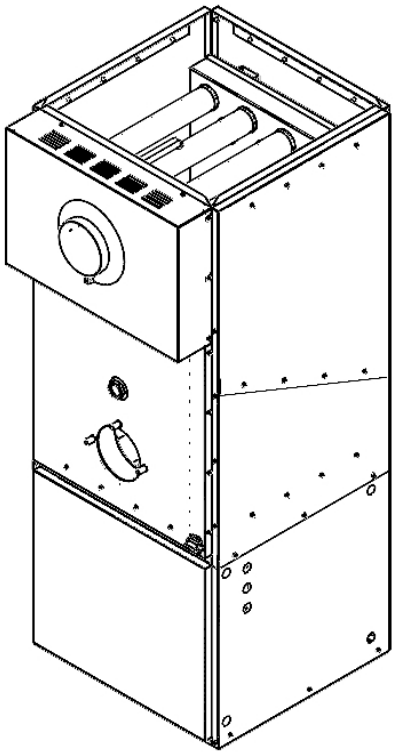
Installation, Operation & Service Manual

OIL FIRED LOBOY FURNACE - 83% + EFFICIENCY

HTL-100
HTL-200



INSTALLATIONS MUST MEET ALL LOCAL AND FEDERAL CODES THAT MAY DIFFER FROM THIS MANUAL

Please read the manual in its entirety before beginning installation. This manual must be kept with the boiler for future reference. For maintenance or question, please refer to your installer – contractor directly.

2023-08-01

5IM-OE-HTL0-00

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1.0 IMPORTANT SAFETY ADVICE

Please read and understand this manual before installing, operating or servicing the furnace. To ensure you have a clear understanding of the operating procedures of the unit please take the time to read the **IMPORTANT SAFETY ADVICE section** of this manual.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

Familiarize yourself with location of furnace oil supply manual shut-off valve and any electrical switches, fuse or circuit breaker associated with furnace.

WARNINGS

NEVER burn garbage or paper in the unit.
NEVER store combustible material around it.
DO NOT attempt to start burner when excess oil has accumulated, when unit is full of vapour or when heat exchanger is very hot.
DO NOT use gasoline, crankcase draining's or any oil containing gasoline.

CAUTION

DO NOT TAMPER WITH THE FURNACE OR CONTROLS, CALL A QUALIFIED BURNER TECHNICIAN.

If lock out condition occurs, do not attempt to reset control. Contact qualified installer, service agency or oil supplier to bleed air from oil line or investigate cause of lock out condition.

DANGER

Do not use this furnace as a construction heater. Use of this furnace as a construction heater exposes it to abnormal conditions, contaminated combustion air and lack of air filtering. Failure to follow this warning can lead to premature furnace failure which could result in a fire hazard and/or bodily harm and/or material damage.

IMPORTANT

This manual contains instructional and operational information for the HTL OIL-FIRED FURNACE. Read the instructions thoroughly before installing furnace or starting the burner. Consult local authorities about your local FIRE SAFETY REGULATIONS. All installations must be in accordance with local state or provincial codes. Improper installation will result in voiding of warranty

2.0 PRODUCT INFORMATION

CLEARANCE (minimum) TO COMBUSTIBLES

Top of Supply Plenum	1” (25 mm)
Front (Maintenance)	36” (915 mm)
Rear	1” (25 mm)
Side – Non-Access	1” (25 mm)
Side – Access maintenance	24” (610 mm)
Flue Pipe	9” (229 mm)

Floor (Can be installed directly on combustible or non-combustible)

DRAFT PRESSURE

Breech draft pressure	-0.01” WC minimum

BURNER TUBE INSERTION

HTL-100	6-3/8" (162 mm)
HTL-200	9-1/2" (240 mm)

AIR/BLOWER DATA

Maximum external static pressure	0.50” WC
Maximum cooling unit capacity	HTL-100, up to 3.0 tons. HTL-200, up to 5.0 tons.
Maximum air temperature rise	85°F

MOTOR/BLOWER

HTL-100	1/2 hp 4 Speed PSC / G10-8 DD or 1/2 hp 5 speed ECM / G10-8 DD
HTL-200	3/4 hp 4 Speed PSC / GT12-10 DD or 3/4 hp ECM 5 speed / GT12-10 DD

FAN/HIGH LIMIT CONTROL

United Technologies 1158-120 Fan Center & Thermo-Disk (7” stem)

FLUE-PIPE CONNECTION

5” breech

CLEANOUTS

Front breech cover & burner opening (HTL)

THERMOSTAT

Any wall thermostat
Thermostat adjustment as per thermostat manufacturer installation.

FUEL
Not heavier than No. 2 furnace oil
Up to a maximum of B20 bio fuel blend

The maximum bio-diesel content in Type 2 oil described in CAN/CGSB-3.2 is 5%. When considering higher blends of bio-diesel, careful consideration should be given to cold temperature properties to allow for proper operation of the equipment, especially in areas where colder weather has had historic precedent for the type of fuel selected.

ELECTRICAL – 120 Volts, 1PH-60 Hz, 15 amps. circuit protection, USA circuit protection 20 amps.

AIR FILTERS

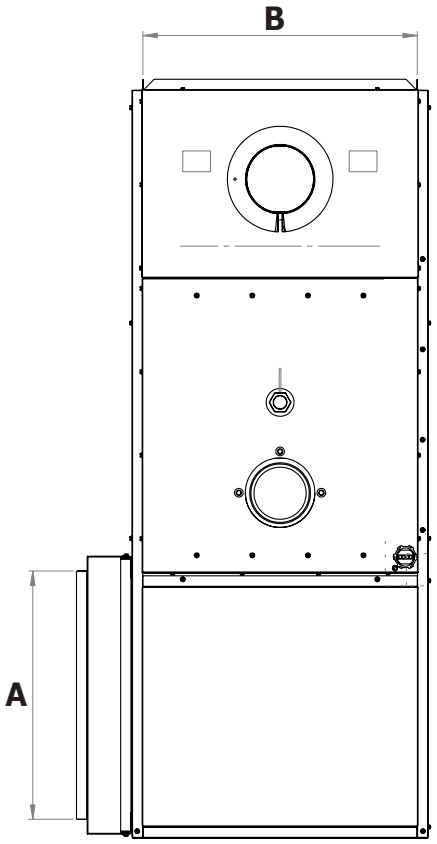
HTL-100	20" x 20" x 2" non-pleated UL approved
HTL-200	20" x 25" x 2" non-pleated UL approved

PLENUM DIMENSIONS (HTL-100)

Cold air return	(A)	18" x 18" (460 x 460 mm)
Hot air supply	(B)	20" x 20" (508 x 508 mm)

PLENUM DIMENSIONS (HTL-200)

Cold air return	(A) 23" x 18" (585 x 460 mm)
Hot air supply	(B) 20" x 24" (508 x 610 mm)

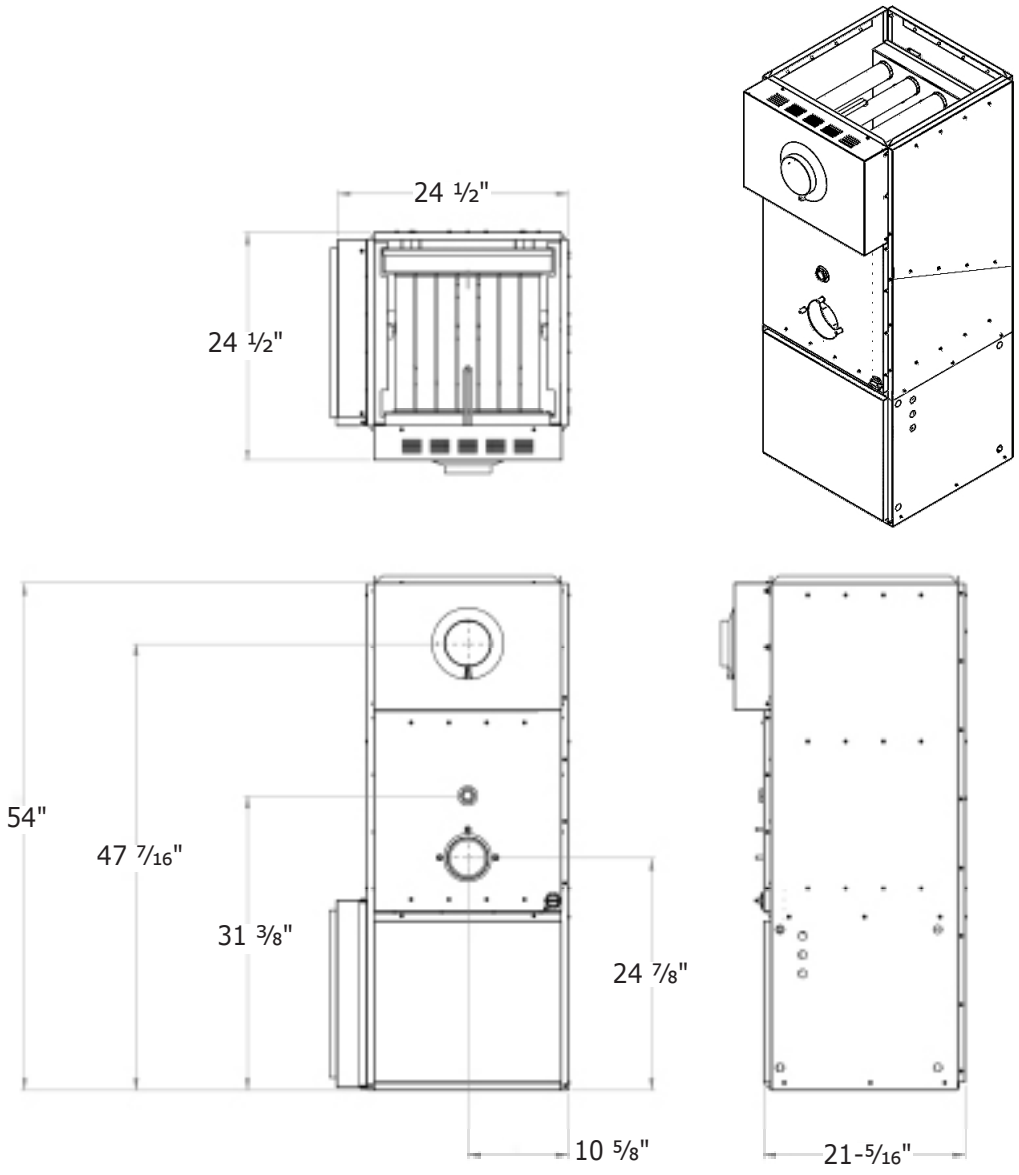


DIMENSIONS (HTL-100)

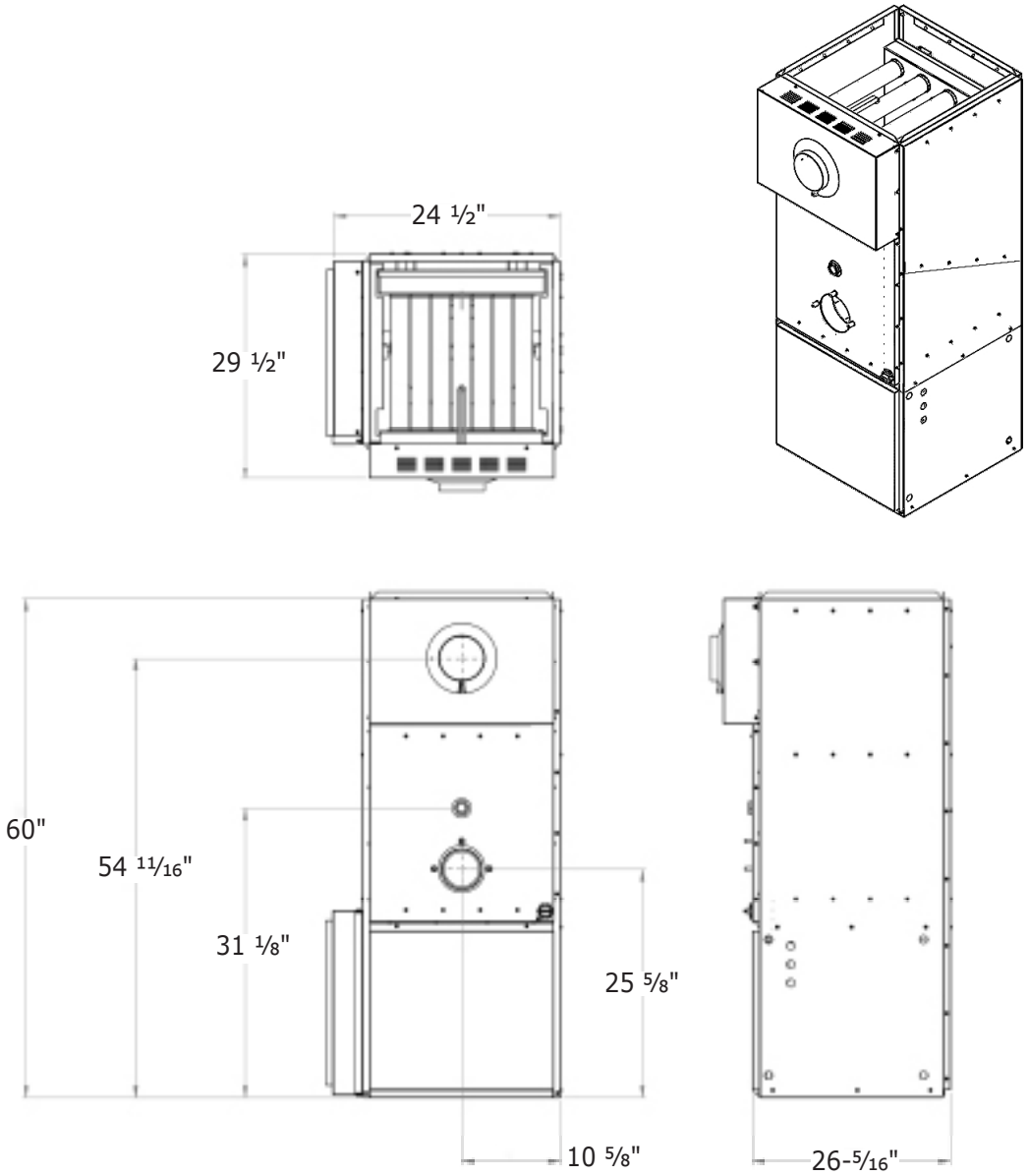
Depth	24-1/2"	(622 mm)
Height	54"	(1372 mm)
Width	21-1/2"	(546 mm)

DIMENSIONS (HTL-200)

Depth	29-1/2"	(750 mm)
Height	60"	(1524 mm)
Width	24-1/2"	(622 mm)



HTL-100 - DIMENSIONS
Dimensions are in inches



HTL-200 - DIMENSIONS

Dimensions are in inches

3.0 FURNACE INSTALLATION

The installation of the appliance shall be in accordance with the regulations of the authorities having jurisdiction.

