

**HVAC SYSTEM MAINTENANCE
U.S. ARMY CORPS OF ENGINEERS
OTTER BROOK LAKE
KEENE, NH
PERFORMANCE WORK STATEMENT**

APPENDIX C
Training Manuals

Table Of Contents

Training Manuals

1. Air Handling Unit
2. Cabinet Unit Heater
3. Mini Split
4. Boiler
5. Circulator Pumps
6. Heat Pump Water Heater



Routine Maintenance

⚠️ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, **MUST** follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

⚠️ WARNING

Rotating Components!

Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury. The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel.

Maintenance Checklist

Table 44. Maintenance Checklist

Frequency	Maintenance
Every week	Observe unit weekly for any change in running condition and unusual noise.
Every month	<ul style="list-style-type: none">• Clean or replace air filters if clogged or dirty.
Every three to six months	<ul style="list-style-type: none">• Manually rotate the fan wheel to check for obstructions in the housing or interference with fan blades. Remove any obstructions and debris.• Check motor bracket torque.• Inspect and clean drain pans.• Inspect coils for dirt build-up. Clean fins if airflow is clogged.
Every year	<ul style="list-style-type: none">• Inspect the unit casing for chips corrosion. If damage is found, clean and repaint.• Clean the fan wheels. Remove any rust from the shaft with an emery cloth and recoat with L.P.S. 3 or equivalent.• Inspect and clean drain pans.• Check damper linkages, fan set screws, and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings.• Clean damper operators.• Inspect, clean, and tighten all electrical connections and wiring.• Rotate the fan wheel and check for obstructions. The wheel should not rub. Adjust the center if necessary.• Examine flex connections for cracks or leaks. Repair or replace damaged material.

Air Filters

⚠️ WARNING

Rotating Components!

Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury. The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel.

Always install filters with directional arrows pointing toward the fan. For units with high efficiency filters (MERV 8 or MERV 13), the filters need to be replaced with equivalent MERV-rated filters to maintain unit performance.

Fans

⚠️ WARNING

Rotating Components!

Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury. The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel.

Inspecting and Cleaning Fans

Fan sections of air handlers should be inspected every six months at a minimum or more frequently if operating experience dictates. If evidence of microbial growth (mold) is found, identify and remedy the cause

immediately. Refer to ["Diagnostics and Troubleshooting, p. 108](#) for possible causes and solutions. To clean the fan section:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any contamination.
3. Vacuum the section with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
4. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
5. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
6. Allow the unit to dry completely before putting it back into service.

7. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized..

Fan Motors

Inspect fan motors periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection.

Torque Rating

Check and adjust fan wheel set screws whenever a component is removed or an adjustment is made. Refer to [Table 45](#) for recommendations.

Table 45. Recommended torques

	Torque (in·lb)	Ft·lb	N·m
Fan wheel screw	120-130	10.0-10.8	13.6-14.7

Table 46. BCHD/BCVD fan, filter, and mixing box general data

Unit Size	12	18	24	36	54	72	90
Nominal cfm	400	600	800	1200	1800	2400	3000
Air flow							
Minimum cfm	250	375	500	750	1125	1500	1875
Maximum cfm	500	675	1000	1600	2400	3000	4000
Fan data							
Fan wheel, in. (dia. x width)	9.5 x 4.5	9.5 x 4.5	9.5 x 6.0	9.5 x 6.0	12.6 x 9.5	12.6 x 9.5	12.6 x 9.5
RPM range	900-2300	900-2300	800-2000	800-2000	600-1500	600-1500	600-1500
Motor hp	1/2-1	1/2-1	1/2-1	1/2-1	1/2-3	1/2-3	1/2-3
Unit flat filter							
(Qty.) Size	(1) 12 x 24	(1) 12 x 24	(1) 16 x 25	(2) 16 x 20	(2) 20 x 20	(1) 20 x 20 (1) 20 x 25	(3) 16 x 25
Area, sq. ft	2.000	2.000	2.778	4.444	5.556	6.250	8.333
Velocity, ft/min.	200	300	288	270	324	384	360
Angle filter							
(Qty.) Size	(2) 12 x 24	(2) 12 x 24	(2) 12 x 24	(2) 20 x 20	(4) 16 x 20	(6) 16 x 16	(6) 16 x 20
Area, sq. ft	4.000	4.000	4.000	5.556	8.889	8.889	11.111
Velocity, ft/min.	100	150	200	216	203	270	270
Bottom / top access filter box							
(Qty.) Size	(1) 12 x 20	(1) 12 x 24	(1) 16 x 25	(1) 16 x 20 (1) 16 x 16	(1) 16 x 20 (1) 20 x 20	(1) 20 x 25 (1) 20 x 20	(1) 16 x 25 (2) 14 x 25
Area, sq. ft	1.700	2.000	2.800	4.000	5.000	6.300	8.000
Velocity, ft/min.	240	300	288	300	360	384	375
Mixing box							
Damper opening width, in.	15.5	19.5	19.5	31.5	31.5	31.5	31.5
Damper opening height, in.	7	7	7	7	12.75	12.75	12.75
Area, sq. ft	0.753	0.948	0.948	1.531	2.789	2.789	2.789
Velocity, ft/min.	531	633	844	784	645	861	1076

Note: Minimum air flow limits apply to units with hot water or electric heat only. There is no minimum airflow limit on cooling on units. Maximum airflow limits are to help prevent moisture carryover.



Routine Maintenance

Table 47. BCCD fan and filter general data

Unit Size	24	36	48	60
Nominal cfm	800	1200	1600	2000
Airflow				
Minimum cfm	500	750	1000	1250
Maximum cfm	1000	1500	2000	2500
Fan data				
Fan wheel, in. (dia. x width)	9.50 x 6.00	9.50 x 6.00	12.60 x 8.00	12.60 x 8.00
RPM range	800-2000	800-2000	600-1400	600-1400
Motor hp	0.50-1.00	0.50-1.00	0.50-1.00	0.50-1.00
Unit flat filter				
(Qty.) Size	(1) 12 x 24	(1) 18 x 24	(1) 18 x 20	(1) 18 x 24
Area, sq. ft	2.00	3.00	4.20	5.00
Velocity, ft/min.	400	400	380	400

Note: Minimum air flow limits apply to units with hot water or electric heat only. There is no minimum airflow limit on cooling only units. Maximum airflow limits are to help prevent moisture carryover.

Table 48. BCHD/BCVD coil general data

Unit Size	12	18	24	36	54	72	90
Nominal cfm	400	600	800	1200	1800	2400	3000
Hydronic and DX coil data							
Area - ft ²	0.89	1.11	1.67	2.67	4.00	5.00	6.67
Width - in. (a), (b)	8.00	8.00	12.00	12.00	18.00	18.00	24.00
Length - in. (d)	16.00	20.00	20.00	32.00	32.00	40.00	40.00
Velocity - ft/min.	450	540	480	450	450	480	450
Hydronic coil data - high capacity							
Area - ft ²	0.89	1.11	1.67	2.67	3.89	4.86	6.25
Width - in. (a), (c)	8.00	8.00	12.00	12.00	17.50	17.50	22.50
Length - in. (d)	16.00	20.00	20.00	32.00	32.00	40.00	40.00
Velocity - ft/min.	450	540	480	450	463	494	480
1-row coil							
Minimum gpm (e)	1.00	1.00	1.00	1.00	6.10	6.10	7.90
Maximum gpm (f)	5.20	5.20	5.20	5.20	32.60	32.60	42.00
Dry coil weight - lb	4.40	5.20	6.60	9.30	17.60	20.40	25.80
Wet coil weight - lb	5.10	6.00	7.80	11.00	22.40	26.00	32.90
Internal volume - in ³	19.40	22.20	33.20	47.10	132.90	155.10	196.60
2-row coil - high capacity							
Minimum gpm (e)	1.00	1.00	2.00	2.00	6.10	6.10	7.90
Maximum gpm (f)	5.20	5.20	10.40	10.40	32.60	32.60	42.00
Dry coil weight - lb	5.90	7.00	9.90	14.10	27.20	32.10	39.40
Wet coil weight - lb (kg)	7.20	8.40	12.30	17.60	36.10	42.50	52.60
Internal volume - in ³	36.00	38.80	66.50	96.90	246.50	288.00	365.50
3-row coil - DX coil							
Internal volume - in ³	50	60	96	141	225	269	381
4-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.80	8.80	11.70
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.00	47.00	62.60
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	37.20	44.50	58.50
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	48.30	57.70	77.00
Internal volume - in ³ (g)	n/a	n/a	n/a	n/a	307.40	365.50	512.30
4-row coil - high capacity							
Minimum gpm (e)	2.00	2.00	2.90	2.90	6.10	6.10	7.90
Maximum gpm (f)	10.40	10.40	15.70	15.70	32.60	32.60	42.00
Dry coil weight - lb	10.50	12.40	17.70	25.50	47.00	56.30	73.10
Wet coil weight - lb	13.10	15.50	22.50	32.50	62.70	74.90	97.90
Internal volume - in ³	72.00	85.80	132.90	193.80	433.00	516.70	688.30
4-row coil - DX coil							
Internal volume - in ³	65	78	123	182	287	346	484
6-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.80	8.80	11.70
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.00	47.00	62.60
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	52.40	63.10	82.70
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	68.10	82.00	108.70
Internal volume - in ³ (g)	n/a	n/a	n/a	n/a	434.80	523.40	720.00
6-row coil - high capacity							
Minimum gpm (e)	2.0	2.00	2.90	2.90	6.10	6.10	7.90
Maximum gpm (f)	10.4	10.40	15.70	15.70	32.60	32.60	42.00
Dry coil weight - lb	14.6	17.40	24.70	36.10	65.40	78.60	101.50
Wet coil weight - lb	18.2	21.80	31.50	46.10	87.80	105.60	137.00
Internal volume - in ³	99.7	121.80	188.30	276.90	620.40	745.90	983.10
6-row coil - DX coil							
Internal volume - in ³	94	114	176	265	411	500	689
Steam coil data							
Area - ft ²	0.71	0.88	1.75	2.75	4.13	5.13	6.83
Width - in. (a)	6.00	6.00	12.00	12.00	18.00	18.00	24.00
Length - in. (d)	17.00	21.00	21.00	33.00	33.00	41.00	41.00
Velocity - ft/min.	26.00	25.00	18.00	17.00	17.00	16.00	16.00
1-row coil							
Minimum steam press - psig	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Maximum steam press - psig	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Dry coil weight - lb	16.70	18.70	32.50	41.10	57.40	64.80	84.90
Wet coil weight - lb	18.20	20.40	36.00	45.80	64.50	73.20	96.10
Internal volume - in ³	41.70	47.70	95.30	130.80	196.10	231.60	308.70

(a) Coil width = Length in the direction of a coil header, typically vertical.

(b) "Hydronic and DX coil data" width dimensions apply only to DX coils (all unit sizes), 1-row standard capacity hydronic coils (unit sizes 012 through 036), and 4-row and 6-row standard capacity hydronic coils (054 through 090).

(c) "High-capacity hydronic coil data" width dimensions apply only to 1-row standard capacity hydronic coils (unit sizes 054 through 090) and 2-row, 4-row, and 6-row high capacity hydronic coils (all unit sizes).



Routine Maintenance

- (d) Coil length = Length of coil in direction of the coil tubes, typically horizontal and perpendicular to airflow.
 (e) The minimum waterflow at 1.5 fps tubeside velocity is to ensure the coil self-vents properly. There is no minimum waterflow limit for coils that do not require self venting.
 (f) Maximum gpm limits are to prevent erosion and noise problems.
 (g) DX coil height and width dimensions are same as comparable hydronic coils. Four- and six-row DX coil dry weight dimensions are same as comparable 4-row and 6-row hydronic coils. A 3-row DX coil dry weight is 25% less than a comparable 4-row hydronic coil. Internal volumes are approximately 6% less than comparable hydronic coils.

Table 49. BCCD coil general data

Unit size	24	36	48	60
Nominal cfm	800	1200	1600	2000
Hydronic coil and DX coil data				
Area - ft ²	1.67	2.50	3.47	4.17
Width - in. (a)	12.00	18.00	20.00	24.00
Length - in. (b)	20.00	20.00	25.00	25.00
Velocity - ft/min	480	480	461	480
1 - row coil				
Minimum gpm (c)	1.40	1.40	2.30	2.70
Maximum gpm (d)	7.10	7.10	11.80	14.10
Dry coil weight - lb	4.80	6.30	8.30	9.60
Wet coil weight - lb	6.20	8.30	10.90	12.70
Internal volume - in ³	38.80	55.40	72.00	85.90
2 - row coil				
Minimum gpm (c)	2.70	4.10	4.50	5.40
Maximum gpm (d)	14.10	21.20	23.60	28.30
Dry coil weight - lb	7.60	10.50	13.80	16.20
Wet coil weight - lb	10.00	14.10	18.60	21.90
Internal volume - in ³	66.50	99.70	133.00	157.90
4 - row coil				
Minimum gpm (c)	2.70	4.10	4.50	5.40
Maximum gpm (d)	14.10	21.20	23.60	28.30
Dry coil weight - lb	14.60	20.00	27.00	31.50
Wet coil weight - lb	19.40	27.20	36.90	43.30
Internal volume - in ³	133.00	199.50	274.30	326.90
6 - row coil				
Minimum gpm (c)	2.70	4.10	4.50	5.40
Maximum gpm (d)	14.10	21.20	23.60	28.30
Dry coil weight - lb	19.70	27.70	37.50	44.10
Wet coil weight - lb	26.70	38.10	51.80	61.10
Internal volume - in ³	193.90	288.10	396.20	471.00

Coils

All coils should be kept clean to maintain maximum performance.

Steam and Water Coils

⚠️ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

⚠️ WARNING

Hazardous Chemicals!

Failure to follow all safety instructions below could result in death or serious injury. Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices.

To clean steam and water coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
 - Maintain minimum nozzle spray angle of 15 degrees.
 - Spray perpendicular to the coil face.
 - Keep the nozzle at least 6 inches from the coil.
 - Do not exceed 600 psi.
6. Spray the leaving air side of the coil first, then the entering air side.

7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins that may have been damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials.

Refrigerant Coils

⚠️ WARNING

Hazardous Pressures!

Failure to follow safety precautions below could result in coil bursting, which could result in death or serious injury. Coils contain refrigerant under pressure. When cleaning coils, maintain coil cleaning solution temperature under 150°F to avoid excessive pressure in the coil.

To clean refrigerant coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
 - Maintain minimum nozzle spray angle of 15 degrees.
 - Spray perpendicular to the coil face.
 - Keep the nozzle at least 6 inches from the coil.
 - Do not exceed 600 psi.
6. Spray the leaving air side of the coil first, then the entering air side.
7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.

Routine Maintenance

8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Coil Winterization

Water coil winterization procedures consist primarily of draining water from the coil before the heating season. Trane recommends flushing the coil with glycol if coils will be exposed to temperatures below 35 degrees.

NOTICE

Coil Freeze-up!

Failure to follow instructions below could result in coil damage. Drain and vent coils when not in use. Trane recommends glycol protection in all possible freezing applications. Use a glycol approved for use with commercial cooling and heating systems and copper tube coils.

Install field-fitted drains and vents to permit winterization of coils not in use and to assist in evacuating air from the water system during startup. If draining is questionable because of dirt or scale deposits inside the coil, fill the coil with glycol before the heating season begins.

Individual coil types determine how to properly winterize the coil. To determine the coil type find the "Service Model No of Coil" on the coil section nameplate. The coil type is designated by the second and third digits on that model number. For example, if the model number begins with "DUWB," the coil type is UW; if the model number begins with "DW0B," the coil type is W.

Note: On many unit sizes, there are multiple coils in the coil section. Be sure to winterize all coils in a given coil section.

To winterize type D1, D2, WL, LL, UA, UW, UU, W, P2, P4, P8, WD, 5D, and 5W coils:

1. Remove the vent and drain plugs.
2. Blow the coil out as completely as possible with compressed air.
3. Fill and drain the coil several times with full strength glycol so that it mixes thoroughly with the water retained in the coil.
4. Drain the coil out as completely as possible.

5. To ensure no water remains in the coil, do not replace the vent and drain plugs until the coils are put back into service.

Note: Use care in removing header plugs from Type P2, P4, and P8 coils. Over-torquing may result in twisted tubes.

Moisture Purge Cycle

By its very nature, any HVAC unit with a cooling coil serves as a dehumidifier, reducing the surrounding air's ability to hold water vapor as its temperature falls. This normally doesn't present a problem when the unit is running. However, when the fan stops, water vapor condenses on the cold metal surfaces inside the air handler and remains there until the air warms sufficiently to re-evaporate it. This damp, dark environment—though temporary—can encourage the growth of mold, mildew, and other microbial contaminants.

Providing a moisture purge cycle 15 to 30 minutes after shutdown disperses the cold, humid air inside the air-handling system more evenly throughout the building. This four-step cycle:

- Closes the outdoor air dampers.
- Turns off the cooling coil.
- Opens any variable-air-volume terminals connected to the air handler.
- Operates the supply fan for 10 to 15 minutes.

Air movement discourages water condensation and hastens re-evaporation of any condensate that does happen to form. This simple preventative measure effectively combats microbial growth and curbs moisture-related deterioration of air-handling components.

Cleaning Non-Porous Surfaces

! WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

If microbial growth on a non-porous insulating surface (closed cell insulation or sheet metal surface) is observed:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a brush for sheet metal surfaces or a soft sponge on a foil face or closed cell foam surface to mechanically remove the microbial growth.

Note: Be careful not to damage the non-porous surface of the insulation.

3. Install a block-off to prevent spray from going into a dry section of the unit and/or system ductwork.

4. Thoroughly clean the contaminated area(s) with an EPA-approved sanitizer specifically designed for HVAC use.
5. Rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of the drain pan and drain line
6. Repeat steps 4 and 5 as necessary.
7. Confirm the drain line is open following the cleaning process.
8. Allow the unit to dry thoroughly before putting it back into service.
9. Replace all panels and parts and restore electrical power to the unit.
10. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Cleaning Porous Surfaces

⚠️ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

To clean a porous insulating surface (fiberglass insulation):

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a vacuum device with a HEPA filter (99.97 percent efficient at 0.3 micron particles) to remove the accumulated dirt and organic matter.
- Note: Be careful not to tear the insulation surface or edges.**
3. Confirm the drain line is open following the cleaning process.
4. Allow the unit to dry thoroughly before putting it back into service.
5. Replace all panels and parts and restore electrical power to the unit.
6. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Drain Pans

⚠️ WARNING

Hazardous Chemicals!

Failure to follow all safety instructions below could result in death or serious injury. Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices.

The condensate drain pan and drain line must be checked to assure the condensate drains as designed. This inspection should occur a minimum of every six months or more often as dictated by operating experience.

If evidence of standing water or condensate overflow exists, identify and remedy the cause immediately. Refer to ["Diagnostics and Troubleshooting," p. 108](#) for possible causes and solutions.

To clean drain pans:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any standing water.
3. Scrape solid matter off of the drain pan.
4. Vacuum the drain pan with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
5. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
6. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
7. Allow the unit to dry completely before putting it back into service.
8. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

MAINTENANCE

PERIODIC SERVICE

WARNING Open all disconnect switches and secure in that position before servicing unit. Failure to do so may result in personal injury or death from electrical shock.

Because of the simple design of the steam and hot water unit heaters, they are nearly maintenance free. However, depending on the environment, simple maintenance practices should be adopted.

Periodically check the finned surfaces and vacuum these as often as necessary to remove any accumulation of lint and dirt. Check fan blades and remove dirt accumulation. If fan blades are not cleaned they tend to become unbalanced.

Most of the motors supplied on the unit heaters have either ball bearings or sleeve bearings and should not require lubrication for long periods of time. It is however advisable that motor maintenance and lubrication recommended by the motor manufacturer be followed.

Check motors for dirt and dust accumulation, and remove any accumulation as often as necessary. Open type motors may overheat if the dirt or dust is not removed from ventilation openings.

CAUTION Allow rotating fans to stop before servicing to avoid serious injury to fingers and hands.

