



By
EconoHeat Inc.



**USED OIL or GAS/PROPANE
FIRED AIR COOLED
ABSORPTION WATER
CHILLER
OWC-5 Series**

INSTALLATION ♦ STARTUP ♦ ADJUSTMENT ♦ MAINTENANCE

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

IF UNIT OVERHEATS OR UNIT'S GAS VALVE FAILS TO SHUT OFF:
DO NOT SHUT OFF ELECTRICAL SUPPLY TO UNIT. INSTEAD, SHUT "OFF" GAS SUPPLY TO UNIT.
CALL SERVICE COMPANY.

WARNING:
Never burn chlorinated solvents mixed with oils or otherwise rapid corrosion to internal metals will occur. An optional chlorine test kit is available from the factory upon request.

NOTE:
The power supply line must not be used to turn the unit "ON" or "OFF". The dedicated control switch in the R-Y line is for this purpose.

The OWC-5 Chiller can operate using either used oil or gas/propane. Normal operation of the Chiller will attempt to run on used oil first then automatically switch over to gas or propane if used oil burner is turned off or not operating due to lack of fuel or flame.

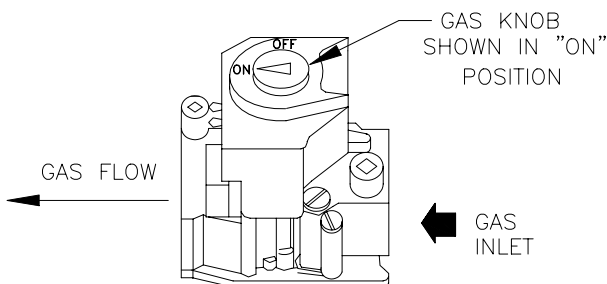
FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- WHAT TO DO IF YOU SMELL GAS**
- Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in the building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to move the gas control knob. Never use tools. If the knob will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. CHILLER – Set the thermostat to highest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Turn the gas control knob to "OFF".
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.
7. Move gas control knob to "ON".
8. Replace control access panel.
9. Turn on all electric power to the appliance.
10. Set thermostat to desired setting.
11. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to highest setting (chiller).
2. Turn off all electric power to the appliance if service is to be performed.
3. Turn the gas control knob to "OFF". Do not force.
4. Replace control access panel.

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NOTE

Carefully read the information contained in this manual. It contains important instructions regarding installation, use and maintenance safety. Save this manual for any future needs. The manufacturer cannot be held responsible for any damages from improper, erroneous or irrational use.

With the aim of continuously improving of quality of our products, manufacturer reserves the right to change reported instructions and drawings without any prior notice.

1 GENERAL WARNINGS

This manual is an integral and essential part of the product and must be given to the owner.

Only qualified technicians, strictly complying with the manufacturer's instructions and the local standards, should install this product. The manufacturer will not accept responsibility for personal injuries or property damage resulting from improper installation.

Qualified technicians are those having specific technical competence in air conditioning and gas appliances according to international and national standards.

This appliance must be used exclusively for its intended purpose. All chilling applications must be in accordance with the operating specifications of the unit. Any other use is considered improper and, therefore, dangerous. Steps must be taken to avoid improper use and potential dangers.

The fluids used in the sealed refrigerant circuit may cause health problems if inhaled, ingested or when allowed to come into contact with the skin. It is recommended that no work be performed on the sealed refrigerant circuit except by a qualified service technician or engineer. Care should also be taken not to disturb or handle the valves of the chiller's sealed refrigerant circuit.

The manufacturer will not accept contractual or non-contractual liability for damages resulting from improper installation or misuse of the unit or intentional disregard of any of the manufacturer's instructions.

After unpacking the unit, check the unit for integrity. Due to the potential danger, keep all packaging materials (plastic bags, polystyrene foam, nails, etc.) away from children.

Before installation, it is recommended that all chilled water and oil/gas supply piping be flushed. If not flushed prior to installation, residual materials may be left in the piping that could cause improper functioning of the chiller.

The installation of the appliance must conform to the requirements of the authority having jurisdiction or in the absence of such requirements, to the latest edition of the **National Fuel Gas Code, ANSI Z223.1**. If the unit is installed in Canada, the installation must conform to the **Canadian Gas Association Standard CAN1 B149.1** and **2**.

The chiller's electrical connections and grounding must be in accordance with the latest edition of the **National Electrical Codes, ANSI/NFPA No. 70 (CSA Standard C22.1** when installed in Canada) and with any local codes. To ensure the electrical safety of this appliance, it must be correctly connected to an efficient grounding system. The manufacturer is not responsible for any damages caused by the failure of the grounding system.

In the case of failure and/or poor unit performance, shut the unit down in the proper manner, disconnect the unit's power supply and close the gas valve. Do not attempt any repair and call a qualified technician for service. The chiller should also be disconnected when not in use for a prolonged period of time.

The manufacturer's authorized service technicians, using only original replacement parts, must perform repairs to the product. Failure to adhere to this guideline may compromise the safety of the unit. To ensure the correct operation and efficiency of the unit, it is essential that qualified service technicians perform annual maintenance in accordance with the manufacturer's instructions.

Should the unit be sold or transferred to another owner, it is imperative that this manual be provided for use to the new owner and/or installer.

Under no circumstances should the unit be operated with any safety or electrical component by-passed or defective.

Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control, which has been under water.

Before starting the appliance:

A qualified service technician must verify that:

- The electric and oil/gas supplies are the same as indicated on the rating plate
- The fuel supply and water distribution systems are water tight
- The appliance is supplied with the type of fuel for which it is preset
- The oil and gas supply gallons per hour and pressure conform to the oil flow rate and gas pressure indicated on the rating plate.
- The oil/gas supply system is appropriately designed for the BTU and gas rate needed by the unit, and equipped with all safety and control devices prescribed by standards in force.

