Northwest ENERGY STAR® Homes, Version 3 (Rev. 01) Thermal Enclosure System Verifier Checklist[1]

Home Address: _____ City: _____ State:_____

Inspection Guidelines	Must Correct	Builder Verified[1]	Verifier Verified	N/A
1. High-Performance Fenestration				
1.1 Fenestration shall meet or exceed Northwest ENERGY STAR Homes BOP or TCO [2]	☐	☐	☐	☐
2. Quality-Installed Insulation				
2.1 Ceiling, wall, floor, and slab insulation levels shall meet or exceed Northwest ENERGY STAR Homes BOP Prescriptive Path or TCO requirements [3,4,5]	☐	☐	☐	☐
2.2 All ceiling, wall, floor, and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces with insulated sheathing (see checklist item 4.4.1 for required insulation levels)	☐	☐	☐	☐
3. Fully-Aligned Air Barriers[6]				
At each location noted below, a complete air barrier shall be provided that is fully aligned with the insulation as follows: • At interior surface of ceilings. Also, include barrier at interior edge of attic eave using a wind baffle that extends to the full height of the insulation. Include a baffle in every bay or a tabbed baffle in each bay with a soffit vent that will also prevent wind washing of insulation in adjacent bays. • At exterior surface and interior surface of walls [7] • At interior surface of floors, including supports to ensure permanent contact and blocking at exposed edges [8,9]				
3.1 Walls [10]				
3.1.1 Walls behind showers and tubs	☐	☐	☐	☐
3.1.2 Walls behind fireplaces	☐	☐	☐	☐
3.1.3 Attic knee walls	☐	☐	☐	☐
3.1.4 Skylight shaft walls	☐	☐	☐	☐
3.1.5 Wall adjoining porch roof	☐	☐	☐	☐
3.1.6 Staircase walls	☐	☐	☐	☐
3.1.7 Double walls	☐	☐	☐	☐
3.1.8 Garage rim / band joist adjoining conditioned space	☐	☐	☐	☐
3.1.9 All other exterior walls	☐	☐	☐	☐
3.2 Floors				
3.2.1 Floor above garage	☐	☐	☐	☐
3.2.2 Cantilevered floor	☐	☐	☐	☐
3.2.3 Floor above unconditioned basement or vented crawlspace	☐	☐	☐	☐
3.3 Ceilings [10]				
3.3.1 Dropped ceiling / soffit below unconditioned attic	☐	☐	☐	☐
3.3.2 All other ceilings	☐	☐	☐	☐
4. Reduced Thermal Bridging				
4.1 For insulated ceilings with attic space above (i.e., non-cathedralized ceilings), uncompressed insulation ≥ R-21 extends to the inside face of the exterior wall below. [11]	☐	☐	☐	☐
4.2 For slabs on grade, insulation under slab meets or exceeds Northwest ENERGY STAR Homes BOP or TCO, and 100% of slab edge insulated to ≥ R-5 at depth specified by BOP or TCO and aligned with thermal boundary of the walls.[4,5]	☐	☐	☐	☐
4.3 HVAC and other attic platforms constructed to allow for full-depth insulation below.	☐	☐	☐	☐
4.4 Reduced thermal bridging at above-grade walls separating conditioned from unconditioned space (rim / band joists exempted) using one of the following options: [12,13]				
4.4.1 Continuous rigid insulation sheathing, insulated siding, or combination of the two; ≥ R-3 in Climate Zone 4, ≥ R-5 in Climate Zones 5 & 6 [14,15], **OR**;	☐	☐	☐	☐
4.4.2 Structural Insulated Panels (SIPs), **OR**;	☐	☐	☐	☐
4.4.3 Insulated Concrete Forms (ICFs), **OR**;	☐	☐	☐	☐
4.4.4 Double-wall/staggered stud framing[16], **OR** (see next page);	☐	☐	☐	☐

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Inspection Guidelines			Must Correct	Builder Verified[1]	Verifier Verified	N/A
4.4.5		Advanced framing, including all of the items below:	☐	☐	☐	☐
	4.4.5.a	All corners insulated to ≥R-6 at edge[17], **AND**;	☐	☐	☐	☐
	4.4.5.b	All headers above windows & doors insulated[18], **AND**;	☐	☐	☐	☐
	4.4.5.c	Framing limited at all windows & doors[19], **AND**;	☐	☐	☐	☐
	4.4.5.d	All interior / exterior wall intersections insulated to the same R-value as the rest of the exterior wall [20], **AND**;	☐	☐	☐	☐
	4.4.5.e	Minimum stud spacing of 19 in. o.c. framing unless construction documents specify other spacing is structurally required [21]	☐	☐	☐	☐
5.	**Air Sealing**					
5.1		Penetrations to unconditioned space fully sealed with solid blocking or flashing as needed and gaps sealed with caulk or foam				
5.1.1		Duct / flue shaft	☐	☐	☐	☐
5.1.2		Plumbing / piping	☐	☐	☐	☐
5.1.3		Electrical wiring	☐	☐	☐	☐
5.1.4		Bathroom and kitchen exhaust fans	☐	☐	☐	☐
5.1.5		Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and fully gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 to minimize condensation potential.	☐	☐	☐	☐
5.1.6		Light tubes adjacent to unconditioned space include lens separating unconditioned and conditioned space and are fully gasketed. [22]	☐	☐	☐	☐
5.2		Cracks in the building envelope fully sealed				
5.2.1		All sill plates adjacent to conditioned space sealed to foundation or sub-floor with caulk. Foam gasket also placed beneath sill plate if resting atop concrete or masonry and adjacent to conditioned space.	☐	☐	☐	☐
5.2.2		At top of walls adjoining unconditioned spaces, continuous top plates or sealed blocking using caulk, foam, or equivalent material	☐	☐	☐	☐
5.2.3		Sheetrock sealed to top plate at all attic / wall interfaces using caulk, foam, or equivalent material. Either apply sealant directly between sheetrock and top plate or to the seam between the two from the attic above. Construction adhesive shall not be used.	☐	☐	☐	☐
5.2.4		Rough openings around windows & exterior doors sealed with caulk or foam	☐	☐	☐	☐
5.2.5		Marriage joints between modular home modules at all exterior boundary conditions fully sealed with gasket and foam	☐	☐	☐	☐
5.2.6		All seams at Structural Insulated Panels (SIPs) foamed and/or taped per manufacturer's instructions	☐	☐	☐	☐
5.2.7		In multi-family buildings, the gap between the drywall shaft wall (i.e. common wall) and the structural framing between units fully sealed at all exterior boundaries	☐	☐	☐	☐
5.2.8		Rim/band joists between conditioned and unconditioned space fully sealed using caulk or foam	☐	☐	☐	☐
5.3		Other Openings				
5.3.1		Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions gasketed or made substantially air-tight	☐	☐	☐	☐
5.3.2		Attic access panels and drop-down stairs equipped with a durable ≥R-10 insulated cover that is gasketed (i.e., not caulked) to produce continuous air seal when occupant is not accessing the attic [23]	☐	☐	☐	☐
5.3.3		Whole-house fans equipped with a durable ≥R-10 insulated cover that is either installed on the house side or mechanically operated [23]	☐	☐	☐	☐

