Why Air Source Heat Pump Field Assessments Matter

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Have you ever wondered why the NYS Clean Heat utilities are completing these quality assurance and quality control (QAQC) field assessments? Do you wonder why these checklist items are so important?

The NYS Clean Heat QAQC field assessments ensure the high-quality installation of program-incentivized air source heat pumps, which leads to optimized energy efficiency, greater comfort, lower operating and maintenance costs, and longer equipment lifespans. These checks also safeguard program integrity by verifying contractors are meeting program requirements. Installations that can fulfill all items of the NYS Clean Heat field-assessment checklist support a positive public perception of heat pump technology, higher adoption rates of clean heating technologies, and in turn more business for contractors. Higher quality installations will also lead to fewer call backs and more satisfied customers.

The tables below summarize the *why's* behind each air source heat pump (ASHP) checklist item, what can go wrong if installations do not comply with program standards, and best practices that will lead to better energy and operational performance. **Click on the Checklist Objective or Page # in Table 1 to get to the Checklist Purpose in Table 2.**

Table 1. ASHP Checklist Summary and Table 2 Reference Guide

CHECKLIST #	OBJECTIVE	PAGE #
C1	Make/Model Match	3
C3	Condensate Drain Function	3
C4	Safe Access	3
C5	Load Sizing Match	4
C8	Refrigerant Leakage Wand Test	4
C9	Sealed/Insulated Ductwork	5
C10	UV/Insulation Protected Refrigerant Lines	5
C10B	UV/Insulation Protected Refrigerant Lines at the Outdoor Unit Connection	5
C11	Air Filter Confirmation	5
C12	Equipment and Piping Supports	6
C13	Outdoor Unit Clearances	6
C14	Indoor Unit Top/Bottom Clearances	7
C14B	Indoor Unit Side Clearances	7
C15	Outdoor Unit Snow Protection from Above	7
C15B	Outdoor Unit Snow Height	8
C16	Outdoor Unit Level	8
C16B	Outdoor Unit Dampeners	9
C17	Functional Testing - Heating & Cooling	9
C18	Electric Disconnect	9
C19	Plumbing Freeze Protection	9
O2	Manufacturer's Warranty Documentation	10
O3	Customer Operations Training	10
O4	Owner’s Manual/Maintenance Doc	10
O5	Supplemental Heat Controls Training	10
O6	Functional Distribution System	11
IC1	Proper Integrated Controller Installed	11
IC2	Integrated Control System Match	11
DE1	Decommissioning Checklist	11
DE2	Site Matches Decommissioning Checklist	11
DE3	Fossil Fuel Heating System Removed	11
DE4	Fossil Fuel DHW Removed/Capped	11
DE5	Fossil Fuel Thermostat Removed	11
DE6	Exhaust Vents Sealed	12
DE7	Exhaust Resized for DHW Only	12
DE8	Wall Penetrations Sealed	12

Table 2. ASHP Checklist Item Objectives and Purpose

CHECKLIST #	OBJECTIVE	PURPOSE
C1	Verify installed equipment is as proposed on application, quantity, make and model.	**SYSTEM OPERATION**: Even seemingly slight changes in equipment model types or indoor unit configurations can affect the system's capacity and efficiency. If the installed system is improperly sized for the heating load, the system may not operate as designed, and the contractor could face legal action by a homeowner. The contractor should inform NYS Clean Heat and the homeowner about any changes and submit updated documentation. **PROGRAM INTEGRITY**: NYS Clean Heat bases its energy savings claim on the installed model's HSPF and system capacity. System changeouts may alter the program's savings claim. A changeout may also accidentally result in the installation of a unit not listed on the NEEP ccASHP Product List, making it ineligible for incentives. Installing a unit that does not match application documentation could be considered program fraud by the utilities, risking contractor status and participation eligibility in the program.
C3	Observe condensate line where accessible for leaks. Confirm condensate lines terminate in either a domestic drain or external location. External locations must not terminate onto another heat pump unit or onto a walking surface that could cause slips if condensate freezes. Confirm with the homeowner that there is no indication of condensate line leakage.	The heat pump's condensate drainage system removes condensation formed on the unit's refrigeration coils. If it is not functioning properly, water can build up inside and around the unit leading to mechanical issues, damage to equipment and surroundings, and growth of mold and mildew. Contractors are required to install condensate drainage for all installed heat pump units and ensure the condensate is draining properly without leaks. The drainage must terminate in a safe location away from walking surfaces to prevent risk of slips and falls by occupants and drain to an area that does not cause long-term damage to the building exterior, foundation, electrical conduit, fixtures, or equipment.
C4	Verify that safe access to the site and associated equipment has been provided .	Homeowners, the field-QC agents, and service technicians need to be able to safely access both the indoor and outdoor units to conduct regular maintenance. A system that is difficult to access will create unsafe work environments, likely deferring maintenance. Lack of maintenance leads to reduced equipment efficiency and lifespan.