WARNING

<p>To guarantee the correct operation of the unit and avoid possible failures, ALWAYS turn off the unit by means of the thermostat or any switch that controls the operation of the unit.</p>
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<p>NEVER turn off the unit by shutting off the power supply.</p>

2 OVERVIEW AND TECHNICAL DATA

2.1 OVERVIEW

The High Efficiency ACF series chiller is a single-block water-chilling unit equipped with an air-cooled condenser and designed for outdoor installation. The absorption cooling cycle is based upon a solution of water and ammonia for the production of chilled water at a temperature as low as 37°F. The chilling system is fed by thermal energy provided by used oil burner or gas burner; therefore, the required electric energy is limited to driving the fan, pump motors and oil burner components. The removal of combustion gases is handled by the appliance's condenser fan and oil burners internal blower, which creates a forced draft.

The combustion fuel is Fuel Oil or Used Oil, Natural Gas or Propane Gas.

Required electric supply is 208 / 230V – 60Hz single phase.

2.2 USED OIL AND GAS FIRED CHILLER OPERATION CYCLE

DESCRIPTION OF THE ABSORPTION REFRIGERANT CYCLE

The fluid used in the cooling cycle is a solution of water and ammonia (see Figure 1). Ammonia is the **refrigerant** and water is the absorbing fluid. In the chiller's generator, the ammonia-water solution is heated to boiling producing both a vapor with a strong concentration of ammonia and a liquid solution with a low concentration of ammonia. Liquid solution with a low concentration of ammonia is called a "weak solution".

The ammonia vapor passes into the rectifier, which separates the water from the vapor. The hot and pressurized ammonia vapor exiting the rectifier enters the condenser where it is cooled and changed to a liquid.

The liquid ammonia is then brought to a lower pressure by means of a restrictor and further cooled in a "tube-in-tube" refrigerant heat exchanger. Finally, the liquid ammonia is reduced to a pressure of 39 to 60 psig and a temperature lower than 37°F by a second restrictor.

Under this low pressure and temperature condition, liquid ammonia enters the evaporator where the ammonia evaporates due to heat being removed from water returning from the user's required cooling application (thermal blowers, fan-coils, etc.) within the chilled water system.

The cold, low-pressure ammonia vapor exiting the evaporator exchanges heat with the liquid ammonia coming from the condenser in the refrigerant heat exchanger. The ammonia vapor then enters the "solution cooled absorber" where it comes into contact with "weak solution" from the generator that has been brought to a low pressure by means of a restrictor.

Inside the "solution cooled absorber" the absorption process starts, i.e. the dilution of ammonia vapor into the "weak solution". The absorption of ammonia vapor is an exothermic process. (i.e. heat is produced) To have the vapor completely absorbed by the solution, the solution exiting the "solution cooled absorber" must be further cooled in a portion of the condenser/absorber coils.

Once the absorption process is complete, the liquid solution contains a high concentration of ammonia, also called "strong solution". A hydraulically driven, diaphragm pump pumps the "strong solution" to the generator at high pressure.

As the "strong solution" is pumped to the generator, it passes through the coil of the rectifier and the solution cooled absorber (the GAX section) where it is preheated before entering the generator. The cycle then starts over.