Verifier Name: _____ Verifier Pre-Drywall Inspection Date:_____ Verifier Initials: _____

Verifier Name: _____ Verifier Final Inspection Date: _____ Verifier Initials: _____

Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____

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Notes:

1. At the discretion of the Verifier, the builder may verify up to eight items specified in this Checklist. When exercised, the builder's responsibility will be formally acknowledged by the builder signing off on the Checklist for the item(s) that they verified.

2. All windows, doors and skylights shall meet or exceed the component U-factor and SHGC requirements specified in the relevant Northwest ENERGY STAR Homes BOP or TCO, located at: www.northwestenergystar.com/partners. Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.

   Fenestration utilized as part of a passive solar design may be exempt from these requirements. Exempted windows shall be facing within 15 degrees of true south and directly coupled to thermal storage mass that has a heat capacity > 20 btu/ft^{3}x^{o}F and provided in a ratio of at least 3 sq. ft per sq. ft. of south facing fenestration. Generally, thermal mass materials will be at least 2" thick.

   Up to 0.75% of conditioned floor area (CFA) may be used for decorative glass that does not meet Northwest ENERGY STAR Homes BOP or TCO requirements. For example, a home with total above-grade conditioned floor area of 2,000 sq. ft. may have up to 15 sq. ft. (0.75% of 2,000) of decorative glass. However, all decorative glass and skylight window areas count toward the total window area to above-grade conditioned floor area (WFA) ratio. For homes using the Prescriptive Path that have a WFA ratio greater than that stipulated in the BOP or TCO, an improved window U-Value is required. Guidance and calculations for determining the adjusted U-value are provided in the BOP Reference Design Notes.

3. Insulation levels in a home shall meet or exceed the component insulation requirements specified in the relevant Northwest ENERGY STAR Homes BOP or TCO, located at: www.northwestenergystar.com/partners. Compliance can be determined by meeting component insulation requirements or using a total UA alternative. Where compliance will be determined with a total UA approach, the State Certifying Organization (SCO) must approve the calculation method. Note that the U-factor for steel-frame envelope assemblies shall be calculated using the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method. Additionally, reduction of ceiling insulation in space-constrained roof/ceiling assemblies shall be limited to 500 sq. ft. or 20% of ceiling area, whichever is less. Also, note that while ceiling and slab insulation can be included in trade-off calculations, Items 4.1 through 4.3 of the Checklist shall be met regardless of the UA tradeoffs calculated.

4. Slab edge insulation is only required for slab-on-grade floors with a floor surface less than 24 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall.

5. Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the home's qualification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: www.energystar.gov/slabedge.

6. For purposes of this checklist, an air barrier is defined as any durable, rigid, solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams. Air barriers shall not be made of materials that are easily bent or torn. Additional information on proper air sealing of thermal bypasses can be found on the Building America Web site (www.eere.energy.gov/buildings/building_america) and in the EEBA Builder's Guides (www.eeba.org). These references include guidance on identifying and sealing air barriers as well as details on many of the items included in the checklist.

7. EPA highly recommends, but does not require, inclusion of an interior air barrier at band joists. An exterior air barrier at band joists is required and can be achieved by sealing from the interior with caulk or foam or from the exterior with caulk or gasket before sheathing is attached.

8. Examples of supports necessary for permanent contact include staves for batt insulation or netting for blown-in insulation. Batts that completely fill a cavity enclosed on all six sides may be used to meet this requirement without the need for supports, even though some compression will occur due to the excess insulation, as long as the compressed value meets or exceeds the required insulation level. Specifically, the following batts may be used in six-sided floor cavities: R-19 batts in 2x6 cavities, R-30 batts in 2x8 cavities, R-38 batts in 2x10 cavities, and R-49 batts in 2x12 cavities. For example, in a home that requires R-19 floor insulation, an R-30 batt may be used in a six-sided 2x8 floor cavity.

9. Fully-aligned air barriers may be installed at the exterior surface of the floor cavity in all Climate Zones if the insulation is installed in contact with this exterior air barrier and the perimeter rim and band joists of the floor cavity are also sealed and insulated to comply with the fully-aligned air barrier requirements for walls.

10. All insulated vertical surfaces are considered walls (e.g., exterior walls, knee walls) and must meet the air barrier requirements for walls. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings.

