



Platte River Power Authority Efficiency Works Home Efficiency Program – Final Installation Standards: V7

Effective: 2/8/2018

General notes

- Efficiency Works Home Energy Audit required as prerequisite for all measures. (Exceptions: Windows can be installed pre-audit & HVAC jobs no longer require an audit)
- To participate in the Efficiency Works for Homes Program (EW-H), installation contractors must apply for inclusion, and pass the applicable training certification course.
- Do-It-Yourself installation will not qualify for incentives.
- The information in this matrix is subject to change. Platte River Power Authority (PRPA) will provide thirty (30) days notice of any changes in installation standards.
- Field Guide standards for building shell improvements generally follow the 2009 Saturn Building Shell Field Guide, with addendums adding clarity or different standards.
- Field Guide standards for HVAC and Hydronic system installations generally follow the 2009 Saturn Mechanical Systems Field Guide, with addendums adding clarity or different standards.
- All HVAC equipment must be installed per the manufacturer's installation instructions, industry standards, and all applicable federal, state, and local codes and regulations.
- Where possible, all insulation measures must meet the R-value requirements prescribed by the IECC version adopted in each Authority Having Jurisdiction.
- Refer to the *EW-H Home Efficiency Program Rebate Matrix* for incentive summary.
- Homes participating in the Efficiency Works Program are evaluated for tightness and whole-house controlled mechanical ventilation rates using ASHRAE 62.2-2010. The initial tightness is reported in the Audit Report and the Homeowner is required to sign a post-improvement disclosure acknowledging the potential need for controlled mechanical ventilation.



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- Where any building envelope improvement measures (attic insulation, frame wall insulation, window replacement, etc.) are undertaken, the corresponding building component(s) must be durably air sealed. In addition, for buildings with an air leakage rate greater than 3.0 ACH50 as determined at the time of the Efficiency Works Home Energy Audit, the **envelope air leakage rate must be reduced. This is applicable to all homes where building envelope improvements are made** – not just for homes where air-sealing rebates are sought.
- Where required, combustion safety testing must be performed the day of the completion of improvements.
- **Note special conditions that exist as follows**
 - **Loveland rebates are only available for Tier 2 gas furnaces; rebates are not available for gas boilers or water heaters.**
 - **Loveland rebates for air sealing and insulation must have operational mechanical cooling or primary electric heating to qualify for building envelope improvements.**
 - **Estes Park rebates are only applicable for homes with electric heat.**

Efficiency Measure	Existing Conditions	Installation Standards	Post-installation Tests	Field Manual, Notes
Air Sealing	<ul style="list-style-type: none"> • Initial blower door test: ACH50 = 3.0 or greater 	<p>Attic to living space air sealing:</p> <ol style="list-style-type: none"> 1. In order to qualify for rebates, efforts must be taken to air seal significant leaks and bypasses that allow connection between the outside and living space. Areas to air seal may include: bypasses around chimneys, drop soffits, shower inserts or other large penetrations; interior and exterior wall top-plates; and plumbing and wiring penetrations. 2. Use approved high temp sealant around heat sources like B-vents, fireplaces and chimneys, and make sure they maintain the required clearance to combustibles. 	<ul style="list-style-type: none"> • Combustion Safety Test required record results on Appendix F • Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> • Need to fully educate customer on front end so they understand about house as a system, ventilation and combustion safety. • Options to mitigate a failed Combustion Safety Test may include:



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		<ul style="list-style-type: none"> • Minimum shell leakage (CFM50) reduction of: 25% to be eligible for Tier 1 rebate; 33% reduction to qualify for Tier 2 rebate; 50% reduction to qualify for Tier 3 rebate. <ul style="list-style-type: none"> ○ If the Combustion Safety Test fails under Worst Case Conditions, the contractor is required to counsel the Homeowner about possible solutions. ○ If the Combustion Safety Tests fail under Natural Conditions, the contractor is required to council the Homeowner on possible solutions and refer them to the list of Participating HVAC Contractors for further diagnostics and solutions. No rebates will be approved for houses that have CAZ failures under natural conditions until those failures are remedied. 		<ol style="list-style-type: none"> 1. Replace natural draft gas burning appliances with sealed combustion, direct vented, or power vented equipment. 2. Seal return air duct and filter slot in CAZ. 3. Re-line the old common B-vent. 4. Add combustion air ducts 5. Obtain further diagnostics and solutions from an EW-H Participating HVAC contractor. <p>Contractor to educate homeowner about these options.</p>
Garage-to-House Connection Reduction	<ul style="list-style-type: none"> - Air Leakage pathways exist between the attached garage and the main house 	<ul style="list-style-type: none"> • All accessible air leakage pathways from attached garage to main house must be durably air sealed to prevent air movement between the garage and the house. • These areas may include, but are not limited to the following <ul style="list-style-type: none"> - Around outlets and switches - Around the door trim - Around any penetrations made by the garage door rail support systems - Along the bottom of the drywall on walls adjacent to conditioned space - Along the accessible top plates of walls adjacent to conditioned space <p>Around the bottom of any duct or vent chases that protrude into the garage, adjacent to the conditioned space</p>	<ul style="list-style-type: none"> - Combustion Safety Test required. Record results on Appendix F 	