OIL TANK PIPING

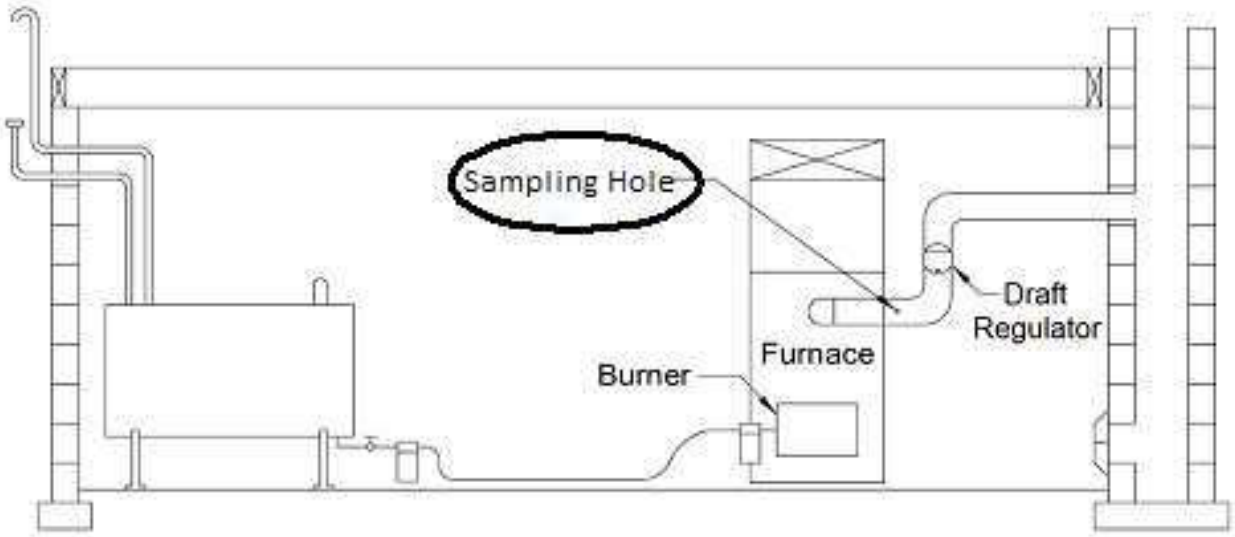
Tank installation must conform to local requirements.

Install according to the applicable code such as CAN/CSA B139 and NFPA 31 in the USA.
Minimize number of connections in suction line and make all connections air tight. Use a pipe joint compound suitable for oil on all pipe threads. To reduce possibility of air leaks, tighten stem packing gland nut on any valves installed in the suction line. Also, be sure the oil filter is tight, as filter gaskets often shrink. Check for kinks in the oil lines as well as for possible air pockets and for loose connections. Two filters as shown below are recommended. Optional tank gauge protectors and outlet protectors are available at your local dealer.

ONE PIPE SYSTEM Where the tank outlet is above the burner and when the oil flows by gravity to the oil pump, a single-stage fuel unit with a single oil line to the pump may be used.

TWO PIPE SYSTEM When a single line is not suitable, use two-line system. Install by-pass plug on burner fuel pump as specified in the burner manual.

FRONT FLUE FURNACE ILLUSTRATION



PLACEMENT & VENTING

Furnace installation shall conform to the required installation code for oil-fired equipment (USA: NFPA 31, Canada: CAN/CSA B139).

FLOOR SUPPORT If required, support furnace on five (5) concrete blocks. Make sure the center of the furnace base is supported.

CHIMNEY/VENT Connect the furnace to a chimney/vent system of size and material required by the NFPA 31 (USA) or CAN/CSA B139 (Canada) code. Furnace is approved for factory built chimney type "L" vents. Breech is certified for 5" vent pipe. Keep vent/flue pipe as short as possible with min. 1/4" per foot upward slope. Vent/flue pipes MUST NOT pass through a ceiling. Maximum flue gas temperature is 575°F.

PRESENCE OF CONDENSATION IN THE CHIMNEY OR FLUE PIPE

Presence of condensation in your chimney or flue pipe is not normal, all necessary precautions should be taken to prevent condensation build-up in the flue pipe and inside the chimney. Make sure that the chimney size is according to the tables in CAN/CSA B139 / NFPA 31.

The base temperature of the chimney can be increased by insulating the flue pipe between the furnace and the chimney base. If this is not sufficient, consider cutting evenly the flue baffles in the furnace.

BE AWARE THAT MODIFYING OR REMOVING BAFFLES REDUCES THE UNIT'S EFFICIENCY.

Note: See **Base temperature** definition inside NFPA-31 and CAN/CSA B139 codes.

The base temperature of the chimney shall be measured after the unit has been in operation for a minimum of 5 minutes or long enough for the flue gas temperatures to have reached equilibrium. Install a thermometer in the vent pipe as close as possible to the entry point of the vent pipe into the chimney, at the base "T", the barometric damper must be completely shut and the flue gas temperature reading is stable. The base temperature must be within the values indicated in table 1 or 2 of the CAN/CSA B139 code for Canadian installations or values indicated in the NFP-31 code for USA installations.

ELECTRICAL

Wire according to the National Electrical Code (Canadian Electrical Code in Canada) or local codes. Use a separately fused #12 electrical line directly from the service panel to the furnace junction box. Install a manual shut-off switch at the door or stairway to furnace room so furnace can be shut off remotely.

COMBUSTION & VENTILATION AIR

Oil-fired appliances shall be connected to vents having sufficient draft at all times to provide safe and proper operation of the appliance.

Oil combustion appliances must be installed only when sufficient combustion air is available to ensure appropriate combustion and circulating air temperatures as per NFPA-31 code in the USA and CAN/CSA B139 code in Canada. If the construction of the building cannot allow for enough air infiltration through natural infiltration of the building to satisfy combustion air requirements and circulating air requirements outside air must be brough inside the space surrounding the oil combustion appliance.

ADDITIONAL CONSIDERATIONS

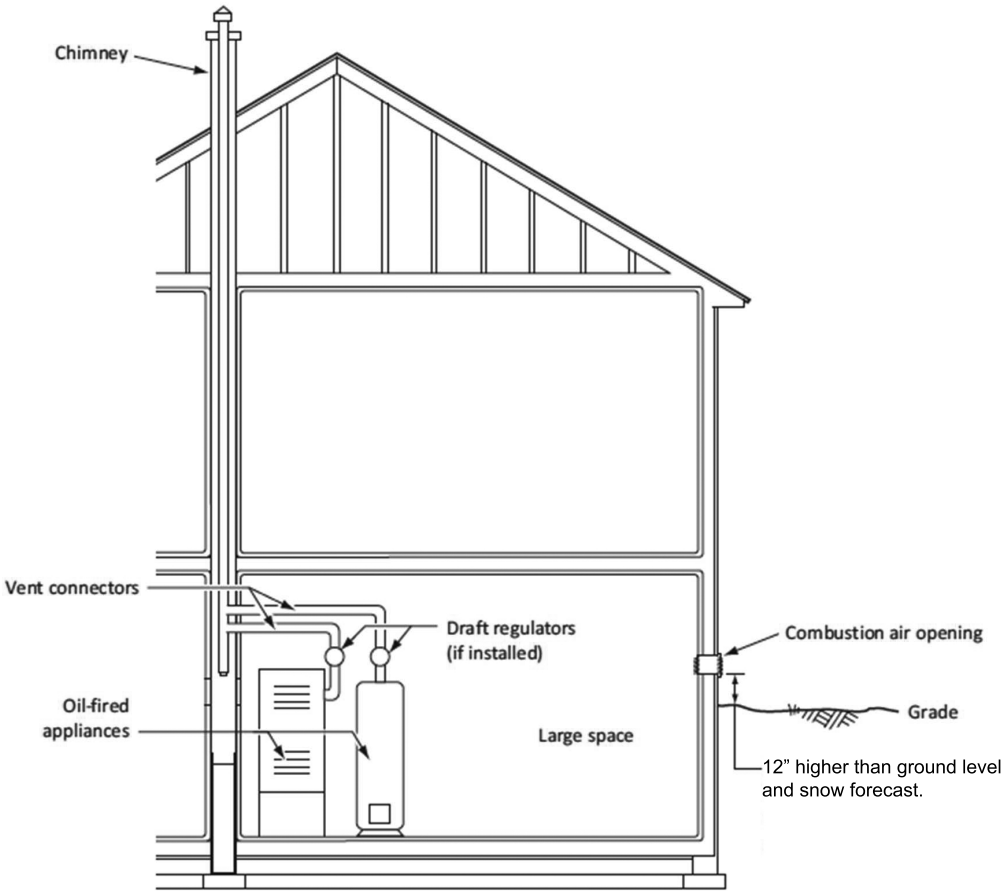
Keep clear space around the appliance. Do not stack items or box in the appliance within the required clearances to combustibles.

To ensure proper operation of the appliance it is important to maintain a free flow of air through the return air registers.

Contact an authorized service representative before any remodeling of the residence to ensure that the furnace is sized properly and the heating ducts are suitable for any new additions.

Appliance(s) located in a large space

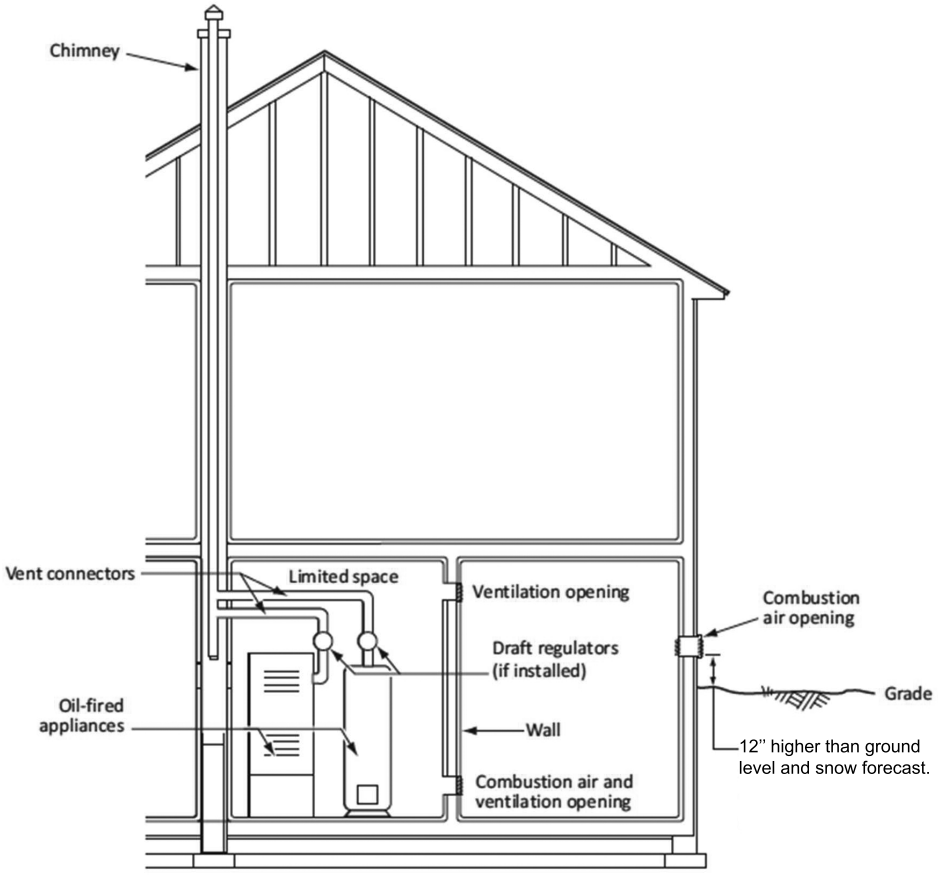
Combustion air and additional ventilation from outdoor



The opening shall have a total free-flow area of not less than 4,4 cm2/kW (1 in²/5000 BTU/h) of the total input rating for the appliance(s) located in a large space.

Appliance(s) located in a limited space

Combustion air from outdoors by infiltration and ventilation from inside the building



The opening shall have a total free-flow area of not less than 4,4 cm2/kW (1 in²/5000 BTU/h) of the total input rating for the appliance(s) located in a limited space.

Each ventilation opening through the inside wall (venting opening of the combustion air and ventilation opening) shall have a free-flow area of not less than 22 cm2/kW (1 in²/1000 BTU/h) of the input rating of the appliance(s) located in the limited space.

4.0 ACCESSORIES INSTALLATION

BLOCKED VENT SWITCH (BVSO)
(FOR CANADIAN INSTALLATION ONLY)

Oil-fired appliances installed in Canada require a blocked vent shut off switch (BVSO) system when installed on a chimney. A BVSO **Field Controls Model: WMO-1 (Manual Reset)** is included with the furnace to perform this function. It is the installer's responsibility to install the BVSO in accordance with the instructions provided.

Switch Operation
Blocked vent switches are flue gas temperatures safety devices for detecting spillage of flue gases due to a blocked flue or inadequate draft. After detecting a problem, the switch de-energizes the system's burner control. **NEVER reset the switch unless the cause of the blockage has been corrected.**

Installation
1) Drill a 5/8" hole in to the flue vent pipe near the appliance breech connection.
2) This hole must be before the draft regulator, vertically or horizontally.
3) Remove one of the securing nuts from the threaded tube of the safety switch.
4) Tighten the other securing nut onto the pipe as far as possible (Figure 1).
5) Insert the threaded tube end into the pierced hole of the flue vent pipe.
6) Install the securing nut on the safety switch tube, which protrudes into the flue vent pipe. Tighten the nut securely (Figure 1).