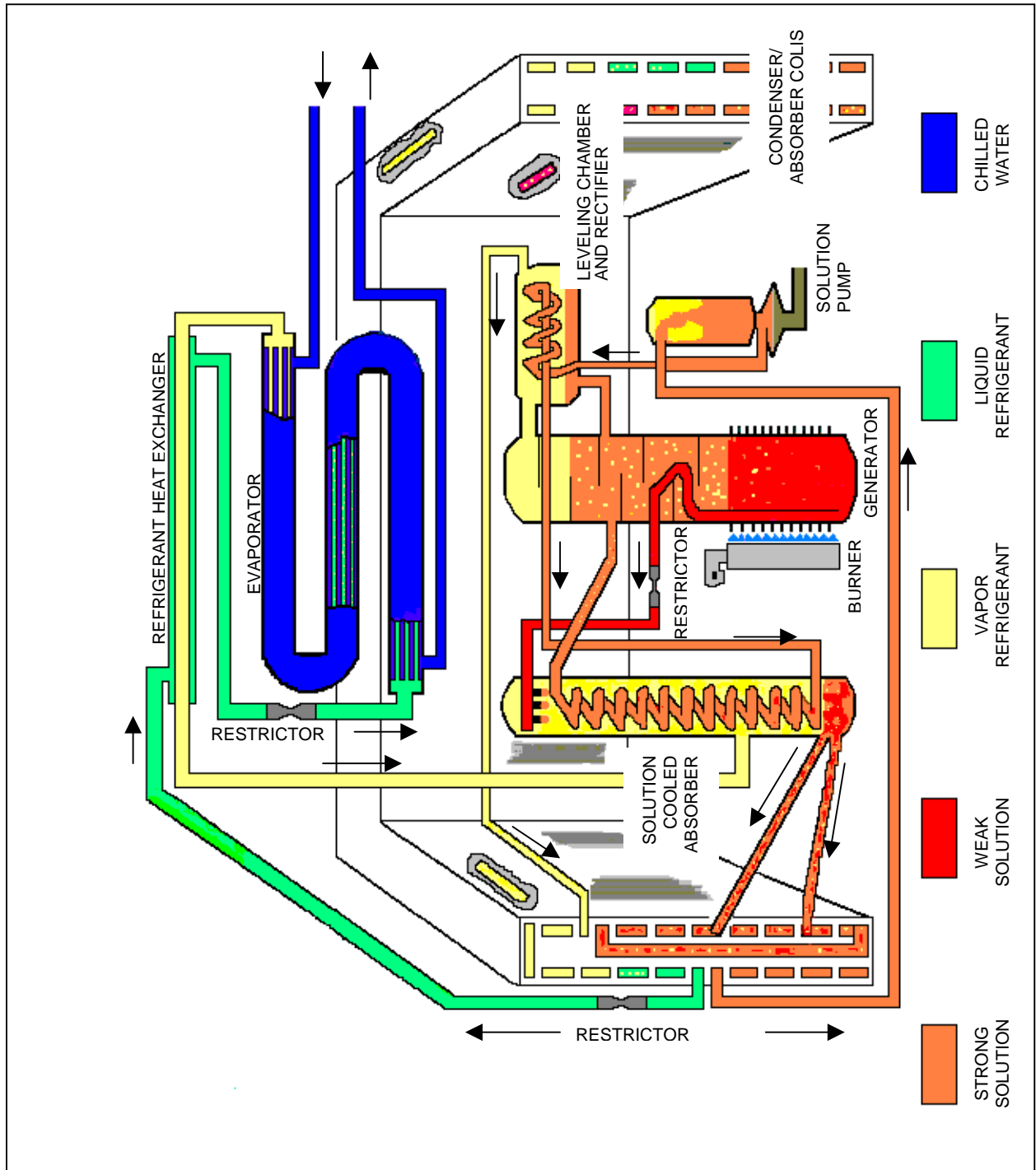


Figure 1 – ABSORPTION REFRIGERANT CYCLE

DESCRIPTION OF THE CHILLER OPERATIONS

All chiller functions and operations are monitored and controlled by the electronic control board.

The temperature probes, placed on the system in order to monitor the operation of the chiller, are transferring the following operating temperatures to the electronic control board:

- outlet chilled water temperature
- inlet chilled water temperature
- ammonia outlet temperature from condenser
- external ambient temperature
- generator temperature

Further control of the chiller's operation is carried out by:

- high temperature limit switch
- high pressure limit switch
- water flow switch
- differential air pressure switch
- chilled water thermostat
- hydraulic pump rotation probe

To control the startup of the chiller, it is necessary to install a **control switch (not included with the unit)**. The switch can be a programmable timer, room thermostat or any other type of on/off switch. **The installer must do installation of this switch.** Approximately 1 second after the control switch is closed, the electronic control board will start the hydraulic pump, condenser fan and water pump (if controlled by the board). Simultaneously, the electronic control board will energize the ignition control box. The ignition control box will check the differential air pressure switch's status and then start the ignition sequence. The premixer motor will then start.

Used Oil (Primary): Assuming Oil Pre-heater has established set-point temperature, the Oil Primary will energize the burner blower motor, fuel valve, igniter circuitry, and on-burner air compressor at which time a flame is established. The chiller is then in normal operation.

Natural Gas (Secondary): After a 15-second purge period, the ignition control box will energize the ignition transformer and dual gas valve simultaneously. The ignition transformer sends a high voltage current through the igniter to generate a spark igniting the fuel-air mixture at the burner. When flame is established, the flame sensor signals that fact to the ignition control and the ignition control stops the spark. The chiller is then in normal operation.

After the burning device has established a flame, the 3 digit display (detail A Figure 2) on the electronic control board shows the inlet water line temperature and the temperature difference, ΔT , between the inlet and outlet chilled water lines. The red light indicates the inlet water temperature and the green light indicates the temperature difference between the chilled water lines (detail B Figure 2).

When operating demand has been satisfied and the control switch opens, the electronic control board will-

Used Oil: de-energize the transfer relay which will shut down the Oil Primary causing the oil burner to shut off.

Natural Gas: shutdown the ignition system (i.e. the dual gas valve will close and the premixer motor will stop). The gas burner shuts off.

And 215 seconds later the hydraulic pump, condenser fan and water circulator contacts on the electronic control board open stopping the hydraulic, fan and water pump motors. These motors are ran for the 215 seconds to assure that solution is returned to the generator, residual cooling in evaporator is used and the unit is made ready for the next operating demand.

- **Ammonia-water solution pump:** The unit will stop if 15 seconds after start-up or during the operation of the appliance, no signal is received from the hydraulic pump rotation probe. (fault code E11 will appear on the electronic control board display)

- **Condenser Fan:** The fan's speed depends on the external ambient and condenser outlet temperatures. When ambient temperature is above 91°F, the fan is at full speed. Condenser and external ambient temperatures are monitored continuously. Fault codes will appear on the electronic control board display and the appliance will stop if any of the following occur: condenser overheating - fault code E04; external ambient temperature above 131°F - fault code E05; external ambient temperature below 10°F - fault code E06.
- **Used Oil Burner Cooling Fan:** The fan will be operative whenever the used oil burner is running. It helps in cooling the combustion chamber and burner assembly.
- **Generator Temperature Probe:** This probe controls the generator temperature. If the generator temperature exceeds 330°F, the unit will shut down and fault code E07 will be displayed. When the temperature of the generator drops below 280°F, the fault code will disappear and the unit will automatically restart. If the probe senses 330°F three times in 60 minutes, the unit will shut down and display fault code E08 on the electronic control board display.
- **Water Pump** (not supplied with the unit): A water pump is used for chilled water circulation. The burner will turn off when the water flow rate is insufficient or stopped for more than 15 seconds and a fault code of E10 will appear on the electronic control board. During a normal shut down, the water pump will, if controlled by the electronic control board, continue to run for 215 seconds.
- **Chilled Water Thermostat:** (on the electronic control board, detail C Figure 2) The Chilled Water Thermostat allows the service technician to adjust the minimum leaving water temperature set point. When the leaving chilled water temperature reaches the set point, the unit will shut down. If the control switch is still calling for cooling, i.e. closed, the unit will restart when the leaving water temperature reaches 1°F above the chilled water thermostat setting.
- **Low Temperature Chilled Water Control:** When the leaving water temperature is below the chilled water thermostat set point, the appliance will be shut down. If the control switch is calling for cooling, i.e. closed, and the water temperature falls below 33°F (fault E03 will appear on the electronic control board display), the water pump will run continuously after the normal shut down time of 215 seconds. The unit will automatically restart when the outlet water temperature reaches 1°F above the chilled water thermostat set point.

When chiller is running, the following operations are continuously monitored:

- Temperature probes; in the case of a short circuit or missing signal from the probes, the unit will stop and the respective fault code will display on the electronic board.
- High temperature limit switch and high pressure limit switch, both are manual reset; The intervention of any of these safeties causes the unit to stop and the respective fault code will display on the electronic board.
- Oil burner photo eye; detects the absence of flame, If flame is not detected within 45 seconds the Oil Primary will shutdown the oil burner.

