



2800 Shirlington Road
Suite 300
Arlington, VA 22206

703.575.4477
Fax 703.575.8107

www.acca.org

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ACCA Standard 4

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Maintenance of Residential HVAC Systems

Residential Heating, Ventilating, and Air Conditioning (HVAC) Applications

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2800 Shirlington Road
Suite 300
Arlington, VA 22206
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Phil Forner (Committee Chair), Allendale Heating Co., Inc.
 Dave Galbreath (Committee Vice Chair), Seaman’s Mechanical
 Tom Jackson, Jackson Systems
 Raymond Granderson, Johnson Controls, Inc.
 Warren Lupson, Lupson & Associates, LLC
 Timothy Offord, Alabama Power Co.
 Joe Pacella, Ferris State University
 Matt Todd, Pac Crest Business Engineering
 Brent Ursenbach, Salt Lake County Planning Development & Inspection
 Danny Halel (Committee Secretary), ACCA

ACCA gratefully acknowledges the direction, guidance and encouragement provided by the diverse expertise embodied in the memberships of the 2018-2019 Technical Service Committee members, the Professional Development Committee members, the 2013 QM Standard Advisory Committee, and the 2007 QM Standard Development Committee:

2018-2019 ACCA REVIEWING COMMITTEES	
Technical Service Committee	Professional Development Committee
Chair: John Sedine <i>Engineered Heating and Cooling</i>	Chair: Stephen Pape <i>Pape Service Co.</i>
Jack Bartell <i>Virginia Air Distributors</i>	Richard Biava <i>GAC Services, Inc.</i>
Mike Beaver <i>Beaver Brothers, Inc.</i>	Linda Couch <i>Parrish Services, Inc.</i>
Lee Clifton <i>International Code Council</i>	Thomas Jackson <i>Jackson Systems, LLC.</i>
Dan Foley <i>Foley Mechanical Inc.</i>	Eric Knaak <i>Isaac Heating & Air Conditioning, Inc.</i>
Phil Forner <i>Allendale Heating Company Inc.</i>	Dave Kyle <i>Trademasters Service Corp.</i>
Warren Lupson <i>Lupson & Associates LLC.</i>	Matt Marsiglio <i>Flame Furnace</i>
Stephen Pape <i>Pape Service Co.</i>	Rob Minnick <i>Minnick’s AC.</i>
Bryan Stack <i>Stack Heating & Cooling</i>	Keith Paton <i>Ivey Mechanical LLC.</i>
Robert Volin <i>Air Design Concepts, Inc.</i>	Jennifer Pierce <i>Clay’s Climate Control LLC.</i>
	Kathe Stewart <i>Precision Air Conditioning & Heating, LLC.</i>

2013 ADVISORY COMMITTEE MEMBERS		
CONTRACTORS	OEMs	ASSOCIATIONS & OTHERS
Phil Forner <i>Allendale Heating Inc.</i>	Garry Georgette <i>Carrier Corporation</i>	Luis Romeo Escobar <i>ACCA</i>
Darrick Philp <i>Bel Red Energy Solutions</i>	Raymond Granderson <i>Rheem Manufacturing Co</i>	Michael Lubliner <i>WSU – Extension Energy Program</i>
Michael Rackers <i>Cropp Metcalfe</i>	UTILITIES	Warren Lupson <i>AHRI</i>
DISTRIBUTORS	Jack Bartell <i>Virginia Air Dist.</i>	Dick Shaw <i>ACCA</i>
Marshall Hunt <i>Pacific Gas & Electric</i>	Tom Robertson <i>Baker Distributing</i>	
David Swett <i>Omaha Public Power District</i>		
Special acknowledgments and appreciation go to Mike Rackers for service as Chair of the Committee.		

2007 DEVELOPMENT COMMITTEE MEMBERS		
CONTRACTORS	OEMs	ASSOCIATIONS & OTHERS
Walter Byrnes <i>Keyes North Atlantic</i>	Ron Butcher <i>York International</i>	Wes Davis <i>ACCA</i>
Phil Forner <i>Allendale Heating Inc.</i>	Souhel Stanbouly <i>Lennox Industries</i>	Glenn Hourahan <i>ACCA</i>
Larry D. Sambrook <i>Indoor Air Quality Network</i>	Peter Van Lancker <i>Rheem Manufacturing Co.</i>	Warren Lupson <i>Lupson & Associates</i>
John Sedine <i>Engineered Heating and Cooling</i>	UTILITY	Pat Murphy <i>NATE</i>
Steve Sturdevant <i>Sturdevant Refrigeration and A/C</i>	Glenn Langan <i>Gulf Power</i>	John Parker <i>Consultant</i>
		Dick Shaw <i>ACCA</i>
		Jim Walter <i>ARI</i>

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Reviewers of the 2019, 2013, and/or 2007 standard drafts:

Joe Bamford, F.H. Furr Plumbing, Heating, and AC
Bill Boehm, Entek Corp
Juan Cardona, JC Heating and Cooling
Dave Campbell, Entek Corp.
Steve Davies, Davies Air Design
Jack Davis, Marke's Heating and Air
Richard Dean, Environmental Systems Association
Al Fordeck, WaterFurnace International
Todd Forner, Allendale Heating
Bill Fortner, Hallmark Air Conditioning and Heating
Michael Glowka, Airtron
Ellis Guiles, Jr., P.E. TAG Mechanical Systems; Syracuse, NY
Thomas Hackshaw, P.E. Dynatemp
Danny Harel, NTHALP Engineering
Michael Harding, Tempo
Tim Hawkins, P.E. Rheem Manufacturing Company
Steve Helms, Brothers Heating and Cooling
John Jackson, Alabama Power
John Kelly, Geothermal Heat Pump Consortium
Hung Pham, Emerson Climate Technologies
Donald Prather, ACCA
Joe Presley, Tri-City Mechanical
George Rodriguez, ServTECH Air Conditioning
Bob Roth, The Trane Company
John Sigerson, O'Connor Co.
Russell Smith, Stan's Heating and Air Conditioning, Inc.
Mark Stokes, Goodman Manufacturing
Larry Taylor, Air Rite
Kenny Watson, Roscoe Brown Co.
Tony Whidden, Sea Pines Resort
Ward Woodruff, Hurley & David, Inc.
Thomas Yacobellis, Ductz International

FOREWORD

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Heating Ventilating and Air-conditioning (HVAC) Contractors use different approaches for inspecting and maintaining HVAC systems. There are many types and intensity levels of “seasonal tune-ups”, “clean and checks”, and “maintenance services” performed on HVAC equipment. This standard establishes the minimum level of acceptable compliance for HVAC equipment maintenance inspections for residential applications.

For the public good, it is essential that residential HVAC systems support a comfortable, healthy indoor environment and operate efficiently throughout their lifecycles. This standard provides a nationally-recognized, manufacturer-endorsed set of inspection tasks to meet this need. From this base, consumers can compare the value of the additional recommended corrective actions needed to remedy identified faults. For contractors, it provides a common platform for creating a customized maintenance programs, allowing for bundling different recommended corrective actions at competitive fee structures.

HVAC contractors who perform maintenance on residential HVAC systems should be properly licensed or, where necessary, certified. These contractors should strive to have the highest quality technician perform this standard’s tasks for their customers. These technicians should be fully acquainted with the proper operation of the systems they are working on, including the components that comprise the subsystems. Technicians who are certified by an industry-recognized national program have demonstrated that they have a body of knowledge which supports proper implementation of this standard.

It is recommended that HVAC contractors relate the importance of routine maintenance of the HVAC system to their clients. This will likely take the form of annual/semiannual visits to perform the inspection and applicable remediation actions, though the exact frequency may vary.

The performance objective of the system will be based primarily on the equipment manufacturer’s performance data. Acquiring this performance data, however, may be more difficult for older equipment. Original Equipment Manufacturers (OEMs) will generally have performance data for equipment dating back several decades, and the data is usually available at the distributor level.

Some HVAC systems are unable to achieve the manufacturer’s performance objectives because the system:

- Was incorrectly designed, selected, or installed, or
- Is beyond the normal service life, or
- Has suffered neglect for long periods of time.

These systems may require levels of remediation beyond the scope of this document or require replacement of the equipment or components. Practitioners are referred to the ACCA 5 QI (Quality Installation Specification) and ACCA 6 QR (Restoring System Cleanliness) Standards. Additionally, other documents listed in Appendix C (Bibliography and Resources) may be helpful to contractors to assess which additional activities may be required.

INTRODUCTION

[This Introduction is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

Mechanical systems require routine monitoring, adjustments, periodic cleaning, and eventual replacement of components. Regularly scheduled inspections and maintenance are often required to maintain the original equipment manufacturers (OEM) warranty.

This standard prescribes basic maintenance inspection tasks and offers recommended corrective actions to maintain most residential HVAC systems. It provides checklists for the inspection of typical residential HVAC systems to meet the minimum maintenance requirements. These equipment checklists are divided by equipment type and provide the minimum visual inspections, performance tests, and measurements. The recommended corrective actions provide generic guidance that should return the equipment to good working order.

Conducting regularly scheduled inspections, maintenance, and remediation of HVAC systems prolongs equipment efficiency, promotes healthy clean air, supports lower utility costs, guards against unexpected failures, and prolongs equipment life. Occupants and the environment will both benefit.

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1.0 PURPOSE

The purpose of this standard is to establish minimum inspection requirements in the maintenance of HVAC equipment found single-family and multi-family dwellings.