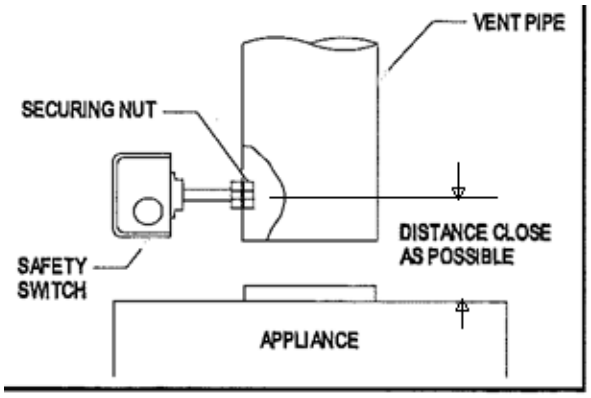


Figure 1 - Illustration from Field Controls

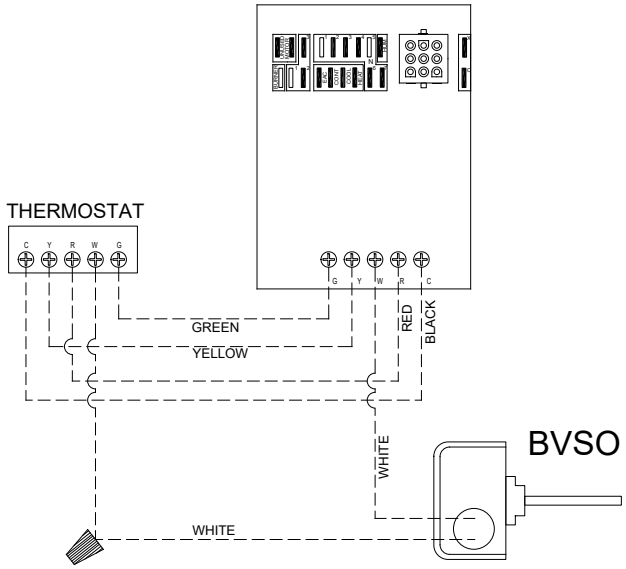


Figure 2 - BVSO wiring diagram

Wiring Instructions (BVSO)

Caution: Disconnect the electrical power when wiring the unit.

Wire the blocked vent switch in accordance with The National Electrical Code and applicable local codes. Wire the BVSO in series with the thermostat and furnace operating control (Figure 2).

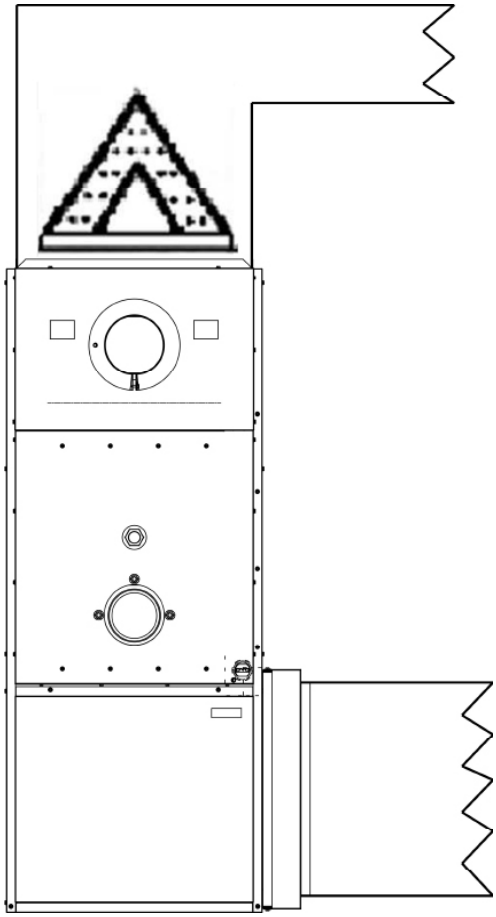
System Test Procedure (BVSO)
1) With the power re-established, block the chimney or vent pipe downstream of the switch.
2) Adjust the thermostat to call for heat.
3) Once the heating system has started the blocked vent switch should shut down the burner within 10 minutes or sooner.
4) Once the system has cooled, the blocked vent switch can manually be reset.
5) This procedure should be tested a second time.
6) After testing the blocked vent switch the chimney should be cleared of obstruction and the heating system should be tested over a long run cycle.

If the block vent switch shuts down the system, check to ensure there is enough draft in the chimney and venting pipes.

AIR CONDITIONING

An air conditioning coil may be installed on the supply plenum only. Coils installed on the return plenum will cause condensation on the heat exchanger; this will shorten the heat exchanger life and may cause products of combustion to enter the house. Wire as per wiring label and diagram. **Height of the coil above the unit shall be at least 4" (102 mm).**

See A/C coil Manufacturers Requirements.
To check the AC coil total air flow resistance, see procedure at page 41



HUMIDIFIER

If a humidifier is installed ensure that no water can drip or run from it into the furnace. This would cause deterioration and void the furnace warranty.

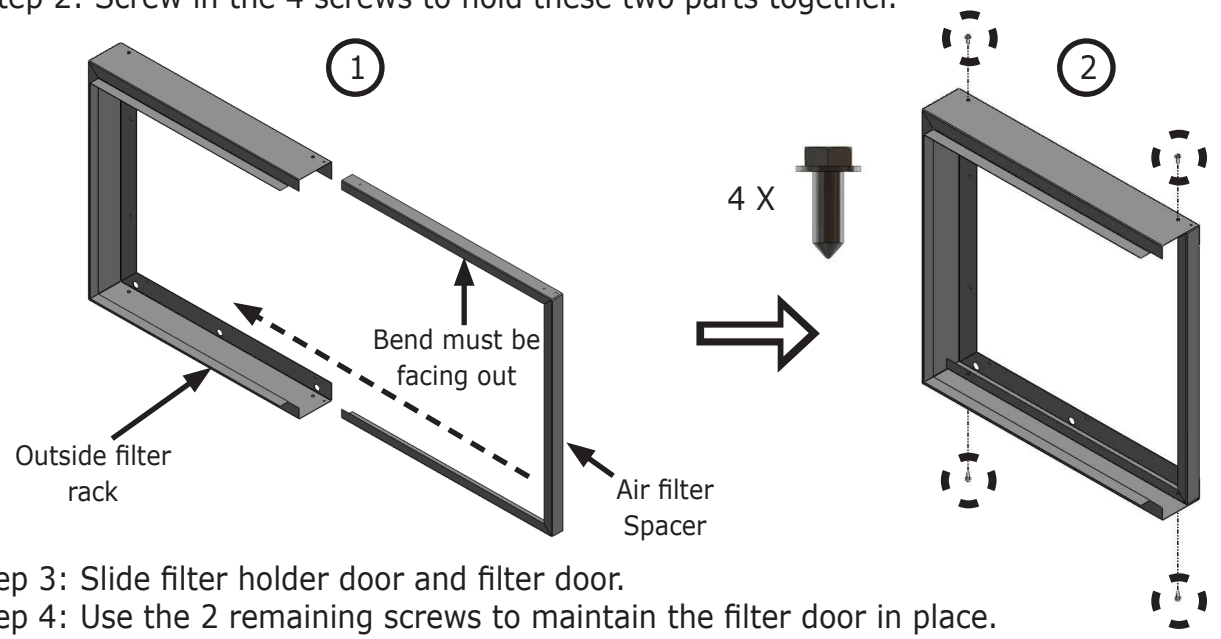
AIR FILTER RACK INSTALLATION

Tank installation must conform to local requirements.

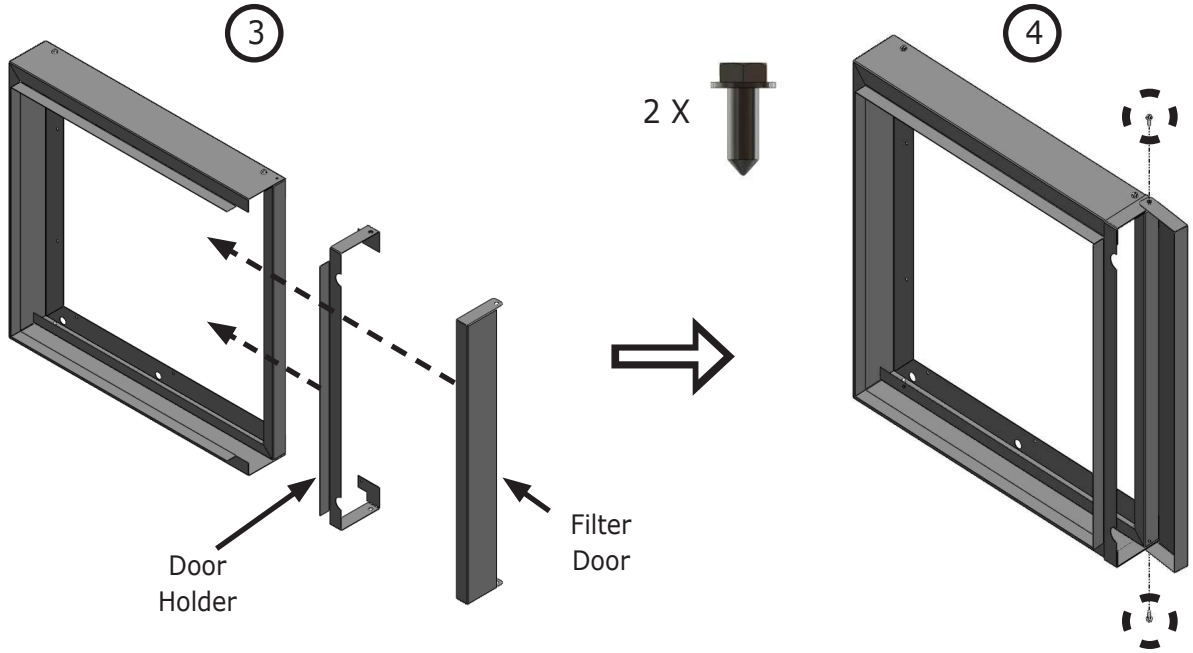
THE AIR FILTER RACK IS A FIELD INSTALLED COMPONENT. AFTER INSTALLATION THE RACK MUST BE SEALED (WITH DUCT TAPE OR EQUIVALENT) TO MINIMIZE AIR LEAKS. THIS IS THE RESPONSIBILITY OF THE INSTALLER.

The air filter rack is shipped uninstalled inside the furnace. This way the owner can install it in the position that he wants. There are 3 possible locations to install the air filter rack which are: bottom left side, bottom right side and under the furnace. Follow the instructions below to install the air filter support properly.

Step 1: Slide air filter spacer inside the outside filter rack.
Step 2: Screw in the 4 screws to hold these two parts together.

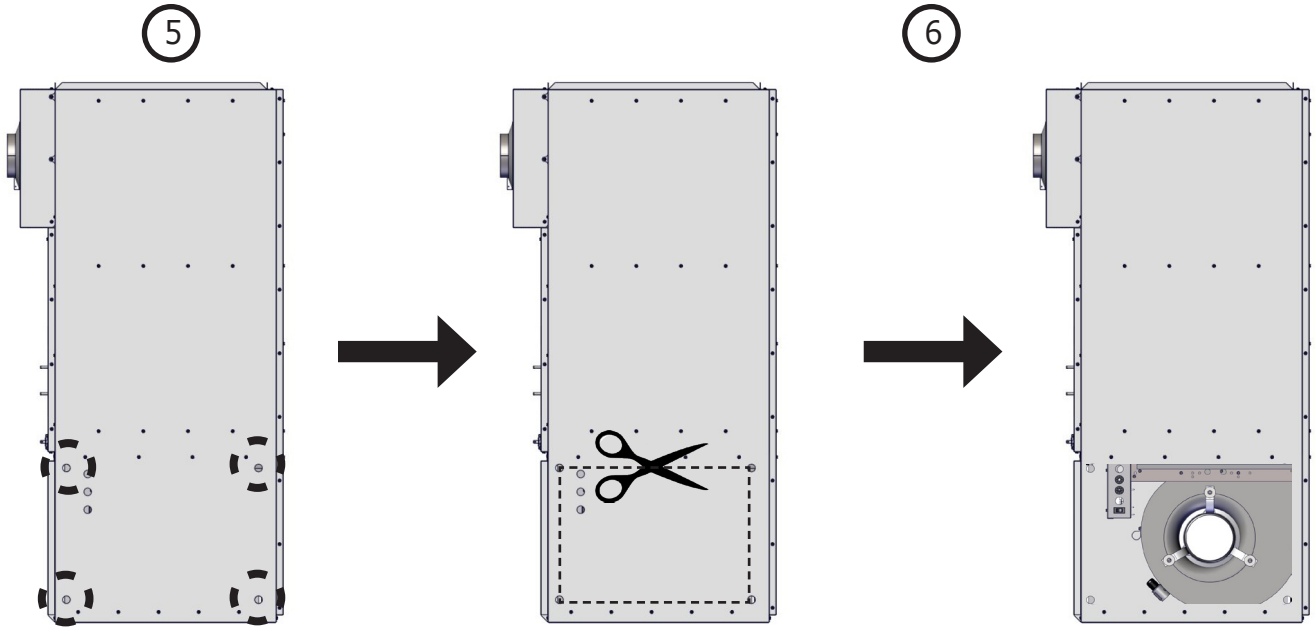


Step 3: Slide filter holder door and filter door.
Step 4: Use the 2 remaining screws to maintain the filter door in place.