NOTE

When the appliance is turned off from the control switch (thermostat, programmable timer or similar), the hydraulic pump, fan and water pump (if controlled from electronic board) will **continue to run for the next 215 seconds**.



Figure 2 - The S-50 Electronic Control Board

CHILLER'S COMPONENTS AND MAIN CONSTRUCTIVE FEATURES

Generator: made of mild steel, baffle distillation column, integrated vapor rectifier, externally finned on the combustion chamber portion in order to improve the heat exchange characteristics.

Condenser – Absorber: two integrated circuits made of mild steel tubes, with induction-welded elbows and mechanically joined aluminum fins. Designed to ensure condensation in external ambient temperatures up to 130°F.

Evaporator: "tube-in-shell" type heat exchanger; titanium stainless steel; high efficiency heat exchanger which guarantees excellent performance of the unit in wide operating conditions; thermal losses are reduced by a polystyrene insulation.

Solution pump: Teflon diaphragm pump operated hydraulically by a one-piston hydraulic pump that is driven by an electrical motor by means of a pulley and belt system.

Solution Cooled Absorber: mild steel "tube-in-shell" heat exchanger.

Refrigerant Heat Exchanger: stainless steel "tube-in-tube" heat exchanger.

Restricters for ammonia and "weak solution": "drilled stainless steel disk" type.

2 Fans: axial type, directly coupled to one being a 8-pole electrical motor, protected against over-heating and equipped with protective weather cover.

Hydraulic pump: variable volumetric one-piston pump that creates an oscillating flow of oil directed to the solution pump diaphragm; an electric motor using a pulley and belt system drives the pump.

Gas Burner: premixed type; multiple-gas designed either for natural or propane gas operation with high efficiency of combustion and low emission of NO_x (less than 40 ppm).

Used Oil Burner: pre-heated oil and air provides optimum atomization (spray) and viscosity to the burner that results in a very thorough and clean burn. Can burn a wide range of fuel from kerosene to 90W gear oil (including synthetics).

Cabinet Panels: made of galvanized sheet metal with powder epoxy coating to guarantee the best resistance against the atmosphere's oxidizing agents.

Sealed refrigerating circuit: all components are assembled by welding, heat-treated and pressure tested at a pressure of 1000 psig.

CHILLER'S CONTROL AND SAFETY DEVICES

Electronic Control Board with integrated microprocessor controls the operation of the chiller.

High Temperature Limit Switch (manual reset) is located at the generator wall above the combustion chamber; the switch opens if the generator's sidewall temperature exceeds 330°F; the switch is manual reset. The switch can be reset when the generator sidewall temperature drops below 280°F (Fault code E01 will display when the switch is open).

High Pressure Limit Switch (manual reset) opens when internal pressure exceeds 375 psig causing the appliance to stop. (Fault code E02 will display when the switch is open).

Safety Relief Valve on the sealed circuit is set to release ammonia vapor if internal pressure exceeds 450 psig; the valve closes automatically when pressure is under 450 psig.

Differential Air Pressure Switch on the combustion circuit stops the burner ignition due to insufficient combustion air flow. (Fault code E12 will display).

Ignition Control Box controls the burner ignition. Checks the differential air pressure switch and starts the premixer blower. After 15 seconds of purging, the ignition control box opens the gas valve and starts the ignition transformer sparking at the burner for 10 seconds. If no flame is detected, the ignition control box will close the gas valve and retry lighting after an inter-purge period of 15 seconds. The ignition control box will try a total of three times to light. The unit will stop if no flame has been established or detected after the 3 tries. (Fault code E12 will display) To restart the unit, turn off supply power, wait at least 3 seconds and reapply supply power.

Dual Gas Valve: two gas valves in the same housing, electrically controlled, which positively stops gas flow when either closes.

Flow Switch monitors the chilled water flow and shuts down the unit when the water flow stops or drops to an insufficient level (Fault code E10 will display).

Oil Primary Control controls the oil burner ignition. Checks for flame in the combustion chamber. If no flame is detected within 45 seconds, the oil primary control will shutdown the oil burner. To restart the unit, reset the red button on the oil primary control.