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C5	Verify site conditions are consistent with Load Sizing Analysis or a revised energy analysis has been completed. Review of ACCA (Manual J, S, and D) or other approved heating and cooling calculation methodologies, with observed site conditions.	An accurate building load calculation and equipment sizing is key to proper system design. A properly sized and designed system will operate efficiently, maximize home comfort, lower utility bills, reduce callbacks, limit maintenance, and increase customer satisfaction. A well thought out system design is also important for increasing consumer trust and public perception of heat pump technology. Conducting the following will ensure a more accurate system design. 1. Complete an ACCA approved Manual J load sizing analysis. 2. Select heating and cooling outdoor air design temperatures that are within ±5°F of the nearest ACCA or ASHRAE weather station data. 3. Size a whole-home heating system equipment so that the maximum capacity at the design temperature is between 90% and 120% of the design heating load. Learn more on the effects of oversizing at: CHC-CON-ashp-oversize-fs-1-v2_acc.pdf (ny.gov)
C8	Sample for refrigerant leaks at exposed field connections.	Refrigerant leaks can be expensive, hazardous, and harmful to the environment. Proper flare fitting, brazing, and charge-testing is critical to a heat pump system operating efficiently and lasting their designed life. **PERFORMANCE**: Refrigerant leaks will lead to an undercharged system. The more substantial the leaks, the greater their impact on energy and operational performance. An undercharged system will lead to reduced efficiency, capacity, comfort, and longevity of the equipment. It will also lead to higher operating costs. **SAFETY**: Since refrigerants are heavier than air, refrigerant leaks in an enclosed area can displace room air and lead to oxygen deprivation for occupants. Breathing in high concentrations of refrigerant vapors can lead to unconsciousness and heart irregularities. It is crucial that there are no refrigerant leaks, especially inside the home. **ENVIRONMENT**: Commonly seen in residential are heat pumps with HFCs like R-410A, which has a global warming potential (GWP) thousands of times greater than carbon dioxide. Some older residential heat pumps may still have HCFCs like R-22, which has both a high GWP and ozone depleting potential (ODP). As a result, refrigerant leakage can lead to a substantial release of greenhouse gas emissions.