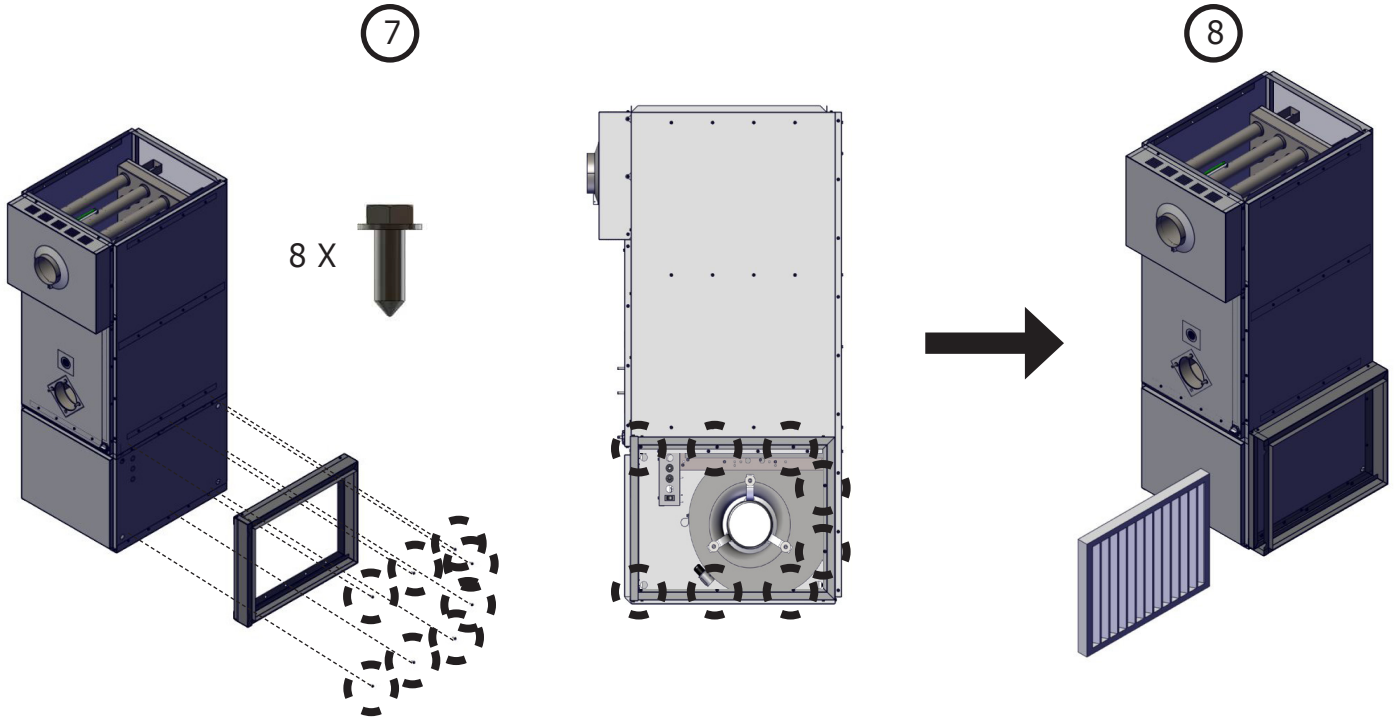
Step 5: Remove the 4 knockouts on the panel (left side, right side or base panel) where you want to install the air filter

Step 6: Cut the panel between the 4 knockouts.



Step 7: Using 8 screws, install the air filter rack on the furnace. Seal Properly.

Step 8: Slide the air filter inside the air filter rack.



5.0 BURNER INSTALLATION AND SPECIFICATIONS

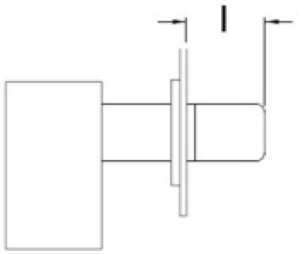
5.1 ASSEMBLY & INSTALLATION OF BURNER

ASSEMBLY Install only a burner approved for use with this furnace according to these instructions.

SELECT NOZZLE Select oil input, nozzle and burner configuration as shown on furnace operating decal.

INSTALL NOZZLE Install selected nozzle, check for clean seating and tighten in nozzle adaptor.

ELECTRODES See burner manufacturer's instructions for correct setting



BURNER INSERTION (I)

Model	in	mm
HTL-100	6-3/8"	162
HTL-200	9-1/2"	240

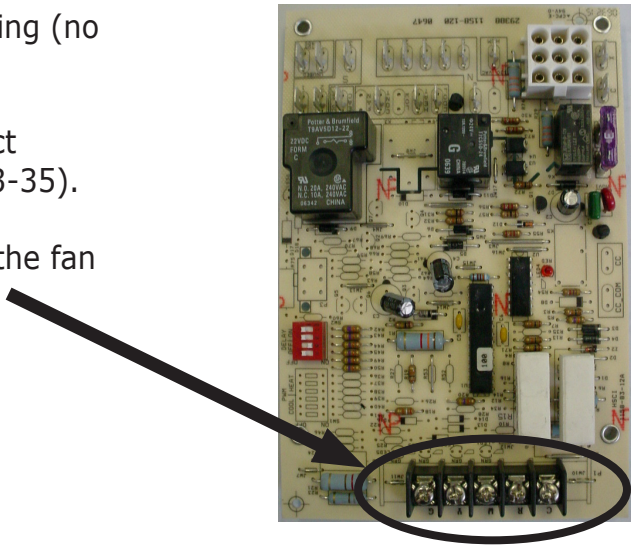
INSERTION MOUNT BURNER IMPORTANT: When installing the burner on the furnace make sure that the burner head does not damage the firepot. If the burner head touches the firepot inspect that the firepot is seated properly in the heat exchanger.

Tighten top nut first so burner tips down slightly. The burner is always installed in an upright position by three (3) nuts.

PUMP BY-PASS PLUG For two-pipe system, factory setting (no bypass plug).

WIRING Refer to wiring diagram for correct burner connections (see pages 33-35).

THERMOSTAT Connect the thermostat wires to the fan timer control board (1158-120).



5.2 SET BURNER FOR EFFICIENT OPERATION

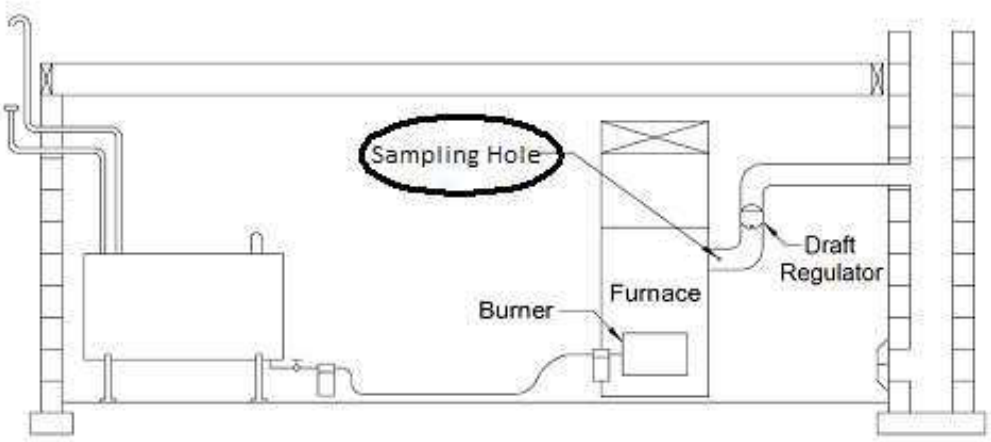
BURNER SETTING Use burner settings in the table on page 20-21 or operating decal as a starting guide to set the burner, particularly for nozzle changes. **Those settings are only starting points for the adjustments and are not meant as final settings.**
On Beckett AFG burner, make sure the correct retention head and static disk are installed on the burner for the desired firing rate. The head is held in place by two screws at the end of the burner blast tube. From the burner technical information table on page 20-21, the head model is always after the AFG designation and the static disk size after the head model information. For example, the AFG F0 3-3/8'' means an AFG chassis burner with a F0 head and a static disk of 3-3/8''.

PUMP PRESSURE Refer to the table on pages 20-21 or operating decal.

AIR SETTING Use air settings on pages 20-21 as a guide to set air adjustment. **Those settings are only starting points for the adjustments and are not meant as final settings.**

DRAFT REGULATOR The draft regulator should be installed at least 3 flue pipe diameters from the breech of the furnace.

SAMPLING HOLE On smoke/vent pipe, drill a 3/8" round sampling hole. The sampling hole should be at least 1 flue pipe diameters away from the draft regulator, between the breech and the draft regulator of the furnace.

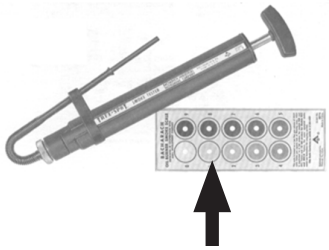


Front Flue Furnace Illustration

COMBUSTION TEST

All your tests must be done with the burner cover on

ADJUSTMENTS After 10 minutes of normal operation, adjust the breech draft with the barometric control to obtain a value of -0.01'' WC, after proceed to take a smoke test and adjust the burner in order to obtain a reading of '1' on the smoke scale, once achieved take a CO^2 reading and note the result.



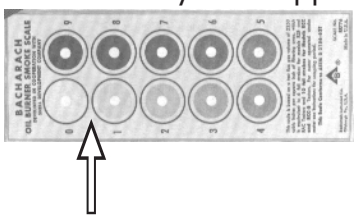
To reach the optimal smoke test reading, a 10, full slow steady pump action is required

- Lower the CO2 reading noted before by the value of 1% by opening the air gate of the burner.

CO^2 test can be done **mechanically**, activate 18 full slow steady pump action.

OR by using an electronic CO^2 analyser.

- Once your CO^2 is reduced by 1% take another smoke test
- You should now have a small "slight trace" of smoke.
- A 'slight' trace of smoke (between 0 and 1) is recommended for chimney vent applications.



Relation between % of CO^2 and O^2

CO^2 (%)	O^2 (%)	Excess Air (%)
13.5	2.6	15.0
13.0	3.3	20.0
12.5	4.0	25.0
12.0	4.6	30.0
11.5	5.3	35.0
11.0	6.0	40.0

5.3 HTL TECHNICAL INFORMATION / BURNER AND BLOWER CONT'D

No 2 Fuel Oil Ratings

HTL Series	HTL-100			HTL-200		
Riello Burner*	**F3**			**F5**		
Unit Model	HTL-E1-*065-03	HTL-E1-*076-03	HTL-E1-*087-03	HTL-E3-*100-05	HTL-E3-*110-05	HTL-E3-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	77,000	91,000	105,000	119,000	133,000	154,000
Output (BTU/h)	65,000	76,000	87,000	100,000	110,000	127,000
Nozzle	0.50-70 W	0.60-70 W	0.65-70 W	0.75-60 W	0.85-60 W	1.00-60 W
Pump Press (PSI)	140	140	140	140	140	140
Turbulator Setting	0	0	0	3	3	3
Air Gate Adjustment	2.5	2.5	4	2	2.5	5
%CO2 for Factory Setting	10.0	11.5	10.5	11.5	10.5	10.0
%CO2 for AFUE	13.0	13.0	13.5	13.0	13.0	13.5
AFUE	85	84	83	85	84	83
Energy Star Approved	NO	NO	NO	NO	NO	NO
* These values are with the burner cover on						

Beckett Burner	AFG			AFG		
Unit Model	HTL-G2-*065-03	HTL-G2-*076-03	HTL-G2-*087-03	HTL-G2-*100-05	HTL-G2-*110-05	HTL-G2-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	77,000	91,000	105,000	119,000	133,000	154,000
Output (BTU/h)	65,000	76,000	87,000	100,000	110,000	127,000
Nozzle	0.50-70 B	0.60-70 W	0.65-70 W	0.75-70 W	0.85-70 W	1.00-70 B
Static Disk	3-5/8 U	3-3/8 U	3-3/8 U	2-3/4 U	2-3/4 U	2-3/4 U
Head	F0	F0	F0	F3	F3	F3
Low Fire Rate Baffle	Yes	Yes	Yes	Yes	No	No
Pump Press (PSI)	140	140	140	140	140	140
Air Band Setting	0	0	2	1	0	1
Air Gate Gate Setting	6	9	10	10	8	10
%CO2 for Factory Setting	10.5	11.5	11.8	11.5	11.5	12.0
%CO2 for AFUE	13.0	13.0	13.5	13.0	13.0	13.5
AFUE	85	84	83	85	84	83
Energy Star Approved	NO	NO	NO	NO	NO	NO

Carlin Burner	EZ-1 SELECT			EZ-1 SELECT		
Unit Model	HTL-C1-*065-03	HTL-C1-*076-03	HTL-C1-*087-03	HTL-C3-*100-05	HTL-C3-*110-05	HTL-C3-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	77,000	91,000	105,000	119,000	133,000	154,000
Output (BTU/h)	65,000	76,000	87,000	100,000	110,000	127,000
Nozzle	0.50-60 B	0.50-60 B	0.60-60 B	0.65-60 B	0.75-60 B	0.85-60 B
Pump Press (PSI)	125	170	155	170	160	170
Head Setting	0.0	0.0	1.0	3.0	3.0	4.0
Air Gate Adjustment	30	35	50	55	65	65
%CO2 for Factory Setting	12.5	12.7	12.7	11.7	12.7	12.3
%CO2 for AFUE	13.3	13.2	13.5	13.5	13.5	14.0
AFUE	85	84	83	85	84	83
Energy Star Approved	NO	NO	NO	NO	NO	NO

(*) For administration only.

B20 Bio-diesel Ratings

BCL Series	HTL-100			HTL-200		
Riello Burner*	F3			F5		
Unit Model	HTL-E1-*065-03	HTL-E1-*076-03	HTL-E1-*087-03	HTL-E3-*100-05	HTL-E3-*110-05	HTL-E3-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	74,800	88,400	102,000	115,600	129,200	149,600
Output (BTU/h)	62,000	74,000	85,000	98,200	108,500	124,000
Nozzle	0.50-70 W	0.60-70 W	0.65-70 W	0.75-60 W	0.85-60 W	1.00-60 W
Pump Press (PSI)	140	140	140	150	150	150
Turbulator Setting	0	0	0	3	3	3
Air Gate Adjustment	2	2.5	4	2	2.5	5
%CO2 for Factory Setting	10.2	11.0	12.2	11.0	10.5	10.0
* These values are with the burner cover on						

Beckett Burner	AFG			AFG		
Unit Model	HTL-G2-*065-03	HTL-G2-*076-03	HTL-G2-*087-03	HTL-G2-*100-05	HTL-G2-*110-05	HTL-G2-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	74,800	88,400	102,000	115,600	129,200	149,600
Output (BTU/h)	62,000	74,000	85,000	98,200	108,500	124,000
Nozzle	0.50-70 B	0.60-70 W	0.65-70 W	0.75-70 W	0.85-70 W	1.00-70 B
Static Disk	3-5/8 U	3-3/8 U	3-3/8 U	2-3/4 U	2-3/4 U	2-3/4 U
Head	F0	F0	F0	F3	F3	F3
Low Fire Rate Baffle	Yes	Yes	Yes	Yes	No	No
Pump Press (PSI)	140	140	140	140	140	140
Air Band Setting	0	0	2	1	0	1
Air Gate Gate Setting	6	9	10	10	8	10
%CO2 for Factory Setting	10.5	10.5	11.0	12.0	12.5	12.5

Carlin Burner	EZ-1 SELECT			EZ-1 SELECT		
Unit Model	HTL-C1-*065-03	HTL-C1-*076-03	HTL-C1-*087-03	HTL-C3-*100-05	HTL-C3-*110-05	HTL-C3-*127-05
Firing Rate (USGPH)	0.55	0.65	0.75	0.85	0.95	1.10
Input (BTU/h)	74,800	88,400	102,000	115,600	129,200	149,600
Output (BTU/h)	62,000	74,000	85,000	98,200	108,500	124,000
Nozzle	0.50-60 B	0.50-60 B	0.60-60 B	0.65-60 B	0.75-60 B	0.85-60 B
Pump Press (PSI)	125	170	155	170	160	170
Head Setting	0.0	0.0	1.0	3.0	3.0	4.0
Air Gate Adjustment	30	35	50	55	65	65
%CO2 for Factory Setting	11.5	12.0	12.5	12.5	12.9	12.5

(*) For administration only.