11. The minimum designated R-values must be achieved regardless of the trade-offs determined using an equivalent U-factor or UA alternative calculation. Note that if the minimum designated values are used, they must be compensated with higher

values elsewhere using an equivalent U-factor or UA alternative calculation in order to meet the overall insulation requirements. Also, note that these requirements can be met by using any available strategy, such as a raised-heel truss, alternate framing that provides adequate space, and / or high-density insulation. In Climate Zones 1 through 3, one option that will work for most homes is to use 2x6 framing, an R-21 high-density batt, and a wind baffle that only requires 0.5 in. of clearance.

12. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentional designed details (e.g., architectural details such as thermal fins, wing walls, or masonry fireplaces; structural details, such as steel columns). It shall be apparent to the Verifier that the exempted areas are intentional designed details or the exempted area shall be documented in a plan provided by the builder, architect, designer, or engineer. The Verifier need not evaluate the necessity of the designed detail to qualify the home.

13. Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this item. To be eligible for this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal mass, a distribution system, and a control system. For more information, see: http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10270.

14. If used, insulated siding shall be attached directly over a water-resistive barrier and sheathing. In addition, it shall provide the required R-value as demonstrated through either testing in accordance with ASTM C 1363 or by attaining the required R-value at its minimum thickness. Insulated sheathing rated for water protection can be used as a water resistant barrier if all seams are taped and sealed. If non-insulated structural sheathing is used at corners, advanced framing details listed under Item 4.4.5 shall be met for those wall sections.

15. Steel framing shall meet the reduced thermal bridging requirements by complying with item 4.4.1 of the checklist.

16. Double-wall framing is defined as any framing method that ensures a continuous layer of insulation covering the studs to at least the R-value required in Section 4.4.1 of the checklist, such as offset double-stud walls, aligned double-stud walls with continuous insulation between the adjacent stud faces, single sill (2x8) with staggered studs, or single-stud walls with 2x2 or 2x3 cross-framing. In all cases, insulation shall fill the entire wall cavity from the interior to exterior sheathing except at windows, doors and other penetrations.

17. All exterior corners shall be constructed to allow access for the installation of ≥ R-6 insulation that extends to the exterior wall sheathing. Examples of compliance options include standard-density insulation with alternative framing techniques, such as using three studs per corner, or high-density insulation (e.g., spray foam) with standard framing techniques.

18. Header insulation shall be ≥ R-3 for wall assemblies with 2x4 framing, or equivalent cavity width, and ≥ R-5 for all other assemblies (e.g., with 2x6 framing). Compliance options include continuous rigid insulation sheathing, SIP headers, other prefabricated insulated headers, single-member or two-member headers with insulation either in between or on one side, or an equivalent assembly, except where a framing plan provided by the builder, architect, designer, or engineer indicates that full-depth solid headers are the only acceptable option. The Verifier need not evaluate the structural necessity of the details in the framing plan to qualify the home. Also, the framing plan need only encompass the details in question and not necessarily the entire home. R-value requirement refers to manufacturer's nominal insulation value.

19. Framing at windows shall be limited to a maximum of one pair of king studs and one pair jack studs per window opening to support the header and window sill. Additional jack studs shall be used only as needed for structural support and cripple studs only as needed to maintain on-center spacing of studs.

20. Insulation shall run behind interior/exterior wall intersections using ladder blocking, full length 2"x6" or 1"x6" furring behind the first partition stud, drywall clips, or other equivalent alternative.

21. Vertical framing members shall either be on-center or have an alternative structural purpose (e.g., framing members at the edge of pre-fabricated panels) that is apparent to the Verifier or documented in a framing plan provided by the builder, architect, designer, or engineer. The Verifier need not evaluate the structural necessity of the details in the framing plan to qualify the home. Also, the framing plan need only encompass the details in question and not necessarily the entire home. No more than 5% of studs may lack an apparent or documented structural purpose, which is equivalent to one vertical stud for every 30 linear feet of wall, assuming 16 in. o.c. stud spacing.

22. Light tubes that do not include a gasketed lens are required to be sealed and insulated ≥ R-6 for the length of the tube.

23. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with adhesive, or batt insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping).

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HVAC System Quality Installation Contractor Checklist[1]