2.0 SCOPE

- 2.1 This standard provides minimum requirements for the inspection, by appropriately licensed HVAC contractors¹, of residential HVAC equipment found in one -family and multi-family dwellings.
- 2.2 This standard includes checklist tasks for inspecting, testing, and measuring electrical, controls, mechanical, venting, air distribution, and piping systems of residential HVAC systems. The checklists also provide recommended corrective actions which the HVAC contractor shall present to the homeowner to remedy identified faults like cleaning, or adjusting, and/or replacing equipment and components on a periodic basis.
- 2.3 This standard presumes that the HVAC system was designed, installed, and tested in accordance with original equipment manufacturers (OEM) instructions, applicable codes, and other industry standards.
- 2.4 This standard shall not be used to circumvent safety, health, environmental, or the equipment manufacturer's requirements.

3.0 EXECUTION

A maintenance inspection seeks to identify deficiencies that degrade or impair the HVAC system, including its components. The HVAC contractor shall recommend actions to correct these deficiencies. The following are the responsibilities and elements for a maintenance inspection:

3.1 *HVAC contractor's responsibilities:* Appropriately licensed HVAC contractors shall:

- Inspect all HVAC equipment and components to identify faults which contravene the following applicable documents: manufacturer's instructions, manufacturer's warranty requirement, building codes, occupant safety or health standards, environmental regulations, and recognized industry good practices.
- Inform the customer of improper operation finding(s), corrective action(s) taken, corrective action(s) recommended, and the price to complete the recommended action(s).

3.2 *Homeowner's responsibilities:* The homeowner is ultimately responsible for the HVAC equipment's required maintenance. They shall use appropriately licensed and certified HVAC contractor to either perform inspection tasks or implement a maintenance program. The homeowner must understand which corrective actions are included as maintenance items and which corrective actions require their authorization to perform service on the equipment.

3.3 *Maintenance inspection elements:*

3.3.1 *Homeowner(s) interview:*

3.3.1.1 Initial interview: During the first visit to a home, HVAC contractors shall ask questions which help them assess:

¹ Appropriately licensed HVAC contractors meet the state and local requirements for licensing, insurance, bonding, and proficiency.

- 3.3.1.1.1 Customers concerns and opinions of their comfort, indoor air quality, utility costs, and equipment performance
 - 3.3.1.1.2 Known home history (when built, renovations, etc.)
 - 3.3.1.2 Subsequent interviews: During following visits, HVAC contractors shall have the discretion to simplify the questions to reveal changes since the last visit.
 - 3.3.2 *Inventory*: Identifying the HVAC system(s) inventory of equipment², controls, components, and accessories. Information to be collected includes the following:
 - 3.3.2.1 Equipment Type (e.g., condenser)
 - 3.3.2.2 Make (e.g., ABC Brand)
 - 3.3.2.3 Model (e.g., AC 1000LMNOP-030)
 - 3.3.2.4 Serial number if applicable (e.g., ABC-123-XYZ)
 - 3.3.2.5 Year of manufacture (e.g., 2007)
 - 3.3.2.6 Start-up date (e.g., February 5, 2018) if known
 - 3.3.3 *Equipment maintenance checklists*: From Section 5 (Maintenance Tasks) identify appropriate checklists for each piece of equipment in the inventory,
 - 3.3.4 *Code requirements*: Identify and observe the applicable code references (e.g., International Residential Code, Uniform Mechanical Code, National Fire Protection Association, etc.).
 - 3.3.5 *Performance objectives*: Identify minimum equipment performance criteria based on the manufacturer's performance data and industry standards. The HVAC contractor shall make a reasonable effort to retrieve this performance data from the OEM or a distributor.
 - 3.3.6 *Testing and maintenance procedures*: Follow OEM maintenance procedures and guidance.
 - 3.3.7 *Safety*: If during the maintenance procedures, it is determined that there is a condition that could result in unsafe operation, the contractor shall shut off the equipment and advise the occupant and/or owner, in writing, of the unsafe condition.
- 3.4 *Regional Considerations*: Each region of the country has its own unique set of characteristics (e.g., extreme temperature, humidity, high altitude, fuel sources options, etc.) and special environmental concerns (e.g., sea salt spray). The HVAC contractor shall have the discretion to modify the inspection task list for each piece of equipment to reflect these unique characteristics based on regional guidance from the equipment or accessory manufacturer, municipal ordinances, applicable codes, and other industry standards or good practices.

² In the event that the equipment nameplate is missing or illegible, the contractor shall make a reasonable effort to get the information by contacting the OEM or by looking at prior work bills, as available.

4.0 DOCUMENTATION

The HVAC contractor records measurements, observations, and identifies recommended corrective action(s) to maintain the system's ability to efficiently provide clean, conditioned air to the home for its normal expected lifetime. The minimum documentation shall identify:

- 4.1.1 *Inventory*: The inventory of the equipment for the home's HVAC system(s) per Section 3.3.2.
- 4.1.2 *Checklists*: Those applicable tasks for the inspected equipment from Section 5.0 Inspection Tasks. Deviations from checklist tasks and requirements shall be detailed.
- 4.1.3 *Code violations*: Violations of the applicable model codes.
- 4.1.4 *Performance objectives*: The HVAC system's capability compared to the performance objectives from criteria taken from Section 3.3.5 and OEM performance data.
- 4.1.5 *External conditions*: Observed circumstances apart from the HVAC system which cause health and safety issues, accelerated wear, poor performance, or increased energy use (e.g., building envelope problems).
- 4.1.6 *Inaccessible items*: Inform the homeowner of components that are inaccessible or if the limited accessibility of the component impairs the inspection or maintenance task.
- 4.1.7 *Regional considerations*: The HVAC contractor shall document any modification of a checklist due to a regional consideration and will provide written justification.
- 4.1.8 *Corrective actions*: Those tasks, authorized by the home owner or included by the HVAC contractor, undertaken to improve indoor comfort conditions, safety of occupant, system performance, efficiency, or durability.

5.0 MAINTENANCE TASKS

This section identifies inspection maintenance tasks, and recommended service actions for residential HVAC equipment.

- 5.1 *Maintenance inspection task*: This portion of the checklist describes the minimum tasks that are required for most major pieces of residential equipment.
- 5.2 *Service task / recommended corrective actions*: The checklists offer remedies for faults identified during the inspection process. The HVAC contractor shall inform the homeowner of remedies included as part of the inspection and coordinate prior approval for remedies which are not part of the inspection process. All home owner authorized corrective actions shall be performed in accordance with the applicable OEM's instructions. Corrective actions which involve health and safety shall follow the applicable building codes.
- 5.3 *Component/ equipment listings*: The major pieces of HVAC equipment and accessories have checklists. If the HVAC system in the home is not covered by a checklist, HVAC contractors are to assemble a checklist from similar functions listed on checklists 5.1 – 5.16.
- 5.4 *Maintenance inspection task and service task / recommended corrective action scheduling*:

- 5.4.1 Maintenance inspection tasks for cooling and heating shall be performed when the equipment is operating within the temperature parameters established by conditions which meet the manufacturer’s operating range.
- 5.4.2 The HVAC contractor shall have the discretion to recommend increasing maintenance inspection tasks or frequency of inspection to address deficiencies if unacceptable performance is found during successive inspections. For ‘heating-only’ and/or ‘cooling-only’ equipment that are seasonally operated, the contractor shall have the discretion to recommend that the frequency of inspections are decreased from ‘semiannually’ to ‘annually.’
- 5.4.3 The Home Owner shall have the discretion to reject or accept increasing maintenance inspection frequencies and/or service task recommended corrective action scheduling.

Component / Equipment	Component / Equipment Description	Checklist Number
Air Distribution System	Plenums, trunk ducts, fittings, branch ducts, boots, grilles, registers and diffusers	5.1
Steam Distribution System	Piping, radiator, controls, steam traps.	5.2
Controls and Safeties	Thermostats, outdoor sensors, humidistats, zone controls	5.3
Furnace	Gas-fired air heating system	5.4
	Oil-fired air heating system	5.5
	Electric air heating system	5.6
Evaporator Coil	The cased or field enclosed evaporator coil, metering device, condensate drain, and associated refrigeration tubing	5.7
Condenser Unit	The outdoor section of a split system: air conditioner or heat pump	5.8
Fan Coil	The filter rack, evaporator coil, metering device, associated refrigeration tubing, blower assembly, condensate drain, and electric auxiliary heat	5.9
Boiler	Gas-fired water heating system	5.10
	Oil-fired water heating system	5.11
	Electric water heating system	5.12
Package Units	Packaged air conditioners or heat pumps	5.13
Geothermal/ Water Source Heat Pumps	Packaged geothermal/water source heat pump units	5.14
Evaporative Coolers	Packaged cooling only equipment using evaporative heat transfer	5.15
Accessories	Heat and energy recovery ventilators, central system humidifiers, central system dehumidifiers, electronic air cleaners, media air cleaners, ultra-violet lights, economizers, and condensate pumps	5.16

Table 1: Component and Equipment

Checklist 5.1 Air Distribution System				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Inspect for particulate accumulation on filters.	Clean or replace filters if accumulation results in PD higher than design or if airflow is outside of established operating limits.	Semiannually	Adjust, repair, replace as needed.
b.	Inspect air filter housing integrity and air seal.	Clean as needed.	Semiannually	Adjust, repair, replace as needed.
c.	Inspect grilles, registers, diffusers, and trunk/branch balancing dampers for dirt accumulation.	Clean as needed.	Semiannually	Adjust, repair, replace as needed.
d.	Inspect all accessible ductwork for areas of moisture accumulation or biological growth.	Clean or replace as needed.	Annually	Adjust, repair, replace as needed. Install access door or panel as needed.
e.	Inspect integrity of all accessible ductwork insulation.	Record locations of damaged ductwork insulation and associated exterior vapor retarders.	Annually	Repair ductwork insulation and associated exterior vapor retarders and repair all accessible rips, voids to insulation adhesives and/or tapes
f.	Inspect the integrity of all accessible ductwork including: duct strapping, hangers, sections, joints, and seams.	Record improper alterations, straps, air leaks, and failing duct tapes or mastics.	Annually	Repair, seal, replace as necessary.