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<p>Conditioned Crawl Space Insulation</p>	<ul style="list-style-type: none"> Contractor must inspect for proper grading, downspout leaders, moisture evidence on foundation walls, cracks in the foundation, and damp ground. All moisture problems must be mitigated. If any evidence of moisture intrusion having occurred at any time is present, (efflorescence on the foundation wall, cracked soil, mold, staining) the crawl space must be treated as having moisture present. Un-insulated or poorly installed insulation being removed. 	<ul style="list-style-type: none"> All three elements (rim joist, foundation wall, and moisture/soil gas barrier) of a conditioned crawl space must be completed in order to qualify for a rebate. If any one of the elements already exists, it must meet EW-H Installation Standards AND the other elements must be completed to EW-H Installation Standards for a conditioned crawl space rebate. Moisture/ soil gas barrier installation requirements: <ol style="list-style-type: none"> Barrier must meet ASTM specs listed in Field Manual Notes Remove all debris and major ground surface irregularities Cross laminated polyethylene barrier is required; the barrier must be sealed and mechanically fastened at least 12" up crawl space foundation wall or, in cases involving moisture, to the foundation plate (urethane caulk meets sealing and mechanical fastening requirements). Seams must be overlapped 6" minimum and be sealed w/ approved tape or sealant. If the foundation or soil in the crawl space is damp or shows evidence of moisture intrusion, the soil gas barrier must be extended up to and be sealed to the foundation plate to keep moisture out of wall insulation. Provision must then be made for moisture under the barrier or in the foundation wall to be removed so covered areas can dry to the outside. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> Moisture/ soil gas barrier specifications: <ol style="list-style-type: none"> Cross laminated poly sheeting used as a moisture and soil gas barrier in crawl spaces must be performance tested to ASTM E-1745 and installed per ASTM E-1643 with a minimum of Class C rated. It must resist deterioration from contact with the soil and maintain a perm of 0.3 or less (per ASTM E-154 section 13). The moisture and soil gas barrier must have a minimum strength of 13.6 lbs/in (ASTM E-154 section 9) and puncture resistance of 475 grams (ASTM D-1709 method B).



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	<ul style="list-style-type: none"> If framed floor above is insulated with anything except closed cell foam, and vapor barrier which is attached to the cold side of the framed floor assembly is not allowed. 	<ul style="list-style-type: none"> Field stone foundation wall will need to be air sealed. (See Field Manual) Insulate and air seal rim joists and foundation plate to R-value prescribed by the IECC as adopted by the AHJ: <ol style="list-style-type: none"> XPS foam board cut to fit, foamed-in place. Closed or open cell 2-part spray foam <ul style="list-style-type: none"> Foam insulation does not require thermal barrier on rim joist (per IRC), but does require an ignition barrier as outlined in 2012 IRC Section R316.5.4 Insulate Interior of Foundation walls to R-value prescribed by the IECC as adopted by the AHJ: <ol style="list-style-type: none"> Perforated vinyl faced fiberglass blanket <ul style="list-style-type: none"> Vinyl faced insulation blanket is NOT allowed if foundation or ground shows evidence of past or present moisture- Unless the moisture barrier extends up to and is sealed to the foundation plate. Insulation blanket must be full height and be in substantial contact with the foundation wall along its entire width and not be pulled out by the footing. Seal vinyl facing to top of wall and soil barrier so conditioned inside air cannot reach foundation wall and condense Foam board: Polyisocyanurate, XPS or EPS <ul style="list-style-type: none"> Ignition barrier required, unless listed and approved for use without a thermal or ignition barrier in this application by the ICC ES (see Field Manual notes) 2-part closed or open cell spray foam <ul style="list-style-type: none"> Ignition barrier required, unless listed and approved for use without a thermal or ignition barrier in this application by the ICC ES (see Field Manual notes) 		<ol style="list-style-type: none"> Field stone and brick foundation details: moisture barrier must run up to foundation plate, and be fastened and caulked; or apply spray foam with an ignition barrier covering all fieldstone or brick foundation walls. <ul style="list-style-type: none"> Crawl spaces that contain atmospherically vented combustion appliances must have adequate volume for combustion air and/ or provide outside combustion air per 2012 IRC Section G2407. No spot ventilation exhaust vents may terminate in the crawl space. No insulation needed on wall between crawl space and basement. All foam must meet ASTM E-84 Class 1 standards for Flame Spread and Smoke Development. Ignition barriers are required over spray foam or foam board installed on the inside



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		<ul style="list-style-type: none"> ◦ Open cell spray foam is only allowed on the interior of foundation walls if there is no indication of moisture, unless the soil moisture barrier extends to the foundation plate with mechanical ventilation underneath • Exterior foundation wall insulation, XPS <ul style="list-style-type: none"> ◦ Foam board insulation must extend down to top of footing, and be protected above grade by a non-organic exterior finish. Provide flashing from under existing exterior finish, over top of foam exterior finish. • Crawl space must be provided with conditioned air in accordance with IRC as adopted by the AHJ. 		<p>of crawl space foundation walls:</p> <ol style="list-style-type: none"> 1. Ignition barriers include: intumescent coatings listed for this use, 1½” mineral fiber (includes fiberglass), and other materials listed in the 2012 IRC, Section 316.5.4. 2. Spray foam insulation that has been approved by the ICC ES for use in these locations without the addition of an ignition barrier can be used. The ICC ES Report for such material must be provided to the program administrator for reference prior to the issuance of rebates. <ul style="list-style-type: none"> • Rim joist and sill plate in a crawlspace can have up to 3.25” of spray foam applied without a thermal barrier being required (2012 IRC Section R316.5.11). An ignition barrier is still required in this location.