PSC Motor Info

Model	HTL-065-03	HTL-076-03	HTL-087-03	HTL-100-05	HTL-110-05	HTL-127-05
Temperature Rise (°F)	45-75	45-75	50-80	45-75	45-75	45-75
Blower Speed (0.2" w.c.)	Med-Low	Med-Low	Med-High	Med	Med-High	Med-High
Blower Speed (0.5" w.c.)	Med	Med	High	Med-High	High	High

ECM Motor Info (0.2" w.c to 0.5" w.c.)

Model	HTL-065-03	HTL-076-03	HTL-087-03	HTL-100-05	HTL-110-05	HTL-127-05
Temperature Rise (°F)	40-70	40-70	45-75	50-80	50-80	50-80
Blower Speed	Med	Med-High	Med-High	Med-High	Med-High	High

CFM Air Flow

Blower Speed	PSC 1/2 hp		PSC 3/4 hp		ECM 1/2 hp		ECM 3/4 hp	
	0.2" w.c.	0.5" w.c.	0.2" w.c.	0.5" w.c.	0.2" w.c.	0.5" w.c.	0.2" w.c.	0.5" w.c.
HIGH	1,350	1,200	1,920	1,745	1,650	1,485	1,990	1,770
M-HIGH	1,450	1,180	1,720	1,595	1,600	1,330	1,525	1,415
MEDIUM	-	-	-	-	-	-	-	-
M-LOW	1,400	1,190	1,390	1,300	1,315	1,250	-	-
LOW	1,340	1,175	-	-	1,230	1,170	-	-

(*) For administration only.

6.0 FURNACE OPERATION AND SETTINGS

SHUTTING FURNACE DOWN

POWER OFF Turn off main power breaker or disconnect.

FUEL OFF Shut off manual fuel supply valve.

Always keep manual fuel supply valve shut off if the burner is shut down for an extended period.

RESTARTING FURNACE

Follow this procedure before restarting a unit that has been shut down for an extended period.

Do not start the burner unless the blower access door is secured in place.

INSPECTION Have the furnace/system serviced and inspected by a **qualified technician.**

FUEL Turn on fuel supply and check that there are no leaks.

POWER Turn on power and check that the furnace starts and operates as usual.

OPERATION If the furnace/system fails to operate or operates in an unusual manner, call your service technician. If the burner fails to operate at any time, call a qualified burner technician.

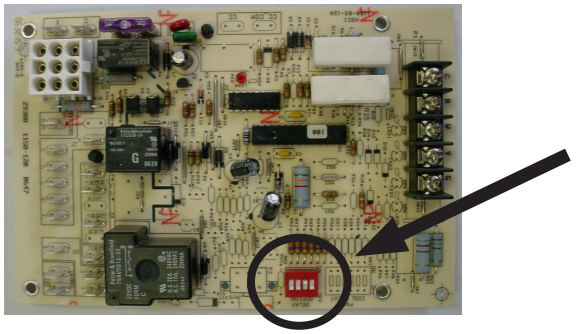
6.1 BLOWER SETTING

Ensure power is off when adjusting blower setting. For heating, use the blower speeds shown on the furnace specifications to give a temperature rise according to the technical information tables on page 22. The 'Low' blower speed can be used for air re-circulation when heating or cooling are not required. Set blower speeds to match the installation requirements.

Fan On 30 seconds after the burner starts
Fan Off Adjustable on 1158-120 board (see page 24)

6.2 FAN TIMER CONTROL BOARD (1158-120)

"FAN OFF Timer" Dip Switches adjustment



MODELS WITH ELECTRONIC FAN TIMER CONTROL AND SNAP-DISC LIMIT CONTROL

ELECTRONIC FAN TIMER INTEGRATES CONTROL OF BURNER AND CIRCULATOR FAN OPERATIONS. CONTROL IS CENTRAL WIRING POINT FOR MOST OF FURNACE ELECTRICAL COMPONENTS.

- United Technologies 1158-120 has an adjustable fan on time set by selecting dipswitch combination displayed in below chart. Fan on delay can be set at 30, 60, 90 or 120 seconds. Provides a delay between burner ignition and blower start-up to eliminate excessive flow of cold air when blower comes on.
- United Technologies 1158-120 has an adjustable fan off time of 2, 3, 4 or 6 minutes as displayed in below chart. Fan off delay time starts when burner motor is de-energized at end of call for heat. Blower shutdown is delayed to remove any residual heat from heat exchanger.
- Electronic fan timer board works in conjunction with snap disc limit controls, performing a safety function, and breaks power to oil burner primary control, shutting off burner if furnace over-heats.
- Limit control is thermally operated and automatically resets. Limit control is factory installed, pre-set and is not adjustable.
- If limit control opens with United Technologies 1158-120 electronic fan control, circulating fan will energize. When limit closes, fan off timer begins. At the end of fan off time cycle burner is energized, initiating normal burner cycle.

United Technologies 1158-120

Dip Switch Position				Blower Delay Times	
1	**2**	**3**	**4**	**On Seconds**	**Off Minutes**
Off	Off			30	
On	Off			60	
Off	On			90	
On	On			120	
		Off	Off		2
		On	Off		3
		Off	On		4
		On	On		6

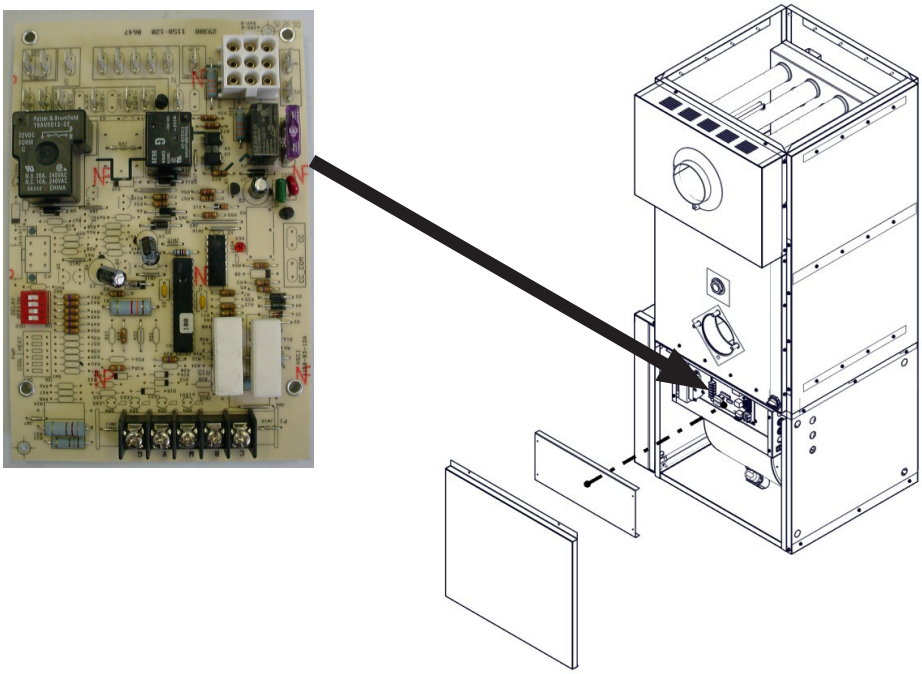
6.3 CONTROL BOARD

1158-120 Electronic Fan Timer Board (EFT) Detailed Sequence Of Operation

Mode	Action	System Response
HEAT	Thermostat calls for heat. ("W" terminal is energized).	EFT closes the oil primary control T - T connections. Ignition system and the oil primary control start the furnace. Oil flows as long as the oil primary control senses flame. Burner motor is energized and heat "fan on" delay timing begins. When timing is complete, the circulator fan is energized at heat speed.
	Thermostat ends call for heat. ("W" terminal is de-energized).	The oil primary control is de-energized, terminating the burner cycle. Heat "fan off" delay timing begins. Length of delay depends on EFT dipswitch settings. When timing is complete, the circulator fan is de-energized. EFT returns to standby mode, (Oil primary control and circulator fan are off, unless continuous fan operation is selected at the thermostat).
	Burner fails to light.	Oil primary control locks out within lockout timing, (15 seconds). Burner motor is de-energized. (Even though thermostat is still calling for heat). If circulator fan has started, it continues through the selected heat "fan off" delay period.
	Established flame fails.	Burner motor is de-energized and oil primary control goes into recycle mode. If the selected heat "fan off" delay timing is longer than the recycle delay timing, the circulator fan continues to run through the next trial for ignition.
COOL	Thermostat begins call for cool. (G and Y terminals are energized).	Cooling contactor is energized immediately. Circulator fan is energized at cool speed.
	Thermostat ends call for cool. (G and Y terminals are de-energized).	Cooling contactor is de-energized immediately. Circulator fan turns off immediately.
FAN	Thermostat begins call for fan. (G terminal is energized).	Circulator fan is energized immediately at cooling speed.
	Thermostat ends call for fan. (G terminal is de-energized).	Circulator fan is de-energized immediately.
LIMIT	Limit switch string opens.	Oil primary control shuts off burner. Circulator fan is energized immediately at heat speed. EFT opens the oil primary control T - T connections. Circulating fan runs as long as limit string stays open. If there is a call for cooling or fan, the circulating fan switches from heating to cooling speed.
	Limit switch string closes (with existing call for heat).	EFT begins heat "fan off" delay sequence. Circulating fan turns off after the selected heat "fan off" timing. EFT re-closes the oil primary control T - T connections. Oil primary control is energized, initiating burner light off.
	Limit switch string closes (without existing call for heat).	Circulator fan turns off when heat "fan off" delay time is complete. Normal operation resumes; EFT control is in standby mode awaiting next thermostat command.
FAN	Continuous circulating fan is connected.	Circulating fan is energized when there is no call for heat, cool, or fan. If fan operation is required by a call for heat, cool, or fan, the EFT switches off the continuous fan speed tap before energizing the other fan speed.

EAC	Electronic Air Cleaner is connected.	Electronic air cleaner (EAC) connections are energized when the heat or cool speed of the circulator fan is energized. EAC connections are not energized when the optional continuous fan terminal is energized.
HUM	Humidity control is connected.	Humidifier connections are energized when the oil burner motor is energized.

Location of the 1158-120 Electronic Board



HTL-100 and 200

6.4 SERVICING - FAN TIMER

System and General Troubleshooting

Problem	Possible Cause	Remedy
Furnace will not start.	Thermostat not calling for heat	Check thermostat and adjust. Check thermostat for accuracy; if mercury switch type, it might be off level.
	No power to furnace	Check furnace switch, main electrical panel furnace fuse or circuit breaker. Look for any other hand operated switch, such as old poorly located furnace switch, which was not removed during furnace replacement.
	Thermostat faulty	Remove thermostat wires from oil primary control terminals T-T. Place a jumper across T-T. If furnace starts, replace thermostat, thermostat sub-base (if equipped), or both.
	Oil primary control faulty	Check reset button on oil primary control. Remove thermostat wires from oil primary control terminals T - T. Check for 24V across T -T. If no voltage is present, check for 115V to oil primary control. If 115V is present, refer to oil primary control documentation provided with oil burner.
	Photo Cell wiring shorted or room light leaking into photo cell compartment	Check photo cell (cad cell) wiring for short circuits. Check for room light leaking into cad cell compartment. Repair light leak if necessary.
	Open safety switch	Check for open limit or auxiliary limit. Check internal wiring connections; loose connectors, etc.
FURNACE WILL NOT START WITHOUT FIRST PUSHING OIL PRIMARY CONTROL RESET BUTTON. (HAPPENS ON FREQUENT BASIS)	No fuel oil	Check fuel oil supply. Check all hand operated fuel oil valves are in open position. Fill oil storage tank if necessary.
	Clogged nozzle	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Verify erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for signs of oil leaks. Any oil leak is potential source of air or contaminants.
	Defective burner motor	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.

System and General Troubleshooting continued

Problem	Possible Cause	Remedy
Furnace starts, but cuts out requiring manually resetting oil protector reset button.	Photo Cell (Cad Cell) defective.	If cad cell is dirty, clean it. Determine why cad cell is getting dirty. If cad cell is poorly aimed, realign it. NOTE: Photocell should have resistance of 100 KΩ in absence of light; maximum of 1500 Ω in presence of light. Verify room light is not leaking into the cad cell compartment. (See diagnostic light section).
Furnace starts, but cuts out requiring manually resetting oil protector reset button.	No fuel oil.	Check fuel oil supply. Check that all hand operated fuel oil valves are in the open position. Fill oil storage tank if necessary.
	Clogged nozzle.	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter.	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure.	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Verify erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective.	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for any signs of oil leaks. Any oil leak is a potential source of air or contaminants.
	Defective burner motor.	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.
	Water or contaminants in oil.	Drain fuel oil storage tank; replace fuel oil. (Consult with fuel oil supplier).
	Frozen oil line.	Gently warm oil line. Insulate oil line. (Outdoor piping size may require increased diameter).
Oil burner sputtering at nozzle	Electrodes out of adjustment or defective.	Check electrode settings. Check electrodes for dirt build-up or cracks in porcelain.
	Poor igniter connections or defective igniter.	Check contacts between the igniter and electrodes. If OK, replace the igniter
	Fuel oil filter clogged.	Replace fuel oil storage tank filter and / or fuel oil in-line filter.
	Defective oil pump.	Check burner motor and / or fuel oil pump coupling. Check oil pump pressure. Replace fuel oil pump if necessary.
	Fuel oil line partially clogged or contains air.	Bleed air from oil line. If problem persists, replace oil line.
Excessive fuel oil consumption.	System temperature rise too high.	System temperature rise should not exceed 75°F. Check for clogged air filters. Check blower fan for excess dirt build-up or debris. Speed up blower fan if necessary.
	Poor "fan off" delay timing selection, (fan stops too soon).	Check "fan off" delay timing setting. Use duct thermometer in supply air plenum take-off or first few inches of supply air trunk duct. Fan should shut off at 90° - 100°F. Manipulate dip switch settings or adjust "fan off" temperature setting as applicable to come as close as possible to this "fan off" temperature.
	Fuel oil leak.	Check fuel oil line for leaks. Repair or replace if necessary.
	Stack temperature too high.	Check stack temperature. Stack temperatures will normally range from 400° to 500°F. Check draft regulator. Draft should be set to -0.02 in. w.c.
	Thermostat improperly adjusted or in poor location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to suitable location.