Home Address: _____ City: _____ State:_____					
Heating System Type[2]: ☐Gas Furnace ☐Heat Pump ☐Boiler ☐Other (please specify):					
Heating System Location:					
Spaces Served by Heating System: ☐Whole House ☐Other (please specify):					
Cooling System Type[2]:					
Cooling System Location:		Cooling System Designed for Temp. Occupant Load?[3] ☐Yes ☐No			
Spaces Served by Cooling System: ☐Whole House ☐Other (please specify):					
	Inspection Guidelines	**Must Correct**	**Contractor Verified**	**Verifier/PT Verified [1]**	**N/A**
1.	**Heating & Cooling System Design [3,4]**				
1.1	The SpecPro Design Tool used to calculate heat loss/gain, equipment capacity, and duct sizing, and documentation from tool is attached.	☐	☐	☐	-
2.	**Whole-Building Mechanical Ventilation Design [4]**				
2.1	Ventilation system designed & installed to meet local code or ASHRAE 62.2-2010, whichever is more stringent, including but not limited to requirements in Items 2.2-2.5.[5]	☐	☐	☐	-
2.2	Ventilation system does not utilize an intake duct to the return side of the HVAC system unless the manufacturer's requirements for return air temperature are met and design requirements defined in Footnote 6 are met. Note: In the state of WA, this type of system is only allowable with the approved ventilation TCO. [6]	☐	☐	☐	☐
2.3	Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	☐	☐	☐	-
2.4	If present, continuously-operating ventilation and exhaust fans designed and set to operate during all occupiable hours.	☐	☐	☐	☐
2.5	If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours.	☐	☐	☐	☐
3.	**Selected Heating Equipment [7]**				
3.1	Furnace Mfr. and Model: _____	☐	☐	☐	☐
3.2	Furnace Serial #: _____	☐	☐	☐	☐
3.3	Furnace Listed Output Heating Capacity (Btuh): _____	☐	☐	☐	☐
3.4	Furnace Efficiency (AFUE): _____	☐	☐	☐	☐
3.5	Furnace Listed Output Heating Capacity is 100-140% of design heat loss or next nominal size. A larger air handler is allowable if necessary to achieve a friction rate of ≥ 0.06 inches water column (IWC).[8]	☐	☐	☐	☐
3.6	Heat Pump Condenser Mfr. and Model: _____	☐	☐	☐	☐
3.7	Heat Pump Evap. / Fan Coil Mfr. and Model: _____	☐	☐	☐	☐
3.8	Heat Pump Condenser Serial #: _____	☐	☐	☐	☐
3.9	Heat Pump Evap. / Fan Coil Serial #: _____	☐	☐	☐	☐
3.10	HP Design Total Heat Loss (BTUh) @35 °F: ____	☐	☐	☐	☐
3.11	HP Listed Output Heating Capacity (BTUh) @17 °F: ____ @35 °F: ____ @47 °F: ____	☐	☐	☐	☐
3.12	Heat Pump Efficiency (AHRI listed HSPF): _____	☐	☐	☐	☐
3.13	Heat Pump AHRI Reference #: _____	☐	☐	☐	☐
3.14	HP Listed Output Heating Capacity ≥ HP Design Total Heat Loss @ 35°F	☐	☐	☐	☐
3.15	Heat Pump AHRI Certificate is attached	☐	☐	☐	☐
3.16	For Heat Pump, completed 2011 PTCS® Commissioned Heat Pump Certificate & Startup Form is attached.	☐	☐	☐	☐
4.	**Selected Cooling Equipment[7]**				
4.1	Condenser Mfr. and Model: _____	☐	☐	☐	☐
4.2	Condenser Serial #: _____	☐	☐	☐	☐
4.3	Evap./ Fan Coil Mfr. and Model: _____	☐	☐	☐	☐
4.4	Evap./ Fan Coil Serial #: _____	☐	☐	☐	☐
4.5	AHRI Reference #: _____	☐	☐	☐	☐

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4.6	Listed Total Capacity at Design Cond. (BTUh)[8]: _____	☐	☐	☐	☐
4.7	Listed Sensible Cap. at Design Cond. (BTUh)[8]: _____	☐	☐	☐	☐
4.8	Listed Latent Capacity at Design Cond. (BTUh)[8]: _____	☐	☐	☐	☐
4.9	Listed Efficiency (SEER): _____	☐	☐	☐	☐
4.10	Listed Total Capacity (Item 4.6) of cooling-only equipment is 95-115% of design total heat gain or next nominal size. A larger air handler is allowable if necessary to achieve a friction rate of ≥ 0.06 inches water column (IWC).[8]	☐	☐	☐	☐
4.11	AHRI Certificate is attached	☐	☐	☐	☐
4.12	Completed NWESH Central AC Commissioning & Startup Form is attached.[9]	☐	☐	☐	☐
5.	**Air Flow Tests**				
5.1	Total System Static Pressure: _____ IWC. Test hole locations are well marked and accessible.	☐	☐	☐	☐
5.2	Individual room air flows within 20% or ±25 CFM of design requirements. In spaces where design air flow is less than 40 CFM, up to 40 CFM is allowable.[10]	☐	☐	☐	☐
6.	**Electrical Measurements**				
6.1	Evaporator / Air handler fan: _____amperage _____line voltage	☐	☐	☐	☐
6.2	Compressor unit: _____amperage _____line voltage	☐	☐	☐	☐
6.3	Electrical measurements within OEM specified tolerance of nameplate value.	☐	☐	☐	☐
7.	**System Controls**				
7.1	Operating and safety controls meet OEM requirements	☐	☐	☐	☐
8.	**Drain Pan**				
8.1	Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [11]	☐	☐	☐	☐

Technician Name: _____ **Equipment Installation Date:** _____
Technician Signature[12]: _____ **Company:** _____

HVAC Designer Name: _____ **Company:** _____
HVAC Designer Signature[12]: _____

1. The HVAC System Quality Installation Contractor Checklist is designed to align with the requirements of ASHRAE 62.2-2010 and published addenda and PTCS® standards, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, or HVAC problems (e.g., those caused by a lack of maintenance by occupants). Therefore, this checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

   This checklist shall be provided by the Verifier to the HVAC contractor who shall complete one checklist for each system. Upon completion, the HVAC contractor shall return the checklist(s) to the Verifier. Alternatively, at the discretion of the Builder, Contractor, and Verifier, the Verifier or Performance Tester may verify select checklist items in place of the Contractor. When this occurs, the Verifier or Performance Tester (PT) shall check the box of the verified items in the "Verifier/PT Verified" column. The Verifier is only responsible for ensuring that the Contractor has completed the Contractor checklist in its entirety and for the items that are checked in the "Verifier/PT Verified" column (if any). The Verifier is not responsible for assessing the accuracy of the items in this checklist that are not checked in the "Verifier/PT Verified" column. Instead, it is the contractor's exclusive responsibility to ensure the design and installation comply with the Contractor checklist.

   The "Contractor Verified" column shall be used to indicate items verified by the HVAC Contractor or Technician. The "Verifier Verified" column shall only be used to indicate items verified by the Verifier for homes in which the Verifier has agreed to verify and accept responsibility for one or more requirements.