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<p>Cold Crawl Space</p>	<ul style="list-style-type: none"> Evidence of persistent moisture or bulk water issues are present that cannot be otherwise mitigated or house is known to be located in an area with high water table 	<ul style="list-style-type: none"> Finished floor must be the air barrier. Air seal floor penetrations. Fill floor cavity with insulation installed per RESNET Grade 1 Insulate and air seal rim joists and foundation plate to R-value prescribed by the IECC as adopted by the AHJ <ol style="list-style-type: none"> XPS foam board cut to fit, foamed in place Closed or open cell 2-part spray foam <ul style="list-style-type: none"> Foam insulation does not require ignition barrier on rim joist (per IRC) Install continuous, vapor permeable <u>air</u> barrier on cold side of insulation. Do not install vapor barrier on cold side of insulation. Ventilate crawl space per IRC as adopted by the AHJ. Sealed moisture barrier required on ground in crawl space. Water pipes in cold crawl space must have full floor depth insulation below (build floor down to install same depth of floor insulation below plumbing as is present in the typical floor area). Mechanical equipment ducting must be insulated to R-8. No spot ventilation exhaust venting may terminate in any crawl space. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> Cold crawl space can be an alternative where the ground in the crawl space is wet due to high ground water, where the best mitigation is to install a sealed moisture/soil gas barrier. Cold crawl space detail should be used where there is a shallow footing (< than 30" below grade), and a conditioned crawl space could create frost lenses under the footing, possibly heaving the foundation.
<p>Basement Wall Insulation</p>	<ul style="list-style-type: none"> No existing insulation Exterior grade must drain away from foundation, or be mitigated as part of the job scope. Foundation cracks shall be completely sealed. 	<ul style="list-style-type: none"> Insulate interior of basement walls to the R-value prescribed by the IECC as adopted by the AHJ. All insulation must be installed to Field Manual specifications. <ol style="list-style-type: none"> Exterior foundation wall: XPS foam board <ol style="list-style-type: none"> Exterior foam board insulation must be closed cell and extend down 48" below grade or to top of footer - whichever is less. Insulation must be protected above grade w/ non-organic exterior finish. Provide flashing from under existing exterior 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. Blower door test required prior to air sealing and after insulating in order to 	<ul style="list-style-type: none"> Building code requires basement insulation be covered with a finish material like drywall, even if basement will not be finished at time of insulating. "Best practice" for basement foundations.



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	<ul style="list-style-type: none"> If evidence of moisture exists, it must be or have been mitigated prior to insulating 	<p>finish, over top of foam exterior finish, flashed from under finish on walls.</p> <ol style="list-style-type: none"> Interior Foundation Wall Insulation <ol style="list-style-type: none"> Old brick or field stone foundations must have closed cell spray foam installed over entire interior foundation wall and rim joist. 1" XPS, EPS or Polyisocyanurate foam board + R-13 Batt <ul style="list-style-type: none"> ⇒ R-13 un-faced batt is installed in the finished frame wall so foundation can dry to the inside. (See Field Manual). Interior foundation wall insulation: XPS or EPS foam board or spray foam. <ul style="list-style-type: none"> ⇒ Basement walls with foam insulation must be finished with drywall or equivalent thermal barrier, except where material is listed and approved for use in this application by the ICC ES. ⇒ Open cell spray foam is approved only if there is no indication of moisture on the foundation walls Perforated vinyl faced fiberglass blanket is allowed but is not eligible for rebate <ul style="list-style-type: none"> ⇒ Vinyl faced insulation blanket is NOT allowed if foundation shows evidence of past or present moisture ⇒ Insulation blanket must be full height and be in substantial contact with the foundation wall along its entire width and not be pulled out by the footing. ⇒ Seal vinyl facing to top of wall and soil barrier so conditioned inside air cannot reach foundation wall and condense Insulate and air-seal rim joist and foundation plate to R-value prescribed by the IECC as adopted by the AHJ. <ol style="list-style-type: none"> XPS or Polyisocyanurate foam board cut to fit, foamed-in place. Closed or open cell 2-part spray foam 	<p>measure house tightness improvement.</p> <ul style="list-style-type: none"> For basement finishes, contractor must coordinate post-improvement verification at time of insulation inspection by local Building Department. 	<ol style="list-style-type: none"> Perm rating of insulation ideally should be > 2. Foam board insulation can be open cell or closed cell Best practice is installing 1" foam board on interior of concrete foundation wall, with un-faced R-13 batt in framed wall adjacent on the interior See Field Guide for details on sealing floating wall framing at bottom and top of wall. If foam board is used, the foundation wall must be dry. Tape all seams in foam board <ul style="list-style-type: none"> Cracks causing moisture intrusion into basement shall be sealed as part of the job scope;



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		3. Foam insulation does not require thermal barrier on rim joist (per IRC), but does require an ignition barrier as outlined in 2012 IRC Section R316.5.4		
Cantilever Floor Insulation	<ul style="list-style-type: none"> No restriction on existing condition of exterior cantilevers or cantilevers into garage Exterior finish material must be removed if water pipes are located below the top 1/2 of the floor joist cavity. 	<ul style="list-style-type: none"> Inside end of joist space must be blocked and air sealed (see Field Manual for options). If interior blocking is not in place, and there is adequate room, remove soffits to block and air seal. If soffits cannot be removed to block and air seal interior, other methods of interior blocking can be used (see Field Guide). Floor cavities used as a return air duct must have the header block or pan sealed prior to insulation installation. Make sure insulation does not enter return air floor cavity. Disconnected ducts must be repaired prior to insulation installation Final condition: intact, sealed air barrier, inside and outside. Final condition: joist cavities dense packed with blown insulation. If water pipes are located in the bottom half of the joist cavity in the cantilevered floor area, they must be protected from freezing by installing net under the bottom of pipes so that insulation is only blown on the cold side of the pipe. Contractors must retain photo documentation of the following details: <ol style="list-style-type: none"> Netting of pipes in floor cavities Blocking of inside end of joist space Return air duct sealing to prevent insulation from entering forced air system 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> Other kinds of end blocking that will create the 6th side of insulation cavity: <ul style="list-style-type: none"> Change in direction of floor joists Rim joist on other side of a narrow room adjacent to cantilever House with insulation in interior floors (for sound) Install a burlap bag in each floor cavity that is filled with insulation to act as a block Do not dense pack near panned or leaky return system without air sealing ducts. Advise homeowner to repair ductwork leaks that will compromise insulation, before insulating. The phrase dense-pack refers to a specific process where the insulation is blown into the cavity and then dense-packed. We do not rebate a garage floor