System and General Troubleshooting continued

Problem	Possible Cause	Remedy
Too much smoke.	Insufficient combustion air adjustment at oil burner, or improper draft pressure.	Adjust oil burner combustion air band and draft regulator to gain highest practical CO2 or lowest practical O2 content in flue gases. See Burner Set Up.
	Heat exchanger partially clogged.	Check for soot build-up in heat exchanger flue passages, especially in outer radiator.
Soot building up on blast tube (end coning).	Poor alignment between oil burner blast tube and fire pot.	Check alignment. Blast tube should be centered with fire pot burner opening. Oil burner head should be ¼ inch back from inside surface of fire pot.
	Flame impingement caused by Incorrect nozzle angle.	Check nozzle size and angle. (See Appendix A). Check distance from head to inside surface of fire pot.
	Defective fire-pot	Check fire-pot. Repair or replace.
Furnace will not warm home to desired temperature.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Thermostat adjustments or location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to suitable location.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
	Defective high limit control.	Test high limit function of all limit switches. Use duct thermometer to verify accuracy of limit control. Check for obstructions to airflow around limit switch bimetal elements. Replace control if necessary.
	Under-sized nozzle.	Check nozzle. If problem is not caused by air flow problems, use larger nozzle, if permitted by rating plate.
	Blower fan motor stopping intermittently on overload.	Check blower fan motor amperage draw. Check motor ventilation ports, clean if necessary. Replace motor if necessary.
	Burner motor stopping intermittently on overload.	Check burner motor. Replace if necessary.
Home does not heat evenly	Improper distribution of heat.	This is not likely to be a furnace problem. Balance duct system.
Supply air temperature too hot.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
Supply air temperature too cool.	Excess airflow.	Check system temperature rise. Slow down blower fan if necessary.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.
Supply air temperature too cool during first moments of furnace cycle.	Fan control "fan on" setting too low.	Increase "fan on" temperature settings on fan and limit control or "fan on" dispwitch settings on fan timer board. Register air deflectors may help.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.

7.0 SERVICE / MAINTENANCE

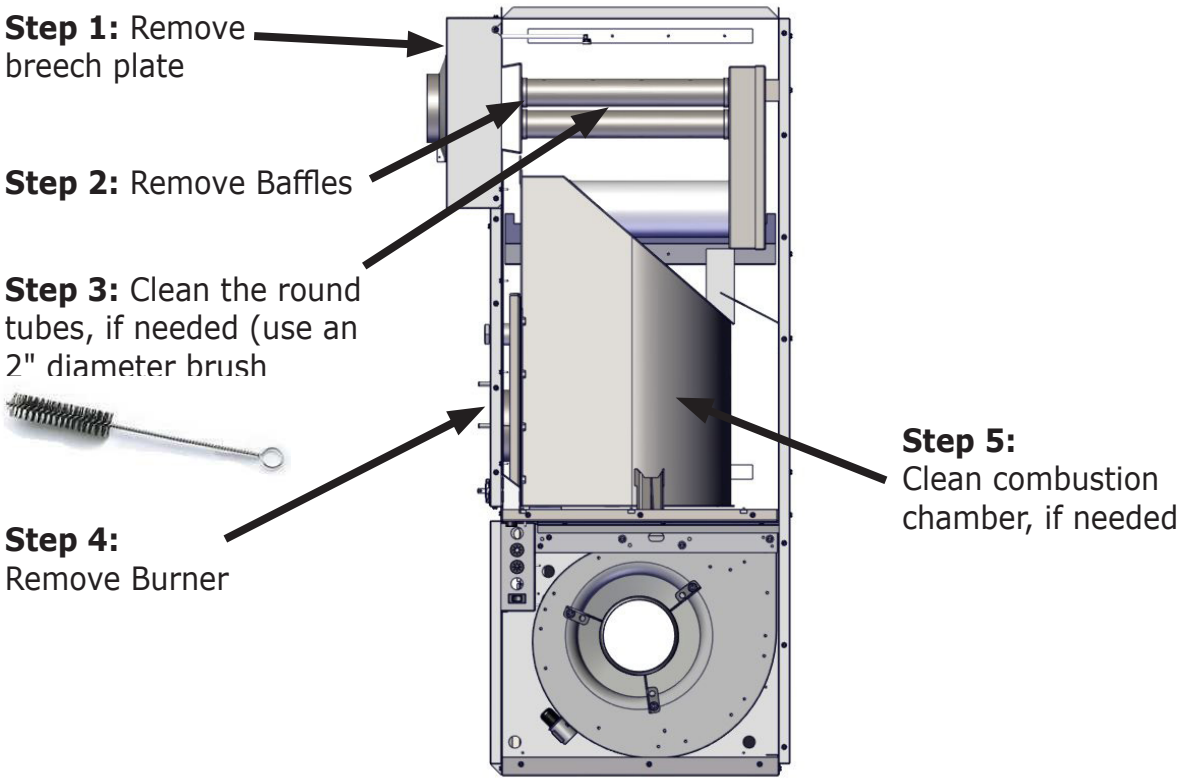
REGULAR MAINTENANCE

Contact an authorized service representative to check complete operation **at least once a year.** In Canada see CAN/B139, (Maintenance), in United States refer to NFPA 31, for recommended servicing procedure. Clean flue pipeson a regular basis. Replace flue pipes if there is any sign of corrosion or other problems. Gaskets should be checked and may have to be replace.

BLOWER REMOVAL

This furnace has a blower sealing system, which is designed to be tight and rattle free. Refer to the instructions and pictures below.

HTL HEAT EXCHANGER



CHANGING NOZZLE

It is recommended that the nozzle be replaced at least once annually. If a new nozzle of a different size is installed, change the blower speed according to section **BURNER INSTALLATION AND SPECIFICATIONS** or operating decal as required. Verify smoke trace and CO2 reading every time the nozzle is replaced.

OIL FILTER OR STRAINER MAINTENANCE

Have a trained, qualified service technician service your oil filter or strainer. Your service technician has the knowledge and equipment to properly perform this maintenance. To ensure proper operation of this appliance oil filter or oil strainer should be cleaned or replace annually.

AIR FILTERS

To maintain furnace performance and safety, replace dirty filters at least once every heating season or as required. Use new approved disposable filters of the same size and type. Dirty, clogged or wrong sized filters will impair the furnace performance and may cause the furnace to shut down or overheat.

BLOWER REMOVAL

This furnace has a blower sealing system, which is designed to be tight and rattle free. Refer to the instructions and pictures below.

1) Shut off oil and power to furnace.

2) Remove the two (2) screws securing the blower door (Figure 1).

3) Open blower compartment (Figure 1).

4) Disconnect the wiring to the blower motor.

5) Remove the screw securing the blower side to the separating panel (Figure 2).

6) Slide the blower toward you and get the blower out of the furnace (Figure 3).

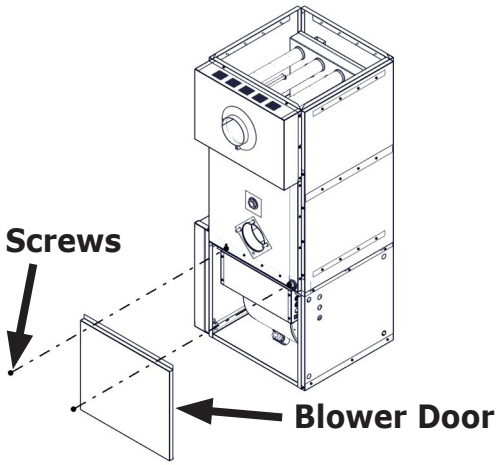


Figure 1

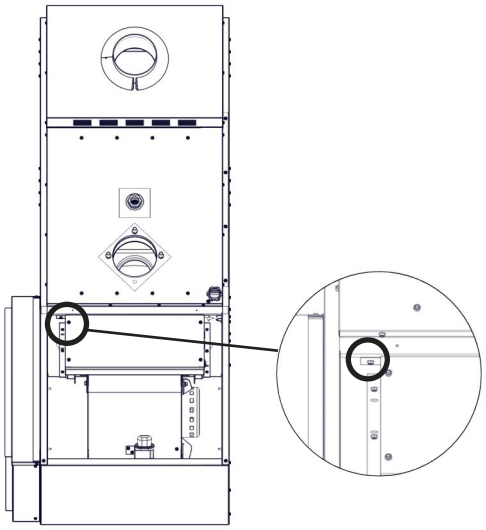


Figure 2

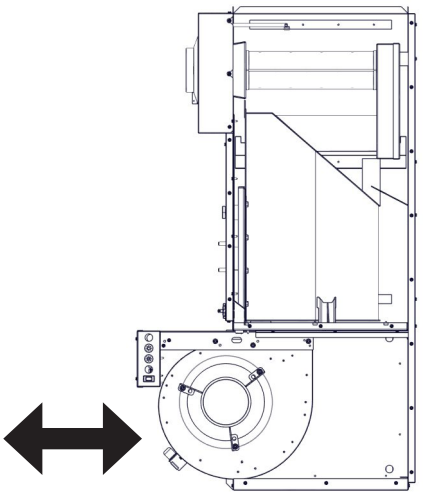
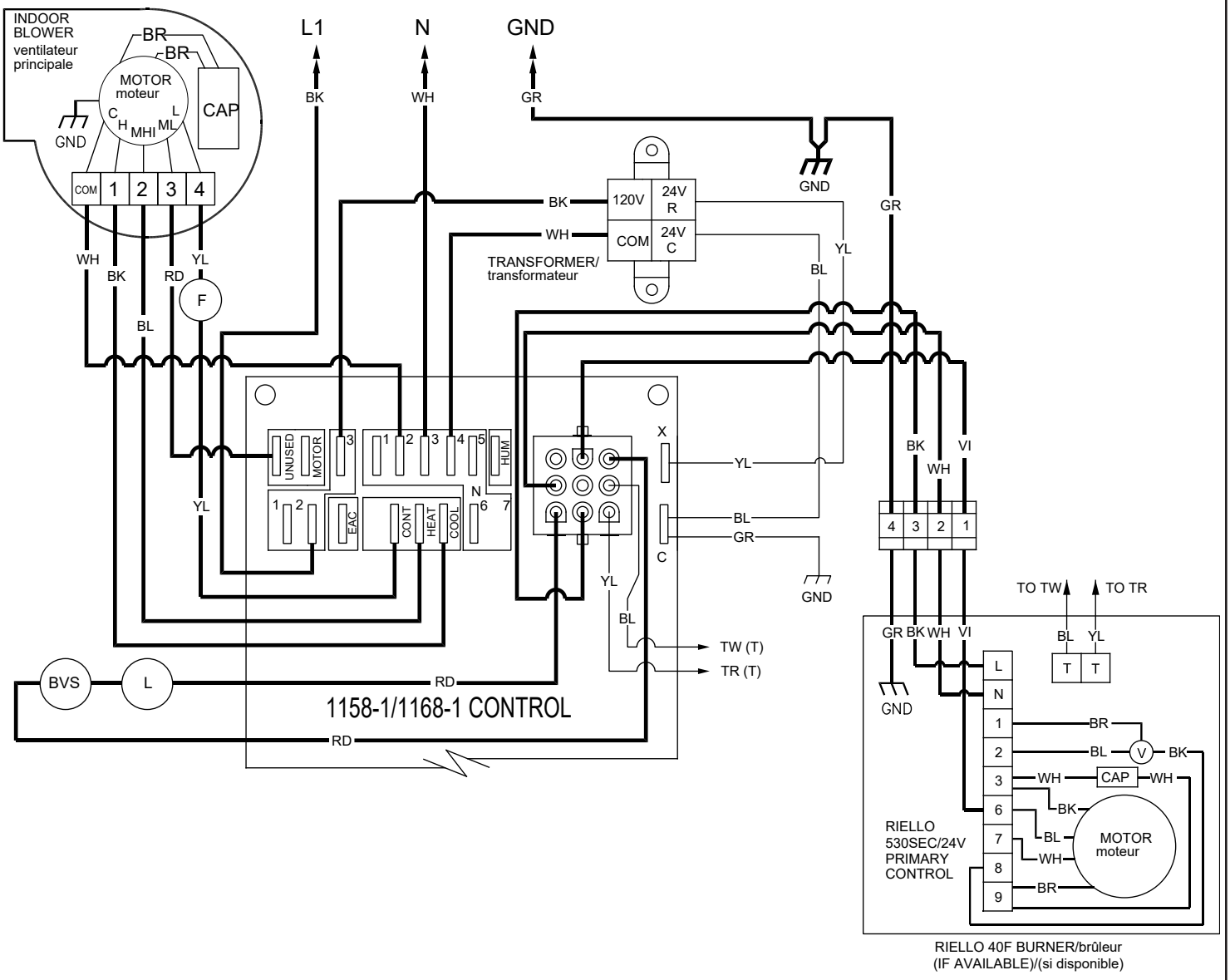