MOTOR LUBRICATION

Sleeve Bearings

Motors with oilers or oil holes are lubricated before shipment with a good grade of electric motor oil. Refill when necessary, with the motor at a stand-still, until oil reaches the proper level.

Use SAE 20W non detergent oil for motors operating in ambient temperatures of 32°F to 100°F (0°C to 38°C). Below 32°F (0°C), SAE 10W non detergent oil will be required.

The frequency of oiling will depend upon operating conditions and length of running time. Inspect the oilers or oil holes when cleaning the unit. If the unit has a fractional horse-power motor, lubricate at least once a year. Under high ambient conditions or constant fan operation, fractional horse-power motors should be lubricated every 90 days. On those motors without oilers or oil holes, follow the instructions given on the motor nameplate.

Ball Bearings

Ball bearing motors are pre-lubricated and normally not equipped with grease fittings. However, motors are equipped with removable grease plugs to allow installation of grease fittings if desired by owner. Motor manufacturers do not recommend or require on the job lubrication of ball bearing motors.

If on the job lubrication is required by the owner, use the following procedure: With the motor at a stand-still, remove the vent and grease plugs. Install grease fitting and add grease sparingly. Remove the old grease from the vent relief chamber. Operate the motor a few minutes before reinstalling the vent plug to allow excess grease to escape. If there is evidence of grease working out around the motor shaft, less grease should be added and the greasing periods lengthened. If grease continues to appear, take the motor to the motor manufacturer's authorized service station for repair.

NOTICE: Consult local motor manufacturer's service facility for information on type of grease and oil to be used.

NOTICE: The heater system should be checked once a year by a qualified technician. All maintenance/service information should be recorded accordingly on the inspection sheet provided in this manual.

Should maintenance be required, perform the following inspection and service routine:

CLEANING THE UNIT

The unit casing, fan, diffuser and coil should be cleaned thoroughly once a year. Coil heat transfer efficiency depends on cleanliness. The following recommended procedures may be performed when lubricating the motor and cleaning the coil.

1. Wipe all excess lubricant from the motor, fan and casing. Clean the motor thoroughly. A dirty motor will run hot and eventually cause internal damage.
2. Clean the coil:
 - a) Loosen the dirt with a brush on the fan side of the coil. Operate the motor allowing the fan to blow the loosened dirt through the unit.
 - b) Use high pressure air or steam on the side of the coil away from the fan.

NOTICE: A piece of cheesecloth or a burlap bag may be used to collect the large particles during the cleaning process.

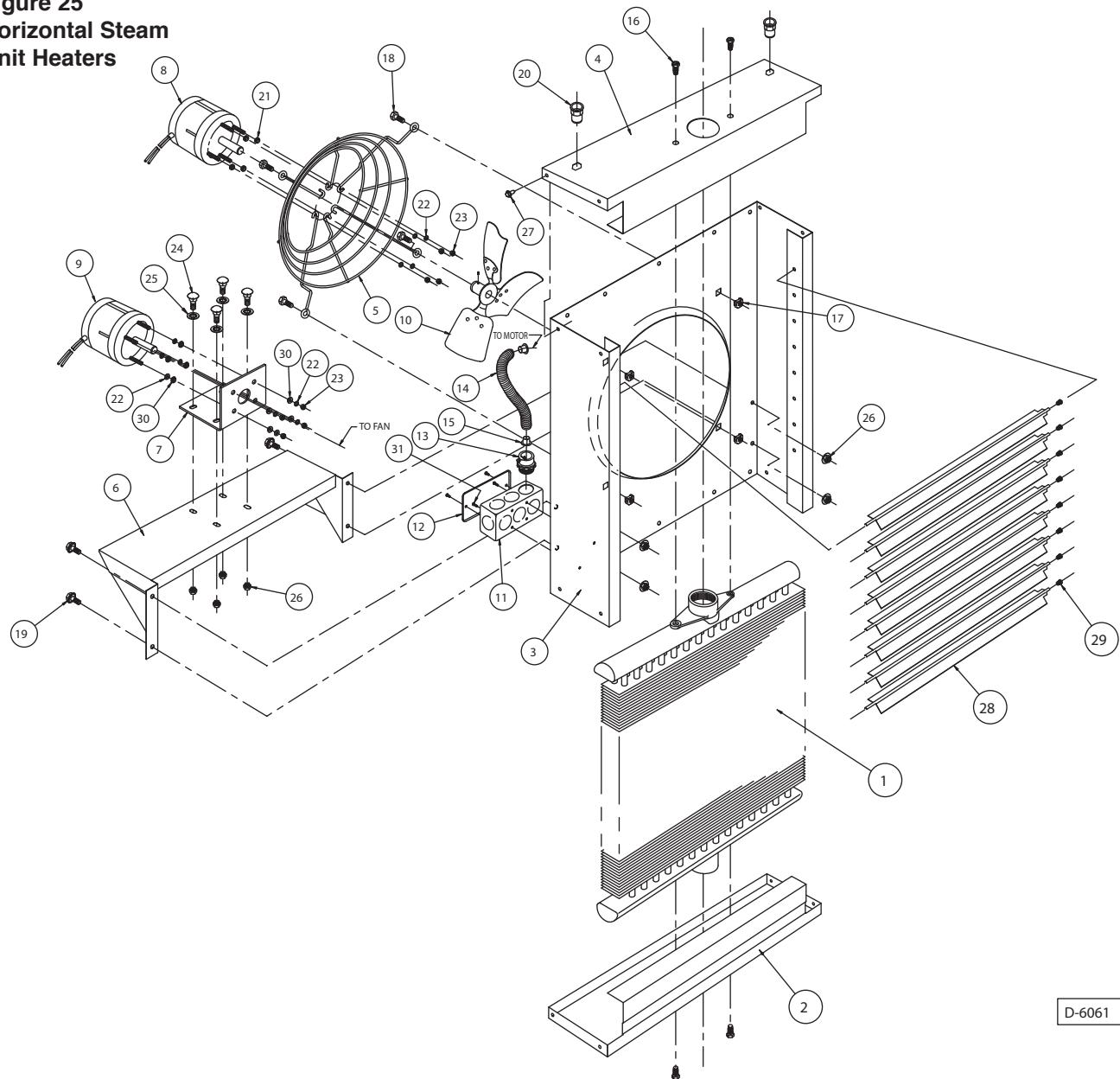
3. Clean the casing, fan blades, fan guard and diffuser using a damp cloth. Any rust spots on the casing should be cleaned and repainted.
4. Tighten the fan guard, motor frame and fan bolts. Check the fan for clearance in the panel orifice and free rotation.

REPLACEMENT PARTS

When ordering replacement parts

Model, Model Type (IE: Standard or Exp. Proof), Size & Item Numbers must be specified
Consult factory for price and availability

Figure 25
Horizontal Steam
Unit Heaters



HORIZONTAL STEAM UNIT HEATER PARTS

1 - Element (1)	10 - Fan (1)	21 - Grommet (4)
2 - Bottom Jacket Panel (1)	11 - Junction Box (1)	22 - Washer, Flat (4)
3 - Venturi Jacket Panel (1)	12 - Junction Box Cover (1)	23 - Nut (4)
4 - Top Jacket Panel (1)	13 - Connector (1)	24 - Bolt (4)
5 - Motor Mount & Fan Guard* [Std. Unit Shown]	14 - Conduit, Flex (1)	25 - Washer, Spring Lock (8)
6 - Motor Mounting Bracket [3 Phase and/or Explosion Proof]*	15 - Anti-Short (2)	26 - Nut (8)
7 - Motor Mounting Angle [3 Phase and/or Explosion Proof]* (1)	16 - Screw (4)	27 - Screw (2)
8 - Motor [Std. Units]*	17 - Nut Retainer (4)	28 - Louvers (Horiz)
9 - Motor [3 Phase and/or Explosion Proof]*	18 - Bolt (3) Models 24 & 36, (4) Models 48/204	29 - Cone Spring
	19 - Flange Screw	30 - Grommet, Stem (4)
	20 - Threaded Inserts	31 - Screw (18)

() = Qty Req'd per unit *Select One

Table 14 - Troubleshooting Guide

SYMPTOMS	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
A. Leaking coil.	1. Frozen coil. 2. Defective coil. 3. Corrosion. 4. Leak in joint.	1. Replace. 2. Replace. 3. Replace 4. Braze joint if joint is exposed where leak has occurred.
B. Poor output on steam.	1. Check for air in coil. 2. Lint on coil fins.	1. Repair or replace thermostatic air vent. 2. Clean coil and fins.
C. Poor output on steam or hot water.	1. No circulation of water through coil. 2. Short cycling of motor. 3. Backward rotating motor.	1. Check circulation pump. Check for blocked tubes. 2. Check voltage and correct. Check for linted coil and clean. Check for defective overload and repair or replace motor. 3. On single phase motor replace motor. On three phase motor, reverse two leads to change rotation.
D. Noisy or vibrating unit.	1. Damaged fan blade. 2. Dirty fan blade.	1. Change fan blade. 2. Clean fan blade.

HOW TO ORDER REPLACEMENT PARTS

Please send the following information to your local representative; If further assistance is needed, contact the manufacturer's customer service department.

- Model number
 - Serial Number (if any)
 - Part description and Number as shown in the Replacement Parts Catalog.
-

LIMITED WARRANTY

HORIZONTAL STEAM & HOT WATER UNIT HEATERS

The Manufacturer warrants to the original owner at the original installation site that the Horizontal Steam and Hot Water Unit Heaters (the "Product") will be free from defects in material and workmanship for a period not to exceed one (1) year from startup or eighteen (18) months from date of shipment from the factory, whichever occurs first. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the Manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective.

This limited warranty does not apply:

- if the Product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, has not been installed, maintained or operated in accordance with the furnished written instructions, or has been altered or modified in any way.
- to any expenses, including labor or material, incurred during removal or reinstallation of the defective Product or parts thereof.
- to any workmanship of the installer of the Product.

This limited warranty is conditional upon:

- shipment, to the Manufacturer, of that part of the Product thought to be defective. Goods can only be returned with prior written approval from the Manufacturer. All returns must be freight prepaid.
- determination, in the reasonable opinion of the Manufacturer, that there exists a defect in material or workmanship.

Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ALL SUCH OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS LIMITED WARRANTY. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE IN ANY WAY FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER, OR FOR ANY AMOUNTS IN EXCESS OF THE SELLING PRICE OF THE PRODUCT OR ANY PARTS THEREOF FOUND TO BE DEFECTIVE. THIS LIMITED WARRANTY GIVES THE ORIGINAL OWNER OF THE PRODUCT SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY BY EACH JURISDICTION.

EQUIPMENT START-UP

Customer _____ **Job Name & Number** _____

PRE-INSPECTION INFORMATION

Type of Equipment: Unit Heater
Serial Number _____ Model Number _____
Name Plate Voltage: _____ Name Plate Amperage: _____
Steam _____ Hot Water _____ Rating: _____ BTU @ _____ °F
_____ kw @ _____ °C

- Are all panels in place?
 - Has the unit suffered any external damage? Damage _____
 - Does the piping and electric wiring appear to be installed in a professional manner?
 - Has the piping and electric been inspected by the local authority having jurisdiction?
 - Is the supply properly sized for the equipment?
 - Were the installation instructions followed when the equipment was installed?
 - Have all field installed controls been installed?
 - Do you understand all the controls on this equipment? **If not, contact your wholesaler or rep. (DO NOT START this equipment unless you fully understand the controls.)**

FAN

With power on.

- Check voltage. L1_____ L2_____ L3_____
 - Check fan rotation.
 - Check motor amps. L1_____ L2_____ L3_____

Remarks:

- Attach unit to wall or ceiling using the three (3) slotted holes in each of the mounting brackets. Mounting brackets are designed to provide both lateral and vertical adjustments.
- Coils are interchangeable for right or left hand connections (units are shipped with left hand connections). **NOTE: If coil connections are reversed, fan speed control must also be reversed.** Coils should be level and adjustment in mounting hardware is provided. Coils for steam service may be pitched for condensate removal using the coil mounting hardware.
- Piping should always be installed and connected using good practice and in accordance with applicable codes.
- Wiring should be completed in accordance with applicable codes. All models are furnished as standard with a solid state variable speed fan control. The fan control, with connection box, is factory mounted on the right side of the unit unless otherwise specified. **NOTE: If coil connections are reversed, fan speed control must also be reversed.** If speed control is to be wall mounted, junction box must be furnished by others.
- Once installation has been completed, unit should be test run. If operational difficulties are experienced, recheck all wiring connections and power source.

FIELD INSTALLED OPTIONS

NOTES:

1. An "installation envelope" is packed with every unit and in it you will find installation instructions and various hardware items, including those listed below.
2. On orders for multiple units, various options may be packed in a separate carton(s) due to quantity. The notes below generally apply to single units of a given model/size.

Option 114 – Duct Collars: Packed in carton with unit. Hardware in "installation envelope". Installs over existing louver. These options are included when ordering models C-1150, RC-1190 and RC-1210. The required cutout (no louver) is provided on these three models.

Option 116 – Leveling Legs: Placed in cloth bag in installation envelope.

Options 118 & 119 – Manual and Motorized Outside Air Damper Kits: Shipped in separate box.

Options 125 and 127 – Aquastat & Line Voltage Thermostat: If either one of the two is ordered, its carton will be taped to the mounting bracket. If both are ordered, they will be shipped in a separate carton.

Options 126A & B – Wall Seals: Packed in carton with unit. Hardware in cloth bag inside installation envelope. Wall seals are included with models RC, RW and RWI, but must be ordered for all other models.

WALL SEAL SCHEDULE

Model	Fully Recessed	2 1/4" Partial Recess
F	F-1020, F-1030	F-1000, F-1010
FI	FI-1050	FI-1040
W, RW	RW-1120	W-1060, W-1070
WI, RWI	RWI-1130	WI-1090, WI-1100
C, RC	C-1170, RC-1200	C-1140, C-1150 C-1160, C-1180 RC-1190, RC-1210

Option 129 – Extra Filter: Packed inside unit carton with standard filter.

Option 140 – 24VAC - 40VA transformer: shipped in separate box.

MAINTENANCE INSTRUCTIONS

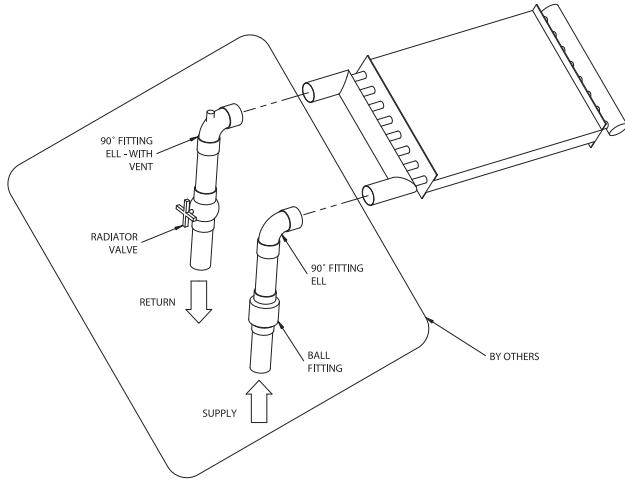
NOTE: Due to the reliability of our cabinet unit heaters, we do not recommend the stocking of any components or subassemblies.

MOTORS

Motors permanent split capacitor (PSC) type and are fitted with permanently lubricated sleeve bearings.

COILS

Coils should be kept clean to insure proper heat transfer. Frequency of cleaning is dependent upon operating environment. Coils may be vacuumed or the following method may be used: Brush the fins on the side where the air enters the unit and then operate the fan after placing a bag or damped cloth over the discharge of the unit to catch the dirt. High pressure air may be used to blow dirt out from the air leaving side.



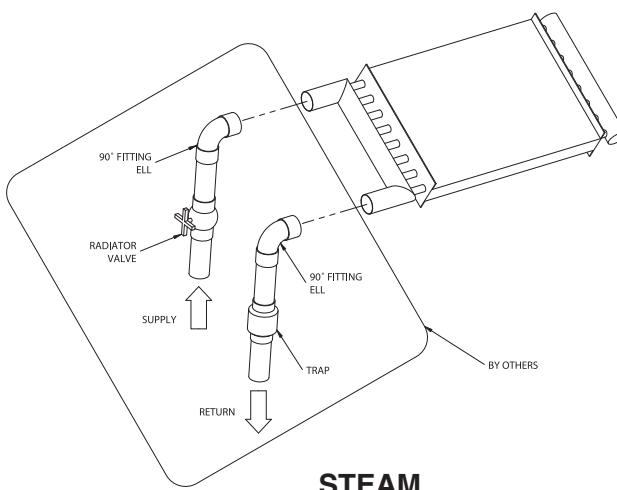
WATER

BLOWERS

Blowers may also be cleaned out using high pressure air.

FILTERS

Filters should be cleaned using compressed air or washed with a mild detergent solution at intervals of three (3) months or sooner depending on job conditions.



STEAM

CABINET UNIT HEATER LIMITED WARRANTY

Mestek, hereinafter referred to as the Company, warrants all material manufactured by it and to be delivered hereunder, to be free from defects in material, workmanship and title and to be as ordered. If within one (1) year from the date of any shipment by the Company, the Company is notified that the merchandise delivered hereunder does not meet the foregoing specific warranty, the Company's sole liability shall be, at its option, to refund the purchase price of the equipment or to correct any defect (the results of ordinary wear and tear, neglect, misuse or accident not to be deemed a defect) including non-conformity with specifications, by repairing any defective parts or, at its option, by furnishing replacement parts F.O.B. the factory where same are manufactured with all freight costs paid by the customer. The company is not liable for any damages to plant, personnel, equipment or products resulting from the use or misuse of any of its products and its sole liability shall be as set forth and as limited herein.

THE WARRANTIES SET FORTH ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES OR REPRESENTATIONS WHETHER ORAL, WRITTEN OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE. THE COMPANY SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES.



A MESTEK COMPANY

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Part 14 - Maintenance

DANGER

The boiler must be inspected and serviced annually, preferably at the start of the heating season, by a qualified service technician. In addition, the maintenance and care of the boiler as outlined in this manual must be performed by the user/owner to assure maximum efficiency and reliability. Follow the maintenance procedures given throughout this manual. Failure to perform the service and maintenance or follow the directions in this manual could damage the boiler or system components, resulting in substantial property damage, severe personal injury, or death.

A. Procedures

Periodic maintenance should be performed once a year by a qualified service technician to ensure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the boiler. The installer must also inform the owner that a lack of proper care and maintenance of the boiler may result in a hazardous condition.

B. Maintenance That May be Performed by the User

Check the Surrounding Area

DANGER

To prevent the potential of substantial property damage, severe personal injury, or death, eliminate all the materials listed in Table 6 from the area surrounding the boiler and the vicinity of the combustion air intake. If contaminants are found:

- Remove products immediately from area.
- If contaminants have been there for an extended period, call a qualified service technician to inspect the boiler for possible damage from acid corrosion.

If products cannot be removed, immediately call a qualified service technician to re-pipe the combustion air intake piping away from the contaminated areas.

Ensure the Cabinet is Closed When the Boiler is Operating

The boiler cabinet must be closed when the boiler is operating.

Combustible/Flammable Materials

Do not store combustible materials, gasoline, or other flammable vapors or liquids near the boiler. If found, remove these materials immediately.

Air Contaminants

If allowed to contaminate combustion air, products containing chlorine or fluorine will produce acidic condensate that will cause significant damage to the boiler. Read the list of potential contaminants and areas likely to have these contaminants in Table 6. If any of these contaminants are in the room where the boiler is located, or combustion air is taken from one of the areas listed, the contaminants must be removed immediately or the intake pipe must be relocated to another area.

Check the Power Source

Make sure the power cord and the main power line are properly connected to the manual switch box inside the boiler.

Check the Status of the Control Panel

Observe the Control Panel to ensure the boiler is powered on and to check for any error codes. Clear any debris from the panel.