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				that has simply been filled with insulation. It must be dense-packed to 3.5lbs/cubic foot (cellulose) – ~2.5lbs/cubic foot for (fiberglass).
Floor Over Garage Insulation	<ul style="list-style-type: none"> Existing insulation does not fill floor cavity. Drywall must be removed if water pipes are located below the top 1/2 of the floor joist cavity. 	<ul style="list-style-type: none"> Inside end of joist space must be blocked and air sealed (see Field Manual for options) If water pipes are located in the bottom half of the joist cavity in the floor over the garage area, they must be protected from freezing by installing net under the bottom of pipes so that insulation is only blown on the cold side of the pipe. <ol style="list-style-type: none"> In order to install net, drywall must be removed from the garage ceiling to gain access to pipes. Drywall must be replaced with 5/8" Type X gypsum board or other material approved for use in this location by the IRC as adopted by the AHJ. Floor cavities used as a return air duct must have the header block or pan sealed prior to insulation installation. Make sure insulation does not enter return air floor cavity. Disconnected ducts must be repaired prior to insulation installation. Insulation must be dense packed (see field notes). Drywall on garage ceiling must be complete and sealed. Garage ceiling with living space floor above is a Firewall. If removed, it must be restored to current code compliance. Contractors must retain photo documentation of the following details: <ol style="list-style-type: none"> Netting of pipes in floor cavities Blocking of inside end of joist space 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F Form. Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> Other kinds of end blocking that will create the 6th side of insulation cavity when dense packing floor joist cavity: <ul style="list-style-type: none"> Change in direction of floor joists Rim joist on other side of a narrow room adjacent to cantilever House with insulation in interior floors (for sound) Install a burlap bag in each floor cavity that is filled with insulation to act as a block Do not dense pack near panned or leaky return system without air sealing ducts. Strongly recommend taking photos of netted water pipes to be provided to PIV inspector. The phrase dense-pack refers to a specific process where the



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		3. Return air duct sealing to prevent insulation from entering forced air system		insulation is blown into the cavity and then dense-packed. We do not rebate a garage floor that has simply been filled with insulation. It must be dense-packed to 3.5lbs/cubic foot (cellulose) – ~2.5lbs/cubic foot for (fiberglass).
Exterior Frame Wall Insulation	<ul style="list-style-type: none"> Existing condition: R-9 or less Do not dense pack walls if knob and tube wiring is present. Measure includes garage/house fire walls. 	<ul style="list-style-type: none"> Use dense-pack cellulose or short fiber fiberglass in all wall cavities, installed with fill tube. Air seal around windows, doors, and electrical boxes in wall assembly prior to insulating. Must seal all penetrations into electrical panels, outlet and switch boxes to keep out insulation. Plug, seal and refinish all drill holes used to fill exterior walls after insulating. Cloth sheathed electrical wire must be evaluated or replaced with contemporary code complying 90 degree C temperature rated wiring prior to dense packing walls by an electrical contractor licensed to perform work in the local jurisdiction. Knob and tube wiring must be replaced with contemporary code complying 90 degree C temperature rated wiring prior to dense packing walls by an electrical contractor licensed to perform work in the local jurisdiction. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	
Masonry Exterior Wall Insulation	<ul style="list-style-type: none"> Existing un-insulated masonry cinder block, 	<ul style="list-style-type: none"> Insulate masonry walls, on either the interior or exterior, to R-value prescribed by IECC Version adopted by the AHJ: 	<ul style="list-style-type: none"> Combustion Safety Test required. Record 	<ul style="list-style-type: none"> Exterior installation may be the best option. It's less destructive;



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	<p>double brick, field stone and other types.</p>	<ul style="list-style-type: none"> - Interior: foam board, 2 part spray foam, or blown insulation inside finished frame wall. Interior wall must be air sealed. - Exterior: closed cell foam board, with taped seams, covered with appropriate finish material. - Insulate and air seal rim joist if applicable (see crawl space rim options). 	<p>results on Appendix F.</p> <ul style="list-style-type: none"> • Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<p>moves thermal boundary to the exterior, with the mass wall on the interior to moderate temp swings.</p>
<p>Attic Insulation (Flat Ceiling)</p>	<ul style="list-style-type: none"> • Existing insulation of assembly must be < R-30 to qualify for attic insulation rebate. • Insulation areas compressed to <R-30 after air sealing can qualify for a rebate. • Attic must be air sealed and have mechanical / duct issues corrected prior to blowing insulation (see installation standards). • Cloth sheathed electrical wire must be evaluated or replaced with code complying wiring prior to insulating 	<ul style="list-style-type: none"> • Insulation baffles must be installed between rafters or trusses to allow air flow from the box soffit to the attic. Baffles must be installed adjacent to all soffit vent locations, with air impermeable insulation stops between all other truss rafter ends (recommend adding passive ventilation to minimum code amounts). • Install an insulation stop on the outside edge of the top plates to maximize R-value at exterior edge of exterior wall top plates and minimize wind washing. This can consist of insulation batts or bags to blow insulation into. • Air-seal all shell components interfacing with attic, including knee walls. • Extend any unvented bath or kitchen fan vent to exterior (vents not allowed to terminate in attic) • Repair and seal any disconnected HVAC prior to blowing attic insulation: <ol style="list-style-type: none"> 1. Un-insulated ducts must be insulated to minimum R-8. 2. Fix ducts that severely restrict airflow. • Insulation < R-30 must be improved to at least R-49 to qualify for a rebate: 	<ul style="list-style-type: none"> • Combustion Safety Test required. Record results on Appendix F. • Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> • Alternative details are allowed for installing adequate insulation at exterior wall top plates (while maintaining ventilation path at soffit vents) • Recommend flagging electrical J boxes that will be buried under insulation. • Recommend adding attic ventilation that meets the requirements of IRC as adopted by the AHJ. • Pull-down stair options: <ul style="list-style-type: none"> ▪ Build a rigid foam box around the perimeter of the stair assembly that is air sealed where it meets the