Figure 3

8.0 ELECTRICAL WIRING DIAGRAMS

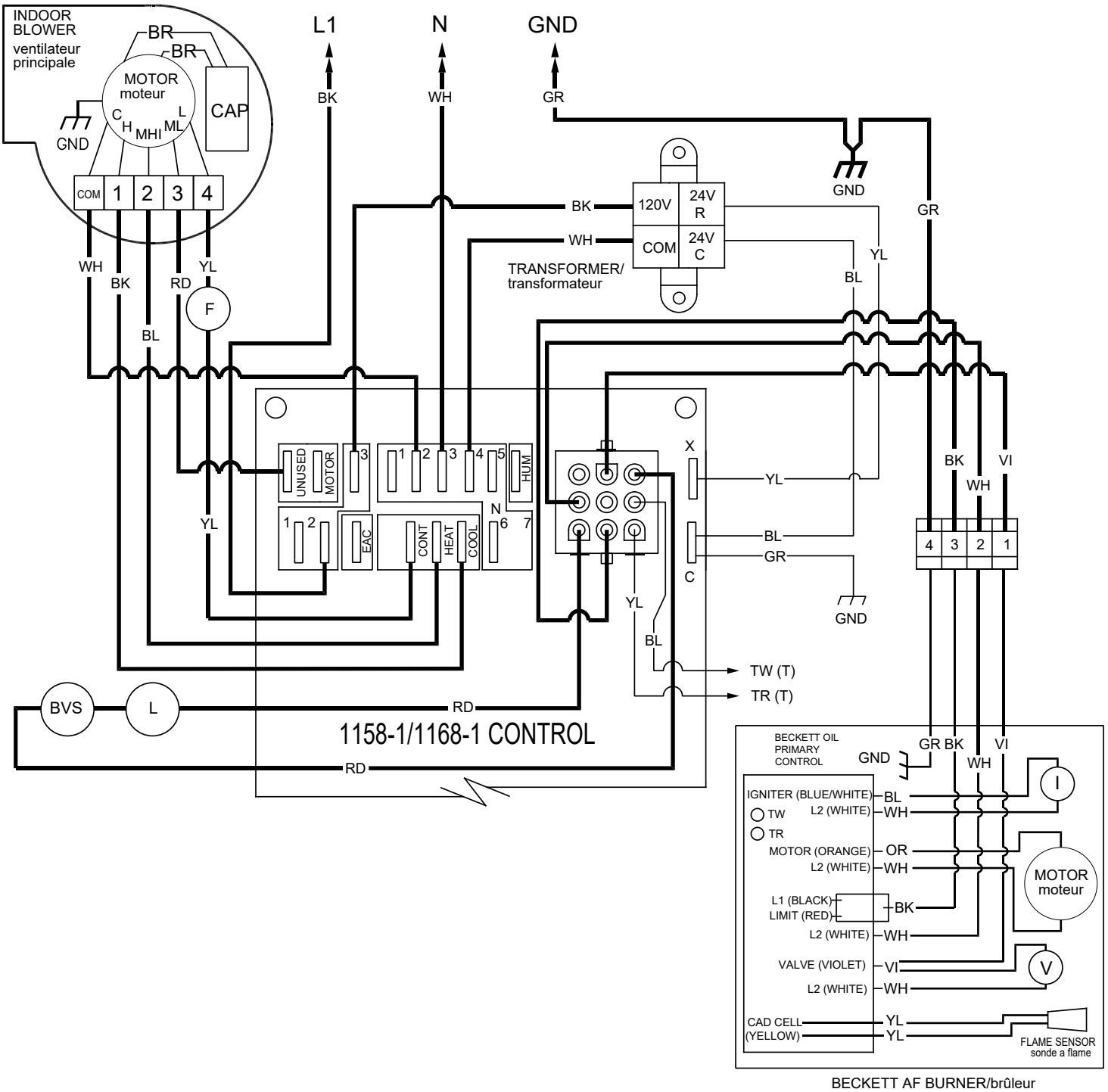
HEATING & COOLING

RIELLO WIRING DIAGRAM



HEATING & COOLING

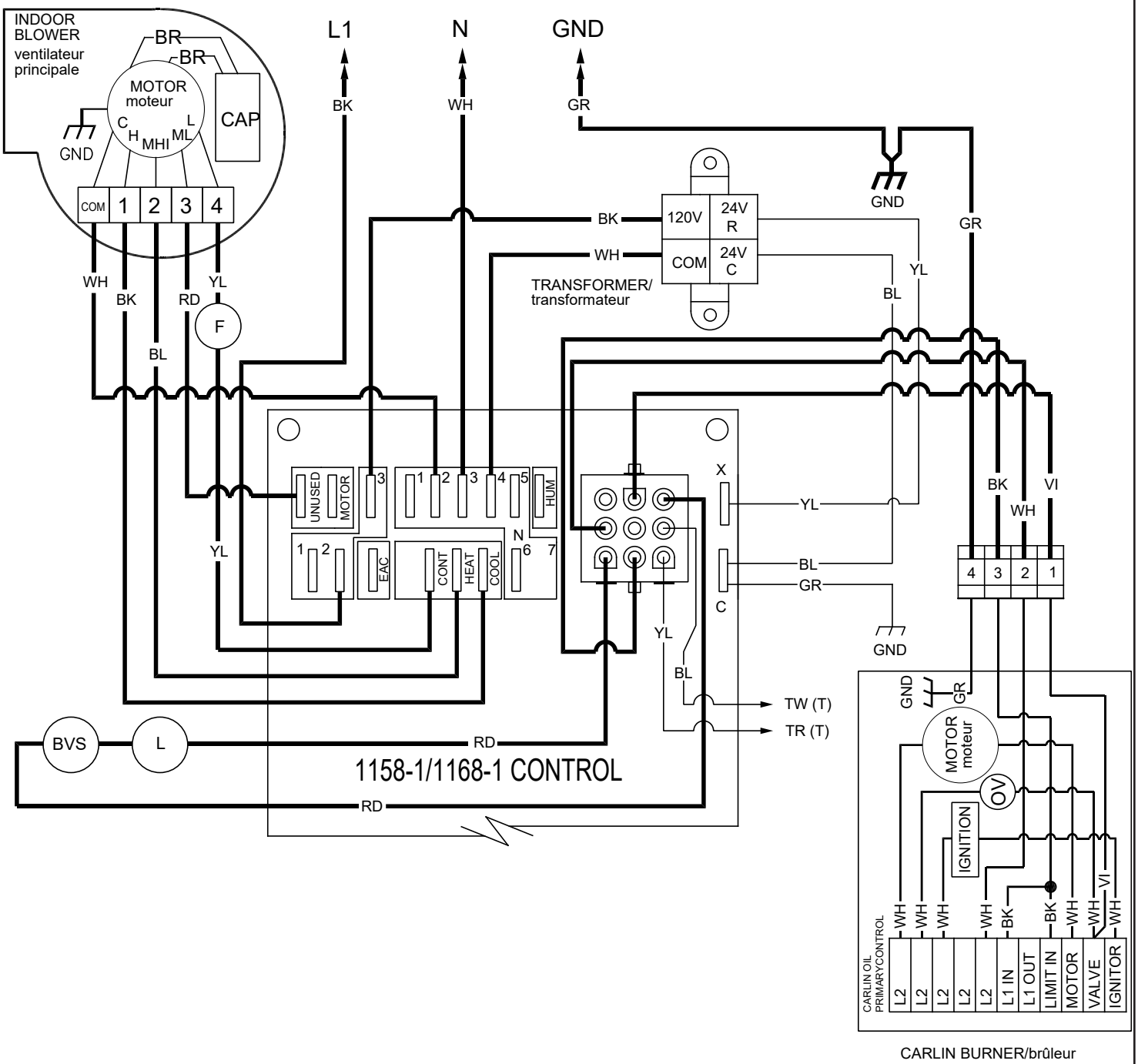
BECKETT WIRING DIAGRAM



BECKETT AF BURNER/brûleur

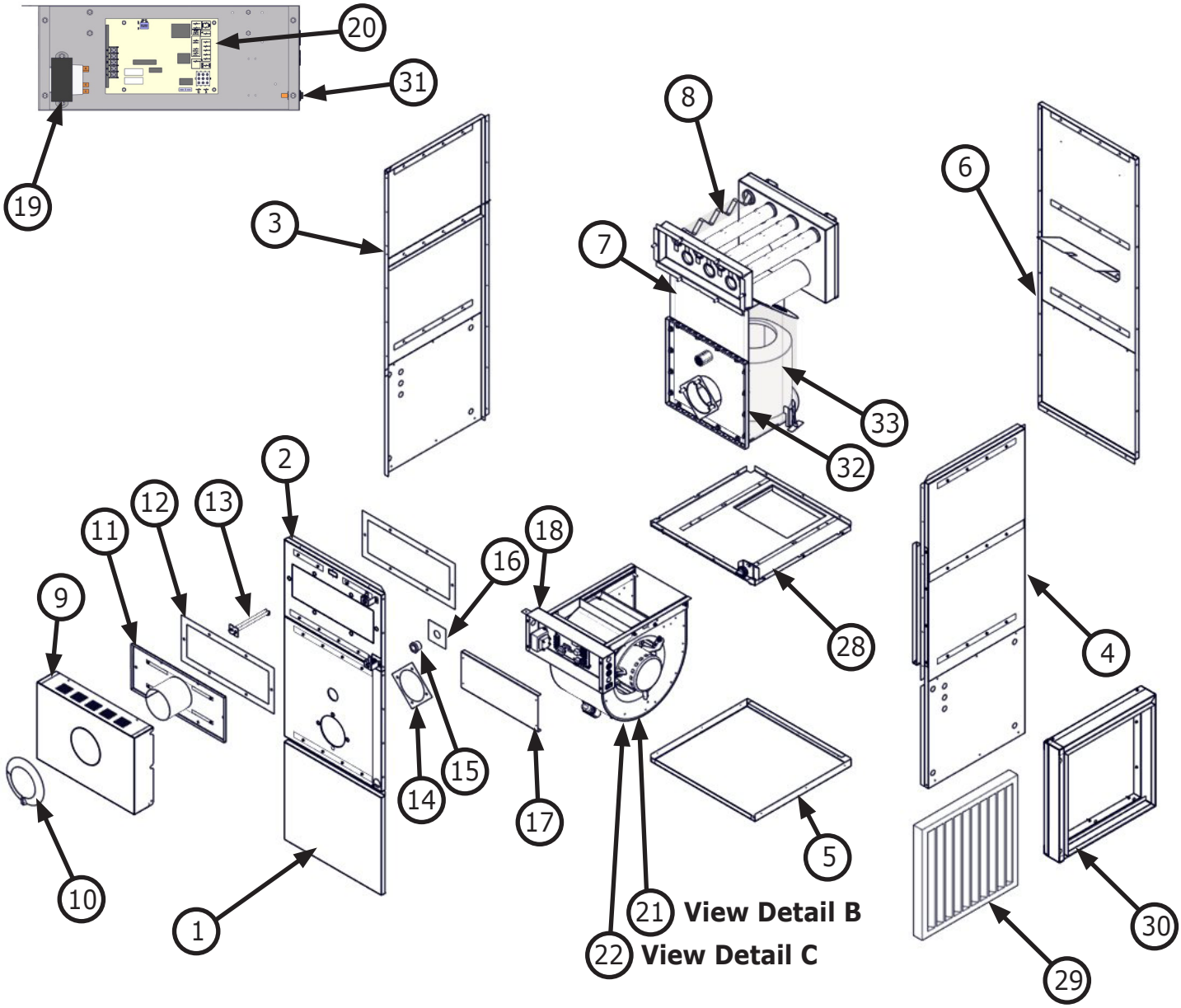
HEATING & COOLING

CARLIN WIRING DIAGRAM



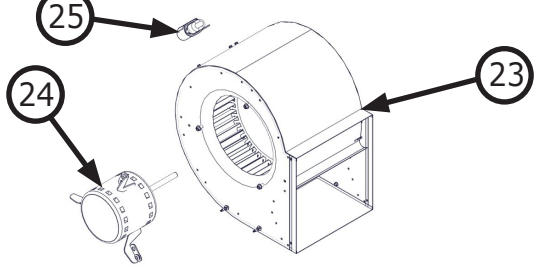
9.0 EXPLODED PARTS VIEW

HTL-100 - EXPLODED PARTS VIEW



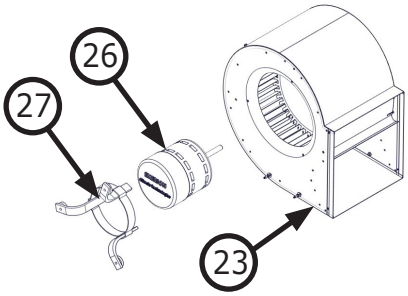
Detail B

21 FAN-A0-0002-00
PSC Motor



Detail C

22 FAN-A0-0002-01
ECM Motor

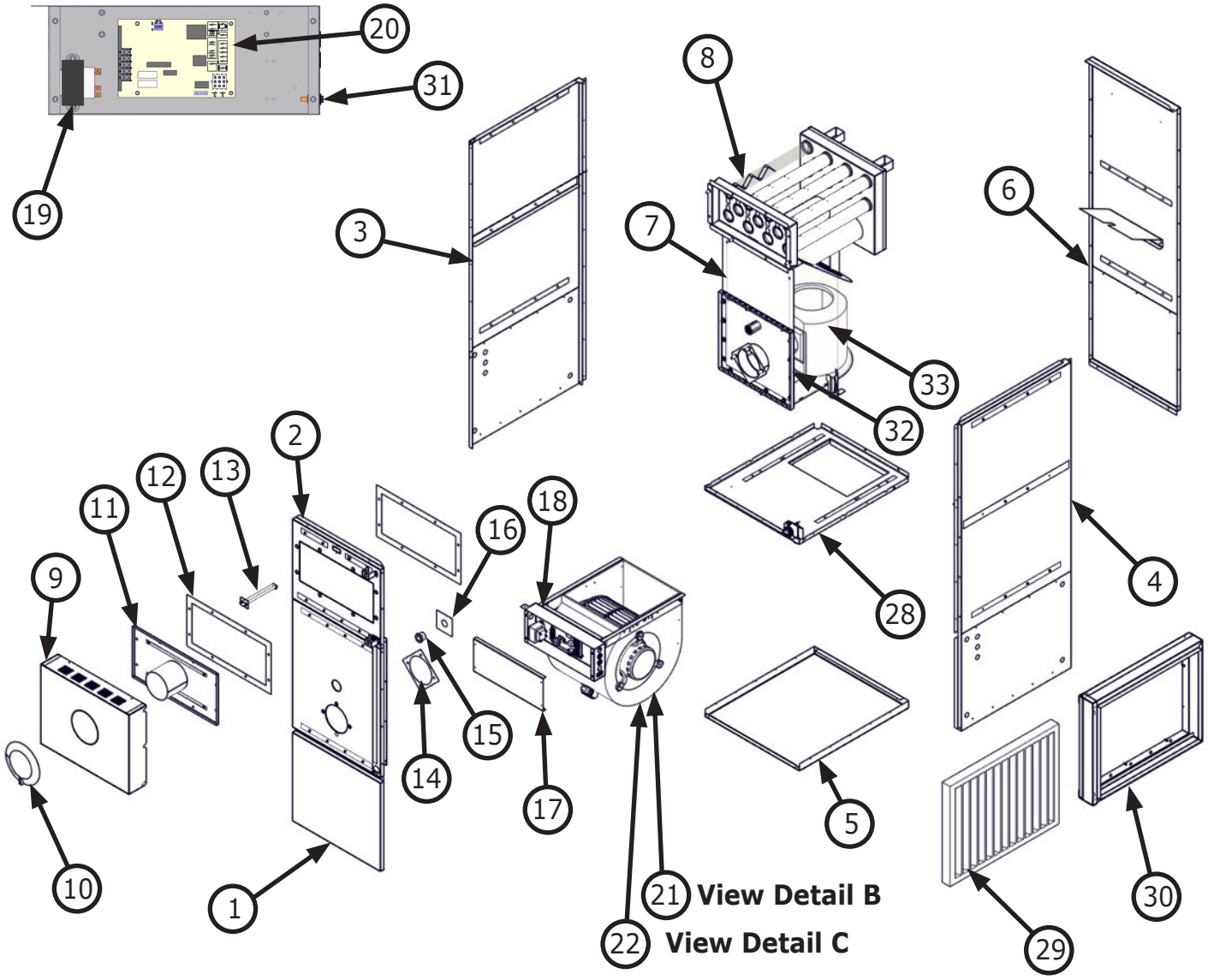


HTL-100 - PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
1	CAB-A1-9050-00	Lower Front Panel Assembly	1
2	CAB-A1-9021-00	Top Front Panel Assembly	1
3	CAB-A1-9023-00	Left Panel Assembly	1
4	CAB-A1-9022-00	Right Panel Assembly	1
5	CAB-P1-9021-00	Base Panel	1
6	CAB-A1-9024-00	Rear Panel	1
7	HEX-A1-9002-00	Heat Exchanger Assembly	1
8	HEX-P1-9011-00	Pipe Baffle	8
9	CAB-P1-9035-00	Front Door Panel	1
10	CAB-P0-0303-00	Front Flue Collar	1
11	HEX-A0-0013-00	Front Collector Assembly	1
12	INS-P0-0015-00	Front Insulation	2
13	4SD-00-0215-00	Control Limit Snap Disc (215) Auto Reset (L215)	1
14	INS-P0-0017-00	Burner's Flange Insulation	1
15	3SG-0P-1030-5A	Glass Sight Clear 1" Npt Hex With Thd Seal	1
16	INS-P0-0018-00	Sight Glass Insulation	1
17	ELB-P1-0014-00	Cover Electrical Box	1
18	ELB-A1-9001-00	Electrical Box Assembly	1
19	4TF-00-40VA-00	Transformer HTC-01A0BB01 40va	1
20	4CB-00-FAN0-01	1158-120 UTEC Electrical Board	1
21	FAN-A0-0002-00	Fan motor assembly HTL-100 psc motor	1
22	FAN-A0-0002-01	Fan motor assembly HTL-100 ecm motor	1
23	3BU-10-08DD-00	Blower 10" x 8" direct drive (g10-8dd)	1
24	3BM-50-4SDD-01	Motor Blower 1/2 Hp Direct Drive 4sp Emerson	1
25	4CA-00-705M-00	Capacitor 7.5 Uf 370vac 70c 60 Hz	1
26	3BM-50-ECM0-02	Motor Blower 1/2 Hp Ecm Ecotech Emerson	1
27	1SB-10-BRKT-00	Bracket motor mounting direct drive blower	1
28	CAB-A1-9019-00	Blower Panel Assembly	1
29	3AF-02-2020-01	Filter Air 20" x20" x2" Non Pleated	1
30	CAB-A1-9044-00	20’’ x 20’’ Filter Holder Assembly	1
31	4SW-00-RA90-10	Rocker Switch, SP/ST,15 AMP	1
32	INS-P1-9021-00	Combustion Chamber Door Gasket	1
33	3CC-00-CHAM-04	Fire Pot	1
**	4WA-00-HRNS-14	Control Box Wire Harness	1

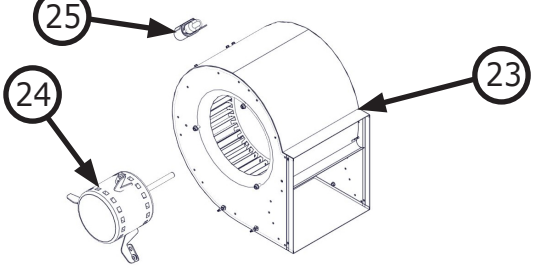
** - Not shown

HTL-200 - EXPLODED PARTS VIEW



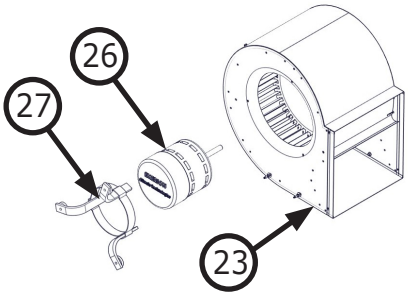
Detail B

21 FAN-A0-0004-00
PSC Motor



Detail C

22 FAN-A0-0004-01
ECM Motor



HTL-200 - PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
1	CAB-A1-9034-00	Lower Front Panel Assembly	1
2	CAB-A1-9030-00	Top Front Panel Assembly	1
3	CAB-A1-9028-00	Left Panel Assembly	1
4	CAB-A1-9027-00	Right Panel Assembly	1
5	CAB-P1-9037-00	Base Panel	1