Check CH Pressure Gauge

Ensure the pressure reading on the CH gauge does not exceed 30 psig. Higher pressure readings may indicate a problem with the expansion tank. Immediately contact a qualified service technician to inspect the boiler and system.

Check Exhaust Vent and Intake Pipe Terminations

Verify that the boiler exhaust vent and intake pipe terminations are clean and free of obstructions. Remove any debris from the exhaust vent or intake pipe openings. If removing the debris does not

allow the boiler to operate correctly, contact your qualified service technician to inspect the boiler and the vent system.

Check Exhaust Vent and Intake Piping

Visually inspect the exhaust vent for any signs of blockage, leakage, or deterioration of the piping. Inspect the exhaust vent bracing. Ensure bracing is undamaged and in good condition. Notify a qualified service technician immediately if any problems are found.

WARNING

Failure to inspect the venting system and have it repaired by a qualified service technician can result in vent system failure, causing severe personal injury or death.

Check Pressure Relief Valve

1. Visually inspect the primary pressure relief valve and discharge pipe for signs of weeping or leakage.
2. If the pressure relief valve often weeps, the expansion tank may not be operating properly. Immediately contact a qualified service technician to inspect the boiler and system.

Operate Pressure Relief Valve

1. Before proceeding, verify that the relief valve outlet has been piped to a safe place of discharge, avoiding any possibility of scalding from hot water.
2. Shut power off to the boiler. To avoid scalding, wait for boiler to cool before operating the relief valve.

WARNING

To avoid water damage or scalding due to relief valve operation, a discharge line must be connected to the valve outlet and directed to a safe place of disposal. This discharge line must be installed by a qualified service technician in accordance with the boiler installation manual. The discharge line must be terminated so as to eliminate possibility of severe burns or property damage should the valve discharge.

3. Lift the relief valve lever. If water flows freely, release the lever and allow the valve to seat. Watch the end of the relief valve discharge pipe to ensure that the valve does not weep after the line has had time to drain. If the valve weeps, lift the lever again to attempt to clean the valve seat. If the valve does not properly seat and continues to weep, contact a qualified service technician to inspect the valve and system.
4. If water does not flow from the valve when you completely lift the lever, the valve or discharge line may be blocked. Immediately shut the boiler down per instructions on page 2 and call a qualified service technician to inspect the valve and system.
5. If relief valve seats properly, restore power to the boiler. Observe operation for five minutes and ensure it operates properly.

Check the Condensate Drain System

1. While the boiler is running, check the discharge end of the condensate drain tubing. Ensure no flue gas is leaking from the condensate drain tubing by holding your fingers near the opening.
2. If you notice flue gas leaking from the opening, this indicates a dry condensate drain trap. If problem persists, contact a qualified service technician to inspect the boiler, condensate line and condensate trap.
3. If applicable, check the condensate neutralizer and ensure it is full of condensate neutralizing marble chips.

C. Maintenance Only to be Performed by a Qualified Service Technician

Removing the Cabinet Cover and Inspecting the Boiler

Before carrying out any work on the boiler, switch off the power supply at the external power switch and circuit breaker. Close the external gas shutoff.



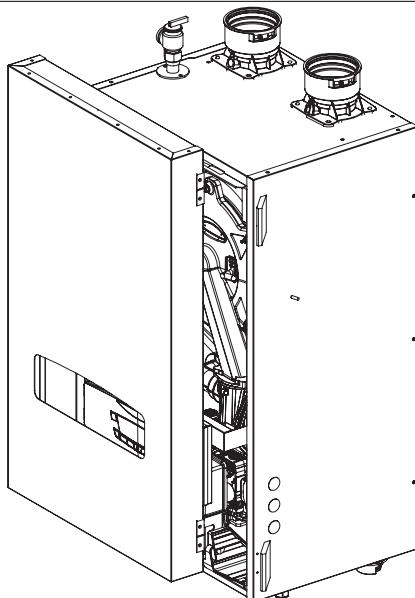
DANGER

Ensure power and gas to the appliance are shut off before performing the following operations. Failure to do so will result in substantial property damage, severe personal injury, or death.

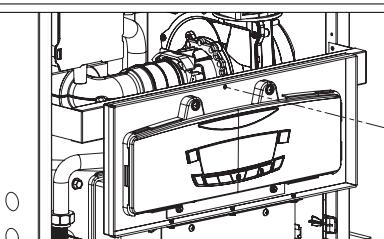
See Figure 80 to access the interior of the boiler:

1. Release the four (4) latches from the front cover (two [2] each side). Lift and remove the front cover from the cabinet (a).
2. Remove the screw securing the control panel to the cross-member (b).
3. Push in the tabs and pull the control panel housing forward (c).

(a)



(b)



(c)

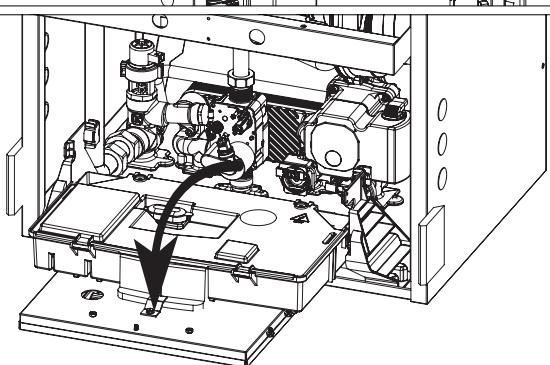


Figure 80 - Removing the Cover and Control Panel Housing

Check Water and Gas Piping

1. Remove the boiler cover and perform a gas leak inspection following Operating Instructions on page 2 of this manual. If gas odor or leak is detected, follow procedures on page 2. Call a qualified service technician.

2. Visually inspect for leaks around the boiler water connections and around the heat exchanger. Visually inspect the external system piping, circulators, and system components and fittings. Immediately call a qualified service technician to repair any leaks.



WARNING

Have leaks fixed at once by a qualified service technician. Failure to comply could result in substantial property damage, severe personal injury, or death.

Before Starting Maintenance:

1. Ensure the power and gas remain off.
2. Close the valves of heating and hot water circuit.
3. Remove the front panel as shown in Figure 80.
4. If necessary, empty the appliance on the water side.

Draining Procedure

To drain the heating system:

1. Ensure the boiler power and gas remain off.
2. Open the manual purge valve.
3. Open the system drain valve and collect the escaping water in a container.
4. Drain the water from the lowest points of the system (where applicable).

If the system is to be inactive in areas where the room temperature may fall below 0°C during winter, it is recommended that anti-freeze liquid be added to the heating system in order to avoid the need for repeated draining. Ensure the antifreeze used is compatible with the stainless steel boiler heat exchanger.



WARNING

NEVER use any toxic chemical, including automotive, standard glycol antifreeze, or ethylene glycol made for hydronic (non-potable) systems. These chemicals can attack gaskets and seals in water systems, are poisonous if consumed, and can cause personal injury or death.

It is recommended to use antifreeze which contains PROPYLENE GLYCOLS as these inhibit corrosion. Use the quantities and formulation suggested by the antifreeze manufacturer to protect against freezing in your region and prevent scaling and corrosion. Regularly check the pH level of the water/antifreeze mix in the boiler circuit and replace it when the value measured is lower than the limit prescribed by the manufacturer.

DO NOT MIX DIFFERENT TYPES OF ANTI-FREEZE.

The manufacturer will not be held liable for any damage caused by the appliance or the system due to the use of inappropriate antifreeze substances or additives.

Draining the DHW System and Indirect Water Heater

Every time there is a danger of freezing, the domestic hot water system must be drained as follows:

1. Shut off the main water inlet valve.
2. Open all the hot and cold water taps.
3. Drain the water from the lowest points of the system.



WARNING

Water drained from the boiler could be scalding hot. Wait for the boiler to cool before draining water, and take precautions when draining water. Failure to do so could result in property damage, personal injury, or death.



WARNING

Allowing the boiler to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in boiler failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

The combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

- Avoid breathing dust and contact with skin and eyes.
- Use a NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent dust.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Cleaning the Heat Exchanger Combustion Chamber

*Before beginning this procedure, have on hand the following items:

- a nylon or other non-metallic brush
- an FDA approved liquid lime scale remover in a spray bottle
- gloves and eye protection

1. Remove the silencer.

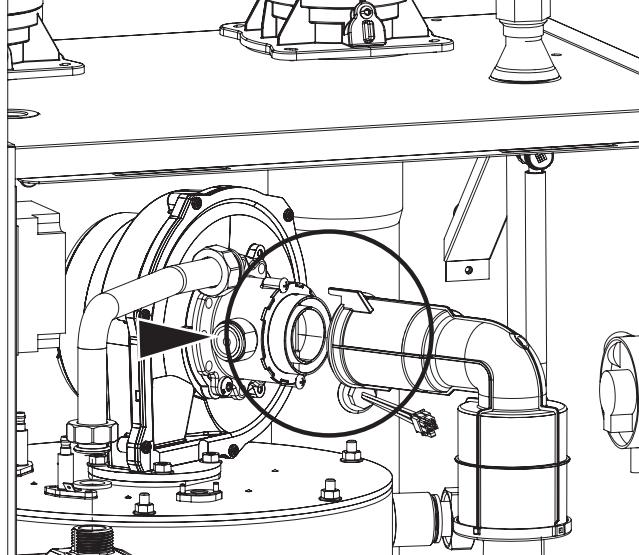


Figure 81 - Remove the silencer

2. Unscrew the two (2) nuts and remove the gas pipe.

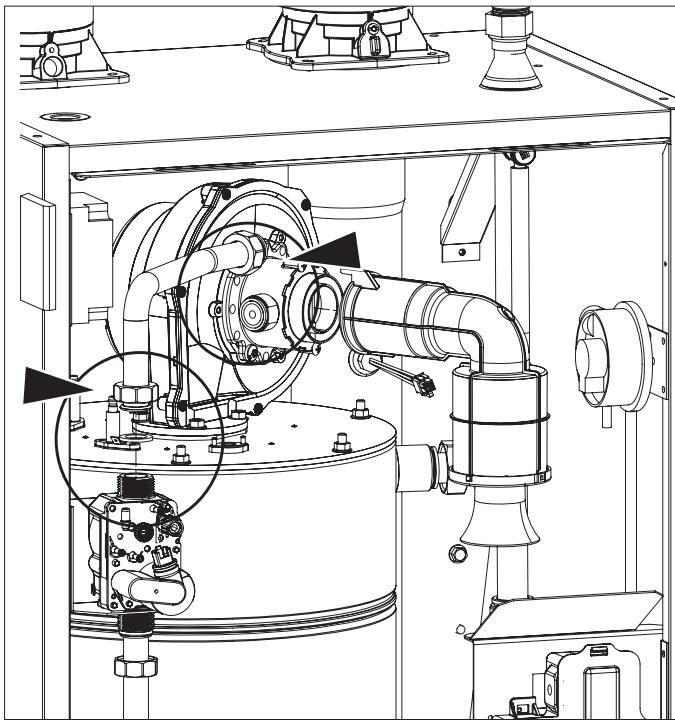


Figure 82 - Remove the gas pipe

3. Remove the gas diaphragm (if present).
4. Disconnect the electrical connections from the electrodes, igniter, and blower.
5. Depending on the boiler model, unscrew the three (3) or four (4) nuts on the blower and four (4) screws on the electrodes. Remove the blower and electrodes.

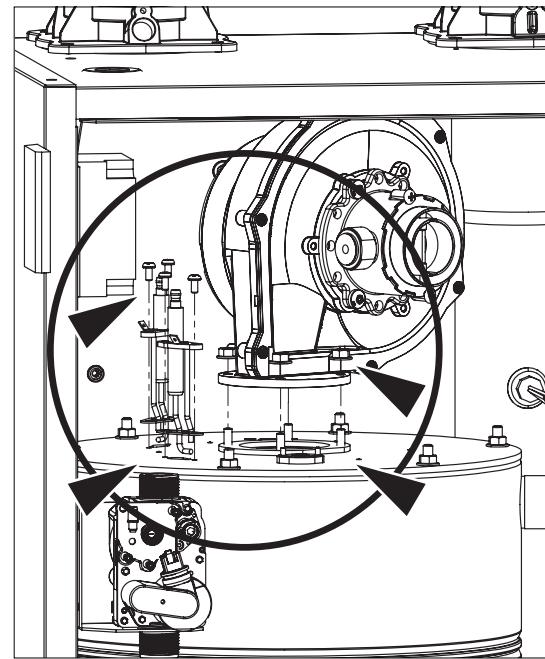


Figure 83 - Remove the Blower and Electrodes

6. Remove the six (6) lock nuts securing the top plate to the heat exchanger. Remove the top plate and burner.

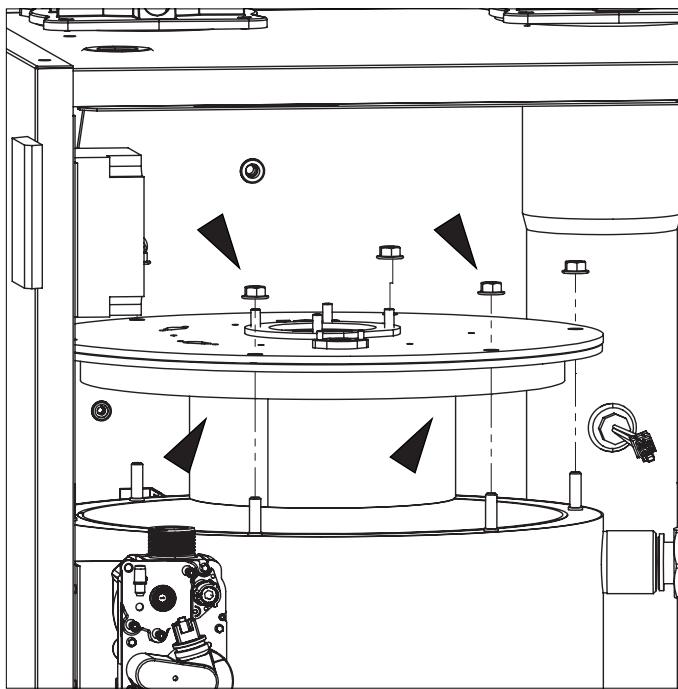


Figure 84 - Remove the Top Plate and Burner

7. Disconnect the condensate hose and siphon cap from the boiler.



WARNING

Protect the top plate insulation from water before performing any cleaning. Failure to do so could result in damage to the insulation, improper boiler operation, personal injury, or death.

Do not use solvents to clean any of the boiler components. The components could be damaged, resulting in unreliable or unsafe boiler operation, substantial property damage, severe personal injury, or death.

8. Clean the combustion chamber by spraying water or solution into the combustion assembly and monitor the flow through the combustion system. Liquid should flow freely through each tube. If there is an obstruction, increase the flow on the tube to force the blockage out.

Checking the Burner

While the combustion assembly is removed from the heat exchanger, inspect the burner assembly. Proceed as follows:

1. Observe the burner assembly (burner, associated gaskets, and combustion assembly sealing ring). Replace any components that are damaged or showing signs of deterioration.



DANGER

Failure to replace a damaged sealing ring will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

NOTE: Whenever assembling the burner to the top plate, **ALWAYS** replace the burner gasket.

2. Reassemble the burner assembly. Ensure the components are installed as described in Figure 85.
3. After all maintenance is complete, reinstall the combustion assembly following the reverse order of steps 7 - 2 of Cleaning the Heat Exchanger Combustion Chamber. Ensure all gaskets are installed and all components are tightened properly.

4. Restore power and gas to the boiler. Restart the boiler. Check for leaks in the combustion system. Observe operation for 5 to 10 minutes.

If boiler is operating properly, condensate is flowing normally, and no gas leaks are detected, combustion coil cleaning is complete.

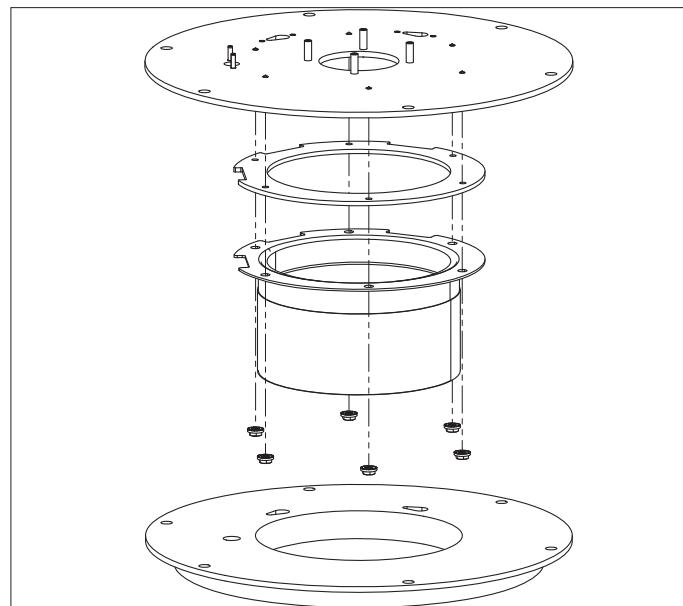


Figure 85 - Disassembled Burner Assembly

Clean the Condensate Trap

1. Remove the condensate drain hose from the bottom of the boiler.



WARNING

Take care when removing the condensate hose, as condensate may escape. Failure to do so could result in property damage due to leaks, personal injury, or death.

2. Working from below the boiler, remove the siphon cap retaining clip. Then remove the siphon cap by depressing the two (2) lateral hinges (use a tool if necessary).

3. Remove the cone and the ball.
4. Clean each part.

5. When the condensate trap is sufficiently clean, reassemble in the reverse order.

NOTE: Ensure all parts shown in Figure 86 are installed with the boiler. If any parts are missing DO NOT operate the boiler. Replace the entire condensate trap assembly.

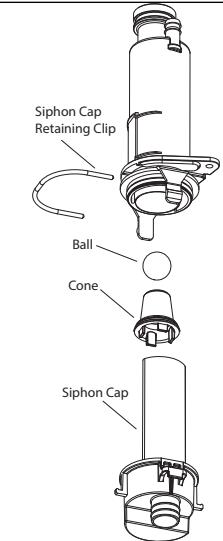


Figure 86 - Clean the Condensate Trap



WARNING

Do not install the condensate assembly if a component is lost or missing. Replace the entire assembly. Failure to follow this warning could result in property damage, serious personal injury, or death.

6. If a condensate neutralizer kit is installed, check the assembly when cleaning the condensate trap, and replenish the limestone chips if necessary. When replacing the limestone chips, take care to ensure chips are no smaller than $\frac{1}{2}$ " to avoid blockage in condensate piping.

7. Check condensate piping for sagging and/or leakage. Repair any sags or leaks before restoring power to the boiler.
8. If the boiler has a condensate pump, ensure the pump operates properly before considering maintenance complete.

! DANGER

When servicing is complete, make sure the siphon cap and retaining clip are replaced securely. The condensate trap assembly **MUST BE PROPERLY INSTALLED** according to these instructions when operating the boiler. Operating the boiler without the condensate trap assembly will cause flue gases to leak and result in serious personal injury or death.

CAUTION

It is very important that the condensate piping be no smaller than $\frac{3}{4}$ ". To prevent sagging and maintain pitch, condensate piping should be supported with pipe supports, and pitched $\frac{1}{4}$ " per foot to allow for proper drainage.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate freezes in the line, or if line is obstructed in any other manner, condensate can exit from the tee, resulting in potential water damage to property.

! WARNING

Ensure the combi boiler DHW heating system has been drained following the instructions in this manual BEFORE attempting to remove the DHW filter. Failure to do so could result in property damage, serious personal injury, or death.

Water drained from the boiler could be scalding hot. Wait for the boiler to cool before draining water, and take precautions when draining water. Failure to do so could result in property damage, personal injury, or death.

Cleaning the DHW Filter (Combi Models ONLY)

1. Remove the clip on the flow meter (1).
2. Remove the flow meter cap (2).
3. Remove the flow meter turbine (3).
4. Remove and clean the filter (4).