2. This checklist applies to ventilation systems, split air conditioners, unitary air conditioners, air-source/water-source (i.e., geothermal) heat pumps up to 65,000 Btu/h and furnaces up to 225,000 Btu/h. Where other HVAC systems such as boilers, ductless mini-splits, or zonal electric heating are in place, the contractor shall indicate the system type and complete all applicable sections of the checklist.

3. Heating and cooling loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the SpecPro Design Tool or substantively equivalent method. If use of specific design conditions or design tools are dictated by local code or regulation, then the requirements of the lawful or controlling authority supersedes these program requirements. Otherwise, the SpecPro Design Tool shall be used. The values for the geographically closest location shall be selected or a justification provided for the selected location.

Cooling systems designed for temporary occupant load may be required in order to accommodate a significant number of guests on a regular or sporadic basis. This additional load shall be satisfied by a supplemental cooling system (e.g., a small single-package or split-coil unit) or by a system that can shift capacity from zone to zone (e.g., a variable volume system).

The HVAC system design shall be completed for the specific configuration (e.g., plan, elevation, option, and orientation) of the home to be built except as follows.

For homes with a date of final inspection through 12/31/2012:

For each house plan with multiple configurations (e.g., orientations, elevations, options), the loads shall be permitted to be calculated for the configuration that will result in the largest load. The largest load shall be permitted to be used for equipment selection for all configurations, subject to the over-sizing limits defined in this Checklist.

For each house plan with multiple configurations, the room-level design airflows shall be permitted to be calculated using the configuration that resulted in the largest load.

For homes with a date of final inspection on or after 01/01/2013:

For each house plan with multiple configurations (e.g., orientations, elevations, options) the loads shall be calculated for each potential configuration. If the loads across all configurations vary by ≤ 25%, then the largest load shall be permitted to be used for equipment selection for all configurations, subject to the specified over-sizing limits defined in Items 3.5 and 4.7. Otherwise, the contractor shall group the load for each configuration into a set with ≤ 25% variation and equipment selection shall be completed for each set of loads.

For each house plan with multiple configurations, the room-level design airflows shall be calculated for each potential configuration. If the design airflows for each room vary across all configurations by ≤ 25% or 25 CFM, then the average room-level design airflow shall be permitted to be used when designing the duct system. Otherwise, the contractor shall group the room-level design airflow for each configuration into a set with ≤ 25% or 25 CFM variation and the duct design shall be completed for the average airflow of that set.

4. The person responsible for the heating, cooling, and ventilation design, whether it be the HVAC technician or other qualified HVAC design professional, shall be responsible for completing sections 1 and 2 of this checklist.

5. For proper procedures, exceptions, and selection methods see ASHRAE 62.2-2010 and published addenda. All components shall be designed and installed per local codes, manufacturers' installation instructions, engineering documents, and Northwest ENERGY STAR Homes program requirements, as specified in applicable BOP or TCO.

   The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of an exhaust ventilation system.

6. If the whole-house ventilation system utilizes the HVAC air handler, then the fan type shall be ECM / ICM, variable speed, and run at a reduced speed during ventilation, or include a controller (e.g., smartcycler) that reduces the ventilation run time by accounting for hours when HVAC system is heating or cooling the home.

7. All evaporators and condensing units shall be properly matched as demonstrated by an attached AHRI certificate. If an AHRI certificate is not available, a copy of OEM-provided catalog data indicating acceptable combination selection and performance data shall be attached.

8. Listed system capacity at design conditions is to be obtained from the OEM expanded performance data. For warm air heating systems, the output capacity must be between 100% and 140% of calculated system load unless a larger size is dictated by the cooling equipment selection or in order to accomplish design friction rate. For alternate heat sources, system capacity adheres to design requirements outlined in the applicable TCO.

   For cooling systems, the next largest nominal piece of equipment may be used that is available to satisfy the latent and sensible requirements. Single-speed systems generally have OEM nominal size increments of ½ ton. Multi-speed or multi-stage equipment may have OEM nominal size increments of one ton. Therefore, the use of these advanced system types can provide extra flexibility to meet the equipment sizing requirements.

9. The Northwest ENERGY STAR Homes AC Commissioning & Startup Form is only required for homes in locations with ≥600 CDD. In locations with <600 CDD, commissioning is recommended, but not required. HVAC System Quality Installation Contractor Checklist items shall be completed for all cooling systems, regardless of location.

10. Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control. Balancing dampers or proper duct sizing shall be used instead of loops to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, opposable blade dampers or dampers located in the duct boot are permitted.

11. Condensate pan shall be made of corrosion-resistant materials, to include galvanized steel and plastic. Drain pan shall drain condensate to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drainage system; and shall be equipped with a backflow prevention valve when drained to a shared drainage system, such as a storm water management system.

12. HVAC technician signature required prior to submittal to Verifier. If the HVAC system design (Sec. 1 & 2) was not completed by the HVAC technician, then the designer shall sign for those sections.