6	CAB-A1-9026-00	Rear Panel	1
7	HEX-A1-9003-00	Heat Exchanger Assembly	1
8	HEX-P1-9013-00	Pipe Baffle	8
9	CAB-P1-9044-00	Front Door Panel	1
10	CAB-P0-0303-00	Front Flue Collar	1
11	HEX-A0-0010-00	Front Collector Assembly	1
12	INS-P0-0020-00	Front Insulation	2
13	4SD-00-0215-00	Control Limit Snap Disc (215) Auto Reset (L215)	1
14	INS-P0-0017-00	Burner's Flange Insulation	1
15	3SG-0P-1030-5A	Glass Sight Clear 1" Npt Hex With Thd Seal	1
16	INS-P0-0018-00	Sight Glass Insulation	1
17	ELB-P0-0014-00	Cover Electrical Box	1
18	ELB-A1-9001-00	Electrical Box Assembly	1
19	4TF-00-40VA-00	Transformer HTC-01A0BB01 40va	1
20	4CB-00-FAN0-01	1158-120 UTEC Electrical Board	1
21	FAN-A0-0004-00	Fan motor assembly HTL-200 psc motor	1
22	FAN-A0-0004-01	Fan motor assembly HTL-200 ecm motor	1
23	3BU-12-10DD-00	Blower 12" direct drive (g12-10dd)	1
24	3BM-75-4SDD-01	Motor Blower 3/4 Hp Direct Drive 4sp Emerson	1
25	4CA-00-156M-2B	Capacitor 15 Uf 370vac 70c 60 Hz	1
26	3BM-75-4SDD-02	Motor Blower 3/4 Hp Ecm Ecotech Emerson	1
27	1SB-10-BRKT-00	Bracket motor mounting direct drive blower	1
28	CAB-A1-9029-00	Blower Panel Assembly	1
29	3AF-02-2025-1	Filter Air 20" x25" x2" Non Pleated	1
30	CAB-A0-0030-00	20” x 25” Filter Holder Assembly	1
31	4SW-00-RA90-10	Rocker Switch, SP/ST,15 AMP	1
32	INS-P1-9021-00	Combustion Chamber Door Gasket	1
33	3CC-00-CHAM-04	Fire Pot	1
**	4WA-00-HRNS-14	Control Box Wire Harness	1

** - Not shown

10.0 START-UP TEST RESULTS

Model: _____ Serial Number: _____

Hiboy HTL _____

Date of installation: _____

Installer (name & address): _____

_____

_____

START-UP TEST RESULTS

Size of unit (Btu/h): _____

Nozzle: _____ Oil Pressure (psi): _____

Chimney _____

Burner adjustments:

RIELLO **F3** _____ RIELLO **F5** _____ Beckett **AFG** _____

CARLIN EZ-1S _____

Turbulator: _____ Air Gate: _____ *Head Setting: _____

Air band: _____ Air shutter: _____ *Air Setting: _____

*Carlin Only

Smoke result: #0 _____ TRACE _____ #1 _____

Combustion Results: _____ CO2 %

Chimney draft: _____ " W.C.

Ambient temperature: _____ °F

Gross flue temperature: _____ °F

Temperature rise: _____ °F (see page 22)

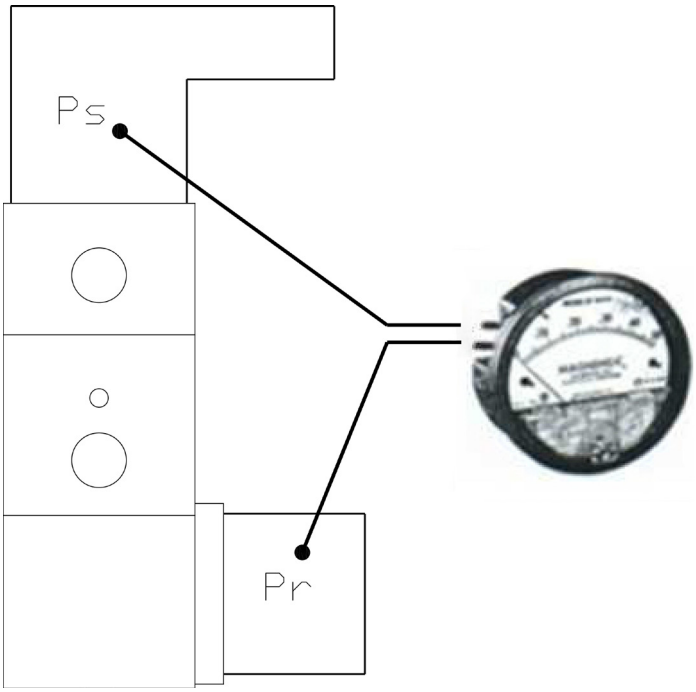
External total static pressure: _____ " W.C. (see page 22)

A/C Coil total resistance: (see page 41)

TEST PROCEDURES

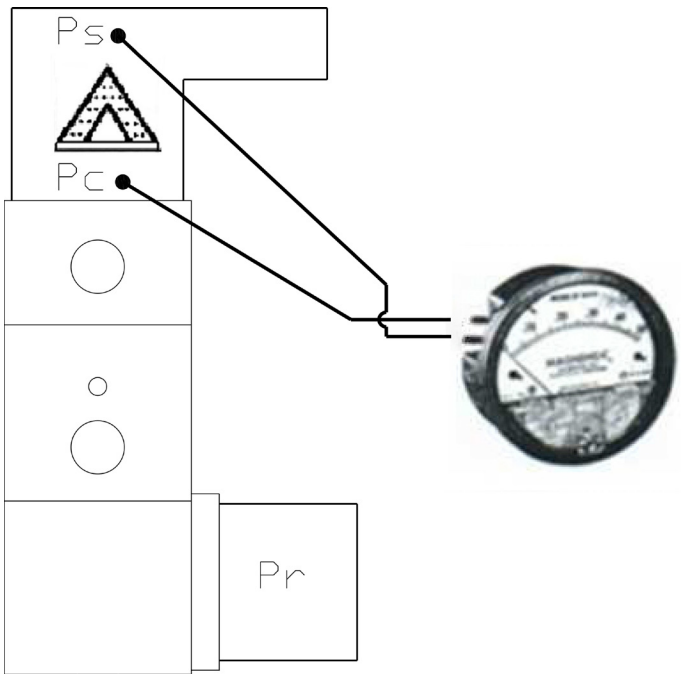
External Total Static Pressure Reading

Supply Pressure (Ps) + Return Pressure (Pr)



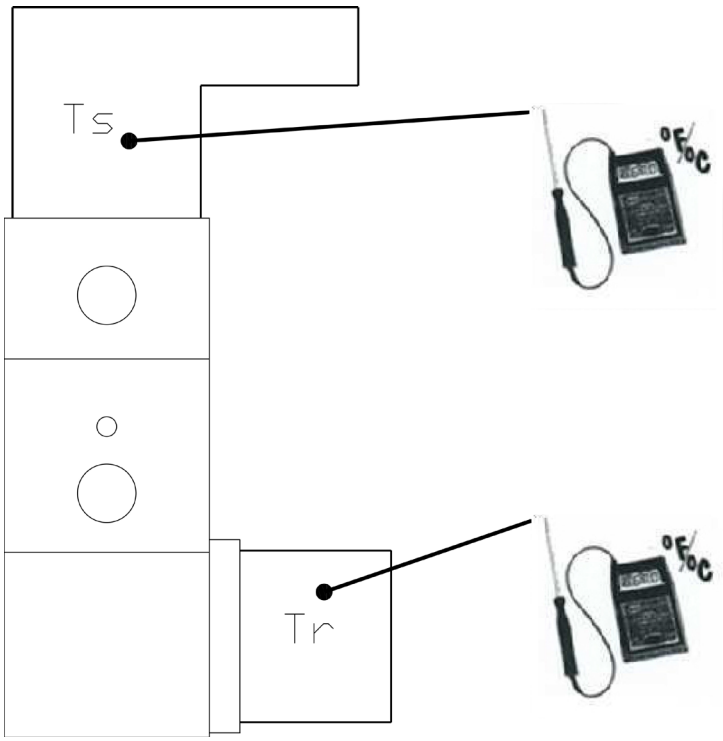
A/C Coil Total Resistance Reading

Coil Pressure (Pc) - Supply Pressure (Ps)



Temperature Rise Reading ***

Supply Temp. (Ts) - Return Temp. (Tr)



*** Probe must not be in direct sight of heat exchanger.

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