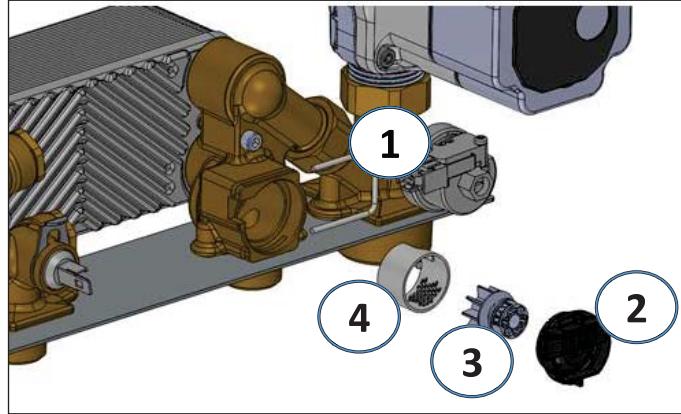


Figure 87 - Removing the DHW Filter

5. Clean the filter with a toothbrush and clean running water.
6. Reinstall the DHW inlet filter.
7. Refill the DHW circuit following the filling and purging instructions in this manual.
8. Restore gas and power to the boiler.

D. Replacing Components

At any point in time over the boiler's service life it may be necessary to replace boiler components. If the boiler displays an error message, determine its cause and possible remedies.

If the remedy is replacement of a component, ensure:

1. That the boiler is powered OFF. Press the ON/OFF button to turn the boiler off. Then turn the main electrical power to the boiler off at the circuit breaker.
2. The boiler electrical connection is connected properly. A loose electrical connection could be the root cause of problems.
3. The front cover has been removed.
4. The main shutoff gas valve is closed.
5. All water valves to and from the boiler (supply, return, inlet, outlet) are closed.
6. If necessary, the water has been drained from the boiler and/or appropriate circuit.
7. No water can get into the display / control panel.

Replacing the Burner

1. Remove the front cover and pivot the electronic housing following the instructions described in **Removing the Cabinet Cover and Inspecting the Boiler**.
2. Remove the combustion assembly as described in **Cleaning the Heat Exchanger Combustion Chamber**.
3. Remove, inspect, and replace the burner as described in **Checking the Burner**.
4. Replace all damaged seals that are damaged or showing signs of wear.

! DANGER

Failure to replace a damaged sealing ring will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

5. Proceed in the reverse order to reinstall the components.

Replacing the Fan

1. Remove the silencer and gas line as described in Cleaning the Heat Exchanger Combustion Chamber.
2. Loosen the three [3] screws to release the Mixer (1) from the fan (5). Ensure the O-Ring (4) is not damaged or deteriorating.

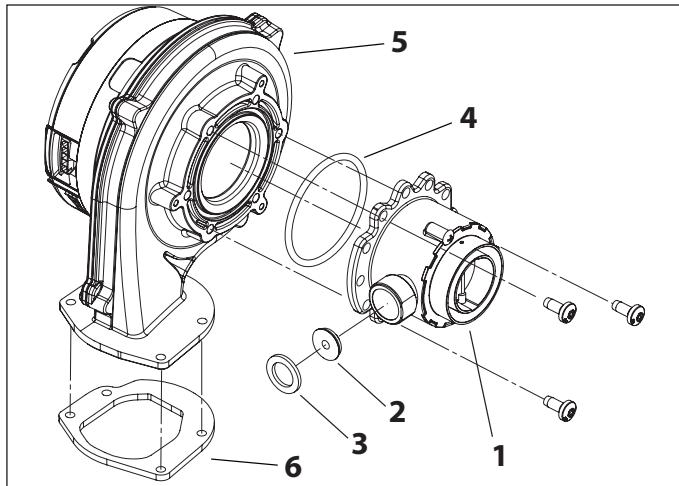


Figure 88 - Removed Fan, Mixer, and Components

Legend:

- 1** - Mixer (when converting to Propane, install the Mixer included in the Natural Gas to Propane Conversion Kit)
- 2** - Gas Diaphragm if applicable (EFTU-150/ EFTU-150C
Natural Gas Models include a Gas Diaphragm.
All Models converted to Propane require a Gas Diaphragm - see Natural Gas to Propane Conversion Instructions)
- 3** - Gas Seal
4 - O-Ring
5 - Fan
6 - Fan to Top Plate Gasket

3. Depending on the model, loosen the three [3] or four [4] screws to release the fan from the heat exchanger.

! DANGER

Ensure that the correct gas diaphragm and mixer are used for the correct fuel type for the boiler - Natural Gas or Propane. See Conversion Kit Instructions. Failure to do so will result in substantial property damage, severe personal injury, or death.

4. Reassemble the mixer and fan assembly in the reverse order. Ensure the O-Ring (4) is installed between the mixer and fan.
5. Reinstall the fan and combustion assembly components as described in Cleaning the Heat Exchanger Combustion Chamber. Ensure the gasket (6) is assembled between the fan and air inlet channel.

! DANGER

Failure to replace damaged or deteriorating gaskets or O-Rings will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

Replacing the Main Heat Exchanger

1. Drain the boiler and remove the combustion assembly as described in **Cleaning the Heat Exchanger Combustion Chamber**.
2. Remove the combustion assembly as described in **Cleaning the Heat Exchanger Combustion Chamber**.
3. Remove the exhaust vent adapter on the top of the boiler.

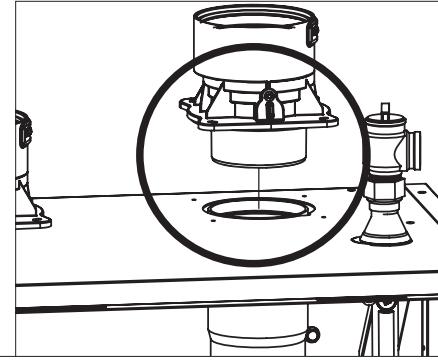


Figure 89 - Remove the exhaust vent adapter

4. Disconnect the CH supply and return pipes.

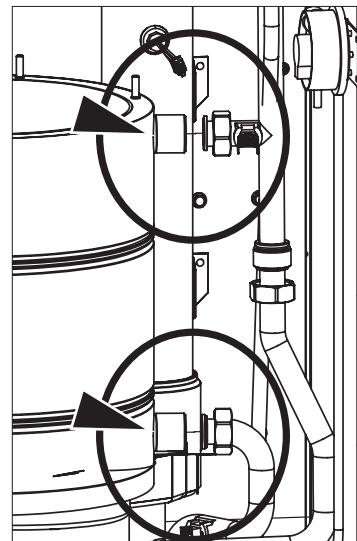


Figure 90 - Remove the CH Supply and Return Pipes

5. Remove the gas pipe.

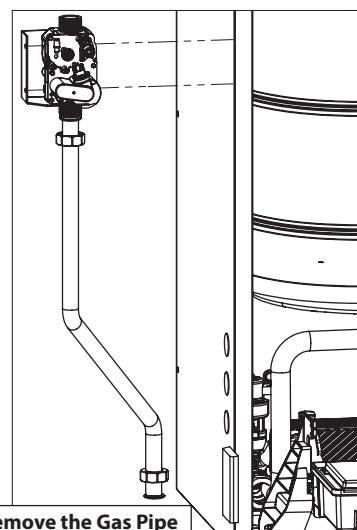


Figure 91 - Remove the Gas Pipe

6. Disconnect the condensate line.

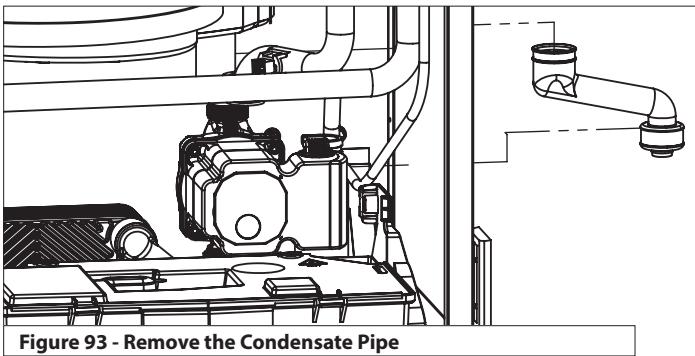


Figure 93 - Remove the Condensate Pipe

7. Remove the electrical junction box.

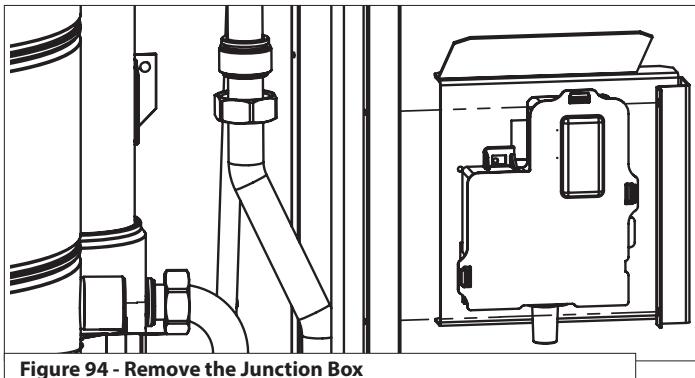


Figure 94 - Remove the Junction Box

8. Remove the bolts mounting the heat exchanger to the cabinet.
9. Proceed in the reverse order to install the new heat exchanger.

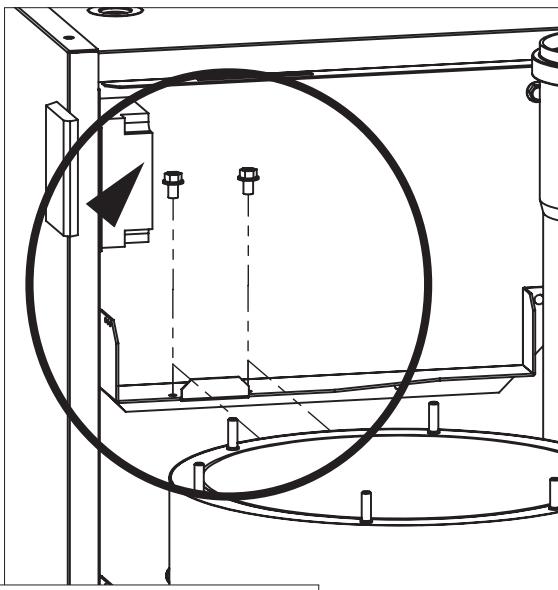


Figure 92 - Remove the Heat Exchanger

Replacing the Gas Valve

1. Remove the electrical connection from the gas valve.
2. Remove the two (2) nuts above and below the gas valve.
3. Remove the two (2) screws securing the gas valve to the bracket.
4. Remove the gas valve.
5. Reinstall the new gas valve in reverse order.
6. **BE SURE TO USE NEW SEALING RINGS.**
7. Ensure there are no gas leaks.



DANGER

Failure to replace the sealing rings will result in gas leaks, and could cause an explosion or fire, substantial property damage, severe personal injury, or death.

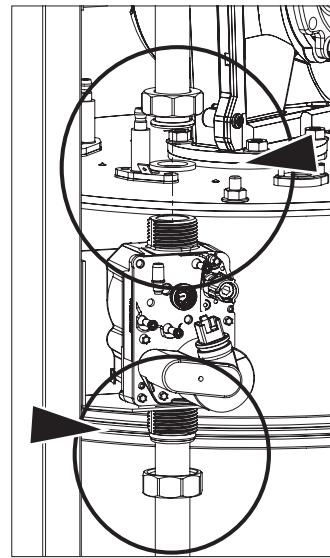


Figure 95 - Disconnect the Gas Valve

Replace the Main PCB

1. Fold down the electronics box.
2. Unlock the two clips and open the electronics box cover.
3. Disconnect the electrical connections.
4. Unhook the controller board and remove it.
5. Proceed in reverse order to install the new PCB.

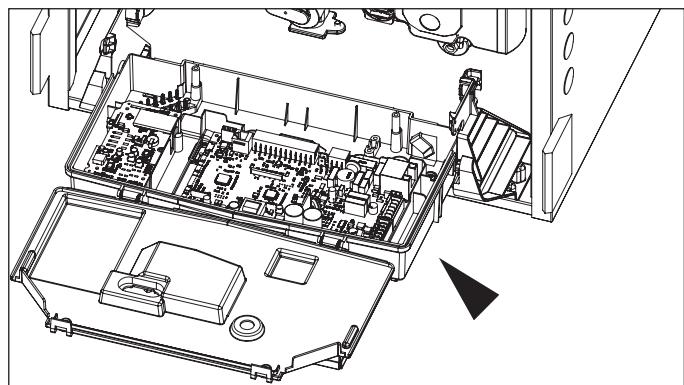


Figure 96 - Disconnect the Main PCB

6. Follow the instructions provided with the replacement PCB kit for setting all necessary parameters.

E. After Maintenance is Complete

Functional Test

After maintenance is complete, ensure the CH circuit is filled and purged with a pressure of 12 psi. Ensure the DHW circuit is filled and purged.

1. Power the boiler on.
2. If necessary, purge air again from the CH and DHW circuits.
3. Check the boiler and system settings and components. Ensure all adjustments are working properly.
4. Ensure the exhaust pipe is connected properly.
5. Reinstall the boiler front cover.
6. If necessary, set the maintenance interval.

Inform the User

1. Inform the user of any changes / adjustments / replacements in the system.
2. Ensure the user understands how the system works.
3. Hand the instructions to the user. Ensure the instructions will be kept close to the unit.
4. Have the user perform these regular tasks:
 - Check the system water pressure regularly.
 - If necessary, restore pressure and vent the system.
 - Set the setpoints and control systems to ensure correct and economical control of the system.
 - Have the system serviced in accordance with regulations at regular intervals.
 - NEVER attempt to service the boiler or adjust the combustion system.

Part 15 - Maintenance Report

CAUTION

In unusually dirty or dusty conditions, care must be taken to keep boiler cabinet door in place at all times. Failure to do so VOIDS WARRANTY!



WARNING

Allowing the boiler to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in boiler failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

The combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

- Avoid breathing dust and contact with skin and eyes.
- Use a NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent dust.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

The boiler requires minimal periodic maintenance under normal conditions. However, in unusually dirty or dusty conditions, periodic vacuuming of the cover to maintain visibility of the display and indicators is recommended.

Periodic maintenance should be performed once a year by a qualified service technician to ensure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the boiler. Installer must also inform the owner that the lack of proper care and maintenance of the boiler may result in a hazardous condition.

INSPECTION ACTIVITIES		DATE LAST COMPLETED			
PIPING		1st YEAR	2nd YEAR	3rd YEAR	4th YEAR*
Near boiler piping	Check boiler and system piping for any sign of leakage. Leaking pipes could cause property damage. Make sure all piping is properly supported. See User's Information manual for instructions.				
Vent	Check condition of all vent pipes and joints. Ensure all vent piping is properly supported. Check for obstructions at exhaust and intake termination points.				
Gas	Check Gas piping, test for leaks and signs of aging. Make sure all pipes are properly supported.				
SYSTEM					
Visual	Do a full visual inspection of all system components.				
Functional	Test all functions of the system (central heat, water heating, Safeties)				
Temperatures	Verify safe settings on boiler or Anti-Scald Valve				
Temperatures	Verify programmed temperature settings				
ELECTRICAL					
Connections	Check wire connections. Make sure they are tight.				
Smoke and CO detector	Verify devices are installed and working properly. Change batteries if necessary.				
Circuit Breakers	Ensure the circuit breaker is clearly labeled. Exercise circuit breaker.				
Switch and Plug	Verify ON/OFF switch and convenience plug are both functional				
CHAMBER/BURNER					
Combustion Chamber	Check burner tube and combustion chamber coils. Clean according to maintenance section of manual. Vacuum combustion chamber.				
Spark Electrode	Clean. Set gap at 1/8".				
CONDENSATE					
Condensate Trap	Clean debris from the condensate trap. Fill with clean water.				
Neutralizer	Check condensate neutralizer. Replace if necessary.				
Condensate hose	Disconnect condensate hose. Clean out dirt and re-install. (NOTE: Verify the flow of condensate, making sure that the hose is properly connected during final inspection.)				
GAS					
Pressure	Measure incoming gas pressure (3.5 to 10.5" W.C. NG, 8 to 13" W.C. LP)				
Pressure Drop	Measure drop in pressure on light off (no more than 1" W.C.)				
Check for leaks	Check gas piping for leaks. Verify that all are properly supported.				
COMBUSTION					
CO/CO2 Levels	Check CO and CO2 levels in Exhaust. Record at high and low fire.				
SAFETIES					
ECO (Energy Cut Out)	Check continuity on flue temperature sensor. Replace the flue gas temperature sensor if corroded. Check continuity on Water ECO. Check position and sensor resistance. Ensure air pressure switch is properly connected (electrical connections and silicone pipe).				
DHW LOOP - Combi Models					
	It is recommended to flush the DHW heat exchanger annually if water hardness exceeds 12 grains per gallon (considered extremely hard water). If water hardness falls below 12 grains per gallon it is recommended to flush the heat exchanger every two to three years. It is also recommended to clean the CH and DHW inlet filters annually.				
FINAL INSPECTION					
Check list	Verify that you have completed entire check list. WARNING: FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH.				
Homeowner	Review what you have done with the homeowner.				
TECH SIGN OFF					

Table 32 - *Continue annual maintenance beyond the 4th year as required.

Part 16 - Shutdown

A. Shutdown Procedure

Turn the boiler off at the on/off power switch. Wait for the combustion blower to stop, so all latent combustion gases are purged from the system. This could take a maximum of 5 minutes.

B. Failure to Operate

Should the burner fail to light, the control will perform four more ignition trials prior to entering a lockout state. Note that each subsequent ignition trial will not occur immediately. After a failed ignition trial, the blower must run for approximately 5 seconds to purge the system.

If the burner lights during any one of these five ignition trials, normal operation will resume.

If the burner does not light after the fifth ignition trial, the control will enter a lockout state.

This lockout state indicates that a problem exists with the boiler, the controls, or the gas supply.

Under such circumstances, a qualified service technician should be contacted immediately to properly service the boiler and correct the problem. If a technician is not available, press a button on the display to wake it. Then press the RESET button to remove the lockout state so additional trials for ignition can be performed.

If the RESET key is not pressed (error code 501 or 503), the boiler will reset automatically after an hour.

C. Important



WARNING

It is extremely important that whenever work is performed on the plumbing system that either:

- The appliance is powered off, and,
- The area that is being worked on is valved off and isolated.

Failure to take these measures could result in a dry-firing condition, explosion or fire, substantial property damage, severe personal injury, or death.

