets includes both water use and minimum performance criteria based on a particular toilet's ability to flush solid waste. Today's low-flush volume toilets often out-perform their conventional counterparts.

How do I comply with the code requirement?

The new building codes require that water-supply fixtures meet the maximum flow rates or consumption specified in the table above. One easy way to do this is to specify WaterSense® labeled fixtures. WaterSense® is a U.S. Environmental Protection Agency program supporting water efficiency. It maintains a directory of lavatory (bathroom) faucets, showerheads, toilets and urinals that meet the program standards (www.epa.gov/WaterSense/product_search.html). For sink faucets or other non-WaterSense labeled fixtures, ask suppliers for products with companion documentation meeting the specifications in the table above. Building Services Division staff will inspect for appropriate labels and specifications.

Where are complying products available? A wide selection of compliant plumbing fixtures is available from traditional suppliers. **For more information:** www.epa.gov/WaterSense , or www.map-testing.com

Low Volatile Organic Compound (VOC) Building Products

This fact sheet describes Fort Collins building-code changes effective January 1, 2012, concerning Indoor Environmental Quality (IEQ). The requirements apply to all new residential and non-residential construction projects for which a building permit is required.

Code reference

International Building Code (IBC) Sec. 3603.2: applies to commercial and all multifamily housing.

International Residential Code (IRC) Sec. R325.1: applies to Single-family houses, duplexes, townhomes.

“Construction materials, floor coverings and site-applied finishes, including sealants and adhesives, resilient flooring, carpeting and pad, site-applied paints, stains and varnishes, structural wood panels, hardwood veneer plywood, particle board and fiber board building products, and insulation (does not include cabinets or wall paper) shall meet specified volatile organic compound (VOC) emissions limits in accordance with California Department of Public Health (CDPH) 01350; GREENGUARD Environmental Institute GGPS.001 standard for building materials and finishes; or Green Seal® standards. Documentation demonstrating compliance shall be required with delivery of such materials and shall be available for inspection.

Exception: Alterations to existing buildings.

What are low-VOC materials and why are they important?

Volatile organic compounds (VOCs) refer to chemicals that readily vaporize (become *volatile*) at typical indoor conditions. Common VOCs include formaldehyde, benzene, toluene, flammable alcohols, household cleaning solvents, lacquers, gasoline and other liquid combustion fuels.

VOCs can affect human health or have adverse effects on the environment. Some are known carcinogens. Indoor VOC sources include many building materials – such as carpet, composite wood products, insulation, paints, adhesives – as well as furniture, cleaning products, copy and fax machines, and tobacco smoke. U.S. EPA studies have found that indoor levels of common organic pollutants are several times higher than outdoor levels.

Do low-VOC products perform as well as conventional products?

Many available low-VOC products reduce “off-gassing” of hazardous and potentially flammable vapor emissions. Local suppliers say performance of approved low-VOC building materials has steadily improved, matching or surpassing hazardous VOC products, with little or no price premium.

How do I comply with the code requirement?

The 2012 Fort Collins building codes require products that are certified as “low-VOC or meet recognized standards limiting VOC emissions as verified by an independent testing agency. Acceptable forms of documentation include copies of verified test report(s) from an approved independent testing agency (as determined by the City of Fort Collins Building Services).

Where can I find compliant VOC building products?

Compliant low-VOC building products are widely available locally. The following contact list will help you locate the appropriate certification or standards organization for categories of building products.

Colorado Governor’s Energy Office (GEO)

GEO is a good starting point, with an inclusive, on-line, user-friendly pdf: *Contractor VOC Reference Sheet* listing specific compliant maximum VOC emission limits for most applications. Go to:

http://rechargecolorado.com/images/uploads/pdfs/GEO_HPBP_Contractor_VOC_Reference_Sheet.pdf

International Green Construction Code™

“Public Version 2.0, Section 806” published by the International Code Council® (ICC), is also a detailed resource for compliant maximum VOC emissions. For a free download, go to:

<http://www.iccsafe.org/cs/IGCC/Pages/default.aspx> The “2012 Edition” is scheduled for Spring 2012.

California Department of Public Health (CDPH) – Section 01350

CDPH testing protocol: *“Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”* This is typically referenced as “CDPH 01350.”