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C9	Verify that exposed new or retrofitted ductwork is properly sealed and insulated if located outside the building's thermal envelope.	**DUCT INSULATION:** Both supply and return air ductwork should always be insulated if located in unconditioned space. Ductwork must be insulated to maintain the air temperature supplying or removing from the space and to prevent moisture build up on the ductwork. If the insulation is not continuous and touching the ductwork, water vapor can condense on the surface of the ductwork and saturate the insulation. This will lead to growth of mold and mildew and reduce the overall thermal effectiveness of the insulation. According to the Section R403.3.1 Insulation of the 2020 NYS ECCC, ductwork 3 inches or greater in diameter outside the thermal envelope must be insulated to an R-value of R-8 and ductwork less than 3 inches in diameter outside the thermal envelope must be insulated to an R-value of at least R-6. **DUCT SEALING:** Sealing the ductwork is also critical whether the ductwork is inside or outside the building thermal envelope. Unsealed ductwork will leak air, which lowers efficiency and comfort by requiring more energy to condition the home.
C10	Verify all accessible refrigerant line (indoor and outdoor) set is insulated. Verify that all outdoor refrigerant line set is protected from UV. To comply, no more than 12" of any accessible refrigerant line may be left un-insulated/protected from UV at the outdoor unit connection.	**LINE SET INSULATION**: Refrigerant line piping insulation is necessary for effective heat transfer. The greater the temperature difference between the surrounding air and the refrigerant lines the more energy is lost. Insulating the refrigerant line is necessary to prevent condensation from forming. Condensation on refrigerant piping could lead to growth of mold and mildew, pipe corrosion, and water damage. It's best practice to select a closed-cell insulation material with low permeability to ensure the insulation will be long lasting. Per Section R403.4 Mechanical System Piping Insulation of the 2020 NYS ECCC, "Mechanical system piping capable of carrying fluids greater than 105°F (41°C) or less than 55°F (13°C) shall be insulated to an R-value of not less than R-3."
C10B	Verify no more than 1" of any refrigerant line is unprotected at the outdoor unit connection.	**LINE SET UV PROTECTION**: According to Section R403.4.1 Protection of Piping Insulation of the 2020 NYS ECCC, any insulated exterior refrigerant lines must also be protected from solar radiation which can cause degradation of the material. Overtime, non-UV protected exterior refrigerant line insulation will break down, become brittle, and lose its thermal and moisture protection capabilities.
C11	Verify the presence of equipment air filters if applicable.	Air filters are necessary to remove particulates in the air and maintain indoor air quality in the home. Non-existent or clogged filters can lead to dirt, dust, pollen, pet dander, bacteria, and mold circulating throughout the house. The state of the air filter can also impact heat pump operation and energy performance. Clogged air filters restrict air flow through the unit, increase stress on the fans, and decrease heat exchange between the refrigerant and air. This can cause the evaporator coil to freeze during the cooling season or equipment shut down during the heating season. Restrictions in airflow also force the blower in a ducted unit or fan in a ductless unit to work harder and in turn use more energy resulting in higher utility bills. Contractors must install the correct type and size air filter and train homeowners how and when to remove, clean, and replace filters.

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C12	Verify all exposed equipment and pipe supports appear to be properly secured.	It is critical that all pieces of the heat pump system are secured to avoid damage to the equipment and surroundings. **OUTDOOR UNITS**: Outdoor units must be secured to a mounting bracket, mounted on concrete blocks, or secured to the exterior building walls for adequate support. Contractors should consider installing concrete pads for outdoor units in all scenarios to ensure the unit stays balanced and sturdy over the course of the equipment lifespan. If the unit is not mounted on a concrete pad, soil erosion and equipment vibration could lead to the unit not being level and eventually equipment malfunction or even failure. Although only required in states with higher risk of hurricane and seismic activity, contractors should also consider bolting the unit down for additional security and support. **INDOOR UNITS**: Indoor heads must be secured to the wall or ceiling in accordance with the manufacturer's installation instructions. Contractors must ensure the placement of the indoor heads adheres to clearance requirements, and that the wall or ceiling mounting can adequately support the weight of the unit. For example, in spaces where the interior walls are made of dry wall, anchoring the units to the stud framing is necessary for sufficient security. **REFRIGERANT LINES**: When installing refrigerant lines, contractors should consider occupant interactions in the space when considering where to run refrigerant lines and where to secure them. According to Table 305.4 of the 2020 NYS Mechanical Code, copper or copper alloy pipe, which is commonly used for refrigerant piping, should be supported every 12 feet for horizontal runs and supported every 10 feet for vertical runs. Refrigerant lines that are not secured or secured in walking areas for occupants could create a trip hazard and be easily damaged by occupants. Additionally, the 2020 NYS Mechanical code requires that "rigid or flexible metal enclosures or pipe ducts shall be provided for soft, annealed copper tubing and used for refrigerant piping" for additional protection.
C13	Verify outdoor unit is installed with sufficient clearances.	Unimpeded airflow into, through, and away from the outdoor unit is critical to capacity and efficiency. The outdoor unit needs sufficient clearance around and above the unit to draw in and expel air after it passes through the refrigerant coils. If the system does not have enough clearance, the fan and compressor will need to work harder to achieve the required output capacity to condition the interior space. If the unit cannot blow conditioned air away from it, it may pull the same cooled/heated air back in through the coils which reduces both capacity and efficiency. Contractors should also inform homeowners that clearance requirements need to be maintained by trimming back any trees, shrubbery or foliage that accumulates around the unit, and to not block or restrict airflow with fencing or other obstructions. If homeowners are insistent the unit is installed in a location that could restrict airflow, contractors should explain to the homeowner the impacts this will have on the unit's energy and operational performance and consult the distributor or manufacturer for guidance.