Outdoor Sensor		Supply/Return Temperature Sensors Indirect Sensor DHW Outlet Sensor	
Outside Temperature (°F)	Resistance (ohms)	Water Temp. (°F)	Resistance (Ohms)
-22	178605	32	27219
-13	132045	41	22021
-4	98438	50	17926
5	73995	59	14674
14	56079	68	12081
23	42846	77	10000
32	32997	86	8315
41	25609	95	6948
50	20027	104	5834
59	15777	113	4917
68	12517	122	4161
77	10000	131	3535
86	8042	140	3014
95	6510	149	2586
104	5302	158	2228
113	4343	167	1925
		176	1669
		185	1452
		194	1268
		202	1110
		212	974

Table 33 - Sensor Temperature Resistance

Service Facts

Split System Cooling 4A7A7060A1000B

IMPORTANT — This document contains a wiring diagram, a parts list, and service information. This is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

⚠ WARNING: HAZARDOUS VOLTAGE - DISCONNECT POWER and DISCHARGE CAPACITORS BEFORE SERVICING

PRODUCT SPECIFICATIONS	
OUTDOOR UNIT ①②	4A7A7060A1000B
POWER CONNS. — V/PH/HZ ③	208/230/1/60
MIN. BRCH. CIR. AMPACITY	35
BR. CIR. PROT. RTG. — MAX. (AMPS)	60
COMPRESSOR	DURATION™ - SCROLL
NO. USED - NO. STAGES	1 - 2
VOLTS/PH/HZ	208/230/1/60
R.L. AMPS ⑦ - L.R. AMPS	26.9 - 152.9
FACTORY INSTALLED	
START COMPONENTS ⑧	NO (Uses BAYKSKT266)
INSULATION/SOUND BLANKET	NO
COMPRESSOR HEAT	NO
OUTDOOR FAN	PROPELLER
DIA. (IN.) - NO. USED	27.6 - 1
TYPE DRIVE - NO. SPEEDS	DIRECT - 1
CFM @ 0.0 IN. W.G. ④	4760
NO. MOTORS - HP	1 - 1/4
MOTOR SPEED R.P.M.	825
VOLTS/PH/HZ	208/230/1/60
F.L. AMPS	1.30
OUTDOOR COIL — TYPE	SPINE FIN™
ROWS - F.P.I.	1 - 24
FACE AREA (SQ. FT.)	30.79
TUBE SIZE (IN.)	3/8
REFRIGERANT	R-410A
LBS. — R-410A (O.D. UNIT) ⑤	12 LBS. - 09 OZ.
FACTORY SUPPLIED	YES
LINE SIZE - IN. O.D. GAS ⑥	1-1/8
LINE SIZE - IN. O.D. LIQ. ⑥	3/8
CHARGING SPECIFICATION	
SUBCOOLING	8°F
DIMENSIONS	H X W X D
CRATED (IN.)	51 X 35.1 X 38.7
WEIGHT	
SHIPPING (LBS.)	312
NET (LBS.)	275

THIS INFORMATION IS INTENDED FOR USE BY INDIVIDUALS POSSESSING ADEQUATE BACKGROUNDS OF ELECTRICAL AND MECHANICAL EXPERIENCE. ANY ATTEMPT TO REPAIR A CENTRAL AIR CONDITIONING PRODUCT MAY RESULT IN PERSONAL INJURY AND OR PROPERTY DAMAGE. THE MANUFACTURER OR SELLER CANNOT BE RESPONSIBLE FOR THE INTERPRETATION OF THIS INFORMATION, NOR CAN IT ASSUME ANY LIABILITY IN CONNECTION WITH ITS USE.

4A7A7060A-SF-1F-EN

⚠ CAUTION

UNIT CONTAINS R-410A REFRIGERANT!

R-410A OPERATING PRESSURE EXCEEDS THE LIMIT OF R-22. PROPER SERVICE EQUIPMENT IS REQUIRED. FAILURE TO USE PROPER SERVICE TOOLS MAY RESULT IN EQUIPMENT DAMAGE OR PERSONAL INJURY.

SERVICE

USE ONLY R-410A REFRIGERANT AND APPROVED POE COMPRESSOR OIL.

TUBING INFORMATION

Tubing Suction	Tubing Sizes	Tubing Length	Additional Refrigerant
1-1/8"	3/8"	20'	4 oz.
1-1/8"	3/8"	30'	11 oz.
1-1/8"	3/8"	40'	18 oz.
1-1/8"	3/8"	50'	25 oz.
1-1/8"	3/8"	60'	32 oz.

① Certified in accordance with the Air-Source Unitary Air-conditioner Equipment certification program, which is based on ARI standard 210/240. In order to achieve ARI standard rating, the indoor fan time delay on the comfort control must be enabled.

② Rated in accordance with ARI standard 270.

③ Calculated in accordance with Natl. Elec. Codes. Use only HACR circuit breakers or fuses.

④ Standard Air — Dry Coil — Outdoor

⑤ This value approximate. For more precise value see unit nameplate.

⑥ Reference the outdoor unit ship-with literature for refrigerant piping length and lift guidelines. Reference the refrigerant piping software pub # 32-3312-xx or refrigerant piping application guide SSAPG006-xx for long line sets or specialty applications (xx denotes latest revision). The outdoor condensing units are factory charged with the system charge required for the outdoor condensing unit, ten (10) feet of tested connecting line, and the smallest rated indoor evaporative coil match. Always verify proper system charge via subcooling (TXV/EEV) or superheat (fixed orifice) per the unit nameplate.

⑦ This value shown for compressor RLA on the unit nameplate and on this specification sheet is used to compute minimum branch circuit ampacity and max. fuse size. The value shown is the branch circuit selection current.

⑧ No means no start components. Yes means quick start kit components. PTC means positive temperature coefficient starter. Optional kit shown.

⚠ CAUTION

HOT SURFACE!
DO NOT TOUCH TOP OF COMPRESSOR.
May cause minor to severe burning.

⚠ CAUTION

CONTAINS REFRIGERANT!

SYSTEM CONTAINS OIL AND REFRIGERANT UNDER HIGH PRESSURE. RECOVER REFRIGERANT TO RELIEVE PRESSURE BEFORE OPENING SYSTEM.

Failure to follow proper procedures can result in personal illness or injury or severe equipment damage.

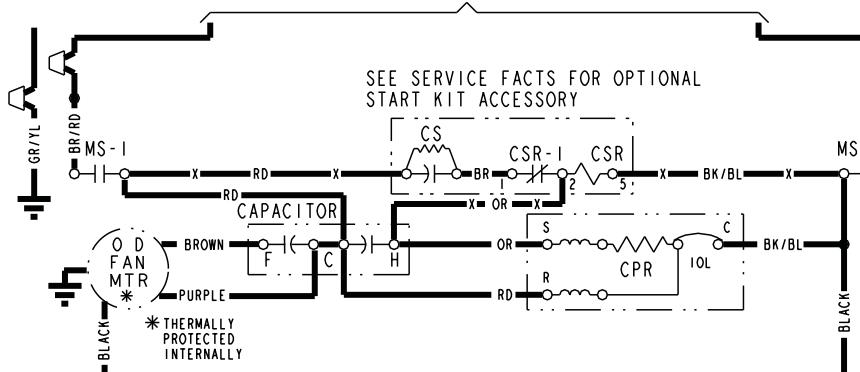
⚠ CAUTION

RECONNECT ALL GROUNDING DEVICES.

ALL PARTS OF THIS PRODUCT CAPABLE OF CONDUCTING ELECTRICAL CURRENT ARE GROUNDED. IF GROUNDING WIRES, SCREWS, STRAPS, CLIPS, NUTS OR WASHERS USED TO COMPLETE A PATH TO GROUND ARE REMOVED FOR SERVICE, THEY MUST BE RETURNED TO THEIR ORIGINAL POSITION AND PROPERLY FASTENED.

SCHEMATIC DIAGRAM

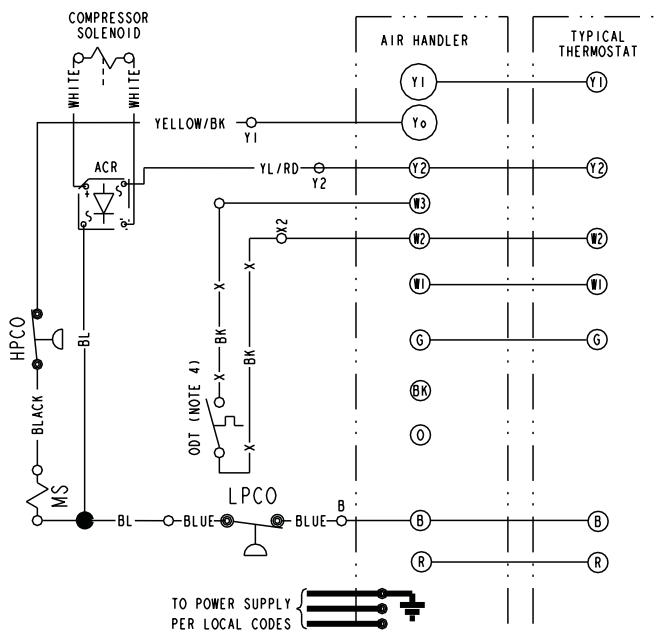
TO POWER SUPPLY PER UNIT NAMEPLATE AND LOCAL CODES



CA	COOLING ANTICIPATOR	LPCO	LOW PRESSURE CUTOUT SW.
CBS	COIL BOTTOM SENSOR	MS	COMPRESSOR MOTOR CONTACTOR
CF	FAN CAPACITOR	ODA	OUTDOOR ANTICIPATOR
CN	WIRE CONNECTOR	OFT	OUTDOOR FAN THERMOSTAT
CPR	COMPRESSOR	ODS	OUTDOOR TEMPERATURE SENSOR
CR	RUN CAPACITOR	ODT	OUTDOOR THERMOSTAT
CS	STARTING CAPACITOR	RHS	RESISTANCE HEAT SWITCH
CSR	CAPACITOR SWITCHING RELAY	SC	SWITCHOVER VALVE SOLENOID
DFC	DEFROST CONTROL	SM	SYSTEM "ON-OFF" SWITCH
F	INDOOR FAN RELAY	TDL	DISCHARGE LINE THERMOSTAT
HA	HEATING ANTICIPATOR	TDR	TIME DELAY RELAY (5 SEC DELAY ON)
HPCO	HIGH PRESSURE CUTOUT SW.	TNS	TRANSFORMER
IOL	INTERNAL OVERLOAD PROTECTOR	TS	HEATING-COOLING THERMOSTAT
ACR	A/C RECTIFIER	TSH	HEATING THERMOSTAT

△ WARNING
HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER
INCLUDING REMOTE DISCONNECTS
BEFORE SERVICING.
FAILURE TO DISCONNECT POWER
BEFORE SERVICING CAN CAUSE
SEVERE PERSONAL INJURY OR DEATH!

△ CAUTION
USE COPPER CONDUCTORS ONLY!
UNIT TERMINALS ARE NOT DESIGNED
TO ACCEPT OTHER TYPES OF
CONDUCTORS.
FAILURE TO DO SO MAY CAUSE



COLOR OF WIRE					
BK/BL	BLACK WIRE WITH BLUE MARKER				
COLOR OF MARKER					
BK	BLACK	OR	ORANGE	YL	YELLOW
BL	BLUE	RD	RED	GR	GREEN
BR	BROWN	WH	WHITE	PR	PURPLE

NOTES:

1. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
 2. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
 3. LOW VOLTAGE WIRING TO BE NO. 18 AWG MINIMUM CONDUCTOR.
 4. IF OUTDOOR THERMOSTAT (ODT) IS NOT USED, CONNECT W2 TO W3.
 5. WITH Y1 ENERGIZED, INDOOR FAN IS 1ST STAGE AIRFLOW.
 6. WITH Y1 & Y2 ENERGIZED, INDOOR FAN IS 2ND STAGE AIRFLOW.
 7. SEE AIR HANDLER INSTALLER GUIDE FOR DIP SWITCH CONFIGURATIONS.

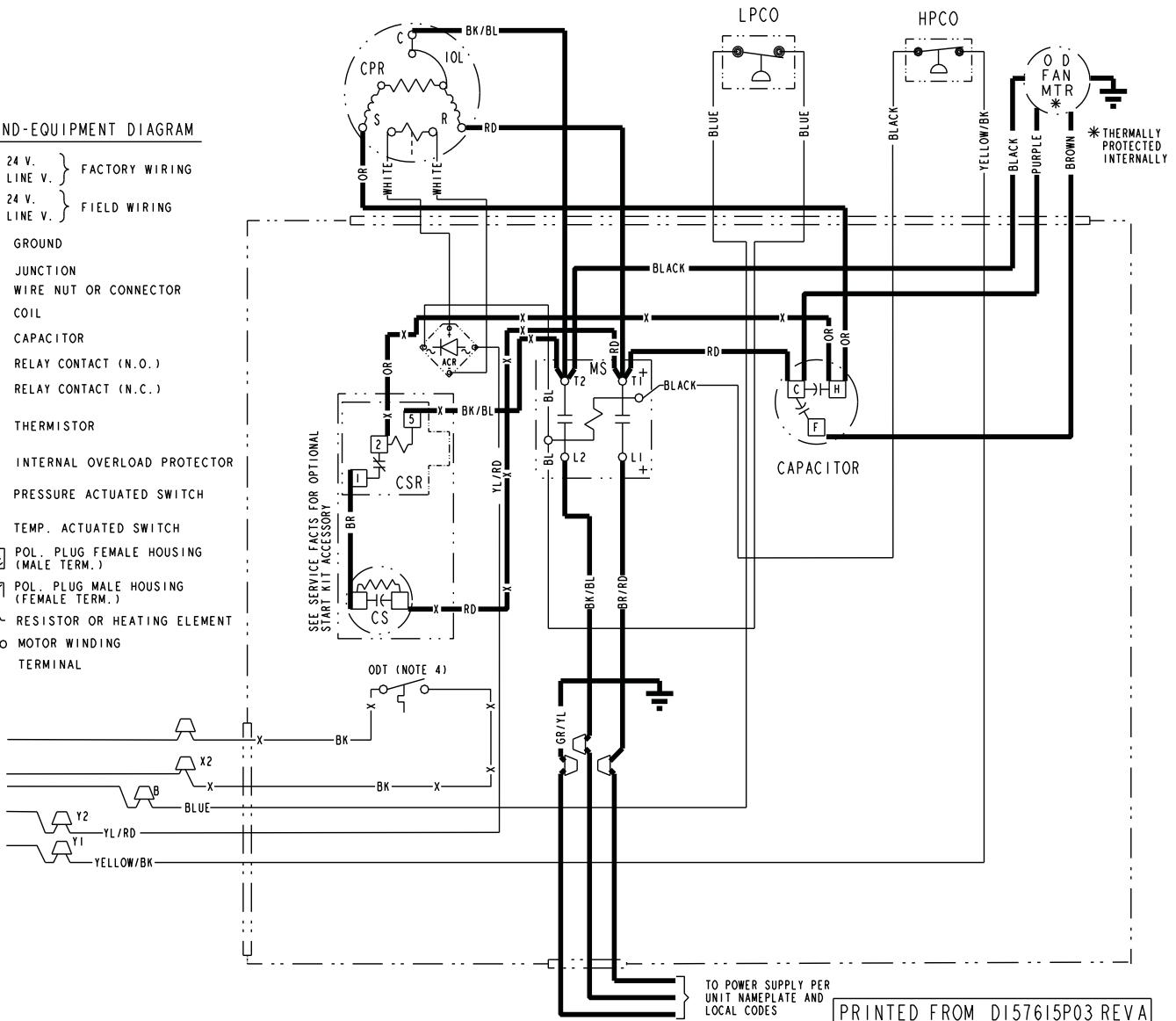
FOR CANADIAN INSTALLATIONS
POUR INSTALLATIONS CANADIENNES

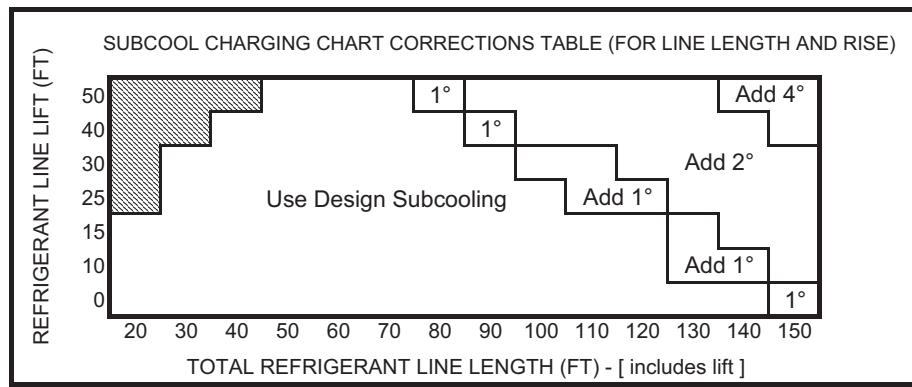
**CAUTION: NOT SUITABLE FOR USE ON
SYSTEMS EXCEEDING 150V-TO-GROUND.
ATTENTION: NE CONVIENT PAS AUX
INSTALLATIONS DE PLUS DE 150 V A
LA TERRE**

WIRING DIAGRAM

LEGEND-EQUIPMENT DIAGRAM

- 24 V. } FACTORY WIRING
- LINE V. } FIELD WIRING
- JUNCTION
- WIRE NUT OR CONNECTOR
- COIL
- CAPACITOR
- RELAY CONTACT (N.O.)
- RELAY CONTACT (N.C.)
- THERMISTOR
- INTERNAL OVERLOAD PROTECTOR
- PRESSURE ACTUATED SWITCH
- TEMP. ACTUATED SWITCH
- POL. PLUG FEMALE HOUSING (MALE TERM.)
- POL. PLUG MALE HOUSING (FEMALE TERM.)
- RESISTOR OR HEATING ELEMENT
- MOTOR WINDING
- TERMINAL





MANUAL CHARGING (HIGH STAGE ONLY) IN COOLING BETWEEN 55°F AND 120°F OD AMBIENT

The manufacturer recommends installing approved matched indoor and outdoor systems.

All split systems are AHRI rated with only TXV indoor systems.

The benefits of installing approved indoor and outdoor split systems are maximum efficiency, optimum performance and the best overall system reliability.

The following charging methods are therefore prescribed for systems with indoor TXVs.

1. Subcooling (in the cooling mode) is the only recommended method of charging above 55°F ambient temperatures.
2. For best results - the indoor temperature should be kept between 70°F to 80°F. Add system heat if needed.
3. At start-up, or whenever charge is removed or added, the system must be operated for a minimum twenty (20) minutes to stabilize before accurate measurements can be made.
4. Measure Liquid Line Temperature and Refrigerant Pressure at service valves.
5. Determine total refrigerant line length, and height (lift) if indoor section is above the condenser. Use the **Subcool Charging Chart Corrections Table** to calculate any additional subcooling required for your specific application.
6. Determine the Design Subcooling from the unit nameplate or Service Facts. Add any additional amount of subcooling calculated in Step 5 to the Design Subcooling to arrive at the final subcooling value.
7. Locate this value in the appropriate column of the **R-410-A Refrigerant Charging Chart**. Locate your liquid line temperature in the left column of the chart, and the intersecting liquid line pressure under your calculated subcooling value column. Add refrigerant to raise the pressure to match the chart, or remove refrigerant to lower the pressure. Again, wait twenty (20) minutes for the system conditions to stabilize before adjusting charge again.
8. When system is correctly charged, you can refer to System Pressure Curves (in Service Facts) to verify typical performance.

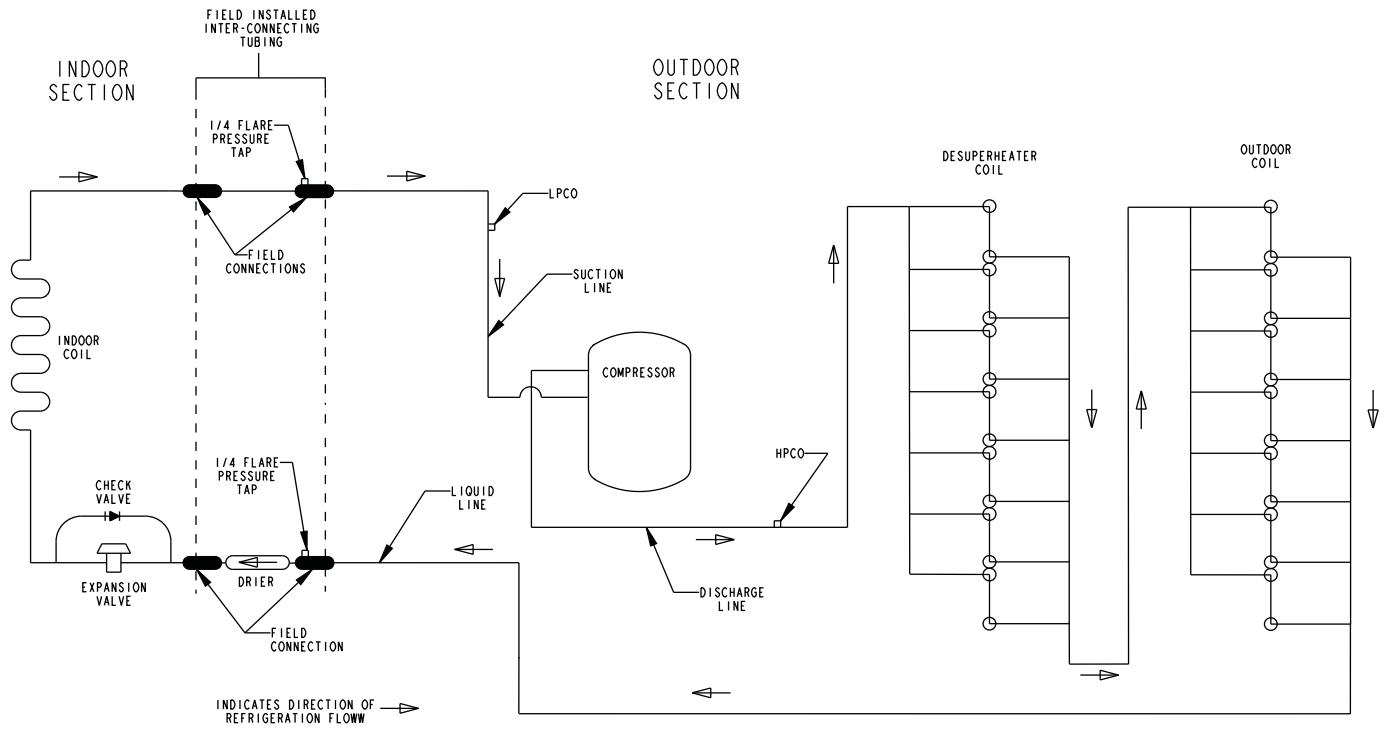
LIQUID TEMP (°F)	DESIGN SUBCOOLING (°F)						
	8	9	10	11	12	13	14
	LIQUID GAGE PRESSURE (PSI)						
55	179	182	185	188	191	195	198
60	195	198	201	204	208	211	215
65	211	215	218	222	225	229	232
70	229	232	236	240	243	247	251
75	247	251	255	259	263	267	271
80	267	271	275	279	283	287	291
85	287	291	296	300	304	309	313
90	309	313	318	322	327	331	336
95	331	336	341	346	351	355	360
100	355	360	365	370	376	381	386
105	381	386	391	396	402	407	413
110	407	413	418	424	429	435	441
115	435	441	446	452	458	464	470
120	464	470	476	482	488	495	501
125	495	501	507	514	520	527	533

Refer to Service Facts or
Installer's Guide for charging method.