Northwest ENERGY STAR® Homes, Version 3 (Rev. 01)
HVAC System Quality Installation Verifier Checklist[1]

Home Address:_____City:_____ State: _____

	Inspection Guidelines	Must Correct	Verifier/PT Verified [2]	N/A
1.	**Review of HVAC System Quality Installation Contractor Checklist** [2]			
1.1	HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records along with documentation on ventilation system (2.3), HVAC design (1.1), commissioning forms (3.15 or 4.12), and AHRI certificate (3.14 or 4.11)	☐	☐	-
1.2	For the following design parameters, the values reported in the SpecPro Design Tool match the rated home.[3]			
	1.2.1 Weather Location	☐	☐	☐
	1.2.2 Number of Occupants	☐	☐	☐
	1.2.3 Conditioned Floor Area (± 10%)	☐	☐	☐
	1.2.4 Window Area (± 10%)	☐	☐	☐
	1.2.5 Predominant Window SHGC (± 0.1)	☐	☐	☐
	1.2.6 Home Orientation	☐	☐	☐
1.3	For furnaces, Listed Output Heating Capacity is 100-140% of design load or next nominal size. A larger air handler is permitted to be used to achieve a friction rate ≥ 0.06 IWC. [4]	☐	☐	☐
1.4	Heat Pump Output Heating Capacity at 35^0F meets or exceeds design heat loss at 35^0F.	☐	☐	☐
1.4	For cooling-only equipment, Listed Output Cooling Capacity is 95-115% of design load or next nominal size. A larger air handler is permitted to be used to achieve a friction rate ≥ 0.06 IWC. [4]	☐	☐	☐
1.5	HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.6, 3.7, 4.1), and AHRI certificate or OEM catalog data all match [5]	☐	☐	☐
1.6	Verifier-tested Total System Static Pressure is within ± 10% of Contractor-reported value (5.1).	☐	☐	☐
2.	**Duct Quality Installation** - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts*			
2.1	Connections and routing of ductwork completed without kinks or sharp bends.[6]	☐	☐	☐
2.2	No excessive coiled or looped flexible ductwork.[7]	☐	☐	☐
2.3	Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	☐	☐	☐
2.4	Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	☐	☐	☐
2.5	Building cavities not used as supply or return ducts	☐	☐	☐
2.6	HVAC ducts and combustion inlets and outlets may pass perpendicularly through exterior walls but if run within exterior walls must meet local code requirements **AND** have ≥60% R-value of wall assembly on exterior of duct or pipe.	☐	☐	☐
2.7	Quantity of supply and return duct terminations match room-level design in the SpecPro Design Tool.	☐	☐	☐
2.8	Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and door undercuts to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported in the SpecPro Design Tool; **OR** b) achieve a verifier-measured room pressure differential ≤ 3 Pa (0.012 IWC) with respect to the main body of the house when bedroom doors are closed and the air handler is operating.[8]	☐	☐	☐
3.	**Duct Insulation** - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [9]			
3.1	All connections to trunk ducts in unconditioned space are insulated.	☐	☐	☐
3.2	Ducts in unconditioned spaces insulated to ≥ R-8, except as follows: ≥ R-4 on exhaust ducts in unconditioned space in all states and ≥ R-6 on return ducts in ID & MT.	☐	☐	☐
4.	**Duct Leakage** - *Applies to All Heating, Cooling, and Balanced Ventilation Ducts* [10]			
4.1	Total measured duct leakage ≤ 0.06 CFM50 per sq. ft. of conditioned floor area or 75 CFM50 total, whichever is greater.[10]	☐	☐	☐
4.2	All rigid duct seams and connections sealed with mastic paste. All flex duct connections made substantially tight with nylon straps.	☐	☐	☐
4.3	Duct boots sealed to floor, wall, or ceiling using caulk, foam, or mastic paste.	☐	☐	☐
5.	**Whole House Mechanical Ventilation**			
5.1	Verifier-measured ventilation rate is 100-120% of design value (2.3).[11]	☐	☐	☐
6.	**Controls**			
6.1	Continuously operating ventilation & exhaust fans include readily accessible override controls.	☐	☐	☐

Northwest ENERGY STAR® Homes, Version 3 (Rev. 01)
HVAC System Quality Installation Verifier Checklist[1]

Inspection Guidelines		Must Correct	Verifier/PT Verified	N/A
6.2	Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled.	☐	☐	☐
7.	**Ventilation Inlets & Source**			
7.1	All ventilation air inlets located ≥10 ft. from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof. [12]	☐	☐	☐
7.2	Ventilation air inlets ≥ 4 ft. above grade or roof deck and not obstructed by snow, plantings, condensing units or other material at time of inspection.	☐	☐	☐
7.3	Ventilation air inlets provided with rodent /insect screen with ≤ 0.5 inch mesh.[13]	☐	☐	☐
7.4	Ventilation air comes directly from outdoors and not from adjacent dwelling units, garages, crawlspaces, or attics.	☐	☐	☐
8.	**Point-Source Ventilation**			
8.1	In each kitchen & bathroom, exhaust fan is installed that exhausts directly to the outdoors and meets local code or ASHRAE 62.2-2010 requirements, whichever is more stringent. Kitchen fans with rated flow ≥ 300 CFM must be capable of operating at multiple speeds.[11, 14, 15]	☐	☐	-
8.2	If fans share common exhaust duct, back-draft dampers installed.	☐	☐	☐
8.3	Common exhaust duct not shared by fans in separate dwellings.[16]	☐	☐	☐
8.4	Clothes dryers vented directly to outdoors, except for vent-less dryers equipped with a condensate drain.	☐	☐	☐
9.	**Ventilation & Exhaust Fan Ratings**			
9.1	Exhaust fans used for whole-house and bathroom ventilation are ENERGY STAR qualified.[15]	☐	☐	-
9.2	Bathroom exhaust fans are rated ≤ 1.0 sone.[17]	☐	☐	-
9.3	Kitchen exhaust fans must meet local code or ASHRAE 62.2-2010 requirements for sound levels, whichever is more stringent. Kitchen exhaust fans set to run continuously must be rated ≤ 1.0 sone at required flow rate.[18]	☐	☐	-
10.	**Combustion Appliances**			
10.1	Furnaces, boilers, and water heaters located within the home's pressure boundary shall be mechanically drafted or direct-vented (NFPA 54 class III or IV). Unvented combustion space or water heating appliances shall not be permitted within the home's pressure boundary.[18, 19]	☐	☐	☐
10.2	In homes with fireplaces that are not mechanically drafted or direct-vented, total rated flow of the home's two largest exhaust fans is ≤ 15 CFM per 100 sq. ft. of conditioned floor area **OR** the verifier-measured pressure differential is ≤ -5 Pa using BPI's or RESNET's worst-case depressurization test procedure.[11, 20]	☐	☐	☐
11.	**Filtration**			
11.1	MERV 6 – MERV 10 rated filter installed in each ducted mechanical system.[21]	☐	☐	☐
11.2	All return air and mechanically supplied outdoor air pass through filter prior to conditioning.	☐	☐	☐
11.3	Filter located and installed so as to facilitate access and regular service by the owner.[22]	☐	☐	☐
11.4	Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass.[23]	☐	☐	☐