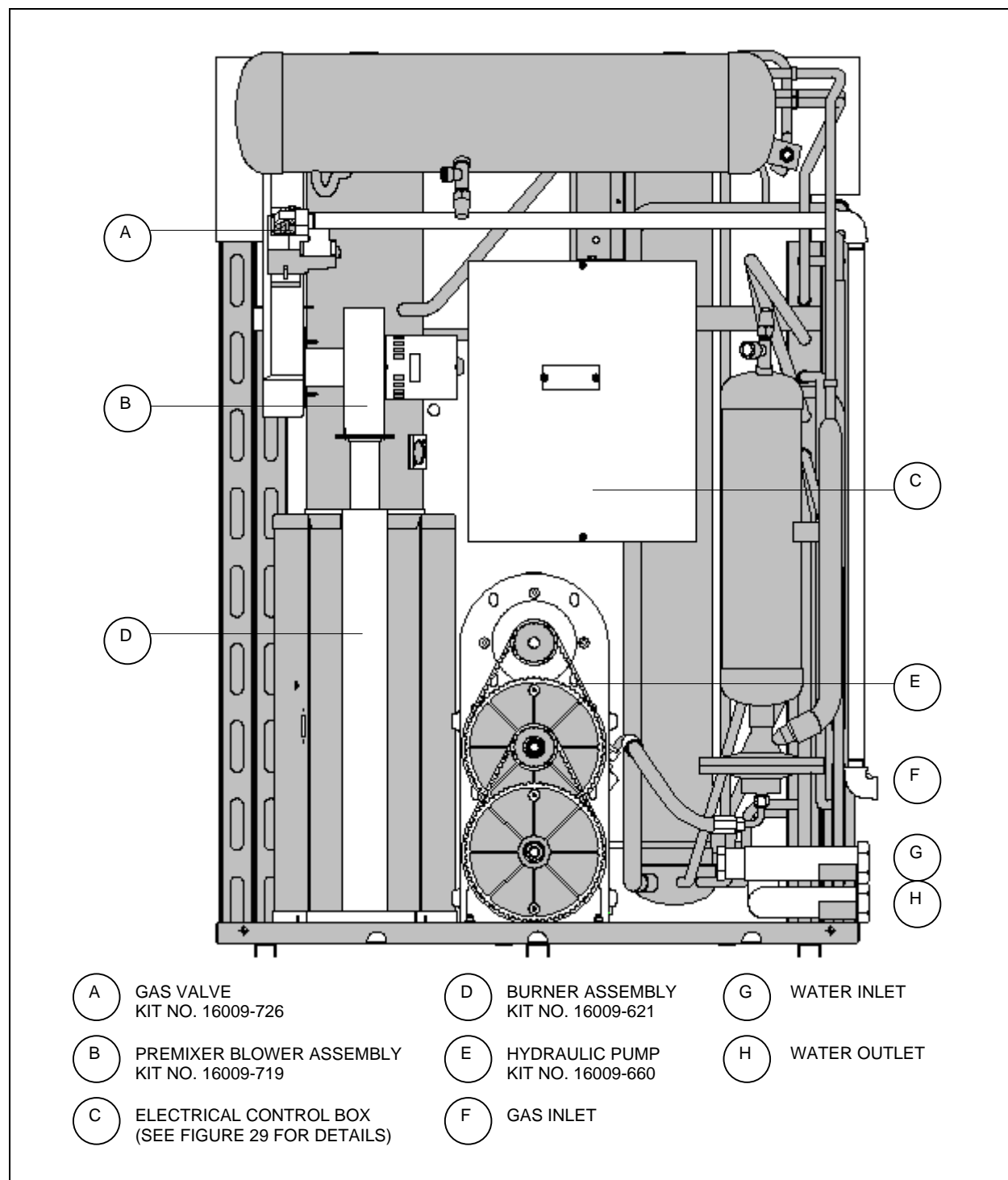


Figure 3 – FRONT VIEW Used Oil Burner Assembly Removed For Clarity.

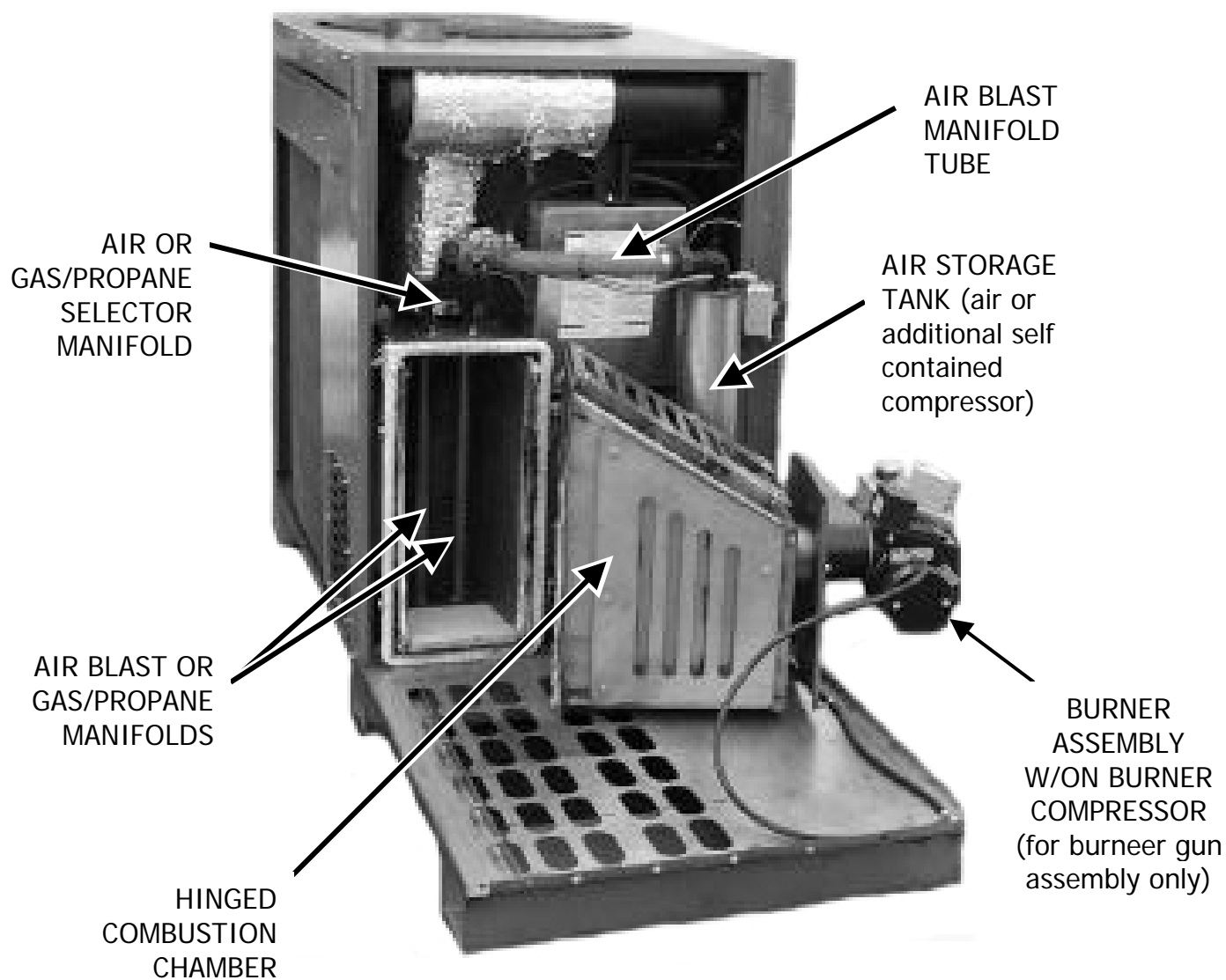


Figure 4 – USED OIL BURNER/COMBUSTION CHAMBER (door open for chamber viewing).