Checklist 5.2 Steam and Hydronic Distribution Systems				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Inspect safety devices.	Clean as needed to remove dirt build up.	Semiannually	Adjust, repair, replace as needed.
b.	Inspect piping for leaks.	Clean as needed to remove dirt build up.	Semiannually	Repair seal, replace as needed.
c.	Inspect piping anchors/supports for integrity and inspect piping for alignment and expansion fittings for proper operation.	Clean as needed to remove dirt build up.	Semiannually	Repair seal, replace as needed.
d.	Inspect blowdown or drain valve.	Clear all debris to ensure proper operation.	Semiannually	Adjust, repair, replace as needed
e.	Inspect system steam traps, pumps, and controls.	Clean as needed to ensure proper operation.	Semiannually	Adjust, repair, replace as needed.
f.	Inspect for evidence of buildup or fouling on heat exchange surfaces.	Record evidence of fouling or build up on heat exchanger surfaces.	Annually	Restore or replace as needed to ensure proper operation.
g.	Inspect for proper fluid flow.	Record when there is improper fluid flow.	Annually	Restore or replace as needed to ensure proper operation.
h.	Inspect strainers.	Clean as needed.	Annually	Restore, repair or replace as needed.
i.	Visually inspect external piping insulation and vapor barrier for integrity.	Record location of insulation and vapor barrier damage.	Annually	Repair seal, replace as needed.
j.	Inspect radiator inlet valve and vents.	Open access valve and adjust vents as needed.	Annually	Restore or replace as needed to ensure proper operation.
k.	Inspect pumps for leakage and proper operation.	Clean as needed to remove dirt build up.	Annually	Restore or replace as needed to ensure proper operation.

Checklist 5.3 Controls and Safeties				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Test modes of operation and control sequences. Test system control devices to ensure they are maintaining their expected range.	Clean and adjust control components.	Semiannually	Repair or replace controls as needed to ensure proper operation.
b.	Test zoning control's modes of operation, zone control to ensure proper damper/valve operation and test bypass dampers for proper function.	Clean and adjust control and damper components.	Semiannually	Repair or replace components as needed to ensure proper operation.
c.	Test remote control thermostat in all modes of operation.	Replace battery annually, check for corrosion on the battery contact points.	Annually	Repair or replace as needed to ensure proper operation.
d.	Initiate a test of the defrost control boards mode of operation, for those with that capability.	Check defrost control for proper operation.	Annually	Repair, replace or adjust controls as needed.
e.	Test drain pan safety switch(es) for proper operation.	Clean and adjust control components.	Annually	Repair wiring or replace safety switch as needed.
f.	Test unit safety switches ³ .	Clean and adjust safety switch.	Annually	Repair wiring or replace safety switch as needed.
g.	Verify that all selectable pins, jumpers, and/or dip switch positions on control board are correctly positioned for the application.	Verify proper settings utilizing the OEM's installation and/or technical publications.	Annually	Repair or replace components as needed to ensure proper operation.

³ For example, furnace venting pressure switches.

Checklist 5.4 Gas Furnace				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause, and record.	Semiannually	Repair or replace as necessary.
Blower Assembly				
j.	Determine and record airflow across heat exchanger.	Adjust, and clean, as necessary to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction and operating properly.	Annually	Repair or replace as necessary.

Blower Assembly (Continued)				
k.	Test variable frequency drive (e.g., ECM) for proper operation.	Record when not operating properly.	Annually	Repair or replace as necessary.
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Annually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications.	Annually	Repair or replace as necessary.
Condensate Removal				
n.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Annually	Repair or replace as necessary.
Gas Combustion				
o.	Inspect burner and flue for signs of water, corrosion, and blockage.	Record cause and clean.	Annually	Repair or replace as necessary.
p.	Test inducer fan motor and blower assembly.	Clean, and check for proper operation.	Annually	Repair or replace as necessary.
q.	Inspect heat exchanger for signs of corrosion, fouling, structural problems (e.g., cracks, perforations, and bulges), and erratic flame operation during blower operation.	Clean, and check for proper operation. Record signs of corrosion or damage.	Annually	Repair or replace as necessary.
r.	Visually inspect burners for signs of contamination.	Clean, as necessary.	Annually	Repair or replace as necessary.
s.	Inspect the burner blower wheel	Clean as needed to ensure proper operation.	Annually	Repair or replace as necessary.
t.	Inspect hot surface igniter for cracks (white spots when energized or check cold with ohmmeter and proper supply voltage).	Clean, and check for proper operation. Record signs of corrosion or damage. Record Ohmmeter readings and power supply voltage. Record signs of cracks or water damage.	Annually	Repair or replace if outside OEM's specifications.

Gas Combustion (Continued)				
u.	Measure and record inlet gas pressure at inlet pressure tap.	If the inlet gas pressure is insufficient for OEM operation specifications, contact the gas supplier.	Annually	Repair or replace components as necessary.
v.	Measure, record, and adjust manifold pressure as necessary.	Adjust the gas valve to provide proper manifold pressure.	Annually	Repair or replace as necessary.
w.	Inspect ceramic insulator, flame probe, and associated wiring for any cracks or abnormalities.	Clean according to OEM recommended procedures.	Annually	Repair or replace as necessary.
x.	Test main burner ignition sequence and flame safety; verify proper operation.	Record micro-amps for comparison with OEM specifications. If outside of OEM operational range, correct combustion problem.	Annually	Repair or replace as necessary.
y.	Test burners.	Fire unit and adjust air shutters (if used) for OEM specification compliance.	Annually	Repair or replace as necessary.
z.	Inspect the spark igniter and associated wiring. Verify that spark gap complies with OEM specifications.	Record if cracking of ceramic insulator or deterioration of spark electrodes is noted. Record if cracking or deterioration of ignition wiring is observed.	Annually	Repair or replace as necessary.
aa.	Test inducer fan motor and blower assembly.	Clean and check for proper operation.	Annually	Repair or replace components as necessary.
bb.	Ensure combustion air volume or provision is correct.	Verify air volume is correct per OEM instructions and local code ⁴ .	Annually	Repair or replace components as necessary.
cc.	Perform combustion analysis test. Measure and record test results.	Adjust as needed. Record final measurements.	Annually	Repair or replace components as necessary.
dd.	Measure and record TD across the heat exchanger.	Clean components or adjust airflow as necessary to meet necessary operating conditions and design parameters.	Annually	Repair or replace components as necessary.

⁴ Direct vent, non-direct vent, and natural draft appliances have differing code requirements for combustion air.

Venting				
ee.	Inspect vent exhaust system (e.g., chimney, chimney liner, flue, inlet and exhaust vent) for signs of improper condensation, water corrosion, cracks, fractures, and blockages.	Clean, and remove blockages.	Annually	Repair or replace components as necessary.
ff.	Inspect all vent connectors for rust discoloration, or signs of condensate.	Ensure they are securely fastened. Record signs of moisture damage.	Annually	Repair or replace as necessary.
gg.	Inspect inlet and exhaust vent pipe for proper support, slope, and termination.	Record locations where support or slope do not meet OEM requirements.	Annually	Repair or replace as necessary.
hh.	Inspect for combustible materials placed too close to vent or pipe.	Notify homeowner of the fire hazard.	Annually	Relocate to safe place or provide approved clearance reduction.

Checklist 5.5 Oil Furnace				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Blower Assembly				
j.	Determine and record airflow across heat exchanger.	Adjust, and clean, to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction and operating properly.	Annually	Repair or replace as necessary.
k.	Test variable frequency drive (e.g., ECM) for proper operation.	Record when not operating properly.	Annually	Repair or replace as necessary.
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment.	Annually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Oil Combustion				
n.	Inspect combustion chamber for structural problems (e.g., cracks, perforations, and deformities).	Clean, and check for proper operation. Record signs of corrosion or damage.	Annually	Repair or replace as necessary.
o.	Inspect heat exchanger and internal flue for signs of corrosion, fouling, and erratic flame operation during blower operation.	Clean, and check for proper operation. Record signs of corrosion or damage.	Annually	Repair or replace as necessary.

Oil Combustion (Continued)				
p.	Inspect all burner gaskets.	Record location of any gaskets that are damaged or would fail to seal adequately.	Annually	Repair or replace as necessary.
q.	Inspect retention head, electrodes and ceramic insulation.	Clean retention head, electrodes and ceramic insulation of soot and carbon.	Annually	Replace electrodes with ceramic cracks or if tips are rounded.
r.	Inspect electrodes for proper positioning.	Position electrodes as necessary.	Annually	Repair or replace as necessary.
s.	Measure and record photo-cell (cad cell) resistance.	Remove photo-cell (cad cell), check resistance, and clean as necessary. Ensure resistance is within OEM specifications.	Annually	Repair or replace components as necessary.
t.	Verify proper combustion air volume or provisions.	Verify air volume is correct per OEM instructions and local code. Remove lint or other foreign material around burner combustion air openings that may obstruct airflow.	Annually	Repair or replace components as necessary.
u.	Verify burner head or nozzle type and location per OEM's specifications.	Adjust as necessary.	Annually	Repair or replace components as necessary.
v.	Replace oil burner nozzle.	Install new (never attempt cleaning) identical flow rated nozzle (verify gallons per hour, spray angle and pattern).	Annually	Replace annually as necessary.
w.	Replace fuel filter.	Replace filter.	Annually	Replace annually or as necessary.
x.	Test burner motor and blower assembly for correct operation.	Adjust as needed.	Annually	Repair or replace as necessary.
y.	Bleed oil line.	With open fuel supply (cap removed), on a one-pipe system, remove any air from oil line.	Annually	Repair or replace as necessary.
z.	Measure and record oil pressure.	Adjust oil pressure as needed, per OEM specification.	Annually	Repair or replace as necessary.
aa.	Inspect oil pump and connections for leaks.	Report leaks.	Annually	Repair or replace as necessary.
bb.	On a two line/pipe oil system verify that oil is returning to tank.	Adjust pressure as needed per OEM specifications.	Annually	Repair or replace as necessary.
cc.	Measure and record ignition transformer secondary voltage.	Nominal range is 10,000 V ac for iron core transformers. Solid state igniters cannot be tested with an iron core transformer tester.	Annually	Repair or replace components as necessary.
dd.	Perform combustion analysis test. Measure and record	Adjust as needed. Record final measurements.	Annually	Repair or replace components as necessary.