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C14	Verify that the top and bottom clearance of ASHP Terminal Units meet the manufacturer's installation requirements, are sufficient for proper function, and that service panels are clearly accessible.	The indoor units of air source heat pump systems pull in surrounding room air, passes it through the filter, then across the refrigerant coils to condition the air. air over the top of the unit, passes it through the filter, then across the refrigerant coils to condition the air. Manufacturer installation instructions set clearance requirements above and below indoor units to reduce any restrictions in air flowing into and out of the unit. Restrictions in airflow will cause the fan to work harder to pull in a sufficient amount of air to maintain the temperature in the space and may reduce both capacity and efficiency. It is best practice to provide at least 6 inches of clearance above wall mounted units and 6 inches of clearance below floor mounted units, but contractors should always check the manufacturer's installation requirements. If the homeowner requests the unit is mounted in a specific location that will prevent proper clearance requirements from being met, contractors should explain to the homeowner the performance consequences that may result from that mounting location and consult the distributor or manufacturer for guidance.
C14B	Verify that the side clearances of ASHP Terminal Units meet the manufacturer's installation requirements.	Most ductless heat pump systems have their temperature sensor on the indoor head itself. The temperature sensor is typically on the side of a wall mounted or floor mounted head. If indoor head side clearance requirements are not met, conditioned air dispelled from the heat pump can hit the surrounding obstructions or walls, bounce back, and be sensed by the unit's temperature sensor. This can cause the unit to turn off or reduce output capacity because it is sensing the temperature setpoint of the space is being met. Side clearances must also be met so the homeowner can open the unit for air filter changes and service technicians can open the front and side access panels for performing maintenance. It is best practice to provide at least 6 inches of side clearance on all sides of the unit, but contractors should always check the manufacturer's installation requirements.
C15	Observe that the outdoor unit is away from or protected from increased sources of water/ice/snow from above (i.e., more than normal precipitation, e.g. beneath drip edge, beneath snow-slide, beneath another heat pump, etc.). The presence of gutters does not provide sufficient protection.	Sources of water/ice/snow from above the outdoor unit can damage the equipment causing system malfunctions and impacting performance. Falling ice can significantly damage the coils and fan particularly for vertical discharge units. Water dripping can form ice on the refrigerant coils, expand, and bend the coils impacting the amount of surface area available for heat transfer and in turn impacting the unit's capacity. Dripping water can also refreeze around the outdoor unit restricting airflow through it. The program requires that all heat pump units be properly protected from excess snow. Heat pumps placed underneath a roof eave's drip line (or under a deck with wide slats) are subject to snowslide or excess water drip that could clog, ice up, or otherwise restrict airflow through the heat pump. Such units must have a snow-deflector installed or be installed away from the dripline to assure winter operation for heating. The snow shield should be installed with sufficient clearance per the manufacturer's installation instructions to prevent airflow restrictions. The preferred and much more common installation approach is to place units on a gable end with no drip at all, under a deck (with sufficient top clearance and limited drip through the decking), or on the eave end with a snow deflector. Horizontal-discharge units can be protected with the combination of a working gutter and a low slope asphalt roof. If the gutters fail due to clogging and lack of maintenance by the homeowner, the outdoor unit may be subject damage from falling water, ice, and snow.