2.3 TECHNICAL DATA¹

PERFORMANCE RATINGS		
Nominal Cooling Capacity ²	Btu/hr	60,000
Natural Gas/Used Oil Input	Btu/hr	96,500
Maximum Ambient Operating Temperature	°F	131
Minimum Ambient Operating Temperature	°F	10
Condenser Air Flow, Nominal	CFM	6,000
Minimum	CFM	2,000
Chilled Water Entering Temperature, Nominal	°F	55
Chilled Water Leaving Temperature, Nominal	°F	45
Chilled Water Flow, Nominal	GPM	12
Maximum Allowable	GPM	16
Internal Pressure Drop	Feet of Head (psig)	13 (5.6)
ELECTRICAL RATINGS		
Required Voltage, 60 Hz, Single Phase ³	-	208/230
Condenser Fan Motor HP (Variable Speed)	-	1/2
Full Load / Locked Rotor Amps, Nominal	-	3.1 / 6.2
Hydraulic Pump Motor HP	-	1/2
Full Load / Locked Rotor Amps, Nominal	-	3.1 / 24.2
Premix Blower Motor HP	-	1/50
Full Load / Locked Rotor Amps, Nominal	-	.55 / .75
Burner Cooling Fan HP	-	1/4
Full Load Amps /Watts	-	.85/186.5
Burner/Pump Electrical Requirements		
Voltage 60Hz	VAC	115
Current	Amp	10.5
Total Electrical Operating Consumption (Unit only)	kW	1.4
Minimum Circuit Ampacity (MCA) (Unit only)	-	20.4
Maximum Over Current Protection (MOCP)	Amp	30
Qty (2) - Field Supplied		
PHYSICAL DATA		
Refrigerant Type	-	717
Unit Chilled Water Volume ⁴	Gallons	1.3
Chilled Water Entering and Leaving Connections ⁵	FPT	1
Gas Inlet Connection	FPT	1/2
Electrical Entrance Knockouts, Diameter	Inches	7/8
Shipping Weight	Pounds	980
Operating Weight	Pounds	930

Notes:

- 4.2 All illustrations and specifications contained herein are based on the latest information available at the time of publication approval. Econo Heat reserves the right to make changes at any time without notice, in materials, specifications, and models or to discontinue models.
- 4.2 Capacity at standard conditions of 95°F ambient. Actual capacity will vary with ambient (condenser) air temperature and leaving water temperature. Capacity characteristics are shown in the table below. Interpolations between tabled values are permissible, but do not extrapolate. For capacities at higher than 105°F ambient temperatures, contact Econo Heat or your authorized distributor.
- 4.2 Units are factory- wired for 230-volt operation. The unit can be field wired for 208-volt operation by placing the high voltage wire from the 230-volt termination to the 208-volt termination on the transformer.
- 4.2 "Chilled Water" refers to a solution of quality tap water and 20% by volume of inhibited permanent antifreeze. Higher antifreeze concentrations may be required in certain applications.
- 4.2 DO NOT USE FERROUS METAL PIPE OR TUBING in the chilled water circulating system.

TYPICAL CAPACITY CHARACTERISTICS in Btu/hr

Leaving Chilled Water Temperature	Ambient Air Temperature Entering Condenser			
	90°F	95°F	100°F	105°F
40°F	60,300	58,700	52,300	42,200
42°F	60,700	59,300	54,200	46,300
44°F	61,000	59,800	56,200	49,900
46°F	61,200	60,200	57,700	52,800
48°F	61,300	60,500	58,500	55,100
50°F	61,400	60,600	58,800	56,600