Verifier Name: _____ Date Checklist Inspected: _____
Verifier Signature: _____ Verifier Company Name: _____

Northwest ENERGY STAR® Homes, Version 3 (Rev. 01)
HVAC System Quality Installation Verifier Checklist[1]

1. The HVAC System Quality Installation Verifier Checklist is designed to align with the requirements of ASHRAE 62.2-2010 and published addenda and PTCS standards, thereby improving the performance of HVAC equipment in new homes when compared to homes built to code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, for instance those caused by a lack of occupant maintenance. Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

2. The Verifier / Performance Tester (PT) is only responsible for ensuring that the Contractor has completed the Contractor Checklist in its entirety and verifying the discrete objective parameters referenced in Section 1 of this Checklist, not for assessing the accuracy of the load calculations or field verifications included or to verify the accuracy of every input on the Contractor Checklist. For Heat Pumps, the contractor shall provide a completed 2011 PTCS Commissioned Heat Pump Certificate & Startup Form. For Central AC systems in locations with ≥600 Cooling Degree Days (CDD), the contractor shall provide a completed NWESH Central AC Commissioning & Startup Form. In locations with <600 CDD, commissioning is recommended, but not required; however, all Items except 4.12 of the HVAC System Quality Installation Contractor Checklist shall still be completed.

3. The Verifier shall either confirm that the contractor selected the geographically closest available weather location or collect from the contractor a justification for the selected location. The Verifier need not evaluate the legitimacy of the justification to qualify the home.

   The number of occupants among all HVAC systems in the home shall be equal to the number of RESNET-defined bedrooms, plus one, unless the system is designed for temporary occupant load as indicated in the header of the Contractor Checklist. This additional load shall be satisfied by a supplemental cooling system (e.g., a small single-package or split-coil unit) or by a system that can shift capacity from zone to zone (e.g., a variable volume system).

   "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.

4. IWC is an abbreviation for Inches of Water Column.

5. In cases where the condenser unit is installed after the time of inspection by the Verifier, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor after installation is complete.

6. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter.

7. Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control. Balancing dampers or proper duct sizing shall be used instead of loops to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers that are located in the duct boot are permitted.

8. For HVAC systems with multi-speed fans, the highest design fan speed shall be used when verifying this requirement.

9. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 3 (e.g., duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.

10. Leakage limits shall be assessed on a per-system, rather than per-home, basis. To demonstrate compliance with the total measured duct leakage requirement, a Performance Tested Comfort Systems® (PTCS®) certified technician shall provide a completed 2011 PTCS Duct Sealing Certificate & Sealing Form to the Program Verifier. The factory-supplied air handler shall be in place at the time of the test, with the following exceptions:

    a. If the air handler is not in place during the test, the leakage limit shall be decreased to 0.04 x floor area served by the system (in square feet) or 50 CFM50, whichever is greater.

    b. If both the ducts and equipment are located within the conditioned space, the system is exempted from the duct testing requirement. Up to five percent (5%) of the linear feet of the duct system may be located outside the thermal and/or air barriers of the house or in exterior cavities of the house.

    Balanced ventilation systems (e.g., HRV or ERV) are not required to be tested if their duct system is separate from the home's main distribution system and ≤ 175 lineal ft.

11. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Verifier using a flow hood, flow grid, anemometer (in accordance with AABC, NEBB or ASHRAE procedures), or substantially equivalent method.

12. The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used. However, if this occurs, the manufacturer's instructions shall be collected for documentation purposes.

13. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner.

14. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, and clothes dryers).

15. Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.
16. Exhaust outlets from more than one dwelling unit may be served by a single exhaust fan if the fan runs continuously or if each outlet has a back-draft damper to prevent cross-contamination when the fan is not running.
17. Remote-mounted fans (i.e., fans outside habitable spaces, bathrooms, toilets, and hallways and with ≥ 4 ft. ductwork between fan and intake grills) are exempt from sone rating requirements.
18. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere. Furthermore, a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure.
19. The pressure boundary is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.
20. Verifiers shall use either the Building Performance Institute's (BPI's) Combustion Safety Test Procedure for Vented Appliances or RESNET's Interim Guidelines for Combustion Appliance Testing & Writing Work Scope and be BPI-certified or RESNET-certified to follow the protocol. If using RESNET's worst-case depressurization protocol to evaluate fireplaces, per Item 10.2, the blower door shall not be set to exhaust 300 CFM to simulate the fireplace in operation, but the remainder of the protocol shall be followed.
21. Per ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space through ductwork exceeding 10 ft in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. Also, mini-split systems typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the guidelines.
22. HVAC filters located in the attic shall be considered accessible to the owner if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter. HVAC filters located in crawlspaces shall not be considered accessible to the owner.
23. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill.