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C15B	Verify that units are above snow depth level according to ACCA Weather Station data as provided by the NYS Clean Heat program.	Clearance above and around the outdoor unit is needed to ensure there is sufficient airflow for complete heat exchange between the surrounding air and the outdoor unit coils. When snow around the unit blocks that airflow, high energy bills and possibly failure of the equipment will follow. The heat pump will work harder and thus consume more energy to try and extract heat from the air or it will revert to emergency electric resistance heating if equipped. To keep units protected from snow build up, contractors should install a snow stand that will mount the unit above the historical snow depth for the region. Within the NYS Clean Heat Prescriptive Incentive Calculator, contractors can determine the minimum outdoor unit mounting height requirement based on the site's zip code per the NYS Clean Heat program guidelines. The incentive calculator uses ACCA weather station data to determine the average snow depth for each region by zip code. It is best practice to measure the unit's mounting height from the point where snow can substantially start to accumulate around the unit to the bottom of the unit. This starting point could be from the top of the concrete pad the unit is mounted on or the ground level depending on the length and width of the pad.
C16	Verify outdoor unit is installed level.	The outdoor unit must be level. Many installers believe that the unit should be slightly off-level to help drain the condensate, but this is incorrect. If the unit is not level, it can lead to vibration, compressor issues, fan issues, and condensate drainage pooling. **COMPRESSOR ISSUES**: The most important component of a heat pump or air conditioning system is the compressor. Oil is used to keep the compressor motor lubricated and running efficient. When the unit is not level, the oil may accumulate in the refrigerant lines leading to a lack of lubrication in the motor, overheating, and shortened equipment life. Oil accumulating in the refrigerant lines can also impact the heat transfer process further reducing the system's efficiency. **VIBRATION ISSUES**: The unit may also begin to vibrate if it is not level, which leads to excess wear and tear on the system and a noisy heat pump. Fan blades can become unbalanced and begin to wobble. **CONDENSATE DRAINAGE ISSUES**: If it is not level, water can pool inside the unit and not drain properly. If defrost water or condensate water accumulates in the heating season, then it could refreeze and cause damage to the refrigerant coils and other components. Contractors must verify the pad or stand is level before installing the unit and the unit is level in all directions post installation. Contractors should also select a location for the unit that will not be subject to soil erosion or shifting over the course of the equipment life.

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C16B	If unit is connected to the building's framing (e.g., wall mounted, or on a connected deck), vibration dampeners are installed.	The installation of vibration dampeners prevent the unit from vibrating. Vibration can lead to noise complaints from homeowners and neighbors and damage to unit components and the structure it is mounted to over time. Heat pumps generate 40 to 70 decibels of noise typically. Without excess vibration, heat pumps are typically no louder than a dishwasher or refrigerator. Directly mounting the units to the building's exterior without any vibration dampeners can cause vibrations to translate to the building structure. Over time, vibrations can loosen nuts and bolts and impact compressor and fan performance. The program requires that outdoor units mounted to the building structure above the concrete foundation or on a connected deck be installed with vibration isolation dampeners. It is best practice to use vibration isolation dampeners whenever possible, to limit any noise concerns and wear and tear on the system and must be installed in a location that interrupts vibration from the heat pump to the mounted surface.
C17	Observe functional testing of equipment in either cooling or heating mode as conducted by contractor or operator, if conditions allow.	Observing the heat pump operating in both heating and cooling mode as conditions allow is essential to confirm the system is serving its primary function and is working as intended to meet the building's load. Once an installation is complete, contractors should complete a commissioning checklist. The NYS Clean Heat Program has a complete commissioning checklist that contractors can reference at the following link: NYS-Clean-Heat-ASHP-Commissioning-Checklist https://cleanheat.ny.gov/assets/pdf/NYS-Clean-Heat-ASHP-Commissioning-Checklist.pdf
C18	Verify that electrical disconnect is installed in an accessible location for service.	Electrical disconnects must be located within sight of and readily accessible from the heat pump equipment per Section 440.14 of the 2017 NYS Electrical Code. This is required so a qualified technician can safely work on the equipment without risk of an outside party powering on the equipment during service. It is best practice to install the disconnect switch within a few feet of the compressor with a lockable cover.
C19	In areas formerly heated, directly or indirectly, by a fossil fuel heating system, confirm that any plumbing outside the thermal envelope is adequately protected from freezing by insulation, heat, or both.	NYS Clean Heat incentivizes the installation of heat pump systems that can heat entire homes year-round without backup. Because the heat pump system is designed to serve the entire heating load, a legacy heating system that is rarely used may not be adequate freeze protection for the plumbing on its own. It is likely that the former appliance will not operate and may even eventually be decommissioned or removed. The plumbing is adequately protected when it is inside the thermal envelope, which is the barrier between the conditioned space and unconditioned space that resists the transfer of heat and moisture. The plumbing is also protected when the space containing plumbing is heated, or heat and insulation are applied directly to the pipes. If the plumbing is not adequately protected, the occupant may incur unnecessary and significant costs from running the backup heat for freeze protection only. Frozen pipes can result in damage to the house's plumbing system, flooding, water damage, and mold growth. If the plumbing does burst, the resulting repairs are extremely costly and disruptive, so this issue is best dealt with through prevention.