	test results.			
Oil Combustion (Continued)				
ee.	Measure and record TD across heat exchanger.	Verify with furnace rating plate, adjust airflow until TD is within OEM’s rating.	Annually	Repair or replace components as necessary.
ff.	Check primary burner control safety timing.	Verify safety control timing is within OEM’s specifications.	Annually	Repair or replace components as necessary.
Venting				
hh.	Inspect vent exhaust system (e.g., chimney, chimney liner, flue, L-vent and exhaust vent) for signs of improper condensation, water, corrosion, cracks, fractures, and blockages.	Clean, remove blockages.	Annually	Repair or replace components as necessary.
ii.	Inspect all vent or chimney connectors for rust discoloration, or signs of condensate.	Record signs of moisture damage.	Annually	Repair or replace components as necessary.
jj.	Inspect inlet and exhaust vent pipe for proper support, slope, and termination. Ensure they are securely fastened.	Record locations where support or slope do not meet OEM requirements.	Annually	Repair or replace as necessary.
kk.	Inspect for combustible materials placed too close to vent or pipe.	Notify homeowner of the fire hazard.	Annually	Relocate to safe place or provide approved clearance reduction.

Checklist 5.6 Electric Furnace				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Inspect insulation to ensure proper operation. Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Inspect motor capacitors
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.
j.	Test electric heater's sequence of operation.	If outside OEM rating or sequencer specification, inspect for cause.	Semiannually	Repair or replace as necessary.
Blower Assembly				
k.	Determine and record airflow across heating elements.	Adjust, clean, to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction.	Semiannually	Repair or replace as necessary.

Blower Assembly (Continued)				
l.	Test variable frequency drive (e.g., ECM) for proper operation.	Record when not operating properly.	Semiannually	Repair or replace as necessary.
m.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Annually	Repair or replace components as necessary to ensure proper operation.
n.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.

Checklist 5.7 Evaporator Coil				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet. Ensure no obstacles to airflow have been installed that would impede airflow.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Condensate Removal				
c.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Annually	Repair or replace as necessary.
d.	Inspect for condensate blowing from coil into cabinet or air distribution system.*	Adjust fan speed, clean coil fins, ensure OEM supplied deflectors are in place, to eliminate water carry over.	Annually	Repair or replace as necessary.
e.	Inspect drain pan and accessible drain line for biological growth.	Clean as needed to remove bio growth and ensure proper operation, add algae tablets or strips as necessary. Ensure algae tablets and cleaning agent are compatible with the fin and tube material.	Annually	Repair or replace as necessary.
f.	Inspect secondary drain lines, drain pans, and overflow protection devices, as applicable, for proper drain flow and evidence of water in secondary drain pan.*	Remove any blockages and investigate cause of recent water in drain pan.	Annually	Repair or replace as necessary.

Refrigeration				
g.	Confirm correct airflow using delta-T and/or static pressure, and compare to OEM target.	Clean coils and blower as necessary. Adjust the system for proper airflow.	Annually	Repair or replace components as necessary.
h.	Measure and record dry bulb and wet bulb TD across evaporator coil. ^{5*}	If DB and/or WB values are outside of appropriate OEM ranges, check for correct airflow, refrigerant charge, and operating conditions.	Annually	Repair or replace as necessary.
i.	Inspect coil fins.	Ensure fins are visibly clean, straight, and open. Clean and straighten as required.	Annually	Repair or replace as necessary.
j.	Inspect accessible refrigerant lines, joints, components, and coils for oil leaks.	Test all oil stained joints for leaks, clean or repair as necessary.	Annually	Repair or replace as necessary.
k.	Inspect refrigerant line insulation.	Record damaged insulation type and location.	Annually	Repair or replace as necessary.
l.	Measure pressure drop across the coil.*	Adjust, and clean.	Annually	Repair or replace, as necessary to ensure to proper airflow.
* Does not apply to wall- or ceiling mounted evaporator units matched with a ductless mini split.				

⁵ This is a minimum standard procedure, and a good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge. See OEM instructions for inverter-driven equipment.

Checklist 5.8 Condensing Unit				
Normative			Informative	
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Repair or replace insulation to ensure proper operation. Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment (as applicable). Seal air leaks.*	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure the case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	If accessible, check printed circuit for hot spots and other damage.	Clean and verify proper operation.	Semiannually	Repair or replace as necessary.
h.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
i.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
j.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Refrigeration				
k.	Inspect accessible refrigerant lines, joints, components, and coils for oil leaks.	Test all oil stained joints and components for leaks. Record leak locations.	Semiannually	Repair or replace as necessary.
l.	If indoor airflow is within OEM specifications but TD is not (see Checklist 5.7 #h), check refrigerant charge using manufacturer recommended procedure. ⁶	Adjust charge as necessary ⁷ .	Semiannually	Repair or replace as components necessary.
m.	Inspect refrigerant line insulation.	Record damaged insulation type and location,	Annually	Repair and replace as necessary.
Condenser Fan Motor				
n.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Condenser Coil				
o.	Inspect coil fins.	Clean, straighten, and repair as required.	Annually	Repair or replace as necessary.

⁶ A good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

⁷ Ensure that the metering device (and sensing bulb) is properly installed.

Checklist 5.8 - HP Additional Tasks for Air-to-Air Heat Pump Condensers				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Test reversing valve operation.	Record findings.	Semiannually	Repair or replace as components necessary.
b.	If indoor airflow is within OEM specifications but TD is not, check refrigerant charge using manufacturer recommended procedure. ⁸	Adjust charge as necessary ⁹ .	Semiannually	Repair or replace components as necessary.
c.	Test defrost cycle controls.	Adjust controls as needed.	Semiannually	Repair or replace components as necessary.
d.	Inspect outdoor unit condensate drain ports.	Ensure condensate drain ports are open and the unit is elevated above obstructions to allow free flow of condensate or per local code for seasonal obstructions like snow.	Semiannually	Repair or replace as necessary.

⁸ A good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

⁹ Ensure that the metering device (and sensing bulb) is properly installed.

Checklist 5.9 Fan Coil				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, Report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.
Blower Assembly				
j.	Determine and record airflow across heat exchanger/coil.	Adjust, and clean, as necessary to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction and operating properly.	Semiannually	Repair or replace components as necessary to ensure proper operation.

Blower Assembly (Continued)				
k.	Test variable frequency drive (e.g., ECM) for proper operation.	Adjust as needed, record when drives are not functioning properly.	Semiannually	Repair or replace as necessary.
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Annually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Evaporator Coil				
n.	Inspect coil, refrigeration components, fittings and fins.	Check for signs of refrigerant leaks. Ensure fins are clean, straight, and open. Clean and straighten as required.	Annually	Repair or replace as necessary.
o.	Confirm correct airflow using delta-T and/or static pressure and compare to OEM target.	Clean coils and blower as necessary. Adjust the system for proper airflow.	Annually	Repair or replace components as necessary.
p.	Measure and record dry bulb and wet bulb TD across evaporator coil.	If DB and/or WB values are outside of appropriate OEM ranges, check for correct airflow, refrigerant charge, and operating conditions.	Annually	Repair or replace as necessary.
q.	Inspect refrigerant line insulation.	Record damaged insulation type and location,	Annually	Repair or replace as necessary.

Condensate Removal				
r.	Inspect for condensate blowing from coil into cabinet or air distribution system.	Adjust fan speed, clean coil fins, ensure OEM supplied deflectors are in place, to eliminate water carry over.	Annually	Repair or replace as necessary.
s.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Annually	Repair or replace as necessary.
t.	Inspect drain pan and accessible drain line for biological growth.	Clean as needed to remove bio growth and ensure proper operation, add algae tablets or strips as necessary. Ensure algae tablets and cleaning agent are compatible with the fin and tube material.	Annually	Repair and replace as necessary.
Auxiliary or Supplemental Electric Heaters				
u.	Test electric heater's capacity and sequence of operation.	If outside OEM rating or sequencer specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Checklist 5.10 Gas Boiler				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete. Replace as necessary.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.
Gas Combustion				
j.	Inspect combustion chamber, burner and flue.	Clean, and check for proper operation. Record signs of corrosion or damage.	Semiannually	Repair or replace as necessary.