Table 1 –

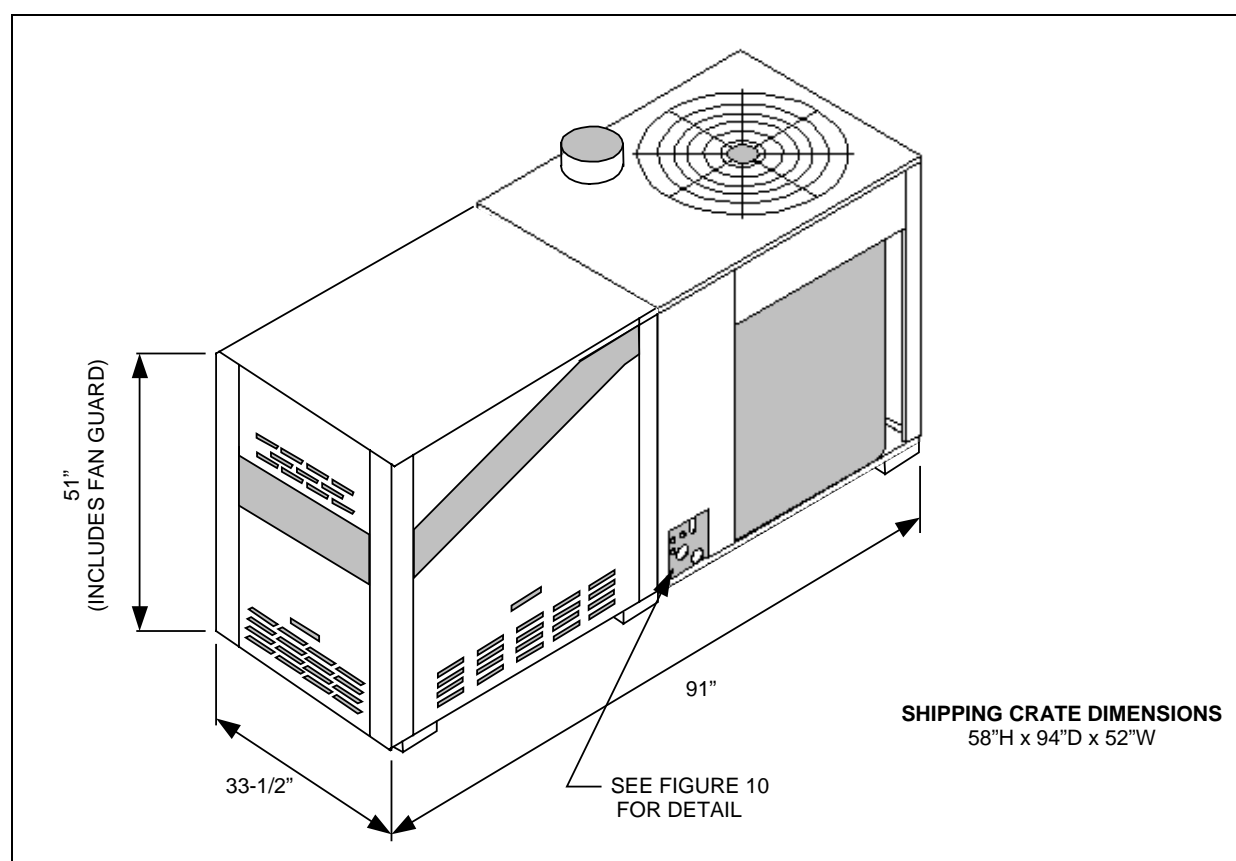
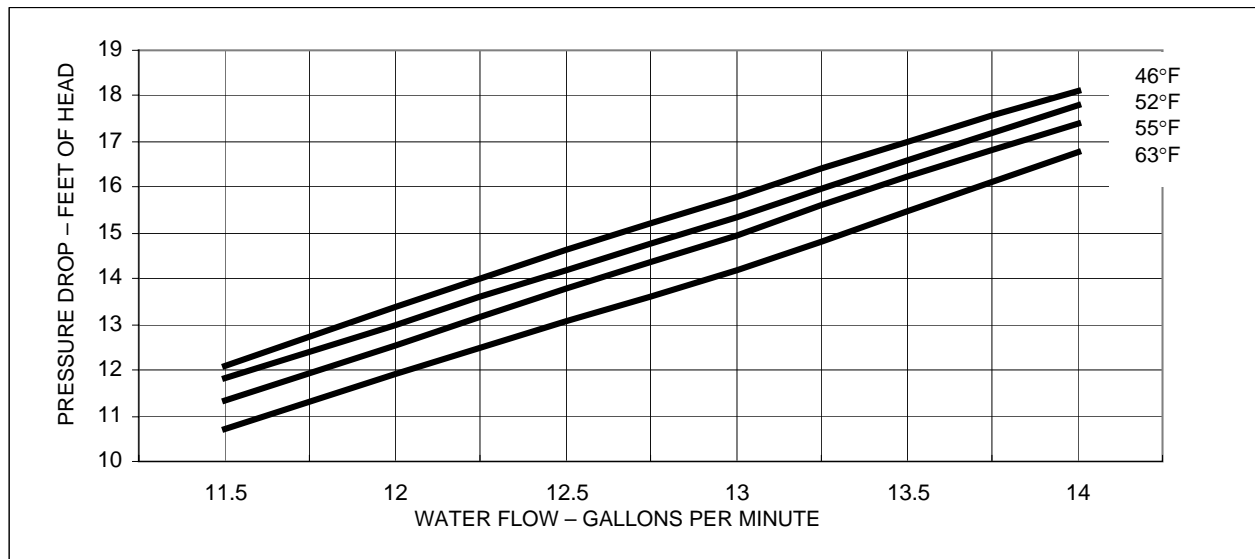


Figure 5 – UNIT'S DIMENSIONS



Graph 1 –UNIT’S PRESSURE DROP AS A FUNCTION OF INLET WATER TEMPERATURE

3 INSTALLATION

3.1 GENERAL RULES

Only qualified technicians, in compliance with the manufacturer's instructions, should carry out the installation and maintenance of the OWC-5 unit. The installation of the appliance must conform to the requirements of the authority having jurisdiction or in the absence of such requirements, to the latest edition of the **National Fuel Gas Code, ANSI Z223.1**. If the unit is installed in Canada, the installation must conform to the **Canadian Gas Association Standard CAN1 B149.1** and **.2**.

All wiring should be installed in accordance with the latest edition of the **National Electrical Codes, ANSI/NFPA No. 70, CSA Standard C22.1** when installed in Canada, and with any local codes.

The manufacturer cannot be held responsible for any damages to persons, animals or goods due to improper, erroneous or irrational installation of these appliances.

To ensure a correct installation and maximum unit performances are obtained, the following rules have to be followed:

- Unpack the unit carefully, checking that it has not suffered damage during transport. Each unit is factory tested before shipping, if damage is found report this immediately to the haulage contractor.
- **Each unit must be installed outdoors in an area of free natural air circulation** and does not require particular weather protection.
In no case must the unit be installed in a room.
- No overhead obstructions should block the outlet of air from the unit top.
- **The unit should not be installed so that the fan discharge is in close proximity to the fresh air intakes of a building or in such a manner that hot or contaminated air from flues, dryer vents, chimney, etc., could be drawn into the unit by the condenser fan.**
- The front and rear sides of the unit must have a minimum clearance of 36 inches and 24 inches, respectively, (for maintenance or servicing) from walls or other stationary constructions. The left and right sides require a minimum distance of 18 inches for proper airflow toward the condenser.
- Be sure that gas supply provided from the gas main meets the manufacturer's specifications. Inlet gas pressure to the unit must not exceed 14.0" W.C. on natural gas or propane gas. The minimum inlet gas pressure at the unit is 5.0" W.C. on natural gas and 11.0" W.C. on propane gas.

WARNING

The electrical safety of the unit is obtained only when it is correctly connected to an efficient grounding system, which meets existing applicable safety standards. Never use gas supply piping to ground the appliances. The ground wire should be longer than power supply wires for safety reasons. If the power supply wires are accidentally stretched, the ground wire will be the last to break. By following this rule, good ground continuity will be assured.

3.2 INSTALLATION OF THE UNIT

HANDLING OF THE UNIT ON SITE

When arriving at the installation site, visually inspect the unit for any signs of damage to the package, which may indicate possible unit damage.

Once on site, the units must remain in the factory packaging and only be unpacked at the moment before installation.

Before locating and unpacking the unit, make a hole in the package to check for ammonia odor. If ammonia odor is present, contact the factory.