From Dwg. D154557P01 Rev. 3

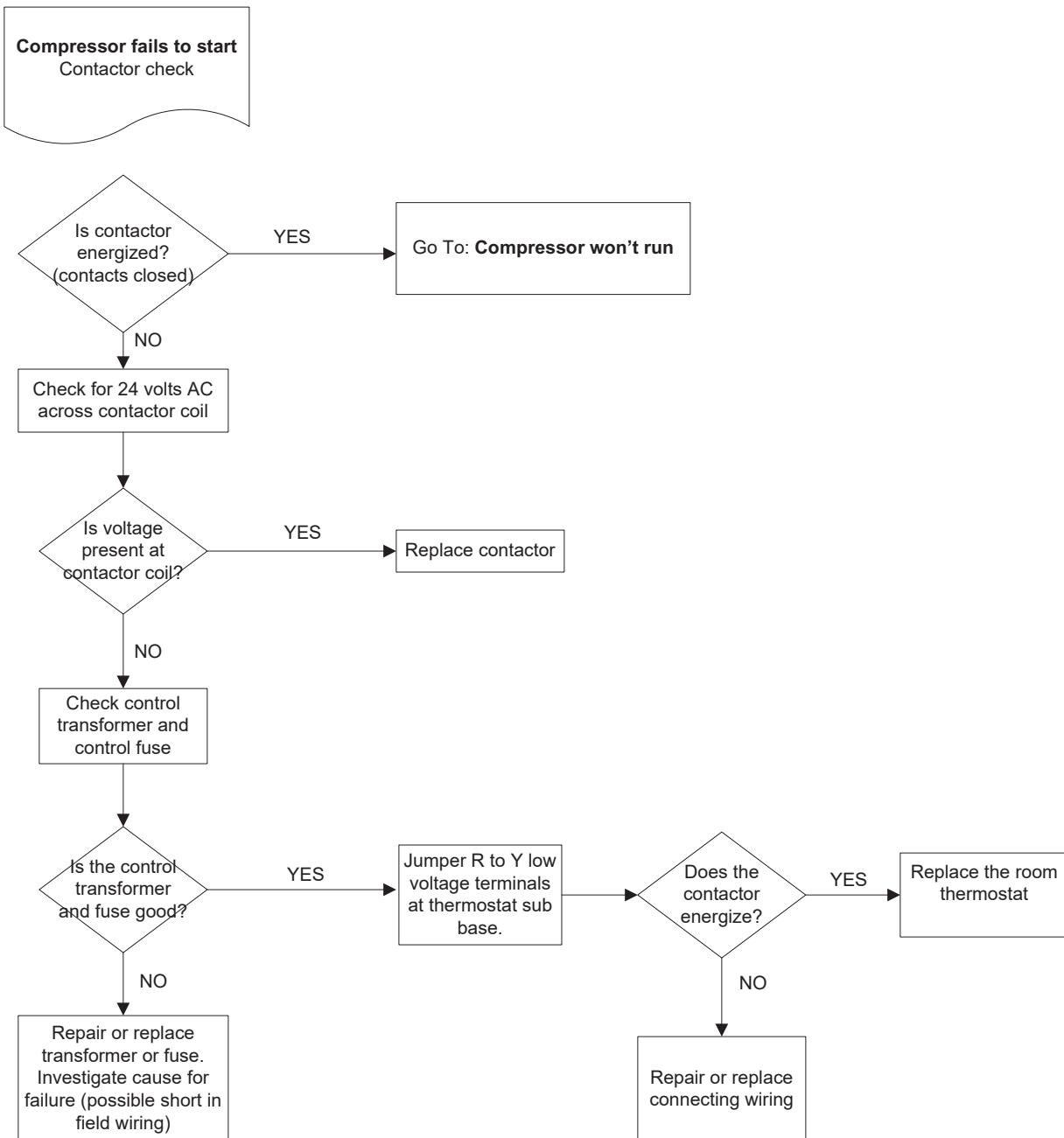
REFRIGERATION CIRCUITS

Cooling Refrigeration Cycle

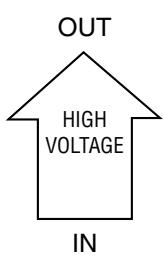


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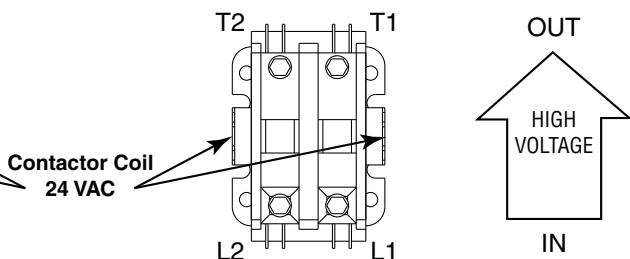
TROUBLESHOOTING



Single Pole Contactor (MS)*

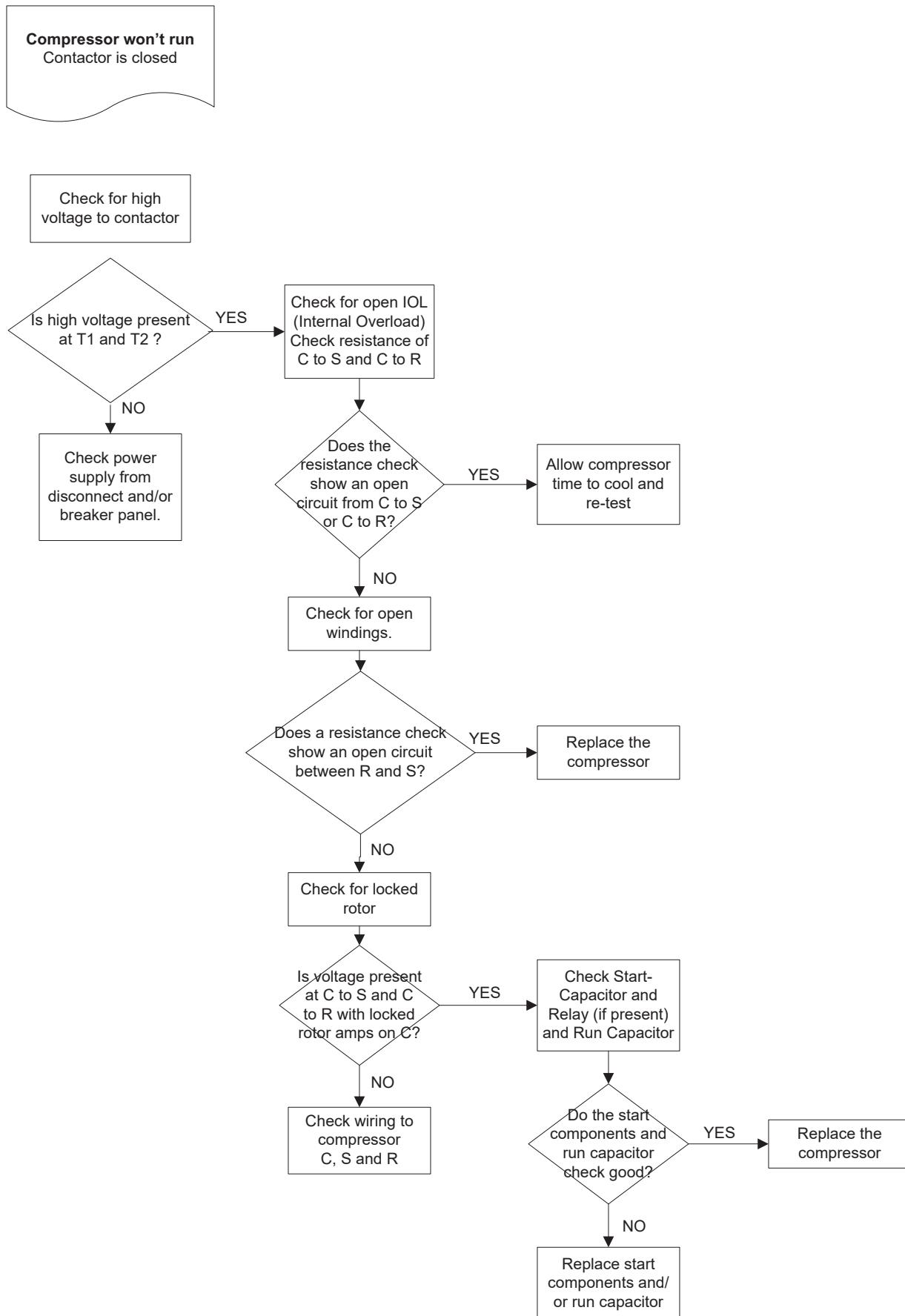


Double Pole Contactor (MS)*



*Refer to Wiring Diagram to determine if a single pole or double pole contactor is used.

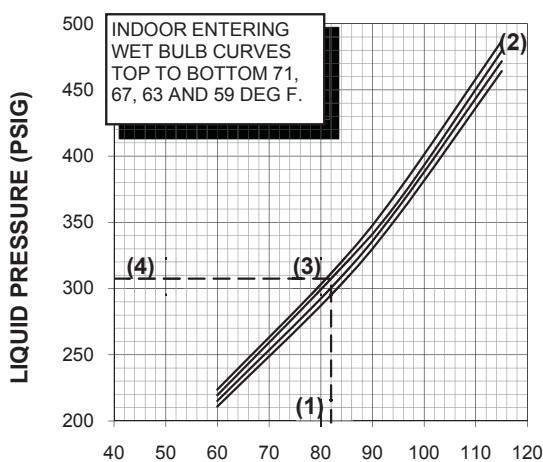
TROUBLESHOOTING



PRESSURE CURVES FOR 4A7A7060A1

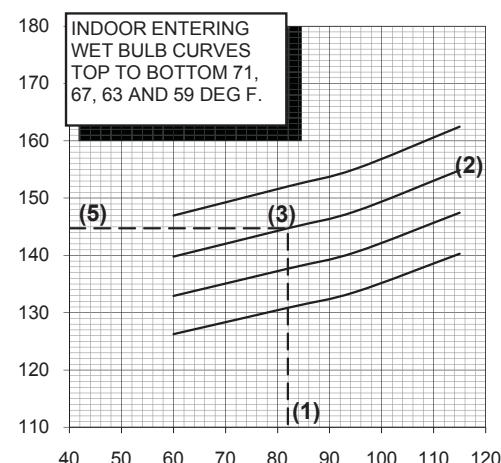
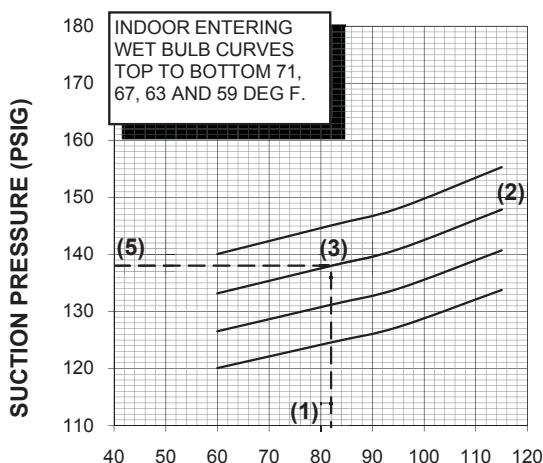
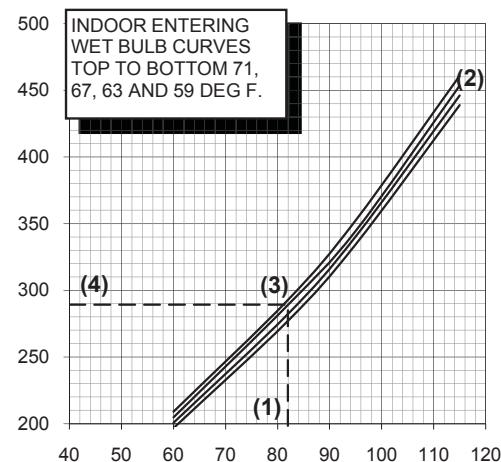
FIRST STAGE
AAM7B0C60H51

Cooling with Thermal Expansion Valve



SECOND STAGE
TAM7B0C60H51

Cooling with Thermal Expansion Valve



COOLING PERFORMANCE CAN BE CHECKED WHEN THE OUTDOOR TEMP IS ABOVE 65 DEG F.

TO CHECK COOLING PERFORMANCE, SELECT THE PROPER INDOOR CFM, ALLOW PRESSURES TO STABILIZE. MEASURE INDOOR WET BULB TEMPERATURE, OUTDOOR TEMPERATURE, LIQUID AND SUCTION PRESSURES. ON THE PLOTS LOCATE OUTDOOR TEMPERATURE (1); LOCATE INDOOR WET BULB (2); FIND INTERSECTION OF OD TEMP. & ID W.B. (3); READ LIQUID (4) OR SUCTION (5) PRESSURE IN LEFT COLUMN .

EXAMPLE: FIRST STAGE

- (1) OUTDOOR TEMP. 82 F.
- (2) INDOOR WET BULB 67 F.
- (3) AT INTERSECTION
- (4) LIQUID PRESSURE @ 1160 CFM IS 307 PSIG
- (5) SUCTION PRESSURE @ 1160 CFM IS 138 PSIG

EXAMPLE: SECOND STAGE

- (1) OUTDOOR TEMP. 82 F.
- (2) INDOOR WET BULB 67 F.
- (3) AT INTERSECTION
- (4) LIQUID PRESSURE @ 1515 CFM IS 289 PSIG
- (5) SUCTION PRESSURE @ 1515 CFM IS 145 PSIG

INTERCONNECTING LINES
GAS - 1 1/8" O.D.
LIQUID - 3/8" O.D.

ACTUAL:

LIQUID PRESSURE SHOULD BE +/- 10 PSI OF CHART
SUCTION PRESSURE SHOULD BE +/- 3 PSIG OF CHART

DWG.NO. 4A7A7060A1



HEATING & AIR CONDITIONING

About American Standard Heating and Air Conditioning

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4A7A7060A-SF-1F-EN 20 May 2020

Supersedes 4A7A7060A-SF-1E-EN (February 2020)

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Instruction Sheet

302-015

1900 Series Pumps

SUPERSEDES: June 1, 2014

Effective: January 21, 2022

Plant ID No. 001-941

APPLICATION:

All 1900 pumps are covered by this instruction sheet. They are designed for pumping water or a glycol/water mixture with no more than 50% glycol.

Working Pressure: 175 PSIG with cold water and
125 PSIG at rated temperature

Temperature: 250°F Standard
300°F with Hi-Temp Seal

INSTALLATION:



The pump must be mounted with the motor in a horizontal position. Optionally, it may be mounted with the motor above the volute.



CAUTION: DO NOT SUPPORT, SUSPEND OR BRACE MOTOR AND/OR BRACKET. SUPPORT PROVIDED BY CASING IS SUFFICIENT FOR STRUCTURAL INTEGRITY OF THE PUMP. UNDER NO CIRCUMSTANCES SHOULD ANY PART OF BRACKET OR MOTOR BE COVERED WITH INSULATION. OBSERVE ALL APPLICABLE ELECTRICAL AND MECHANICAL CODES.

WARNING: USE O-RING SEALS WITH GROOVED FLANGES. DO NOT USE FLAT GASKETS

START UP:

1. Wire the motor according to the nameplate specifications. Warranty is void if the motor is damaged due to improper electrical installation.
2. If a magnetic starter is used, see that the heater element is sized for the service factor load of the motor otherwise nuisance circuit breaker trips may occur.

3. Before starting the motor, ensure that pump is filled with water to lubricate the seal. Do not operate the pump dry, this will result in seal failure.

SEAL REPLACEMENT:

1. Disconnect the electrical connections. Relieve the system pressure, reduce the system temperature to ambient and drain the water from body.
2. Remove the motor and bracket assembly from the pump body. **(Figure 1)**
3. Place the bracket in a vertical position with the impeller up and loosen the bolt at center of impeller, two turns (7/16 Hex Head). This bolt has a **REVERSE** (Left-Handed) thread. Tap the impeller at its outside diameter with handle of hammer to free the tapered fit between the shaft and the impeller and completely remove the bolt, washer, and impeller. **(Figure 2)**
4. Remove the complete rotating element, which includes the spring retainer washer, spring, rotating seal assembly, and the rubber bellows. Next remove the stationary seat from the recessed end of the bracket. It may be necessary to pry it loose. **(Figure 3)**
Important Note: The original seat may be difficult to see, but must be removed before installing the new seat. **(Figure 4)**



Figure 1



Figure 2



Seat & Seal Assembly



Figure 3



Figure 4

5. Thoroughly clean the shaft (or shaft sleeve if applicable) and seat cavity.
6. Insert the new seat. For easy assembly, coat the seat rubber with the special grease provided in the small container. **Do NOT use any other oil or grease.** Push the seat all the way down into the cavity. **(Figure 5)** The seat must not be cocked relative to shaft. Be sure the face of the seat stays absolutely clean – wipe the surface with a soft, clean cloth if necessary.
7. Install the new rotating seal assembly. Coat the inside of the rubber bellows with the special grease provided. **Do NOT use any other oil or grease.** Be sure the carbon face remains absolutely clean. Slide the assembly, carbon first, over shaft until the carbon meets the seat. Install spring and spring retainer washer **(Figure 6)**
8. Ensure the mating surfaces of the shaft and impeller are clean. Replace the impeller using the new impeller bolt and washer provided. **Torque to 9 ft-lbs.**
9. Clean the gasket surfaces of both the casing and the bracket. Using the new gasket provided, reassemble the motor/bracket assembly to the casing.
10. Follow procedure outlined under **START UP** section.

Water Seal Kit

E Type Seal (Standard)	1600-868CRP
S Type Seal (High Temp)	1600-868SRP



Figure 5



Figure 6

IMPELLER REPLACEMENT:

Follow steps 1 → 3 and 8 → 10 outlined under **SEAL REPLACEMENT** section.