Results of the testing are commonly used to identify low-VOC-emitting products, typically certified by other independent ("third-party") testing agencies.

www.eurofins.com/product-testing-services/topics/ecolabels,-quality-labels/section-01350.aspx

GREENGUARD Environmental Institute's (GEI) Children and Schools Certification Program – Standard GGPS.001

GEI certifies products and materials for low chemical emissions and is a free resource for choosing healthier products and materials for indoor environments. To receive its Indoor Air Quality certification, products must meet GEI's *GGPS.001. GREENGUARD IAQ Standard for Building Materials, Finishes and Furnishings*. Certified products can be found online at:

www.greenguard.org/en/QuickSearch.aspx.



Green Seal®

Green Seal® develops life cycle-based sustainability standards for products, services and companies and offers third-party certification for those that meet the criteria in the standards. 1993 Standards relevant to the code requirement are GS-11 (Paints and Coatings) and GS- 47 (Stains and Finishes). Certified products can be found online at:

www.greenseal.org/FindGreenSealProductsAndServices.aspx



Carpet and Rug Institute (CRI) – Green Label

CRI is a nonprofit trade association representing carpet manufacturers as well as their suppliers and service providers. CRI initially developed the Green Label program to help commercial specifiers locate carpet, padding and adhesives with low VOC emissions. More recently, the *Green Label Plus* programs sets even higher standards. For more information, visit www.carpet-rug.org.



Dark Sky Lighting Fixtures

This fact sheet describes a Fort Collins building code change effective January 1, 2012. The requirements apply to all new single-family detached housing, duplexes and townhomes.

Code reference – *International Residential Code (IRC) Sec. R 326.1*

For new buildings, all exterior lighting fixtures shall have the "Fixture Seal of Approval" from the International Dark-Sky Association or meet equivalent criteria approved by the Building Official.

What is "Dark-sky" lighting and why is it important?

Many exterior lighting fixtures project light in many directions. They can be a source of glare, light pollution and light "trespass" onto adjoining properties. These factors can cause safety problems, disrupt wildlife, reduce the view of the night sky and annoy neighbors.

The International Dark-Sky Association (IDA) is a non-profit organization that works to raise awareness of these issues and the advantages of using more carefully designed fixtures. Fully shielded fixtures (sometimes termed "full-cutoff" or "Dark-sky" fixtures) direct light where it is needed, providing quality lighting without the problems noted above.

How do I comply with the code requirement?

The building code specifically references fixtures that have earned the "Fixture Seal of Approval" from the IDA. A directory of IDA-approved residential fixtures is available on-line:
www.darksky.org/index.php?option=com_content&view=article&id=720



The Building Official can also approve the use of other exterior fixtures that meet the intent of the Fixture Seal of Approval (directing light downward, no view of the bulb) or fixtures that are located such that architectural shielding provides the same results.

Some lighting suppliers label exterior fixtures as "Dark-Sky." The criteria used to categorize these products isn't always clear or consistent with the IDA's definition. If you are unsure, check with Building Services Division before making a final selection.

The code requirement does not apply to landscape lighting. However, the City of Fort Collins encourages designers and building owners to take light pollution into account when they consider landscape lighting.

Where are complying light fixtures available?

Compliant light fixtures are available at local lighting supply stores, home-improvement centers and on-line.

For more information

- International Dark Sky Association: www.darksky.org
- IDA brochures and guides:
http://www.darksky.org/index.php?option=com_content&view=article&id=708



Policy, Planning & Transportation Services

Community Development & Neighborhood Services
281 North College Avenue
P.O. Box 580
Fort Collins, CO 80522.0580

970.416.2740
970.224.6134- fax
fcgov.com

Combustion Safety Test - Fact Sheet

Effective January 1, 2012, Fort Collins building codes require a combustion safety test for natural-draft appliances. This fact sheet provides background information, answers questions and suggests possible next steps to reduce risks which may be identified by the combustion safety test.

Exhaust gases of carbon monoxide CO and nitrogen oxide NO_x from combustion appliances, such as natural gas water heaters, furnaces, boilers, fireplaces, kitchen ranges, are hazardous to your health. Combustion by-products are fatal in high doses and can cause chronic health problems and flu-like symptoms at lower concentrations over a period of time or can lead to asthma and other debilitating lung conditions.

Safe combustion means the appliance exhausts 100% of combustion bi-products to the outdoors 100% of the time. Conventional "natural-draft" appliances, which rely on buoyancy- *the natural rising of hot flue gases in the appliance vent*-, can not always guarantee that 100% of the combustion bi-products have been removed. A combustion safety test result indicating no release of combustion bi-products into the home provides a higher level of assurance of safe operation of the appliance.

A combustion safety test is now **mandatory** when a natural-draft appliance is replaced with another natural-draft appliance with a "draft hood" (see photo next page) or when the replacement of a combustion appliance alters the venting of another draft-hooded appliance.