Gas Combustion (Continued)				
k.	Inspect heat exchanger for signs of corrosion, fouling, structural problems (e.g., cracks, perforations, and bulges), and erratic flame operation during blower operation.	Clean, and check for proper operation. Record signs of corrosion or damage. Record Ohmmeter readings and power supply voltage. Record signs of cracks or water damage.	Semiannually	Repair or replace as necessary.
l.	Visually inspect burners for signs of contamination.	Clean, as necessary.	Annually	Repair or replace as necessary.
m.	Inspect the burner blower wheel	Clean as needed to ensure proper operation.	Annually	Repair or replace as necessary.
n.	Inspect hot surface igniter for cracks (white spots when energized or check cold with ohmmeter and proper supply voltage).	Clean, and check for proper operation. Record signs of corrosion or damage. Record Ohmmeter readings and power supply voltage. Record signs of cracks or water damage.	Annually	Repair or replace if outside OEM’s specifications.
o.	Measure and record inlet gas pressure at inlet pressure tap.	If the inlet gas pressure is insufficient for OEM operation specifications, contact the gas supplier.	Annually	Repair or replace components as necessary.
p.	Measure, record, and adjust manifold pressure as necessary.	Adjust the gas valve to provide proper manifold pressure.	Annually	Repair or replace components as necessary.
q.	Test main burner ignition.	Verify thermocouple or flame sensor/pilot assembly is operating within the OEM’s recommended operational range under load.	Annually	Replace thermocouple or flame sensor/pilot assembly if outside of OEM recommended operational range under load.
r.	Test burners.	Fire unit and adjust air shutters (if used) for OEM specification compliance.	Annually	Repair or replace components as necessary.
s.	Test inducer fan motor and blower assembly.	Clean and check for proper operation.	Annually	Repair or replace components as necessary.
t.	Ensure combustion air volume is correct.	Ensure air volume is correct per local code.	Annually	Repair or replace components as necessary.

Gas Combustion (Continued)				
u.	Perform combustion analysis test. Measure and record test results.	Adjust as needed. Record final measurements.	Annually	Repair or replace components as necessary.
v.	Measure and record TD across the heat exchanger.	Clean components or adjust waterflow as necessary to meet necessary operating conditions and design parameters.	Annually	Repair or replace components as necessary.
Hydronic Loop				
w.	Inspect screen on reducing valve, pressure reducing valve, and “Y” strainer if available.	Clean screens and strainers.	Annually	Repair or replace components as necessary.
x.	Test bladder expansion tank for proper air cushion or proper air cushion on expansion tank.	Adjust to provide proper air cushion on expansion tank as per manufactures specifications.	Annually	Repair or replace components as necessary.
y.	Inspect water pump.	Clean or clear as needed to reduce cavitation and ensure proper operation.	Annually	Repair or replace as necessary.
z.	Measure and record TD of water entering to water leaving coil/ heat exchanger.	If TD is outside OEM’s specifications, identify cause and then clean, repair, or replace as necessary.	Annually	Repair or replace as necessary.
aa.	Measure and record PD of the water loop across the water heat exchanger.	Clean heat exchanger, Adjust water pump or control valve as necessary.	Annually	Repair or replace as necessary.
Venting				
bb.	Inspect inside of chimney/ flue/ inlet and exhaust vent for water, signs of condensation, corrosion, cracks, fractures, and blockages.	Clean, remove blockages.	Annually	Repair or replace as necessary.
cc.	Inspect all vent connectors for rust discoloration, or signs of condensate.	Ensure they are securely fastened. Record locations for signs of water damage. .	Annually	Repair or replace as necessary.

Venting (Continued)				
dd.	Inspect inlet and exhaust vent pipe for proper support, slope, and termination.	Record locations where support or slope do not meet OEM requirements.	Annually	Repair or replace as necessary.
ee.	Inspect for combustible materials placed too close to vent or pipe.	Notify homeowner of the fire hazard.	Annually	Relocate to safe place or provide approved clearance reduction.

Checklist 5.11 Oil Boiler				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Oil Combustion				
j.	Inspect combustion chamber for structural problems (e.g., cracks, perforations, and bulges).	Clean, and check for proper operation. Record signs of corrosion or damage.	Semiannually	Repair or replace as necessary.
k.	Inspect heat exchanger and internal flue for signs of corrosion, fouling, structural problems (e.g., cracks, perforations, and bulges), and erratic flame operation during blower operation.	Report bulges cracks and damage locations. Identify cause and clean.	Semiannually	Repair or replace as necessary.
l.	Inspect all burner gaskets.	Record location of worn burner gaskets.	Annually	Replace any gaskets that are damaged or would fail to seal adequately.
m.	Inspect retention head, electrodes and ceramic insulation.	Clean retention head, electrodes and ceramic insulation of soot and carbon.	Annually	Replace electrodes with ceramic cracks or if tips are rounded.
n.	Inspect electrodes for proper positioning.	Position electrodes as necessary.	Annually	Repair or replace as necessary.
o.	Measure and record photo-cell (cad cell) resistance.	Remove photo-cell (cad cell), check resistance, and clean as necessary. Ensure resistance is within OEM specifications.	Annually	Repair or replace components as necessary.
p.	Clean combustion air inlet.	Remove lint or other foreign material around burner combustion air openings that may obstruct airflow.	Annually	Repair or replace components as necessary.
q.	Verify burner head or nozzle type and location per OEM's specifications.	Make all adjustments as necessary.	Annually	Repair or replace components as necessary.
r.	Replace oil burner nozzle.	Install new (never attempt cleaning) identical flow rated nozzle (verify gallons per hour, spray angle and pattern).	Annually	Replace annually as necessary.
s.	Replace fuel filter.	Replace filter.	Annually	Replace annually or as necessary.
t.	Test inducer fan motor and blower assembly.	Clean, and check for proper operation.	Annually	Repair or replace components as necessary.

Oil Combustion (Continued)				
u.	Bleed oil line.	With open fuel supply (cap removed), on a one-pipe system, remove any air from oil line.	Annually	Repair or replace as necessary.
v.	Measure, adjust, and record oil pressure.	Measure and adjust oil pressure.	Annually	Repair or replace as necessary.
w.	Inspect oil pump for proper pressure and leaks.	Record when pump pressure is below OEM specifications or there are signs of leaks.	Annually	Repair or replace as necessary.
x	Test fuel pump for proper operation, pressure, and cut-off. Measure and record line vacuum.	Install a pressure gauge in the nozzle port and run the burner to observe operating pressure and record. Shut the burner off and record cut-off pressure. Record when the cut-off pressure drops below OEM specifications.	Annually	Repair or replace as necessary.
y.	Measure and record ignition transformer secondary voltage.	Nominal range is 10,000 V ac for iron core transformers. Solid state igniters cannot be tested with an iron core transformer tester.	Annually	Repair or replace components as necessary.
z.	Ensure combustion air volume is correct.	Ensure air volume is correct per local code.	Annually	Repair or replace components as necessary.
aa.	Perform combustion analysis test. Measure and record test results.	Adjust as needed. Record final measurements.	Annually	Repair or replace components as necessary.
bb.	Measure and record TD across heat exchanger.	Verify with furnace rating plate. Record when TD is outside of OEM's operating range.	Annually	Repair or replace components as necessary.
cc.	Check primary control safety timing.	Disconnect the cad cell and run the burner and time the lockout. Record when safety control timing exceeds OEM's specifications.	Annually	Repair or replace as necessary.
Hydronic Loop				
dd.	Inspect screen on reducing valve, pressure reducing valve, and "Y" strainer if available.	Clean screens and strainers.	Annually	Repair or replace as necessary.
ee.	Test bladder/expansion tank for proper air cushion or proper air cushion on expansion tank.	Adjust to provide proper air cushion on expansion tank as per manufactures specifications.	Annually	Repair or replace as necessary.

Hydronic Loop (Continued)				
ff.	Inspect water pump.	Clean or clear as needed to reduce cavitation and ensure proper operation.	Annually	Repair or replace as necessary.
gg.	Measure and record PD of the water loop across the refrigerant water heat exchanger.	Adjust water pump or control valve as necessary.	Annually	Repair or replace as necessary.
hh.	Measure and record TD of water entering to water leaving coil/ heat exchanger.	If TD is outside OEM's specifications, identify and record the cause. clean, as necessary.	Annually	Repair or replace as necessary.
ii.	Inspect auto air vent and check for air in system.	Clean as necessary.	Annually	Repair or replace as necessary.
Venting				
jj.	Inspect inside of chimney/ flue/ inlet and exhaust vent for water, signs of condensation, corrosion, cracks, fractures, and blockages.	Clean, remove blockages.	Annually	Repair or replace as necessary.
kk.	Inspect all vent connectors for rust discoloration, or signs of condensate.	Ensure they are securely fastened Record locations for signs of water damage.	Annually	Repair or replace as necessary.
ll.	Inspect inlet and exhaust vent pipe for proper support, slope, and termination.	Record locations where support or slope do not meet OEM requirements.	Annually	Repair or replace as necessary.
mm.	Inspect for combustible materials placed too close to vent or pipe.	Notify homeowner of the fire hazard.	Annually	Relocate to safe place or provide approved clearance reduction.

Checklist 5.12 Electric Boiler				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete. Replace as necessary.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.
Electric Water Heating				
j.	Measure and record TD of water entering to water leaving heat exchanger.	If outside OEM rating or specification, inspect for cause record the cause. Clean as necessary.	Semiannually	Repair or replace as necessary.

Electric Water Heating (Continued)				
k.	Test electric heater’s capacity and sequence of operation.	If outside OEM rating or sequencer specification, identify and record the cause.	Semiannually	Repair or replace as necessary.
Hydronic Loop				
l.	Inspect screen on reducing valve, pressure reducing valve, and “Y” strainer if available.	Clean screens and strainers.	Semiannually	Repair or replace as necessary.
m.	Test bladder expansion tank for proper air cushion or proper air cushion on expansion tank.	Adjust to provide proper air cushion on expansion tank as per manufactures specifications.	Annually	Repair or replace as necessary.
n.	Inspect water pump.	Clean or clear as needed to reduce cavitation and ensure proper operation.	Annually	Repair or replace as necessary.
o.	Measure and record TD of water entering to water leaving coil/ heat exchanger.	If TD is outside OEM’s specifications, identify cause and then clean.	Annually	Repair or replace as necessary.
p.	Measure and record PD of the water loop across the refrigerant water heat exchanger.	Adjust water pump or control valve as necessary.	Annually	Repair or replace as necessary.