Northwest ENERGY STAR® Homes, Version 3 (Rev. 01)
Water Management System Builder Checklist[1,2,3]

Home Address: _____ City: _____ State: _____

Inspection Guidelines	Must Correct	Builder Verified	Verifier Verified	N/A
1. Water-Managed Site and Foundation				
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less.[4]	☐	☐	☐	☐
1.2 Back-fill has been tamped and final grade is sloped ≥ 0.5 in. per ft. away from home for ≥10 ft. See Footnote for alternatives.[4]	☐	☐	☐	☐
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting lapped 6-12 in. or ≥ 1" extruded polystyrene insulation with taped joints.[5]	☐	☐	☐	☐
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., and installed using one of the following three options:[5]				
1.4.1 Placed beneath a concrete slab; OR,	☐	☐	☐	☐
1.4.2 lapped up each wall or pier and fastened with furring strips or equivalent; OR,	☐	☐	☐	☐
1.4.3 Secured in the ground at the perimeter using stakes.	☐	☐	☐	☐
1.5 Exterior surface of below-grade walls finished as follows: • For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proofing coating • For wood framed walls, finish with polyethylene & adhesive or other equivalent waterproofing	☐	☐	☐	☐
1.6 Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls [6]	☐	☐	☐	☐
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent	☐	☐	☐	☐
1.8 Drain tile surrounded with clean gravel and fabric filter[7]	☐	☐	☐	☐
2. Water-Managed Wall Assembly				
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system	☐	☐	☐	☐
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies[8]	☐	☐	☐	☐
2.3 Window and door openings fully flashed[9]	☐	☐	☐	☐
3. Water-Managed Roof Assembly				
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated with drainage plane above[10]	☐	☐	☐	☐
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade ≥ 5 ft. from foundation or to underground catchment system ≥ 10 ft. from foundation.[11]	☐	☐	☐	☐
3.3 Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations	☐	☐	☐	☐
3.4 In 2009 IECC Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall.	☐	☐	☐	☐
4. Water-Managed Building Materials				
4.1 Wall-to-wall carpet *not* installed within 2.5 feet of toilets, tubs, and showers	☐	☐	☐	☐
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used [12]	☐	☐	☐	☐
4.3 Building materials with visible signs of water damage or mold *not* installed[13]	☐	☐	☐	☐
4.4 Interior walls *not* enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content[14]	☐	☐	☐	☐

Builder Employee: _____

Builder Signature: _____ Date: _____

Builder has completed Builder Checklist in its entirety, except for items that are checked in the Verifier Verified column (if any) [2]

Verifier Signature: _____ Date: ____

Northwest ENERGY STAR® Homes, Version 3 (Rev. 01) Water Management System Builder Checklist[1,2,3]

1. The specifications in this Checklist are designed to help improve moisture control in new homes compared with homes built to minimum code. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing sinks or baths can lead to moisture issues and negatively impact the performance of this Checklist's specified features.

2. This Checklist shall be provided by the Verifier to the Builder who shall complete the Checklist. Upon completion, the Builder shall return the Checklist to the Verifier for review. If desired by the Builder, the Verifier may verify any item on this Checklist. When this occurs, the Verifier shall check the box of the verified items in the Verifier Verified column. The Verifier is only responsible for ensuring that the Builder has completed the Builder Checklist in its entirety and for the items that are checked in the Verifier Verified column (if any). The Verifier is not responsible for assessing the accuracy of the field verifications for items in this Checklist that are not checked in the Verifier Verified column. Instead, it is the builder's exclusive responsibility to ensure the design and installation comply with the Builder Checklist.

3. A completed and signed Indoor airPLUS Verification Checklist may be submitted in lieu of the Water Management System Builder Checklist. For more information, see www.epa.gov/indoorairplus

4. Where setbacks limit space to less than 10 ft., swales or drains designed to carry water from foundation shall be provided. Backfill tamping is not required if proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer; **OR**, the builder has scheduled a site visit to provide in-fill and final grading after settling has occurred (e.g., after the first rainy season).

5. Polyethylene sheeting is not required for raised pier foundations with no walls. To earn the ENERGY STAR, EPA recommends, but does not require, that radon-resistant features be included in homes built in EPA Radon Zones 1, 2 and 3. For more information, see www.epa.gov/indoorairplus

6. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, as defined using the desiccant method with Procedure A of ASTM E 96. The following materials are typically rated at ≤ 0.1 perm and therefore shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, foil-faced insulating sheathings, and foil-faced non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced extruded polystyrene rigid insulation board adjacent to a below-grade concrete foundation wall is permitted).

   Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if manufacturer specifications for a specific product indicate a perm rating above 0.1, then the material may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have perm ratings above this limit and may be used unless manufacturer specifications indicate a perm rating ≤ 0.1. Several exemptions to these requirements apply:

   - Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;
   - Class I vapor retarders, such as mirrors, may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

7. Protected drain tile shall be installed at the footings of basement and crawlspace walls, level or sloped to discharge to outside grade (daylight) or to a sump pump. The top of each drain tile pipe shall always be below the bottom of the concrete slab or crawlspace floor. Each pipe shall be surrounded with at least 6 inches of ½ to ¾ inch washed or clean gravel. The gravel layer shall be fully wrapped with fabric cloth or drain tile pre-wrapped with a fabric filter to prevent clogging of the drain tile with sediment.

8. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.

9. Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing, side flashing that extends over pan flashing; and top flashing that extends over side flashing.

10. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.

11. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer. A roof design without gutters is also acceptable if it deposits rainwater to a grade-level rock bed with a waterproof liner and a drain pipe that deposits water on a sloping finish grade ≥ 5 ft. from foundation. Rainwater harvesting systems may also be used to meet this requirement when designed to properly drain overflow, meeting the discharge-distance requirements above.

12. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures and only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.

13. If mold is present, effort should be made to remove all visible signs of mold using detergent or other method. If removal methods are not effective, then the material shall be replaced.

14. For wet-applied insulation products, follow manufacturer's drying recommendations. Lumber moisture content shall not exceed 18%.