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	<ul style="list-style-type: none"> Knob and tube wiring must be abandoned or removed and new code complying wiring installed prior to insulating 	<ol style="list-style-type: none"> If blowing cellulose on top of fiberglass, add an additional 2" of cellulose to the total to account for compression of the fiberglass underneath. Blown cellulose insulation shall contain at least 85% recycled material and be Borate treated in attics. Blown fiberglass shall contain a minimum of 25% recycled material. <ul style="list-style-type: none"> Seal thermal bypasses: <ol style="list-style-type: none"> Chases, plumbing vents, b-vents, chimneys, top plate penetrations, etc. Insulate and air seal knee walls and skylight shafts and provide an air barrier. Separate knee wall and skylight requirements and incentives are listed below. Whole house fan in ceiling must have a sealed, insulated cover, or install fan w/ motorized insulated cover (see whole house fan section below). Recessed lighting (except ICAT rated recessed lighting) must be air-sealed with either can inserts or covers. Covers must maintain 3" clearance to can and unrated cans must not be covered with insulation. If installing inserts also seal gap in drywall around can. Attic hatch must be insulated to the same level as the adjacent attic insulation (with a minimum of R-20 of that insulation being rigid foam), be air-sealed with a dense foam weather strip, and have full depth insulation curb blocking around the hatch installed in accordance with IECC as adopted by the AHJ (The dam must support the weight of a 200 lb adult). Seal all trim around hatch to drywall. The hatch must be fully functional, that is, the hatch must be able to be removed from the access opening, either up into the attic, or down into the house. <ol style="list-style-type: none"> Alternatively, if hatch is insulated with rigid foam board only, R-38 is adequate. 		<p>ceiling plane. (Foam insulation requires an ignition barrier in this case where storage or pull-down stair is present).</p> <ul style="list-style-type: none"> Install a kit like a Battic Tent, Draft Cap, or Energy Guardian that is designed to seal this location. A vertical insulation dam should be mechanically fastened to the vertical face of the knee wall right below where the wall transitions to the ceiling. This will allow the insulation on the ceiling to make great contact with the actual top plate and provide the thermal resistance Insulation dams at ceiling level transitions can be made of cardboard



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		<ul style="list-style-type: none"> • Attic hatches that are pull-down stair assemblies must have some system to air seal and insulate that assembly. This can be a site-built system or a store-bought system. See field manual for suggestions. • Insulation dams are required at all ceiling level transitions (including tops of kneewalls) & around whole house fans. • Ignition barrier not required on exposed foam, provided the following conditions are met, and it is allowed by the product's ESR: <ol style="list-style-type: none"> 1. Entry to the attic or crawl space is only to service utilities and no storage is permitted 2. Air in the attic is not intentionally circulated to other parts of the building 3. Attic ventilation is provided in accordance with IRC Section R806, as applicable 4. Combustion air is provided in accordance with IMC (<i>International Mechanical Code</i>®) Section 701 • If attic storage is present or possible (pull-down stair, platform, etc.) ignition barrier is required on all exposed foam 		
Attic Knee Wall and Skylight Shaft	<ul style="list-style-type: none"> • Un-insulated or insulated to R-11 or less 	<ol style="list-style-type: none"> 1. If un-insulated, first fill cavity, then add a minimum R11 spray foam, foam board or vinyl faced fiberglass blanket over cavity insulation: <ol style="list-style-type: none"> a. Seal all edges and seams of insulation 	<ul style="list-style-type: none"> • Combustion Safety Test required. Record results on Appendix F. • Blower door test required prior to air 	<ul style="list-style-type: none"> • An air barrier alone does not address the significant thermal bridging problems experienced in these assemblies, especially in the summer when attic



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		<p>b. Ignition barrier not required on exposed foam, provided the following conditions are met, and it is allowed by the product's ESR:</p> <ul style="list-style-type: none"> i. Entry to the attic or crawl space is only to service utilities and no storage is permitted ii. Air in the attic is not intentionally circulated to other parts of the building iii. Attic ventilation is provided in accordance with IRC Section R806, as applicable iv. Combustion air is provided in accordance with IMC (<i>International Mechanical Code</i>®) Section 701 <p>c. If attic storage is present or possible (pull-down stair, platform, etc.) ignition barrier is required on all exposed foam</p> <p>d. Insulation must meet flame spread and smoke development requirements of IRC version adopted by the AHJ.</p> <p>e. Insulation must be installed to RESNET Grade I</p> <p>2. If already insulated, add a minimum R-11 spray foam, foam board or vinyl faced fiberglass blanket over existing cavity insulation</p> <ul style="list-style-type: none"> a. Seal all edges and seams of insulation b. Ignition barrier not required on exposed foam, provided the following conditions are met, and it is allowed by the product's ESR: <ul style="list-style-type: none"> i. Entry to the attic or crawl space is only to service utilities and no storage is permitted ii. Air in the attic is not intentionally circulated to other parts of the building 	<p>sealing and after insulating in order to measure house tightness improvement.</p>	<p>temperatures often exceed 130°F.</p> <ul style="list-style-type: none"> • While an air barrier only is a requirement for attic insulation rebates –rebates for attic knee wall insulation requires the addition of a thermal break. • It is recommended, but not required, that un-insulated solar tubes be insulated to R-11. • A vertical insulation dam should be mechanically fastened to the vertical face of the knee wall right below where the wall transitions to the ceiling. This will allow the insulation on the ceiling to make great contact with the actual top plate and provide the thermal resistance • Insulation dams at ceiling level transitions can be made of cardboard