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O2	Verify manufacturer's warranty has been provided to owner.	It is critical that the homeowner receives a copy of the manufacturer's warranty from the contractor for all systems installed to mitigate any additional costs incurred by the homeowner. Most manufacturer's warranties will cover the material costs within 5 years after the installation if the equipment is registered. It is recommended that contractors also review the warranty documentation with the homeowner by explaining the terms and conditions of the warranty, the length of the warranty period, and assist registering the equipment under the warranty.
O3	Confirm customer/ operator has been provided with training on operation of system.	Customers incorrectly operating their new heat pump can lead to poor equipment performance, reduced equipment lifespan, higher utility bills, dissatisfied customers, and more phone calls to the contractor with complaints about the system. It is important contractors not only provide the product manual with the operating instructions, but also take the time to train the homeowner or tenant on how to operate the system. This includes how to adjust temperature, fan speed and direction, humidity modes, and how to adjust the temperature setpoints. Contractors should also remind the occupants that the heat pump can and should be used for both heating and cooling the home. The following resource is available online and can be shared with homeowners to help them better understand their system: Homeowner Maintenance Fact Sheet https://cleanheat.ny.gov/assets/pdf/NYS-Clean-Heat-ASHP-Commissioning-Checklist.pdf
O4	Confirm that the system owner's manual and maintenance instructions are available on site.	Like any heating and cooling system, air source heat pumps require routine maintenance to stay functional and efficient and to ensure long term durability. It is important that the contractor provides the system owner's manual to the homeowner, so they understand how to maintain their system. It is recommended that contractors teach homeowners how to conduct basic maintenance like cleaning the air filters, the importance of keeping outdoor units free from debris, and how to schedule routine service visits. Leaving the customer with an understanding of how to maintain their system will increase customer satisfaction and reduce callbacks. The following resource is available online and can be shared with homeowners to help them better understand their system: Homeowner Maintenance Fact Sheet https://www.nyserda.ny.gov//media/Project/Nyserda/Files/Publications/Fact-Sheets/CHC-SFR-HP-maintenance-fs-1-v1-acc.ashx
O5	Confirm customer/ operator has been provided instructions on controls integration of supplemental heat sources to provide primacy of the ASHP equipment.	Homes that are heated by both an air source heat pump and electric resistance or fossil fuel-based heating should utilize the air source heat pump as the primary source of heating to take advantage of the heat pump's high efficiency and zero direct carbon heating. The supplemental heating system should be set to operate only below the balance point—either economical, carbon, or capacity. If a supplemental electric resistance or fossil fuel heating system is set to operate above this balance point, it could lead to the homeowner relying on a less efficient and less environmentally friendly system. To help homeowners take full advantage of their investment, contractors should inform the homeowner what the system settings are and provide written instructions on how system settings can be adjusted. Contractors should also inform homeowners what the balance point is, and that the backup heating system should only be triggered to operate below this point.