Checklist 5.13 Package Units				
#	Normative			Informative
	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Repair or replace insulation to ensure proper operation. Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment (as applicable). Seal air leaks on indoor air processing sections.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Indoor Blower Motor				
j.	Determine and record airflow across heat exchanger/coil.	Adjust, and clean, as necessary to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction and operating properly.	Semiannually	Repair or replace components as necessary to ensure proper operation
k.	Test variable frequency drive (e.g., ECM) for proper operation.	Record when not operating properly.	Semiannually	Repair or replace as necessary.
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust Fan belt tension and alignment as required.	Semiannually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Evaporator Coil Section				
n.	Inspect coil fins.	Ensure fins are clean, straight, and open. Clean and straighten as required.	Annually	Repair or replace as necessary.
o.	Inspect for condensate blowing from coil into cabinet or air distribution system.	Adjust fan speed, clean coil fins, to eliminate water carry over.	Annually	Repair or replace as necessary.
p.	Inspect accessible refrigerant connecting lines, joints, and coils for oil leaks.	Test all oil stained joints for leaks, clean as necessary.	Annually	Repair or replace as necessary.
q.	Confirm correct airflow using delta-T and/or static pressure, and compare to OEM target.	Clean coils and blower as necessary. Adjust the system for proper airflow.	Annually	Repair or replace components as necessary.

Evaporator Coil Section (Continued)				
r.	Measure and record dry bulb and wet bulb TD across evaporator coil ¹⁰ .	If DB and/or WB values are outside of appropriate OEM ranges, check for correct airflow, refrigerant charge, and operating conditions.	Annually	Repair or replace as necessary.
Condensate Removal				
s.	Inspect for condensate blowing from coil into cabinet or air distribution system.	Adjust fan speed, clean coil fins, ensure OEM supplied deflectors are in place, to eliminate water carry over.	Annually	Repair or replace as necessary.
t.	Inspect condensate drains (and traps) for proper operation.	Clean, and verify the drains are working properly.	Annually	Insulate, repair, or replace as necessary.
u.	Inspect drain pan and accessible drain line for biological growth.	Clean as needed to remove bio growth and ensure proper operation, add algae tablets or strips as necessary. Ensure algae tablets and cleaning agent are compatible with the fin and tube material.	Annually	Repair or replace as necessary.
Condenser Blower Motor				
v.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Condenser Coil Section				
w.	Inspect coil fins.	Ensure fins are clean, straight, and open. Clean and straighten as required.	Annually	Repair or replace as necessary.
x.	Inspect accessible refrigerant connecting lines, joints, and coils for oil leaks.	Test all oil stained joints for leaks, clean as necessary.	Annually	Repair or replace as necessary.
Refrigeration				
y.	Inspect accessible refrigerant connecting lines, joints, and coils for oil leaks.	Test all oil stains for leaks, clean as necessary.	Annually	Repair or replace as necessary.

¹⁰ This is a minimum standard procedure, and a good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

Refrigeration (Continued)				
z.	If indoor airflow is within OEM specifications but TD is not, check refrigerant charge using manufacturer recommended procedure ¹¹ .	Adjust charge as necessary ¹² .	Semiannually	Repair or replace as components necessary.
Auxiliary or Supplemental Electric Heaters				
aa.	Test electric heater’s capacity and sequence of operation.	If outside OEM rating or sequencer specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Checklist 5.13-HP Additional Tasks for Package Heat Pumps				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Test reversing valve operation.	Record findings.	Semiannually	Repair or replace as necessary.
b.	If indoor airflow is within OEM specifications but TD is not, check refrigerant charge using manufacturer recommended procedure. ¹³	Adjust charge as necessary ¹⁴ .	Semiannually	Repair or replace as components necessary.
c.	Test defrost cycle controls.	Adjust controls as needed.	Semiannually	Repair or replace components as required.
d.	Inspect condenser section condensate drain ports.	Ensure condensate drain ports are open and elevated above obstructions to allow free flow of condensate or per local code for seasonal obstructions like snow.	Semiannually	Repair or replace as necessary.

¹¹ A good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

¹² Ensure that the metering device (and sensing bulb) is properly installed.

¹³ A good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

¹⁴ Ensure that the metering device (and sensing bulb) is properly installed.

Checklist 5.13-GP Additional Tasks for Gas Package Units				
#	Normative			Informative
	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Gas Combustion				
a.	Inspect combustion chamber, burner and flue.	Clean, and check for proper operation. Record signs of corrosion or damage	Semiannually	Repair and replace as required.
b.	Inspect heat exchanger for signs of corrosion, fouling, structural problems (e.g., cracks, perforations, and bulges), and erratic flame operation during blower operation.	Clean, and check for proper operation. Record signs of corrosion or damage.	Semiannually	Repair or replace as necessary.
c.	Visually inspect burners for signs of contamination.	Clean, as necessary.	Annually	Repair or replace as necessary
d.	Inspect the burner blower wheel	Clean as needed to ensure proper operation.	Annually	Repair or replace as necessary
e.	Inspect hot surface igniter for cracks (white spots when energized or check cold with ohmmeter and proper supply voltage).	Clean, and check for proper operation. Record signs of corrosion or damage. Record Ohmmeter readings and power supply voltage. Record signs of cracks or water damage.	Annually	Repair or replace if outside OEM's specifications.
f.	Measure and record inlet gas pressure at inlet pressure tap.	If the inlet gas pressure is insufficient for OEM operation specifications, contact the gas supplier.	Annually	Repair or replace components as necessary.
g.	Measure, record, and adjust manifold pressure as necessary.	Adjust the gas valve to provide proper manifold pressure.	Annually	Repair or replace components as necessary.
h.	Test main burner ignition.	Verify thermocouple or flame sensor/pilot assembly is operating within the OEM's recommended operational range under load	Annually	Replace thermocouple or flame sensor/pilot assembly if outside of OEM recommended operational range under load.
Gas Combustion (Continued)				

i.	Test burners.	Fire unit and adjust air shutters (if used) for OEM specification compliance.	Annually	Repair or replace components as necessary.
j.	Test inducer fan motor and blower assembly.	Clean, and check for proper operation.	Annually	Repair or replace components as necessary.
k.	Ensure combustion air volume is correct.	Ensure air volume is correct per local code.	Annually	Repair or replace components as necessary.
l.	Perform combustion analysis test. Measure and record test results.	Adjust as needed. Record final measurements.	Annually	Repair or replace components as necessary.
m.	Measure and record TD across the heat exchanger.	Clean components or adjust airflow as necessary to meet necessary operating conditions and design parameters.	Annually	Repair or replace components as necessary.
Venting				
n.	Inspect vent termination for water, signs of condensation, corrosion, cracks, fractures, and blockages.	Clean, remove blockages, record locations of cracks, fractures and moisture damage. .	Annually	Repair or replace components as necessary.
o.	Inspect all vent connectors for rust discoloration, or signs of condensate.	Ensure they are securely fastened. Record locations for signs of water damage.	Annually	Repair or replace as necessary.
p.	Inspect inlet and exhaust vent pipe for proper support, slope, and termination.	Record locations where support or slope do not meet OEM requirements.	Annually	Repair or replace as necessary.
q.	Inspect for combustible materials placed too close to vent or pipe.	Notify homeowner of the fire hazard.	Annually	Relocate to safe place or provide approved clearance reduction.

Checklist 5.14 Geothermal				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage. Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Indoor Blower Motor				
j.	Determine and record airflow across heat exchanger/coil.	Adjust, and clean, as necessary to ensure to proper airflow. Verify all grilles, registers, and balancing dampers are open and free of obstruction and operating properly.	Semiannually	Repair or replace components as necessary to ensure proper operation.
k.	Test variable frequency drive (e.g., ECM) for proper operation.	Record if not operating properly	Semiannually	Repair or replace as necessary.
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Semiannually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause. I	Annually	Repair or replace as necessary.
Condensate Removal				
n.	Inspect for condensate blowing from coil into cabinet or air distribution system.	Adjust fan speed, clean coil fins, ensure OEM supplied deflectors are in place, to eliminate water carry over.	Annually	Repair or replace as necessary.
o.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Annually	Repair or replace as necessary.
p.	Inspect drain pan and accessible drain line for biological growth.	Clean as needed to remove bio growth and ensure proper operation, add algae tablets or strips as necessary. Ensure algae tablets and cleaning agent are compatible with the fin and tube material.	Annually	Repair or replace as necessary.

Air Side Coil				
q.	Inspect coil fins.	Ensure fins are straight and open. Clean and straighten as required.	Annually	Repair or replace as necessary.
r.	Inspect for condensate blowing from coil into cabinet or air distribution system.	Adjust fan speed, clean coil fins, to eliminate water carry over.	Annually	Repair or replace as necessary.
s.	Confirm correct airflow using delta-T and/or static pressure, and compare to OEM target.	Clean coils and blower as necessary. Adjust the system for proper airflow.	Annually	Repair or replace components as necessary.
t.	Measure and record dry bulb and wet bulb TD across evaporator coil ¹⁵ .	If DB and/or WB values are outside of appropriate OEM ranges, check for correct airflow, refrigerant charge, and operating conditions.	Annually	Repair or replace as necessary
Refrigeration				
u.	Inspect accessible refrigerant connecting lines, joints, and coils for oil leaks.	Test all oil stained joints for leaks, clean as necessary.	Annually	Repair or replace as necessary.
v.	Test reversing valve operation.	Record findings.	Semiannually	Repair or replace as components necessary.
w.	If indoor airflow is within OEM specifications but TD is not, check refrigerant charge using manufacturer recommended procedure ¹⁶ .	Adjust charge as necessary ¹⁷ .	Semiannually	Repair or replace components as necessary.
Closed Loop				
x.	Test pressure of the loop without the unit operating, as applicable.	Add water treatment solution or water to meet industry standards.	Semiannually	Repair or replace as necessary.
y.	Test closed loop solution for antifreeze concentration.	Add appropriate antifreeze if needed.	Annually	Repair or replace as necessary.