MOTOR REPLACEMENT:

1. Follow steps 1 → 4 under **SEAL REPLACEMENT** section.
 2. Remove the bracket from the motor.
 3. Loosen the set screws and remove the shaft adaptor (and sleeve if applicable), being sure to reclaim the original shaft key from the motor.
- Note:** *The key provided with the new motor must be modified to the length of the original before it is installed if the original is not being reused.*
4. Thoroughly clean the shaft (and sleeve if applicable) and reuse it. If unable to reuse replace with stainless steel shaft (Part #1900-1007RP)
 5. Insert the shaft adaptor onto the motor shaft, press until it bottoms out against the end of the motor shaft. (Part # 1900-008RP)
 6. Tighten set screws beginning with the two keyway set screws.
 7. Slide the bracket over shaft adaptor assembly and secure to the motor.
 8. Follow steps: 5 → 10 under **SEAL REPLACEMENT** section.

LIMITED WARRANTY STATEMENT

Taco, Inc. will repair or replace without charge (at the company's option) any commercial pump product or part which is proven defective under normal use within one (1) year from the date code.

Seals provided on commercial pumps are not covered by this warranty.

In order to obtain service under this warranty, it is the responsibility of the purchaser to promptly notify the local Taco stocking distributor or Taco in writing and promptly deliver the subject product or part, delivery prepaid, to the stocking distributor. For assistance on warranty returns, the purchaser may either contact the local Taco stocking distributor or Taco. If the subject product or part contains no defect as covered in this warranty, the purchaser will be billed for parts and labor charges in effect at time of factory examination and repair.

Any Taco product or part not installed or operated in conformity with Taco instructions or which has been subject to misuse, misapplication, the addition of petroleum-based fluids or certain chemical additives to the systems, or other abuse, will not be covered by this warranty.

If in doubt as to whether a particular substance is suitable for use with a Taco product or part, or for any application restrictions, consult the applicable Taco instruction sheets or contact Taco at [401-942-8000].

Taco reserves the right to provide replacement products and parts which

are substantially similar in design and functionally equivalent to the defective product or part. Taco reserves the right to make changes in details of design, construction, or arrangement of materials of its products without notification.

TACO OFFERS THIS WARRANTY IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ANY WARRANTY IMPLIED BY LAW INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESS WARRANTY SET FORTH IN THE FIRST PARAGRAPH ABOVE.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR STATUTORY, OR ANY OTHER WARRANTY OBLIGATION ON THE PART OF TACO.

TACO WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS OR ANY INCIDENTAL COSTS OF REMOVING OR REPLACING DEFECTIVE PRODUCTS.

This warranty gives the purchaser specific rights, and the purchaser may have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or on the exclusion of incidental or consequential damages, so these limitations or exclusions may not apply to you.



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Quick Guide

RE2H50S*-INCWT

RE2H65T*-INCWT

RE2H80T*-INCWT

Heat Pump Water Heater

WATER HEATER SAFETY INFORMATION

! This is the safety alert symbol. This symbol alerts you to potential hazards that can kill or hurt you and others. All safety messages will follow the safety alert symbol and the word "DANGER", "WARNING", or "CAUTION". These words are defined as:

- | | |
|-------------------------|---|
| ! DANGER | Indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| ! WARNING | Indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| ! CAUTION | Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |

IMPORTANT SAFETY INSTRUCTIONS

When using electrical appliances basic safety precautions should be followed, including the following:

! **WARNING** **READ ALL INSTRUCTIONS BEFORE USING.**

Risk of Fire - DO NOT store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Keep rags and other combustibles away.

If the water heater has been subjected to flood, fire, or physical damage, turn off power and water to the water heater.

Do not operate the water heater again until it has been thoroughly checked by qualified service personnel.

Safety Precautions

A. Do turn off power to water heater if it has been subjected to overheating, fire, flood or physical damage.

B. Do Not turn on water heater unless it is filled with water.

C. Do Not turn on water heater if cold water supply shut-off valve is closed.

NOTE: Flammable vapors may be drawn by air currents from surrounding areas to the water heater.

D. If there is any difficulty in understanding or following the Operating Instructions or the Care and Cleaning section, it is recommended that a qualified person or serviceman perform the work.

! **CAUTION**

Risk of Fire - Hydrogen gas can be produced in a hot water system served by this water heater that has not been used for a long period of time (generally two weeks or more). HYDROGEN GAS IS EXTREMELY FLAMMABLE!! To dissipate such gas and to reduce risk of injury, it is recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipe as the water begins to flow. Do not smoke or use an open flame near the faucet at the time it is open.



SAVE THESE INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS. READ ALL INSTRUCTIONS BEFORE USING.

WATER TEMPERATURE ADJUSTMENT

Safety and energy conservation are factors to be considered when selecting the water temperature setting via the water heater's user interface. Water temperatures above 125°F can cause severe burns or death from scalding. Be sure to read and follow the warnings outlined on the label pictured below. This label is also located on the water heater near the top of the tank.

Time/Temperature Relationship in Scalds

Temperature	Time to Produce a Serious Burn
120°F (49°C)	More than 5 minutes
125°F (52°C)	1-1/2 to 2 minutes
130°F (54°C)	About 30 seconds
135°F (57°C)	About 10 seconds
140°F (60°C)	Less than 5 seconds
145°F (63°C)	Less than 3 seconds
150°F (66°C)	About 1-1/2 seconds
155°F (68°C)	About 1 second

Table courtesy of Shriners Burn Institute

The chart shown above may be used as a guide in determining the proper water temperature for your home.

Thermostat has been set at the factory to 120°F (49°C) to reduce the risk of scald injury.

NOTE: Households with small children, disabled or elderly persons may require a 120°F (49°C) or lower thermostat setting to prevent contact with "HOT" water.

! DANGER

There is a Hot Water SCALD Potential if the control water temperature is set too high.

Safety Controls

The water heater is equipped with a temperature-limiting control (TCO) that is located above the heating element in contact with the tank surface. If for any reason the water temperature becomes excessively high, the temperature-limiting control (TCO) breaks the power circuit to the heating element. Once the control opens, it must be reset manually. Resetting of the temperature limiting controls should be done by a qualified service technician.

! CAUTION

The cause of the high temperature condition must be investigated by a qualified service technician and corrective action must be taken before placing the water heater in service again. To reset the temperature-limiting control:

1. Turn off the power to the water heater.
2. Remove the jacket access panel(s) and insulation.
The thermostat protective cover should not be removed.
3. Press the red RESET button.
4. Replace the insulation and jacket access panel(s) before turning on the power to the water heater.



Water temperature over 125°F can cause severe burns instantly or death from scalds.

The electronic temperature control setting usually approximates tap water temperature. However, factors could cause water temperature to reach 160°F regardless of the control setting. Always feel water before bathing and showering.

Children, disabled and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available; see manual.

! FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

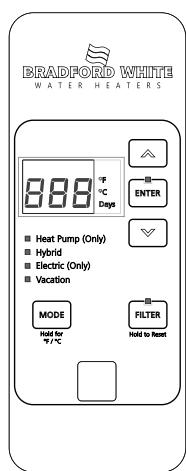
California Law requires that residential water heaters must be braced, anchored or strapped to resist falling or horizontal displacement due to earthquake motions. For residential water heaters up to 52 gallon (236.4 L) capacity, a brochure with generic earthquake bracing instructions can be obtained from: Office of the State Architect, 400 P Street, Sacramento, CA 95814 or you may call 916.324.5315 or ask a water heater dealer.

Applicable local codes shall always govern installation. For residential water heaters of a capacity greater than 52 gallons (236.4 L) consult the local building jurisdiction for acceptable bracing procedures.

California Proposition 65 Warning: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

SAVE THESE INSTRUCTIONS

About the control panel.



This water heater defaults to the Hybrid operating mode. Available modes are listed below and can be selected using the MODE button.

Heat Pump (Only) Mode—RECOMMENDED FOR MAXIMUM SAVINGS

Heat Pump is the most energy-efficient mode for this water heater. It takes heat from the surrounding air to heat the water. The time it takes to heat the water is longer in this mode, so it may not be sufficient if you have a high-demand situation such as a large household or company.

Hybrid Mode

Hybrid mode combines the energy efficiency of Heat Pump (Only) with the recovery speed and power of the Electric (Only) mode in most water usage situations. Hybrid mode will allow the unit to perform like a standard electric water heater while providing significant energy savings.

Cold Climate Efficiency setting (CCE)

For installations where ambient conditions may be considered cold, an available Cold Climate Efficiency (CCE) setting can be activated in the control to achieve additional energy savings in Hybrid mode.

In some regions, rebates may be available which require this setting to be used to qualify [e.g. compliance with NEEA Northern Climate specification Tier 3 requirements]. Check with your local utility for available rebates and requirements.

The CCE setting is activated by pressing and holding the DOWN arrow and the Filter button at the same time for 5 seconds. "CCE" will display temporarily when CCE settings have been activated [“dUC” may display on some models]. To deactivate the CCE setting, press and hold the same buttons [DOWN arrow & Filter button] at the same time for 5 seconds. "Std" will display temporarily when CCE settings have been deactivated and the water heater has returned to normal operation of the selected mode.

A ducting kit is also available for use with your heat pump water heater if desired. [see www.BradfordWhite.com for details].

Ducting kits may be installed to achieve directed flow of inlet and outlet air for heat pump operation independent of whether the CCE setting is activated. Ducting kits may also be installed to allow water heater installation in rooms less than 700cu.ft. or without louvered doors, as specified in the installation instructions.

NOTE: Energy Guide unit performance, energy consumption and savings are based on non-ducted installations in Hybrid mode operation at a temperature setting of 135°F (57°C).

Electric (Only) Mode

This mode uses only the upper and lower heating resistance elements to heat the water, stopping the cool air discharge during heat pump operation. The time it takes to heat the water is less in this mode, but it is the LEAST energy-efficient mode.

Follow these steps to set Electric (Only) mode:

1. Select Electric (Only) mode using the Mode button.
2. Input the total days to remain in Electric (Only) mode using the UP arrow, or remain in Electric (Only) mode indefinitely by selecting “---”.
3. Press ENTER

At the end of the selected time period, the unit will switch back to the previously selected more energy-efficient mode.

NOTE: In this mode the green LED light will flash after 48 hours as an indication that the unit is not operating in the most energy efficient mode. The unit will continue to operate in this mode and does not indicate an operating issue.

NOTE: With the CCE setting active, Electric (Only) mode can be set for 1-7 days.

Vacation

This feature is used when you will be away from the home for an extended period of time and hot water is not needed. In this mode, the unit will drop the water temperature down to 50°F (10°C) and will use the most efficient heating mode to conserve energy while the heater is sitting idle. The unit will automatically resume heating one day before your return, so that hot water will be available.

For example if you will be gone 14 days, follow these steps:

1. Select VACATION by using the Mode button
2. Input total days you will be gone (in this example, 14) by pressing the UP arrow button (the default is 7 days)
3. Press ENTER.

The unit will drop the water temperature down to 50°F (10°C) for one day less than you will be gone (in this example, for 13 days). At the end of the day before you return (in this example, the 13th day), it will automatically return to the previous operating mode and heat the water to the original temperature setting so hot water is available upon your return.

To access any of these modes:

1. Press the MODE button on the control to the desired operating mode.
2. The green light will be illuminated on the chosen mode.

To Adjust the Temperature

Follow these steps:

1. Press the UP or DOWN arrow on the control panel key pad to desired temperature.
2. Press ENTER to accept the new setting.

Note: To change between °F and °C, press and hold MODE.

In winter months, the water heater will take longer to heat incoming water to a preset point due to the colder temperature of the incoming water.

Care and cleaning.

DRAINING THE WATER HEATER

CAUTION: Risk of Shock - Shut off power to the water heater before draining water.

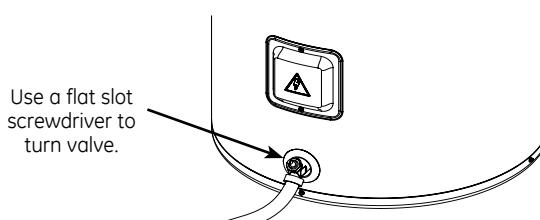
DANGER: Risk of Scald - Before manually operating the relief valve, make certain no one will be exposed to the hot water released by the valve. The water drained from the tank may be hot enough to present a scald hazard and should be directed to a suitable drain to prevent injury or damage.

To drain the water heater, follow these steps:

1. Attach a garden hose to the drain valve located at the bottom of the unit and direct that hose to a drain.

2. Turn off the cold water supply.
3. Admit air to the tank by opening a hot water faucet or lifting the handle on the relief valve.
4. Open the drain valve with a flat screwdriver.

Note: See page 15 for product schematic.



EXTENDED SHUTDOWN PERIODS OR VACATIONS EXCEEDING VACATION MODE OPTIONS

If the water heater is to remain idle for an extended period of time, the power and water to the appliance should be turned off and the water heater drained to conserve energy and prevent a buildup of dangerous hydrogen gas. This unit has no power button, power can only be shut off at the circuit breaker or disconnect switch.

If the water heater has an anode depletion sensing feature (some models) and the water heater cannot be drained, it is recommended to leave the power turned on with the water heater in vacation mode to ensure that the feature will continue to operate properly while still conserving energy.

The water heater and piping should be drained if they might be subjected to freezing temperatures.

After a long shutdown period, the water heater's operation and controls should be checked by qualified service personnel. Make certain the water heater is completely filled again before placing it in operation.

NOTE: Refer to the Hydrogen Gas Caution in the Operating Instructions (see page 3).

CLEANING THE FILTER

In the Hybrid, Heat Pump and High Demand/Boost modes, the heater moves air through the system and out the back of the unit. The filter is in place to protect the evaporator from dirt and dust.

A clean air filter is important to get the highest efficiency. Occasionally this filter will need to be cleaned (minimum once per year). When the filter requires cleaning, the Red light above the Filter button will be illuminated and an audible beep will sound.

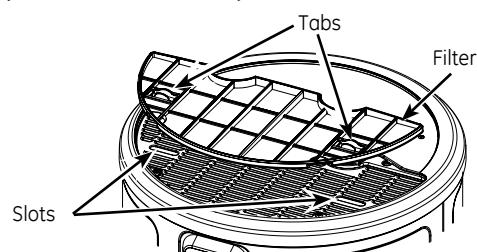
NOTE: If the filter gets too dirty, the unit will automatically switch to Electric/Standard mode and energy savings will be lost.

Leave the power on. Remove the filter from the top of the unit. Squeeze two tabs and lift to remove the air filter. Once it has been removed, the filter can be vacuumed or wiped clean with a damp cloth or rinsed with warm water.

Once the filter has been cleaned and dried, it can be replaced by aligning it into the slots in the top of the unit and pushing it down into place.

After the clean filter has been reinstalled, press and hold the **FILTER** button. If a heating cycle is on when the filter fault is reset, it will continue in electric mode to finish the cycle. After that, it will automatically revert to the mode it was in prior to being switched.

IMPORTANT: Filter must be cleaned when the alarm is displayed. A dirty filter will make the system work harder and result in a reduction of efficiency and possible damage to the system. In order to get the best energy efficiency available, make sure your filter is clean.

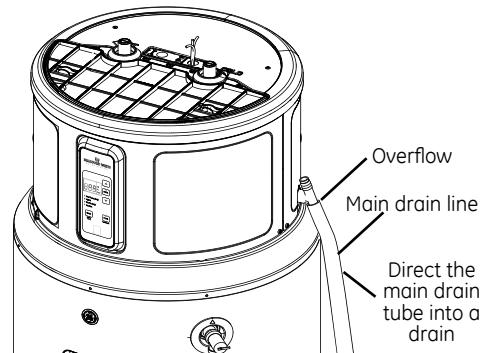


CLEARING THE CONDENSATION DRAIN TUBE

The main drain is intended to carry all condensate away. If it is clogged, the heat pump will stop operating, the display will show F20, and an alarm will sound. Press any button to silence the alarm, then clear the condensate drain by removing any drain lines and connections, and clearing debris. Reattach drain lines and connections, then allow the water heater to run.

Periodically inspect the drain lines and clear any debris that may have collected in the lines.

See Installation Instructions for more information.



Anode Rod Maintenance and Service.

ANODE ROD

The anode rod should be removed from the water heater's tank and inspected once every 3 years service, and replaced when more than 6" (15.2 cm) of core wire is exposed at either end of the rod. For more information contact us at www.bradfordwhite.com.

NOTE: Artificially softened water requires that the anode rod be inspected annually.

Due to shock hazard and to prevent accidental water leaks, this inspection should be done by a qualified servicer or plumber, and requires that the electric power and cold water supply be turned off before servicing the anode rod.

NOTICE: Do not remove the anode rod from the water heater's tank except for inspection and/or replacement, as operation with the anode rod removed will shorten the life of the glass-lined tank and will void warranty coverage.

The anode rod consumption and replacement are not covered by warranty.

Some areas have water conditions that may cause an odor to develop in the water heater. Aluminum-Zinc alloy replacement rods are available to address the condition.

Additional information for products with an anode depletion sensing feature:

When the system indicates that the anode depletion sensing anode rod is approaching end of life, it is recommended to replace it. To silence the alarm, press the Anode button once. Call Bradford White Tech Service to order or to replace the anode depletion sensing anode rod. After replacing, reset the Anode alarm by pressing and holding the Anode button for 10 seconds until the control beeps and the LED above the button turns off.

If an Aluminum-Zinc anode rod is installed to address a water odor condition, the anode depletion sensing feature must be disabled. Upon power-up after installing an Aluminum-Zinc anode rod, the control will sound an alarm. To quiet the alarm and disable the feature, first press the Anode button once to silence the alarm, then press the Anode button 3 times. The control will beep and a message will scroll on the display confirming that the feature has been disabled. Annual inspections of the anode rod are recommended since the water heater will no longer be capable of alerting for a depleted anode rod. To enable the feature if an anode depletion sensing anode rod is installed, press the Anode button 3 times. The control will beep and a message will scroll on the display confirming that the feature has been enabled.

NOTE: If the water heater has been installed with a device that periodically cuts power to the water heater, the accuracy of the anode rod depletion sensing feature may become compromised and anode rod inspection every 2-3 years is recommended.

If the water heater will be inactive for a long period of time and the water heater cannot be drained, it is recommended to leave the power turned on with the water heater in vacation mode to ensure that the feature will continue to operate properly while still conserving energy.

NOTE: Refer to the Hydrogen Gas Caution in the Operating Instructions (see page 1).

Tools needed:

- T20 Torx Screwdriver
- Slot Screwdriver
- Tape
- Softset Sealant
- Socket Extention 12" long
- 1-1/16" Socket
- Socket Wrench
- Anode Rod, if needed

To service the Anode Rod:

1. Disconnect power, shut off the water supply, and partially drain one or two gallons from the water heater through the lower drain valve.
2. Remove the filter, trim ring, and front top cover as show in **Illustration A**.
3. Reinstall the trim ring, place a protective layer of tape on sheet metal edges, as show in **Illustration B**.
4. Remove insulation to uncover the anode rod as show in **Illustration B**. Unplug anode wire (on some models).
5. Using a 1-1/16" socket and extension, unscrew the anode rod, then lift out to inspect as show in **Illustration C**.
6. To install the anode rod, seal the threads with soft set sealant, thread into the port and using the torque wrench tighten to 50 ± 5 ft-lbs of torque. Plug in the wire for the anode rod if present. Reinstall the anode rod insulation. If an Aluminum-Zinc or other non-sensing anode rod is installed, the anode depletion sensing feature must be disabled and the wire end taped (some models).
7. Turn water supply on, open a tap to remove any air in plumbing system, inspect for leaks, then reassemble the unit in reverse order as shown in **Illustration A**, and turn the power on. Reset the Anode button (some models) by pressing and holding for 10 seconds to indicate that a new anode depletion sensing anode rod is installed.

CAUTION - IMPORTANT SAFETY NOTICE

This information is intended to use by individuals possessing adequate background of electrical, electronic and mechanical experience. Any attempt to repair a major appliance may result in personal injury and property damage. The manufacturer or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use.

Installation

LOCATION

The water heater and water lines should be protected from freezing temperatures and *high-corrosive atmospheres*. Do not install the water heater in outdoor, unprotected areas.