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		<ul style="list-style-type: none"> iii. Attic ventilation is provided in accordance with IRC Section R806, as applicable iv. Combustion air is provided in accordance with IMC (<i>International Mechanical Code</i>®) Section 701 c. If attic storage is present or possible (pull-down stair, platform, etc.) ignition barrier is required on all exposed foam d. Insulation must meet flame spread and smoke development requirements of IRC version as adopted by the AHJ. e. Insulation must be installed to RESNET Grade I 3. Insulation dams are required at the tops of kneewalls. (See Field Notes) 		
<p>Cathedral Ceiling Insulation (Unvented Attic and unvented enclosed rafter spaces)</p>	<ul style="list-style-type: none"> • No Class 1 vapor retarders may be installed on the inside face of the roof rafters. • Where wood shingles or shakes are used, a minimum ¼" vented air space must separate the shingles or shakes and the roofing underlayment above the structural sheathing 	<ul style="list-style-type: none"> • In order to earn rebates, unvented attic and unvented enclosed rafter spaces must have R-20 continuous exterior rigid board or sheet insulation installed directly above the structural roof sheathing and covered by an approved roofing material (per the IRC version adopted by the AHJ) <ul style="list-style-type: none"> – R-20 continuous exterior rigid board or sheet insulation must meet the requirements of the 2012 IRC Section R806.5 & R906.2. – All seams in the exterior rigid board or sheet insulation must be sealed at the perimeter of each individual sheet in order to form a continuous layer. • Dense packed short fiber fiberglass insulation (no dense packed cellulose will be allowed) must be installed to completely fill the cavity between the structural roof sheathing and the interior drywall. 	<ul style="list-style-type: none"> • Combustion Safety Test required. Record results on Appendix F. • Blower door test required prior to air sealing and after insulating in order to measure house tightness improvement. 	<ul style="list-style-type: none"> • Contractors and Homeowners should be well aware that these types of unvented assemblies often void the shingle warranty unless the shingle is listed for unvented attics and rafter assemblies. This should be taken into consideration, and a shingle that is listed for these types of assemblies should be selected when re-roofing. • Allowable unvented vaulted ceiling assemblies are



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		<ul style="list-style-type: none"> Replace or air seal any IC recessed lights in vaulted rafter space with Air Tight (ICAT) cans, or install an insert and air seal drywall cutout to can. 		<p>addressed in the 2012 IRC Section 806.5. In addition to the method described in the Installation Standards, unvented vaulted ceilings may also be insulated without the use of exterior rigid board or sheet insulation, but only when an adequately thick layer of air impermeable, vapor impermeable insulation is installed in direct contact with the inside face of the structural roof sheathing. These alternative methods would require the complete removal of the interior drywall</p>
<p>Window Replacement (Including sliding glass doors)</p>	<ul style="list-style-type: none"> Existing windows and/or sliding glass doors must have one of the following conditions: single pane; clear glass; metal frames; or leaky/poor sealing. Walls must be insulated, or be insulated as part of this job scope to receive rebate. 	<ul style="list-style-type: none"> Window installations must be done by EW-H certified window installers. Full frame replacement window installation must be done whenever possible. Replacement windows must meet Northern Climate Zone Energy Star requirements to qualify for our incentives <ul style="list-style-type: none"> U-factor of ≤ 0.30 w/ any SHGC U-factor of 0.31 w/ SHGC of ≥ 0.35 U-factor of 0.32 w/ SHGC of ≥ 0.40 Windows/sliding glass door installation must meet AAMA standards, and must meet AAMA design standards for water and air infiltration. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. 	<ul style="list-style-type: none"> Replacement window types/methods (Install per AAMA standards): <ul style="list-style-type: none"> Block frame- replacement windows are installed inside frame of existing window frame. This is to be used only with wall construction types where full frame replacement window installation may be difficult



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		<ul style="list-style-type: none"> • Windows/sliding glass doors must have low maintenance exterior: clad, fiberglass, composite or vinyl. Exception: If house is being considered for or is registered as a Historic Home, and wood trim is required. • When a replacement window is installed inside an existing window frame (Block Frame method), air sealing is required around the existing window frame (remove interior trim, insulate and air seal between framing and existing window frame). • Replacement windows must be properly insulated and air sealed in the opening with low expansive foams. • Dense pack old weight pockets with cellulose or short fiber fiberglass, or spray full with foam. • Photo-Documentation is required for all window rebates. This can be as simple as taking a picture with your phone during the installation process. We are not expecting a photo of each window - however, we will need to see enough proof to verify the install method and to easily be able to identify the home from the photo. • The intent of the photo requirement for window installations is to capture the moment when the wall is opened up for a Full-Frame install to verify that it has occurred. If the home's circumstances will not allow a full-frame installation, still take the photo, as it will prove why you didn't do a full-frame install. 		<p>to do, including historic homes, brick and stone veneer, or asbestos siding; more prone to leakage. Block frame installations must include air sealing around existing window frame, and insulating the weight pockets in old single/double hung windows.</p> <ul style="list-style-type: none"> – Full frame - replacement windows are installed in existing framing after old window and trim is removed on the inside, and the mounting flange trim is removed on the outside and re-flashed. This method is less prone to leakage. • Must use window wrap approved by the manufacturer; typically, urethane sealant. • Use AAMA or manufacturer approved Low expansive foams to air seal windows in the opening.
Replacement		<ul style="list-style-type: none"> • New motor must be brushless DC 		



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Air Handler Blower Motor	<ul style="list-style-type: none"> Existing motor: Permanent Split Capacitor TESP exceeding 0.8 IWC must be mitigated to qualify for rebate 	<ul style="list-style-type: none"> Undertake minimal airflow mitigation measures such as replacing air filter, checking registers and ducts for problems first. Then measure airflow with flow grid, or use total external static pressure as proxy for airflow. Match new airflow to old airflow, or match new external static pressure to old static pressure after replacing blower motor. 	<ul style="list-style-type: none"> Airflow or static pressure test required. Total External Static Pressure (TESP) cannot exceed 0.8 IWC. 	
Replacement Gas Furnace	<ul style="list-style-type: none"> Contractor must provide existing furnace manufacturer, model #, BTUH Input, efficiency, and age to qualify for a rebate. 	<ul style="list-style-type: none"> Existing furnace efficiency below 90% AFUE must increase in efficiency to either Tier 1 or 2 rebates. Existing furnace efficiency greater than or equal to 90% AFUE must either increase in efficiency to Tier 2 or, if already at Tier 2 efficiency, must move from PSC to ECM blower. Equipment must be right sized using an approved Block Load heat loss calculation; installed and commissioned per ACCA Standard 5-2010. All furnaces shall be sealed combustion, with both intake and exhaust piped to outdoors, and vented per OEM's installation instructions. Tier 1 rebated furnaces shall be a minimum 92% AFUE. Tier 2 rebated furnaces shall be a minimum 95% AFUE and have multi-stage gas valves and ECM motors. <ul style="list-style-type: none"> Multi-stage thermostat required Total External Static Pressure should not exceed manufacturer's spec without investigating cause and correcting if possible. Tier 2 Furnace replacements (with ECM blower motor) with a TESP exceeding 0.8 i.w.c. will not qualify for a rebate. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. No CST required if all appliances in CAZ are sealed combustion. Complete EW-H Furnace Commissioning Form and return with rebate application. 	<ul style="list-style-type: none"> If orphaned water heater does not pass combustion safety test, the homeowner must sign Post-Improvement Carbon Monoxide Disclosure Form, and the contractor must present the homeowner with options to eliminate back drafting. Here are some options: <ul style="list-style-type: none"> Diagnose cause of negative pressure in the CAZ, and propose mitigation. Replace the draft hooded water heater with a sealed combustion water heater that will qualify for our rebate. The old vent must