¹⁵ This is a minimum standard procedure, and a good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

¹⁶ A good diagnostic field practice is to measure superheat or subcooling to ensure proper refrigerant charge.

¹⁷ Ensure that the metering device (and sensing bulb) is properly installed.

Water Loop (Open or Closed)				
z.	Inspect water pump.	Clean or clear as needed to reduce cavitation and ensure proper operation.	Annually	Repair or replace as necessary.
aa.	Confirm correct water flow, and compare to OEM target.	Adjust the system for proper water flow.	Annually	Repair or replace as necessary.
bb.	Confirm correct refrigerant charge using superheat or subcooling and compare to OEM target.	Adjust charge as necessary.	Annually	Repair or replace as necessary.
cc.	Inspect any screen on source water systems.	Clean as necessary.	Annually	Repair or replace as necessary.

Checklist 5.14-HW Additional Tasks for Hot Water Recovery				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
a.	Measure and record amperage to DHW heat recovery pump.	If outside OEM rating or specification inspect for cause.	Semiannually	Repair or replace as necessary.
b.	Measure and record TD of water entering and leaving DHW at the heat recovery pump.	Record location of improper plumbing or insulation of DHW lines and/or when the water temperature exceeds OEM specifications or local codes.	Semiannually	Repair or replace as necessary.
c.	Measure resistance of 120°F water temperature limit switch.	Record when the limit switch is not within OEM specifications.	Annually	Replace if shorted or out of OEM specifications

Checklist 5.15 Evaporative Coolers				
Normative				Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Cabinet				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Repair or replace insulation to ensure proper operation. Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment (as applicable). Seal air leaks.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks
b.	Inspect the required clearance (e.g., service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Electrical				
c.	Inspect electrical disconnect box.	Ensure electrical connections are clean and tight. Ensure fused disconnects use the proper fuse size and are not bypassed. Ensure case is intact and complete.	Semiannually	Repair or replace as necessary.
d.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary
e.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
f.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
g.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
h.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
i.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.
Blower Assembly				
j.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Semiannually	Repair or replace components as necessary to ensure proper operation.

Blower Assembly (Continued)				
k.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.

Evaporative Cooling				
l.	Inspect the cooler's bottom pan.	Clean thoroughly.	Semiannually	Repair or replace as necessary.
m.	Inspect water pump.	Clean the pump screen. Remove and foreign material from the hose adaptor. Clean other water pump components as necessary.	Annually	Repair or replace as necessary.
n.	Inspect the water distributor manifold and ports.	Flush with water.	Annually	Repair or replace portions of the manifold, nozzles, or fittings that do not perform per the OEM specifications.
o.	Inspect the evaporative cooling media pads.	Clean scale, dirt, and foreign material from the pads.	Annually	Replace pads that restrict airflow or do not perform to the OEM specifications.

Checklist 5.16 Accessories				
	Normative			Informative
#	Inspection Task	Maintenance Task	Frequency	Service Task Recommended Corrective Action
Common Cabinet Tasks				
a.	Inspect cabinet, cabinet fasteners, and cabinet panels.	Replace lost fasteners as needed to ensure proper integrity and fit/finish of equipment (as applicable). Clean accessible portions of cabinet interior.	Semiannually	Repair or replace insulation to ensure proper operation. Seal air leaks.
b.	Inspect the required clearance (e.g., combustion and service) around cabinet.	Record and report instances where the cabinet does not meet the requirements.	Semiannually	Repair or replace to ensure proper clearance.
Common Electrical Tasks				
c.	Ensure proper equipment grounding.	Tighten, as necessary.	Semiannually	Repair or replace as necessary.
d.	Measure and record line voltage.	Compare to OEM specifications or equipment nameplate data. Notify homeowner and/or utility.	Semiannually	Repair or replace as necessary.
e.	Inspect and test contactors and relays.	Look for pitting or other signs of damage.	Semiannually	Replace contactors and relays demonstrating evidence of excessive contact arcing and pitting.
f.	Inspect electrical connections and wire.	Ensure wire size and type match the load conditions. Tighten all loose connections, report heat discolored connections.	Semiannually	Repair or replace any damaged electrical wiring.
g.	Inspect motor capacitors.	Record those that are bulged, split, incorrectly sized, or do not meet OEM specifications.	Semiannually	Verify capacitance with a meter replace as necessary.
h.	Measure and record amperage draw to motor/nameplate data (FLA) as available.	If outside OEM rating or specification, inspect for cause.	Semiannually	Repair or replace as necessary.

Energy and Heat Recovery Ventilators				
i.	Inspect filters and filter racks.	Clean filters and adjust filter racks as necessary to ensure proper fit and seal of filters per OEM's specifications.	Semiannually	Repair or replace as necessary.
j.	Inspect transfer core.	Wait for core to dry and clean core as necessary.	Semiannually	Repair or replace as necessary.
k.	Inspect fresh air intake vent.	Clear and remove debris to provide to allow for proper airflow.	Semiannually	Repair or replace as necessary.
Energy and Heat Recovery Ventilators (Continued)				
l.	Inspect fan belt tension. Inspect belt and pulleys for wear and tear.	Adjust fan belt tension and alignment as required.	Semiannually	Repair or replace components as necessary to ensure proper operation.
m.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. Record when amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
Central System Humidifiers				
n.	Inspect humidifier pad.	Clean as necessary.	Annually	Repair or replace as necessary.
o.	Inspect water line by gently flexing it and looking for cracks or signs of leakage.	Record if the water tube if it is cracked, brittle or has been damaged.	Annually	Replace tube if it is cracked, brittle or has been damaged.
p.	Inspect pad tray and frame.	Clean the tray and frame of mineral deposits as necessary.	Annually	Repair or replace as necessary.
q.	Inspect drain hose and fitting.	Clean as necessary.	Annually	Repair or replace as necessary.
Central System Dehumidifiers				
r.	Inspect for particulate accumulation on filters.	Clean or replace filters if accumulation results in PD higher than design or airflow is outside of established operating limits	Semiannually	Repair or replace as necessary.
s.	Inspect air filter housing integrity and air seal.	Clean as needed.	Semiannually	Repair or replace as necessary.

Central System Dehumidifiers (Continued)				
t.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Semiannually	Repair or replace as necessary.
u.	Inspect drain pan and accessible drain line for biological growth.	Clean as needed to remove bio growth and ensure proper operation, add algae tablets or strips as necessary.	Annually	Repair or replace as necessary.
v.	Confirm the fan blade or blower wheel has a tight connection to the blower motor shaft. Inspect fan for free rotation and minimal endplay. Measure and record amp draw.	Lubricate bearings as needed, only if recommended by OEM. record when the amp draw exceeds OEM specifications then adjust motor speed or otherwise remedy the cause.	Annually	Repair or replace as necessary.
w.	Inspect coil fittings and fins.	Ensure fins are straight and open. Check U-Tubes for signs of refrigerant leaks. Clean and straighten as required.	Annually	Repair or replace as necessary.
Electronic Air Cleaners				
x.	Inspect for particulate accumulation on pre-filters.	Clean if accumulation results in PD higher than design or airflow is outside of established operating limits.	Semiannually	Repair or replace as necessary.
y.	Inspect the electrodes or collector plates.	Clean as necessary.	Semiannually	Repair or replace as necessary.
Media Air Cleaners				
z.	Inspect for particulate accumulation on pre-filters.	Replace if accumulation results in PD higher than design or airflow is outside of established operating limits.	Semiannually	Repair or replace as necessary.
Ultra-violet Lights				
aa.	Inspect UV lamps.	Clean or replace to ensure proper operation. UV lamps may contain mercury and must be disposed of properly. Do not throw old lamps into the trash.	Semiannually	Repair or replace as necessary.

Economizers				
bb.	Inspect inlet screen or filter for accumulation, blockage, wear and state of repair.	Clean filters as necessary.	Semiannually	Repair or replace as necessary.
cc.	Inspect minimum position of outside air damper.	Adjust air damper position per design specifications or applicable codes. .	Semiannually	Repair or replace as necessary.
dd.	Inspect rain hood for proper attachment, security, and signs of water leakage inside the rain hood.	Record location of attachment failures and water damage.	Annually	Repair or replace as necessary.
ee.	Inspect actuator motors for free range of motion.	Adjust for proper operation.	Annually	Repair or replace as necessary.
Condensate Pumps				
ff.	Test condensate pump operation and inspect condition.	Clean, flush and test for proper operation.	Annually	Repair or replace as necessary.
gg.	Inspect condensate drain piping (and traps) for proper operation.	Clean, and check for proper drainage.	Annually	Repair or replace as necessary.

APPENDIX A – DEFINITIONS

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

access (to): That which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, door or similar obstruction.

air distribution system: The network of plenums, ducts, fittings, grilles, and registers which move air from the house to the HVAC system and then deliver the conditioned air to the house.

Amps (ampere; A): A unit of electric current.

CO: Carbon monoxide, a poisonous, colorless, odorless gas created during incomplete combustion of fossil fuels.

CO₂: Carbon dioxide, a by-product of fossil fuel combustion.

CPH: Cycles per hour, the number of times a unit cycles on and off in one hour.

DHW: Domestic hot water, heated water for domestic use.

ECM: Electronically commutated motor uses electronics to commutate the motor instead of brushes.

ERV: Energy recovery ventilator. Conditions fresh air from outdoors brought into a home while exhausting contaminated air. A special core transfers both sensible (temperature) and latent (moisture) heat from the exhaust air stream to the incoming air stream or visa-versa, depending on the mode of operation (heating or cooling).

FLA: Full load amps, electric current draw of an induction motor under full load.