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O6	Confirm the distribution system is capable of providing sufficient comfort to all spaces conditioned by the heat pump unit(s).	NYS Clean Heat incentivizes the installation of heat pump systems that can heat entire homes year-round without backup. If there is inadequate distribution from the heat pump system, occupants may resort to operating backup heating systems such as a furnace, boiler, electric baseboard, or space heater to stay comfortable. Furnaces, boilers, electric baseboards, and space heaters are less efficient and may result in higher energy costs for the homeowner. Continued use of a furnace or boiler due to inadequate distribution also forces homeowners to continue costly fuel delivery services and limits their options to decommission or remove the system in the future.
IC1	Confirm integrated control system has been installed and is operational. Contractor documentation must specify the controls settings on-site, referencing set points and control type.	The heat pump system's integrated controls should implement an automatic switchover strategy that gives primacy to the heat pump and only operates the backup heat source under pre-determined conditions. Documenting the exact control settings, switchover temperature, and providing this information to the homeowner reduces the chance of user error, interference between the heat pump and fossil fuel appliance, and unintentional use of the wrong appliance or both appliances at once. Communicating to occupants how the switchover strategy optimizes cost, capacity, or greenhouse gas emission reductions depending on the occupant's priorities will also motivate occupants to operate the system as intended.
IC2	Confirm integrated control system matches that of the application.	
DE1	Confirm the contractor-submitted the Decommissioning Guidance Checklist and it has been filled out in its entirety.	The NYS Clean Heat Decommissioning Guidance Checklist contains best practice steps for proper removal or decommissioning of a residential fossil fuel heating and/or domestic hot water appliances. The checklist considers the type of appliance, the fuel type, and whether the appliance is being removed or decommissioned. A properly completed decommissioning guidance checklist allows a field agent to better understand the steps completed by the contractor in advance of the assessment and makes it easier to know what to look for. Reviewing and completing the decommissioning guidance checklist can confirm that the necessary steps were completed to meet NYS Clean Heat program requirements, reducing the potential for missed details, call backs from the NYS Clean Heat program implementation team, homeowner call backs, and failing scores.
DE2	Confirm the contractor-completed Decommissioning Guidance Checklist matches conditions on site.	
DE3	Verify fossil fuel space heating appliance has been removed from site or fuel lines to appliance have been cut and capped.	This check verifies that the contractor took the appropriate measures to ensure the homeowner does not revert to utilizing the old inefficient fossil fuel equipment and does utilize the heat pump and/or heat pump water heater to the fullest. This check also ensures homeowners are receiving incentives and contractors are implementing projects that meet the intention of the decommissioning incentive and overall decarbonization goals of the NYS Clean Heat program. Homeowners will see a longer return on their heat pump investment and lower energy and cost savings if the fossil fuel appliances are not properly decommissioned or removed.
DE4	Verify the fossil fuel domestic hot water appliance has been removed from the site or fuel lines to appliance have been cut and capped.	

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DE5	Verify the thermostat controlling the fossil fuel heating appliance has been removed or confirm it will be used to control the heat pump system.	Most heat pumps have their own controls and thermostat. It is best practice for the contractor to remove all systems associated with the old fossil fuel system that are no longer used. This includes the fossil fuel system thermostat and all its control wiring. Removing the old thermostat will prevent confusion amongst current and future occupants by preventing them from trying to control the heat pump with the wrong thermostat. Contractors should also seal all wall penetrations associated with removing the thermostat. Completing these best practices will increase customer satisfaction and reduce call backs.
DE6	Confirm any exhaust vent openings for the fossil fuel heating appliance have been sealed.	Exhaust vent openings from the old fossil fuel heating and/or domestic hot water system left unsealed can provide access for animals and insects into the home which can damage the structure. Unsealed openings will lead to unwanted infiltration or exfiltration resulting in heat loss or gain and bulk moisture in the space. Air and water leakage from penetrations can lead to higher energy bills and potential water damage for the homeowner. It is best practice to seal with materials that are similar to the material removed or where the penetration exists. For example, if flue pipes are partially disconnected, it would be best practice to seal with metal caps.
DE7	If the fossil fuel DHW system is retained, confirm that the contractor attests to adequately resizing exhaust vents as needed to prevent carbon monoxide spillage. If resizing of the exhaust vents is required, confirm the contractor provided the original and final dimensions of the vents.	The exhaust vent of a natural draft appliance needs to be properly sized to achieve proper venting and stack effect. Natural draft water heaters may not generate enough hot exhaust gases on their own to properly vent if the water heater previously shared an exhaust vent with a fossil fuel heating system. An oversized vent can lead to back drafting of the flue gases and spillage of carbon monoxide and other combustion byproducts into the space, which in high enough quantities can be toxic to building occupants. Resizing the vent by installing a liner allows the water heater to have a smaller vent to heat up, requiring less hot gas to achieve stack effect. It is best practice for contractors to measure the draft pressure and conduct a spillage test to confirm proper ventilation before and after resizing.
DE8	Verify pipe penetrations of walls and ceilings (where visible) have been sealed where piping has been removed.	Pipe penetrations from the old fossil fuel heating or domestic hot water system left unsealed can result in building envelope performance issues and is aesthetically displeasing for occupants. Penetrations in the walls, ceilings, and floors can lead to unwanted pressure changes and convective heat transfer between spaces. This is especially problematic if penetrations are between conditioned and unconditioned spaces. Moisture in the air can enter the building's cavity leading to water damage and potential mold growth. Unsealed penetrations also provide access for animals and insects into the home, causing damage to the structure of the home.