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		<ul style="list-style-type: none"> Follow EW-H Post-Installation Combustion Safety Test Procedure. 		<p>be capped on both ends or removed and fire-stop the chase.</p> <ul style="list-style-type: none"> Re- line or resized the vent to avoid excess spillage from back drafting. Vent liner sized per liner manufacturer installation sizing tables for water heater BTU input and height. Add combustion air.
<p>Replacement Gas Boiler</p>	<ul style="list-style-type: none"> Hydronic systems must be evaluated by an EW-H Hydronic Specialty Contractor 	<ul style="list-style-type: none"> Must be installed as sealed combustion: intake and exhaust piped to outdoors. Outdoor reset control integrated into design. Initial adjustment of the modulating gas valve must match incoming gas pressure with appropriate high and low fire outputs. Program boiler computer to actual conditions, not default settings. New boiler must be more than 10% more efficient than existing boiler. Boiler over 85% efficient must have return water temps low enough to condense; thus receiving additional efficiency from condensation. All existing circulator pumps must be replaced with DC ECM pumps. Circulation pipes must be insulated when exposed in attics or crawl spaces. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F. No CST required if <u>all</u> appliances in CAZ are sealed combustion. 	<ul style="list-style-type: none"> Return water temps may not be low enough with existing system design for new high efficiency boiler to condense. Thus eliminating efficiency gains. Need to determine suitability of replacing the existing boiler: what type and size of boiler to replace it with, condensing high efficiency, or mid-efficiency. Look at the type and the lineal footage of existing convectors for suitability with new high efficiency boiler system that operates at lower temps: may cause over and under heating of rooms.



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				<ul style="list-style-type: none"> Baseboard convectors may need replacement with a high-capacity model or increase the overall length.
<p>New AC Installation or Replacing AC System</p>	<ul style="list-style-type: none"> Central split AC systems only Existing AC must be SEER 10 or <, OR replacement AC system is at least 1 Ton smaller 	<ul style="list-style-type: none"> System must be right-sized using an ACCA approved Manual J block load calculations, installed per ACCA Standard 5, and commissioned with EW-H AC Commissioning Form. AC systems > 115% of design cooling load: must provide equipment performance data sheets with equipment selection highlighted per Manual S. AC system condenser, evaporator, and furnace must be AHRI matched. 3 Tiers of rebates apply to either New or Replacement AC Installation: Tier 1 is SEER 14.5, EER 12; Tier 2 is SEER 15, EER 12.5; Tier 3 is SEER 16, EER 13 Tier 3 must have 2 stage condensing unit and furnace with ECM motor 	<ul style="list-style-type: none"> Complete EW-H AC Commissioning Form and return with rebate application. 	<ul style="list-style-type: none"> Mini-splits must be AC only to quality for this rebate.



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<p>Heat Pump</p>	<ul style="list-style-type: none"> • Electric heat or heat pump only. • Heat pump must be evaluated by an EW-H Heat Pump Contractor 	<ul style="list-style-type: none"> • Central System must be right-sized using ACCA approved Block Load heat loss/gain calculations, installed per ACCA Standard 5 2010, and commissioned with EW-H AC Commissioning Form. • Determine if existing forced air system duct size is large enough for heat pump. • Min SEER of 14.5 & HSPF of 9.0 • Must be cold-climate air-source multi-stage heat pump, mini-split heat pump or ground source heat pump. • Ductless Mini-Splits do not need Manual J, App E, or App F 	<ul style="list-style-type: none"> • Complete EW-H AC Commissioning Form and return with rebate application. 	
<p>Advanced Evaporative Cooler</p>	<ul style="list-style-type: none"> • New evaporative cooler or replacing existing A/C w/ an evaporative cooler. 	<ul style="list-style-type: none"> • Permanent installations only; temporary or portable units not eligible. • Evaporative Coolers must have: <ul style="list-style-type: none"> - Inorganic media, Thermostat control, automated daily water dump, insulated cover for winter. • Direct evaporative coolers are permanently mounted on roof or ground. Indirect can be mounted on ground or in an attic. • Follow all manufacturer's installation instructions 	<ul style="list-style-type: none"> • No test out requirement. 	<ul style="list-style-type: none"> • Instruct homeowner to open window(s) during operation.



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<p>Replacement Gas Water Heater</p>	<ul style="list-style-type: none"> Replacing natural draft vented water heater, or electric water heater. 	<ul style="list-style-type: none"> Replacement gas water heater must be power vented, direct vented, or high efficiency sealed combustion. Tier 1: Power Vented water heaters must have an $EF \geq 0.67$. Tier 2: Direct Vented water heaters must have an $EF \geq 0.67$. Tier 3: High efficiency sealed combustion must have an $EF \geq 0.82$. Direct vent and high efficiency sealed combustion must have both intake and exhaust piped to exterior. Cap or remove combustion air ducts if all appliances in CAZ are sealed combustion. Do a combustion analysis test verifying the installation meets manufacturer's specifications. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F No CST required if <u>all</u> appliances in CAZ are sealed combustion. 	<ul style="list-style-type: none"> Will solve back-drafting / combustion product spillage in houses with combustion safety problems. Power vented tank helps with combustion safety; still requires combustion air ducts to CAZ; no efficiency gain over current standard efficiency tank. Direct vent tank solves combustion safety problems; eliminates combustion air ducts; is cheaper than high efficiency; no efficiency gain over current standard efficiency tank Direct vent intake and exhaust terminations must be a minimum 22" above grade. High efficiency sealed-combustion tank and tankless units mitigate combustion safety problems; eliminates need for combustion air supply ducts.