Two common situations when the testing requirement applies:

- A conventional draft-hooded water heater is replaced with another draft-hooded water heater.
- A natural-draft furnace, vented with a draft-hooded water heater, is replaced with a sealed-combustion furnace with independent venting. This leaves the natural-draft water heater dependent on a potentially oversized vent, which may result in a poor draft and spillage of combustion products.

Pass / Fail / Disclosure

The combustion safety test determines whether your appliance functions correctly under worst-case and/or natural (normal) conditions. In the worst-case condition, the furnace blower, all exhaust fans and the clothes dryer are turned on; interior doors are opened or closed to simulate the worst negative pressure condition in the vicinity of the appliance. For the natural (normal) conditions test, the furnace blower, exhaust fans and the clothes dryer are turned off. All interior doors are left in the most typical open or closed positions.

- **Pass worst-case:** This means the appliance passed the combustion safety test under worst-case conditions and will most likely function safely under natural (normal) conditions.
- **Fail natural (normal):** This means the appliance failed the combustion safety test under natural (normal) conditions. *This is a dangerous result and the appliance is not allowed to operate* until the problems are fixed and the appliance has been re-tested and passes the combustion safety test under natural (normal) conditions.
- **Disclosure:** This means the appliance failed the combustion safety test under worst-case conditions but passed the test under natural (normal) conditions. Failing a worst-case combustion

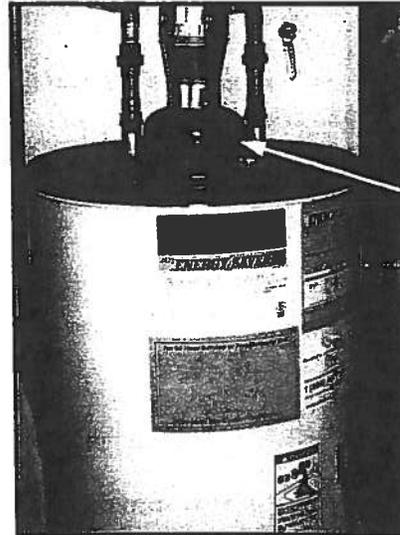
safety test is not uncommon. This may not be a serious problem; however it is an opportunity for you to be aware that combustion products can spill into your home under some conditions. The appliance is allowed to be operated. You will be asked to sign the "Combustion Safety Test Compliance Form" acknowledging that you have received the test results and this fact sheet and that you may want to have the problem further diagnosed and repaired as needed.

You will receive two copies of the "Combustion Safety Test Compliance Form" documenting the test results. Keep one copy for your records and as a reference for further repairs. The City's Building Services department will ask for the other copy as part of the final approval of the appliance installation.

What Causes Appliances to Fail a Test?

Natural-draft water heaters, older natural-draft furnaces or boilers with draft-hoods, and fireplaces with draft-hoods are all susceptible to spillage under certain conditions.

- **Vent problems:** Vents with insufficient slope upward and vents too large for the appliance they serve may not establish a reliable draft, *the natural rising of hot flue gases in the appliance vent*. Vents blocked by bird nests, disturbed vent caps and other obstructions can impact reliable venting.
- **Pressure imbalances:** Even small negative pressure conditions can overcome the natural-draft of the appliance causing "back-drafting" of combustion products into the home. Exhaust fans, leaky HVAC ductwork and air leaks between the house and attic commonly contribute to these pressure imbalances.



The "draft hood" on this natural draft water heater provides an open path through which CO and NOx can spill into the house when the appliance is not correctly venting.

What else should I know?

- If your natural draft appliance fails the combustion safety test, ask your appliance technician to diagnose what is causing the failed results. Items to check: does an over-sized vent need a liner? Is the vent clear of obstructions? Is the spillage caused by the operation of the dryer, or the furnace or the kitchen range hood? Is the furnace filter slot not sealed causing a depressurization? Are the HVAC return ducts leaky causing a depressurization? In some cases, adjustments or simple repairs can correct the problem.
- Installing CO detectors in accordance with Ft Collins ordinances and State Law, near all sleeping areas provides additional protection. A CO detector could also be installed where combustion appliances are located. Consider a detector that measures CO levels as low as 10 parts per million and has the capability to display peak CO levels with the push of a button.
- Gas ranges without a vented hood to exhaust combustion products outside are also a health and safety risk. In particular, gas ovens commonly produce high levels of CO. When using a gas oven/range, a range hood vented to the outside is always advised.

More Information

For more information about the required combustion safety test, contact Fort Collins Building Services 970-221-6760.

4/9/2012