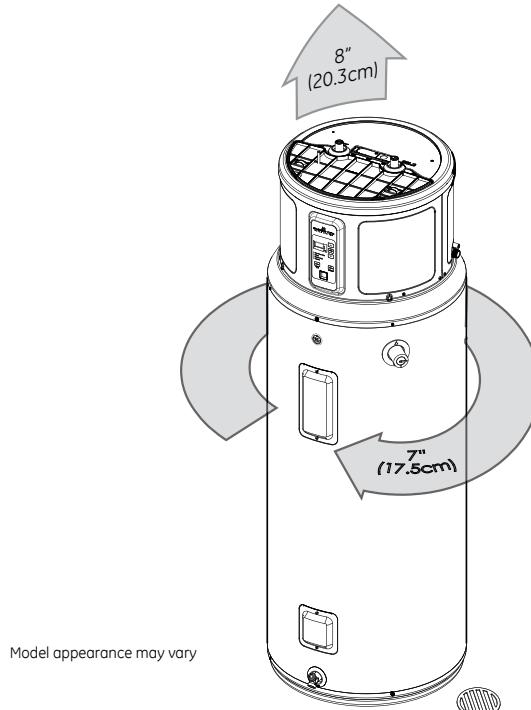
CAUTION: *Risk of Property Damage* - The water heater should not be located in an area where leakage of the tank or connections will result in damage to the area adjacent to it or to lower floors of the structure. Where such areas cannot be avoided, it is recommended that a suitable catch pan, adequately drained, be installed under the water heater.

NOTE: The heat pump operating range is 35°F to 120°F (2°C to 49°C). If the ambient temperature is outside of this range, the heat pump will turn off and the electric elements will be used until the ambient temperature returns to within the operating range.

REQUIRED CLEARANCES:

There must be a 7" (17.5 cm) clearance between any object and the rear and sides of the water heater in the event service is needed. A minimum 8" (20.3cm) clearance above the water heater to remove the filter for cleaning and for service access, and clear access to the front of the water heater, is recommended. Installations that require 6" clearance on the sides or rear of the water heater for earthquake straps are also acceptable. **In these cases, additional clearance must be provided on the opposite side of the unit to allow for service access.** The hot and cold water plumbing and electrical connections must not interfere with the removal of the filter.

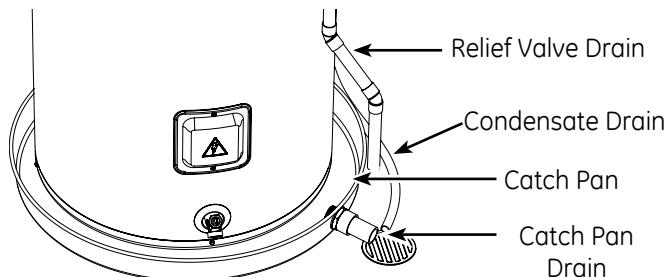
If a separate ducting kit is purchased, additional space is required above and to the rear of the water heater for installation. Consult the ducting kit manual for specific instructions. See www.bradfordwhite.com for details.



CATCH PAN INSTALLATION (If required)

NOTE: Auxiliary catch pan MUST conform to local codes.

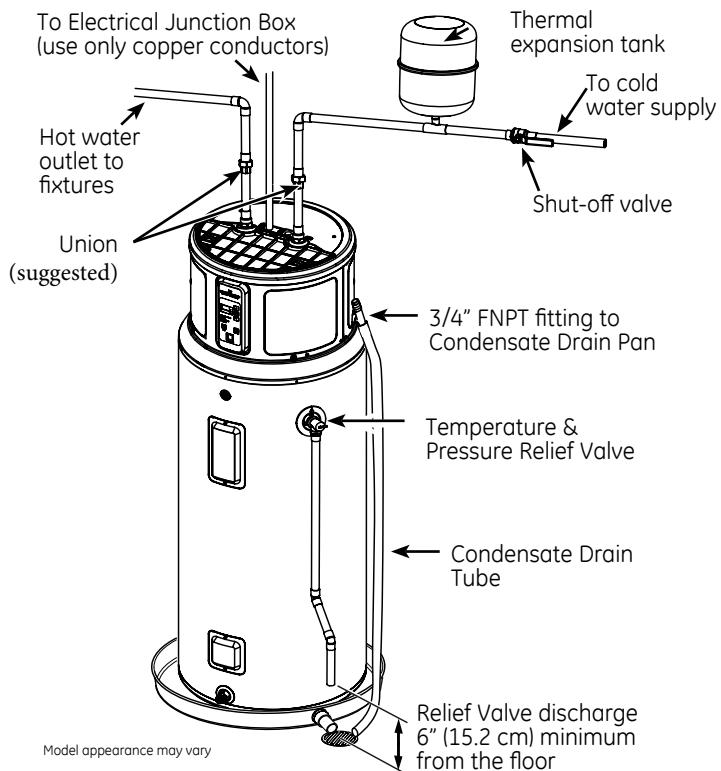
Catch Pan Kits are available from the store where the water heater was purchased, a builder store or any water heater distributor. The catch pan should be 2" (5.1 cm) minimum larger than the Water Heater base diameter. To prevent corrosion and improve Drain Valve access it is recommended that the water heater be placed on spacers inside the catch pan.



THERMAL EXPANSION

If check valve is present on inlet water line, use of a thermal expansion tank is recommended. Check valves on the inlet water line are referred to as a "closed system." A closed system can cause the check valve on the water heater to operate more than intended, causing premature failure. The suggested method of controlling thermal expansion is to install an expansion tank in the cold water line between the water heater and the check valve as shown.

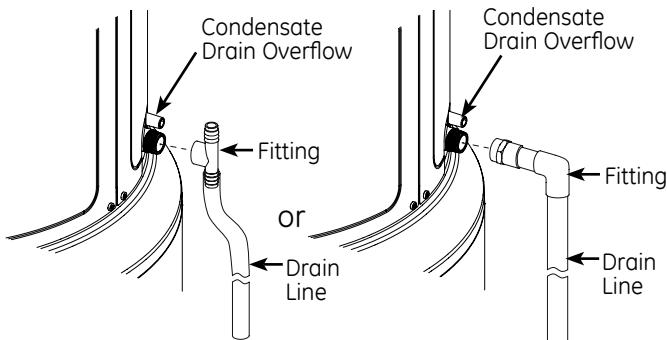
TYPICAL INSTALLATION



CONDENSATION DRAIN CONNECTION

This unit has a condensate drain; therefore a floor or other drain no higher than 36" (91.4cm) above the floor must be available in close proximity to the water heater to allow for the shortest possible drain line with minimal turns to be installed. Drain must meet state and local codes. It is important to install a 3/4" FNPT fitting suitable for either rigid or flexible drain line to the primary drain port coming off the side of the unit. Diameter reductions from a 3/4" drain line are not recommended.

Ensure that the rigid or flexible drain line maintains a downward slope to allow for proper gravity drainage of condensate to the drain and to allow for proper function of the condensate drain blockage sensor (see page 12). If no drain is available, then a common condensate pump with a capacity no less than 1 gallon (3.8L)/day must be purchased and installed. It is important to route the flexible or rigid drain line so that the discharge water cannot contact live electrical parts or cause water damage.



RELIEF VALVE

⚠ WARNING: Risk of Unit Damage - The pressure rating of the relief valve must not exceed 150 PSI (1.03 kPa), the maximum working pressure of the water heater as marked on the rating plate.

A new combination temperature/pressure-relief valve, complying with the Standard for Relief Valves and Automatic Gas Shut-Off Devices for Hot Water Supply Systems, ANSI Z21.22, is supplied and must remain installed in opening provided and marked for the purpose on the water heater. No valve of any type should be installed between the relief valve and the tank. Local codes shall govern the installation of relief valves.

The BTUH rating of the relief valve must not be less than the input rating of the water heater as indicated on the rating label located on the front of the heater (1 watt=3.412 BTUH).

Connect the relief valve outlet to a suitable open drain so the discharge water cannot contact live electrical parts or persons and to eliminate potential water damage.

Piping used should be of a type approved for hot water distribution. The discharge line must be no smaller than the outlet of the valve and must pitch downward from the valve to allow complete drainage (by gravity) of the relief valve and discharge line. The end of the discharge line should not be threaded or concealed and should be protected from freezing. No valve of any type, restriction or reducer coupling should be installed in the discharge line.

⚠ CAUTION:

To reduce the risk of excessive pressures and temperatures in this water heater, install temperature and pressure protective equipment required by local codes and no less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, as meeting the requirements for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22. This valve must be marked with a maximum set pressure not to exceed the marked maximum working pressure of the water heater. Install the valve into an opening provided and marked for this purpose in the water heater, and orient it or provide tubing so that any discharge from the valve exits only within 6 inches above, or at any distance below, the structural floor, and does not contact any live electrical part. The discharge opening must not be blocked or reduced in size under any circumstances.

TO FILL THE WATER HEATER

⚠ WARNING: Risk of Unit Damage - The tank must be full of water before heater is turned on. The water heater warranty does not cover damage or failure resulting from operation with an empty or partially empty tank.

Make certain the drain valve is completely closed.

Open the shut-off valve in the cold water supply line.

Open each hot water faucet slowly to allow the air to vent from the water heater and piping.

A steady flow of water from the hot water faucet(s) indicates a full water heater.

"F11" fault code during installation: If the unit is powered on without a full tank, the error code "F11" will show in the display. Turn off the power, fill the tank with water (see above), then turn the power back on.

NOTE: The DRY TANK DETECTION feature on tank is for the aid of installer and should NOT be used as the primary control to prevent operation with an empty or partially filled tank. Power should NEVER be applied to the water heater until installer has verified tank is filled and all air has been purged from system.

NOTICE:

Do not mis-wire electrical connections. 240V AC or 208AC must be applied across L1 and L2 wires as shown in 'Water heater junction box' illustration. Failure to do so will VOID the warranty, and can result in 120V applied to water heater, which may damage the compressor or other electrical components.

If 4-conductor wire is supplied to the water heater, cap the neutral, and connect the remaining wires as illustrated.

NOTE REGARDING UTILITY POWER-MANAGEMENT DEVICES (Sometimes called Peak Load Reduction Switches):

Some power-management switching devices or even some basic timer switches exist that REDUCE voltage from 240V to 120V during high-electricity-demand periods. These devices must be removed from the circuit providing power to the water heater because of the potential unit damage noted above.

However, switching devices which cut power from 240V to 0V on a periodic basis are acceptable.

"bAd linE" fault code during installation: If "bAd linE" is shown on the display, the unit is not receiving the correct voltage as a result of incorrect wiring. To correct this fault, turn the power off to the unit, correct the wiring issue, then turn the power back on.

Installation

ELECTRICAL CONNECTIONS

A separate branch circuit with copper conductors, overcurrent protective device and suitable disconnecting means must be provided by a qualified electrician.

All wiring must conform to local codes or latest edition of National Electrical Code ANSI/NFPA 70.

The water heater is completely wired to the junction box at the top of the water heater. An opening for 1/2" electrical fitting is provided for field wiring connections.

The voltage requirements and wattage load for the water heater are specified on the rating label on the front of the water heater.

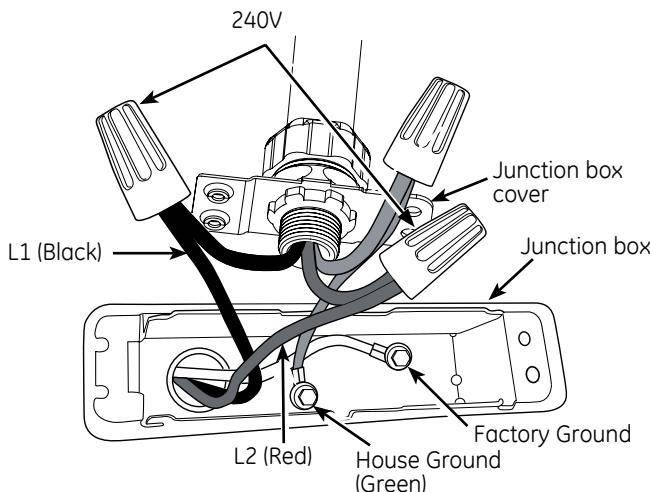
The branch circuit wiring should include either:

1. Metallic conduit or metallic sheathed cable approved for use as a grounding conductor and installed with fittings approved for the purpose.
2. Nonmetallic sheathed cable, metallic conduit or metallic sheathed cable not approved for use as a ground conductor shall include a separate conductor for grounding. It should be attached to the ground terminals of the water heater and the electrical distribution box.

To connect power to the water heater:

1. Turn the power off.
2. Remove the screw/screws holding the junction box top cover.
3. Install L1 to L1, L2 to L2 and ground to the green ground wire connected to the bottom of the junction box.

NOTE: Install electric connections according to local codes or latest edition of National Electrical Code ANSI/NFPA 70.



WARNING: Proper ground connection is essential. The presence of water in the piping and water heater does not provide sufficient conduction for a ground. Nonmetallic piping, dielectric unions, flexible connectors, etc., can cause the water heater to be electrically isolated. Do not disconnect factory ground.

The manufacturer's warranty does not cover any damage or defect caused by installation, attachment or use of any type of energy-saving or other unapproved devices (other than those authorized by the manufacturer) into, onto or in conjunction with the water heater. The use of unauthorized energy-saving devices may shorten the life of the water heater and may endanger life and property.

The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized devices.

If local codes require external application of insulation blanket kits, the manufacturer's instructions included with the kit must be carefully followed.

Application of any external insulation, blankets or water pipe insulation to this water heater will require careful attention to the following:

- Do not cover the temperature and pressure-relief valve.
- Do not cover access panels to the heating elements.
- Do not cover the electrical junction box of the water heater.
- Do not cover the operating or warning labels attached to the water heater or attempt to relocate them on the exterior of the insulation blanket.
- Do not block the air inlet/outlets in the top covers or rear of the unit.

NOTE: This guide recommends minimum branch circuit sizing based on the National Electric Code. Refer to wiring diagrams in this manual for field wiring connections.

BRANCH CIRCUIT SIZING GUIDE

Total Water Heater Wattage	Recommended Over-Current Protection (fuse or circuit breaker amperage rating)			
	208V	240V	277V	480V
3,000	20	20	15	15
4,000	25	25	20	15
4,500	30	25	25	15
5,000	30	30	25	15
5,500	35	30	25	15
6,000	40	35	30	20
8,000	50	45	40	25
9,000	—	50	45	25
10,000	—	—	50	30
11,000	—	—	50	30
12,000	—	—	—	35

Total Water Heater Wattage	Copper Wire Size AWG Based on N.E.C. Table 310-16 (167°F/75°C.)			
	208V	240V	277V	480V
3,000	12	12	14	14
4,000	10	10	12	14
4,500	10	10	10	14
5,000	10	10	10	14
5,500	8	10	10	14
6,000	8	8	10	12
8,000	8	8	8	10
9,000	—	8	8	10
10,000	—	—	8	10
11,000	—	—	8	10
12,000	—	—	—	8

NORMAL STARTUP CONDITIONS:

Once tank is full and power is energized, you may experience the following:
NOTE: Heat Pump operating range is 35°F - 120°F (2°C-49°C).

Elapsed Time	HEWH Actions	Comments
0 to 2 minutes	Unit will go through self-check and display countdown	This 2-minute off-time prevents compressor damage.
2 to 22 minutes	Compressor and fan turn on	This 20-minute period is used to ensure the tank is full of water (Dry-fire prevention algorithm).
22 minutes and beyond	Compressor and fan turn off, heating elements turn on. After initial heat-up, elements turn off and compressor turns on.	The water heater is operating in Hybrid mode. Quickly provides initial amount of hot water, then switches to efficient heat pump for majority of heating.

Troubleshooting...

Before you call for service.... Save time and money! Review the chart below first and you may not need to call for service.

Problem	Possible Causes	What To do
	! CAUTION: For your safety, DO NOT attempt repair of electrical wiring, controls, heating elements or other safety devices. Refer repairs to qualified service personnel.	
Water heater makes sounds	A fan is used to move air through the system	<ul style="list-style-type: none"> Some amount of fan sound is normal. If you hear an abnormal sound or the sound level seems unusually loud, then contact service.
Water heater is making the room cooler	Room is not vented properly or is too small	<ul style="list-style-type: none"> If the room is smaller than 10' x 10' x 7' (3m x 3m x 2.1m) then it must have a louvered door or other means to allow air exchange with surrounding rooms.
	Heat is removed from the air to heat the water	<ul style="list-style-type: none"> This is normal.
Water dripping down the outside of the heater	Condensate drain is clogged	<ul style="list-style-type: none"> Clear out any debris in the drain port on the unit.
	Hot/Cold water connections are not tightened	<ul style="list-style-type: none"> Tighten the inlet and outlet pipe connections.
Not enough or not hot water	Water temperature may be set too low	<ul style="list-style-type: none"> See <i>About the Water Temperature Setting</i> section.
	Hot water usage pattern exceeds the capability of the water heater in current mode	<ul style="list-style-type: none"> Change to different mode. Wait for the water heater to recover after an abnormal demand.
	Leaking or open hot water faucets	<ul style="list-style-type: none"> Make sure all faucets are closed.
	Long runs of exposed pipe, or hot water piping on outside wall	<ul style="list-style-type: none"> Insulate piping.
	Not enough clearance to allow air to circulate for the heater pump	<ul style="list-style-type: none"> Make sure unit is 7" away from the wall and has 8" clearance above the air filter.
	Room size is not appropriate for water heater	<ul style="list-style-type: none"> If room size is less than 10' x 10' x 7' (700 cu. ft.), install louvered door or similar ventilation.
	Inadequate wiring	<ul style="list-style-type: none"> See the <i>Installation Instruction</i> section.
	Manual reset limit (TCO)	<ul style="list-style-type: none"> See the <i>Safety Control</i> section, see page 4.
	Water connections to unit reversed	<ul style="list-style-type: none"> Correct piping connections.
Water is too hot	Water temperature is set too high	<ul style="list-style-type: none"> See <i>About the Water Temperature Setting</i> section.
	Electric control has failed	<ul style="list-style-type: none"> Call for service.
Rumbling noise	Water conditions in your home caused a buildup of scale or mineral deposits on the heating elements	<ul style="list-style-type: none"> Remove and clean the heating elements. This should only be done by a qualified service personnel.
The heater is beeping and the display says F11	The water heater has not been filled with water before powering up. Powering up the heater without water will damage the electric heaters. The water heater warranty does not cover damage or failure resulting from operation with an empty or partially empty tank.	<ul style="list-style-type: none"> Fill the tank completely with water. Press ENTER to stop the alarm and then cycle power when the tank has been filled. If the unit has been confirmed to be filled with water, and an F11 code is experienced, it is possible that the code may be a false indicator due to certain unique environment conditions encountered during the start up. If the unit is full of water, turn the breaker off for about 10 minutes to allow the water temperature to stabilize, then turn the breaker back on. If the F11 code persists, schedule service.
The heater is beeping and the screen says "F17"	The anode rod is not connected properly and the water heater may not be protected from corrosion.	<ul style="list-style-type: none"> Check that the tank is filled completely with water. If the tank is full of water and the F17 code persists, contact service.
The heater is beeping and the screen says, "FA-F8"	There is an issue with the heat pump system.	<ul style="list-style-type: none"> The unit will automatically switch to another available mode to ensure you continue to have hot water. Contact service immediately and give them the codes listed on the display screen.
The heater is beeping and the screen flashes an error code	There is an issue with the water heater that requires immediate attention.	<ul style="list-style-type: none"> The heater may switch to another available heating mode. Contact service immediately. To stop the beeping noise (unless error code F2, F11, F17 or bAd linE) press either the UP or DOWN arrow button and the alarm will stop and the display will go back to normal (set temperature).
Hot water has a rotten egg or sulphur smell	Certain water supplies with high sulphate content will react with the anode rod that is present in all water heaters for corrosion protection of the tank	<ul style="list-style-type: none"> The odor can be reduced or eliminated in most water heaters by replacing the anode rod with less-active material rod. In some cases, an added step of chlorinating the water heater and all hot water lines may be necessary, contact your local water professional or plumber for options and instructions. A qualified servicer or plumber should do this replacement.