HRV: Heat recovery ventilator. Conditions fresh air from outdoors brought into a home while exhausting contaminated air. A special core transfers only sensible (temperature) heat from the exhaust air stream to the incoming air stream or visa-versa, depending on the mode of operation (heating or cooling).

HVAC: Heating, ventilating and air conditioning.

inspect: The visual examination and/or taking of appropriate measurements so as to assess a component's physical condition and/or performance of its intended function.

maintain / maintenance: The process of identifying existing or potential faults, coordinating the allocation of resources to correct the faults, and then applying corrective or remedial measures. In an HVAC system, this will support equipment efficiency, promote healthy clean air, watch against unexpected failure, and promote a correct equipment life cycle. This includes terms like inspecting, repairing, servicing, and parts replacement.

maintenance contractors: Appropriately licensed person or persons responsible for maintaining the HVAC equipment. Referred to throughout this standard as the "HVAC contractor."

maintenance program (for residential HVAC): A program which, at regularly scheduled intervals, will systematically inspect, test, measure, and preserve an HVAC system.

maintenance task: is a work item, requiring a minimum of tools to adjust components and restore expendable materials (such as fluids and filters) to their agreed upon condition.

Informative Note: Typical examples of such tasks include cleaning, adjusting, tightening, calibration, measurement, and lubrication.

metering device: A valve, orifice, or small fixed diameter tubing that meters liquid refrigerant into the evaporator.

MFD (microfarad; μf): The capacitance equal to 1/1,000,000 of a farad, which is unit of electric capacitance.

micron (μm): A unit of measurement equal to 1/1000 of a millimeter. One micron equals .00003936 inches.

OEM: Original equipment manufacturer.

PD: Pressure difference, numerical value determined by subtracting the lower pressure from a high pressure.

RLA: Run or Rated load amps, electric current draw of an induction motor under full load.

reversing valve or four-way valve: A valve found in heat pumps that changes the direction of refrigerant flow between heating and cooling cycles.

safety: condition of being safe; freedom from danger or hazard.

service task: is a work item indicated by an inspection or maintenance task or as determined to be required on a routine basis by the maintenance plan.

test: Engage the operation of a system or a component and compare the results to the manufacturer's specifications or an approved standard.

TD: Temperature difference, numerical value determined by subtracting the lower temperature from a higher temperature.

water pressure/temperature port: A port used to take pressure or temperature readings, designed to eliminate gauge cocks and thermometer wells.

APPENDIX B – HVAC BIBLIOGRAPHY & RESOURCES

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

The following documents are offered for informational purposes only and are not considered part of the requirements of this standard. The editions/versions/dates of the documents indicated here are current as of the date of this ACCA standard.

ACCA **Air Conditioning Contractors of America (2800 Shirlington Road, Suite 200, Arlington, VA, 22206; tel: 703/575-4477; www.acca.org)**

Standards

ANSI /ACCA 2 Manual J - 2016	Residential Load Calculation
ANSI/ACCA 1 Manual D - 2016	Residential Duct Systems
ANSI/ACCA 3 Manual S - 2014	Residential Equipment Selection
ANSI/ACCA 11 Manual Zr - 2018	Residential Zoning
ANSI/ACCA 5 QI - 2015	HVAC Quality Installation Specification
ANSI/ACCA 6 QR - 2015	Restoring the Cleanliness of HVAC Systems
ANSI/ACCA 9 QIvp - 2016	HVAC Quality Installation Verification Protocols
ANSI/ACCA 12 QH - 2018	Home Evaluation and Performance Improvement

Other Documents

- Manual B Balancing and Testing Air and Hydronic Systems, 2009
- Manual T, Air Distribution Basics, 1995
- Technician’s Guide and Workbook for Duct Diagnostics and Repairs, 2016
- Technician’s Guide and Workbook for Quality Installations, 2015
- Technician’s Guide and Workbook for Home Evaluation and Performance Improvement, 2015
- B. A. Penney, J. E. Woods, and G. C. Hourahan, Good HVAC Practices for Residential and Commercial Buildings: A Guide for Thermal, Moisture and Contaminant Control to Enhance System Performance and Customer Satisfaction, 2003

AHRI **Air Conditioning, Heating and Refrigeration Institute (2111 Wilson Blvd, Suite 500, Arlington, VA, 22201; tel: 703/524-8800; www.ahrinet.org)**

Standards and Guidelines

Standard 210/240	Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment, 2017
Standard 700	Specification for Fluorocarbon Refrigerants, 2016
Standard 740	Refrigerant Recovery/Recycling Equipment, 2016
Standard 880	Air Terminals, 2017
Guideline K	Containers for Recovered Non-Flammable Fluorocarbon Refrigerants, 2015
Guideline Q	Content Recovery and Proper Recycling of Refrigerant Cylinders, 2016

Other

- AHRI Product Certification directory/database: AHRI certification consists of manufacturers who voluntarily participate in independent testing to ensure that their product will perform according to published claims at specified controlled testing conditions.

- Industry Recycling Guide (IRG-2), Handling and Reuse of Refrigerants in the US, 1994

ASHRAE **American Society of Heating, Refrigerating and Air-Conditioning Engineers (1791 Tullie Circle, NE., Atlanta, GA; tel: 404/636-8400; www.ashrae.org)**

Standards and Guidelines

Standard 62.2 Ventilation for Acceptable Indoor Air Quality in Low-Rise Residential Buildings, ANSI Approved, 2016

Standard 90.2 Energy Efficient Design of Low-Rise Residential Buildings, 2007

Other Documents

- L. Harriman, G. W. Brundrett, and R. Kittler, Humidity Control Design Guide for Commercial and Institutional Buildings, 2001

EPA **Environmental Protection Agency Office of Radiation and Indoor Air Indoor Environments Division (6601 J; 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 (202) 343-9370 www.epa.gov/iaq7)**

- §608, Clean Air Act, Stationary Refrigeration and Air-Conditioning, Halon Blends & Handling
- “Should you have the air ducts in your home cleaned,” EPA-402-K-97-002, October 1997

IAPMO **International Association of Plumbing and Mechanical Officials (5001 E. Philadelphia Street, Ontario, CA, 91761; tel: 909.472.4100; www.iapmo.org)**

- Uniform Mechanical Code, 2018
- Uniform Plumbing Code, 2018

ICC **International Code Council (500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001; tel: 888/422-7233; www.iccsafe.org)**

- International Energy Conservation Code, 2018
- International Fire Code, 2018
- International Residential Code, 2015
- International Mechanical Code, 2018
- International Fuel Gas Code, 2018
- International Property Maintenance Code, 2015

IGSHPA **International Ground Source Heat Pump Association (1201 S Innovation Way, Suite 400, Stillwater, OK 74078; tel: 405/744-5175; www.igshpa.okstate.edu)**

IGSHPA develops and publishes a variety of standards for the design and installation of geothermal heat pump ground loops.

NATE **North American Technician Excellence (2111 Wilson Blvd, Suite 510, Arlington, VA, 22203; tel: 703/276-7247; www.natex.org)**

NATE offers certifications tests for service and installation technicians to highlight relevant applied knowledge. Separate ‘service’ and ‘installation’ tests are given in the following specialty categories: air conditioning, distribution, air-to-air heat pump, gas heating (air), oil heating (air), hydronics gas, hydronics oil.

NADCA **National Air Duct Cleaning Association (15000 Commerce Parkway, Suite C, Mt. Laurel, NJ 08054; tel: 865/380-6810; www.nadca.com)**

- ACR Standard, 2013 edition: Assessment, Cleaning & Restoration of HVAC Systems

- NFPA** **National Fire Protection Association (1 Batterymarch Park, Quincy, MA, 02169; tel: 617/770-300; www.nfpa.org)**
 NFPA 31 Standard for the Installation of Oil-Burning Equipment, 2016
 NFPA 54 National Fuel Gas Code, 2018
 NFPA 58 Liquid Petroleum Gas Code, 2017
 NFPA 70 National Electric Code, 2017
 NFPA 90a Standard for the Installation of Air Conditioning and Ventilating Systems, 2018
 NFPA 90b Standard for the Installation of Warm Air Heating and Air-Conditioning Systems, 2018
- PHCC** **Plumbing-Heating-Cooling Contractors-National Association (180 S. Washington Street, Falls Church, VA, 22046; tel: (703) 237-8100; www.phccweb.org)**
 – Heating and Cooling Technical Manual
 – Variable Air Volume Systems
- RSES** **Refrigeration Service Engineers Society (1911 Rohlwing Road, Suite A, Rolling Meadows, IL, 60008; tel: 847/297-6464; www.rses.org)**
 Various training manuals, self-study courses, classes and CDs to enhance the professional development of practitioners within the refrigeration sector.
- SMACNA** **Sheet Metal and Air Conditioning Contractors' National Association (4201 Lafayette Center Drive, Chantilly, VA, 20151; tel: 703/803-2980; www.smacna.org)**
 – Fibrous Glass Duct Construction Standards, 2003
 – HVAC Air Duct Leakage Test Manual, 2012
 – HVAC Duct Systems Inspection Guide. 2006
 – HVAC Duct Construction Standards, Metal and Flexible, 2006
 – HVAC Systems Commissioning Manual. 1994
 – HVAC Systems Testing, Adjusting & Balancing. 2002
- UL** **Underwriters Laboratories Inc., (333 Pfingsten Road, Northbrook, IL 60062; tel: 847/272-8800; www.ul.com)**
 Standards
 UL 181 Standard for Safety Factory-Made Air Ducts and Air Connectors, 2013
 UL 181A Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors, 2013
 UL 181B Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors, 2013
 UL60335-2-40 Household and Similar Electrical Appliances-Safety- Part 2-40: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers, 2017



Air Conditioning Contractors of America

2800 Shirlington Road, Suite 300

Arlington, VA 22206

www.acca.org

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