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<p>Whole House Fan</p>	<ul style="list-style-type: none"> • New or replacement of old whole house fans without motorized damper/insulated cover. 	<ul style="list-style-type: none"> • Fans must have motorized, insulated doors or dampers, which shut and seal after every use. • Provide adequate attic venting per fan manufacturer, unless exhaust vent can be terminated outside the attic. • Insulation shall be prevented from being blown into soffits with baffles and/or insulation blocking. Soffits ventilation into attic shall be maintained. • Old, non-qualifying whole house fans must be removed and the space air sealed and insulated per IECC as adopted by AHJ. 	<ul style="list-style-type: none"> • Document that attic ventilation is adequate for the fan air flow rate. Submit with rebate application. 	<ul style="list-style-type: none"> • Quiet fans that seal move low CFM; multiple units may be required to provide comfort.
<p>Duct Sealing and Insulating</p>	<ul style="list-style-type: none"> • Duct leakage to outside thermal envelope must exceed 20% of measured system airflow. • A Participating HVAC Contractor with Duct Sealing Specialty must verify duct leakage. • A portion of the duct system must be present in unconditioned attic space 	<ul style="list-style-type: none"> • Duct Blaster with Blower door test is required before and after duct sealing to measure beginning leakage to outside, and the leakage to outside reduction. • Pressurize house to +25 Pa with blower door, and pressurize duct system to 0 Pa WRT house. Measure duct leakage to outside: must exceed 20% of system airflow to qualify for an incentive. • Seal ducts with approved materials (foil tape can be used at parts that need to be removed for service). • Un-insulated duct in unconditioned space must be insulated per local building code. • Follow EW-H Post-Installation Combustion Safety Test Procedure. • Final leakage must be a minimum of 30% reduction from initial test. 	<ul style="list-style-type: none"> • Combustion Safety Test required. Record results on Appendix F 	<ul style="list-style-type: none"> • Sealing and insulating ducts located outside a home's thermal boundary are usually a cost effective measure. • Can help solve house depressurization issues. • Conditioning crawl spaces containing ducts can be more effective than air-sealing ducts in cold crawl space.



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<p>Mechanical Ventilation</p>	<ul style="list-style-type: none"> Per ASHRAE 62.2-2010 calculation, home requires mechanical ventilation. 	<ul style="list-style-type: none"> Install Ventilation per ASHRAE 62.2-2010 mechanical ventilation requirements. 	<ul style="list-style-type: none"> Combustion Safety Test required. Record results on Appendix F Commission any installed ventilation system (Exhaust only, Supply only, balanced) Measure all system airflows to verify they meet ASHRAE 62.2 ventilation requirements Document intake and/or exhaust flow rates for rebate application submittal 	<p>Below are “BEST PRACTICES” recommendations and specific requirements for each system type:</p> <ul style="list-style-type: none"> Exhaust-Only Ventilation: <ul style="list-style-type: none"> Can potentially depressurize CAZ leading to back drafting. As long as CAZ depressurization is within BPI standards and the Combustion Safety Test passes worst-case, then Exhaust-Only Ventilation is a viable solution. Garage must be air sealed from home so that the garage does not become the source of makeup air. Balanced Heat Recovery Ventilators (HRV), and Energy Recovery Ventilators (ERV): <ul style="list-style-type: none"> Pollutant source point intake is preferred but not always possible <ul style="list-style-type: none"> Exhaust ducted balanced systems: <ul style="list-style-type: none"> Furnace fan need not run continuously: intermittent



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				<p>operation/increased speed for on-demand fan operation ok</p> <ul style="list-style-type: none"> ◦ Furnace fan should be interlocked w/ HRV/ERV for proper air distribution ◦ ECM motor required when furnace is used for ventilation, ◦ ECM motors required with HRV/ERV ventilation systems. ◦ Defrost must be with conditioned air, not electric resistance heat strips. ◦ Airflow commissioning required <ul style="list-style-type: none"> • Exhaust-Only Ventilation Systems: Not appropriate for homes with fireplaces or open combustion appliances unless CAZ pressures are within BPI standards and Combustion Safety Test passes in worst-case. <ul style="list-style-type: none"> - Multi-port exhaust ventilator <ul style="list-style-type: none"> ◦ Includes remote attic mounted fans with multiple drops to



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				<p>bathrooms and other pollutant generating sources (except areas w/ gas or wood burning appliances)</p> <ul style="list-style-type: none"> ◦ Can have continuous or intermittent run times ◦ If fan is in continuous operation, must have a DC motor. <ul style="list-style-type: none"> - Single port fans <ul style="list-style-type: none"> ◦ ENERGY STAR qualified bath or kitchen fans ◦ Quality insulated ducting ◦ Can have continuous or intermittent run times ◦ If fan is in continuous operation, must have a DC motor. - House to garage connection cannot exceed 1%. <ul style="list-style-type: none"> • Supply Ventilation <ul style="list-style-type: none"> - ECM motor required where furnace is used for ventilation, - Do not use in continuous operation: can over ventilate/pressurize the house, which may cause



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				moisture condensation damage inside exterior assemblies. <ul style="list-style-type: none"> - Use Fan Cyclor to control ventilation; a motorized damper on insulated outdoor air intake duct opens when the furnace/air-handler blower operates, and/or a specified amount of time per hour. - Outdoor air duct connects to the furnace return air far enough from furnace to temper cold air so air reaching the heat exchanger is not less than OEM minimum specification. Slope first 4' of intake duct towards outside, use balancing damper