LOCATION

The chillers **must be installed outdoors** in an area of free natural air circulation.

The installation inside a room or a building is not allowed.

There must be a minimum clearance of 4 feet horizontally from electric meters, gas meters, regulators, and relief equipment and in no case located above or below these items unless a 4 feet horizontal distance is maintained.

The unit can be installed at ground level, on a platform or on the roof (if it can withstand the weight).

The noise generated by the condenser fan during unit operation is not excessive. However, avoid locating the unit in an area adjacent to bedrooms or neighboring buildings (see Figure 6).

Also, avoid installing the unit in building corners, where air turbulence can take place or the unit noise (reverberation) can be amplified.

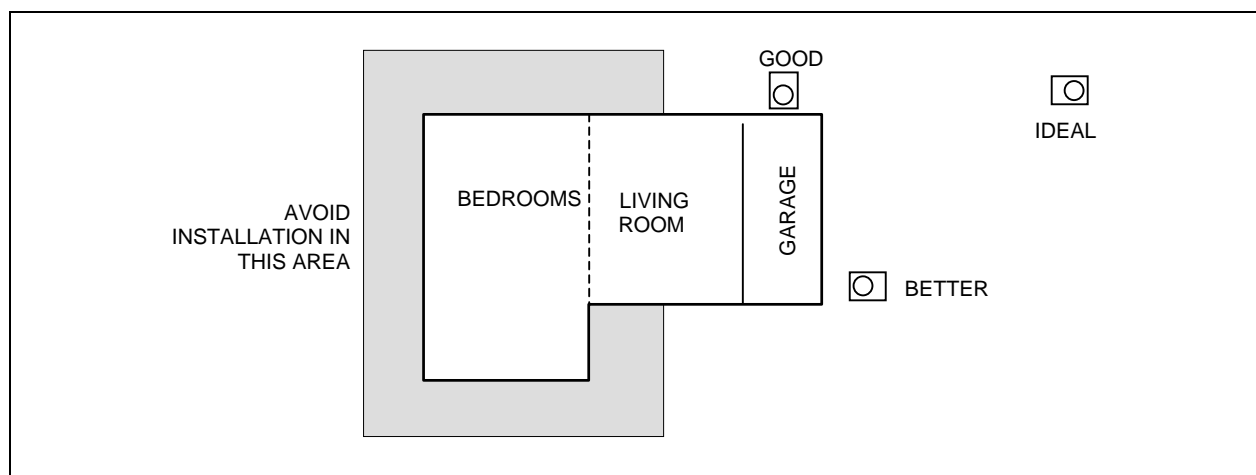


Figure 6 - LOCATION OF THE UNIT

CLEARANCES

A free space is to be provided around the unit to allow for proper unit operation and for servicing. The minimum clearance from walls, obstructions and other units should be as follows (see Figure 7):

- right / left side: 18 inches
- rear side: 24 inches
- front side: 36 inches

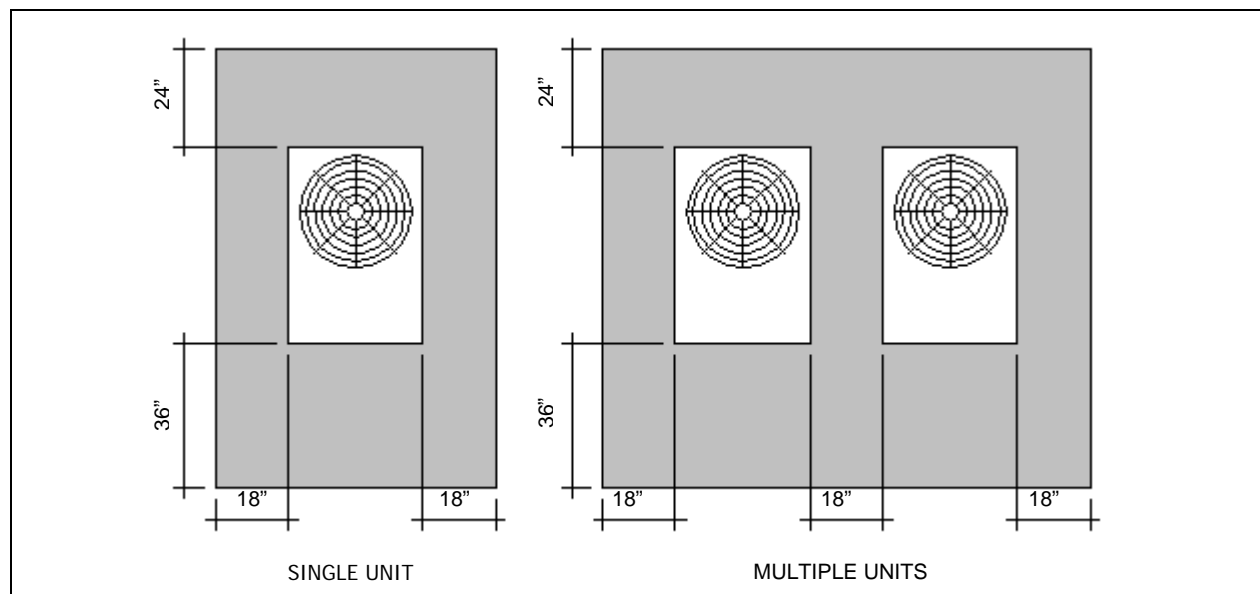


Figure 7 –CLEARANCES FOR CORRECT INSTALLATION OF THE UNIT

There **MUST NOT** be any obstructions or structural overhangs (roof edges, balconies) over the top of the unit. The re-circulation of the air discharged from the condenser results in a poor unit performance.

When the unit is installed in close proximity to buildings, keep the unit away from the roof edge drip line. In no case should the unit be placed within 6 feet of any external air intakes of the building. For installations on balconies or roofs, the unit should not be located within 8 feet from chimney flues, outlets and other such vents. It is important that the unit be located so that hot or contaminated air **IS NOT** drawn into the air intakes of the unit (see Figure 8).

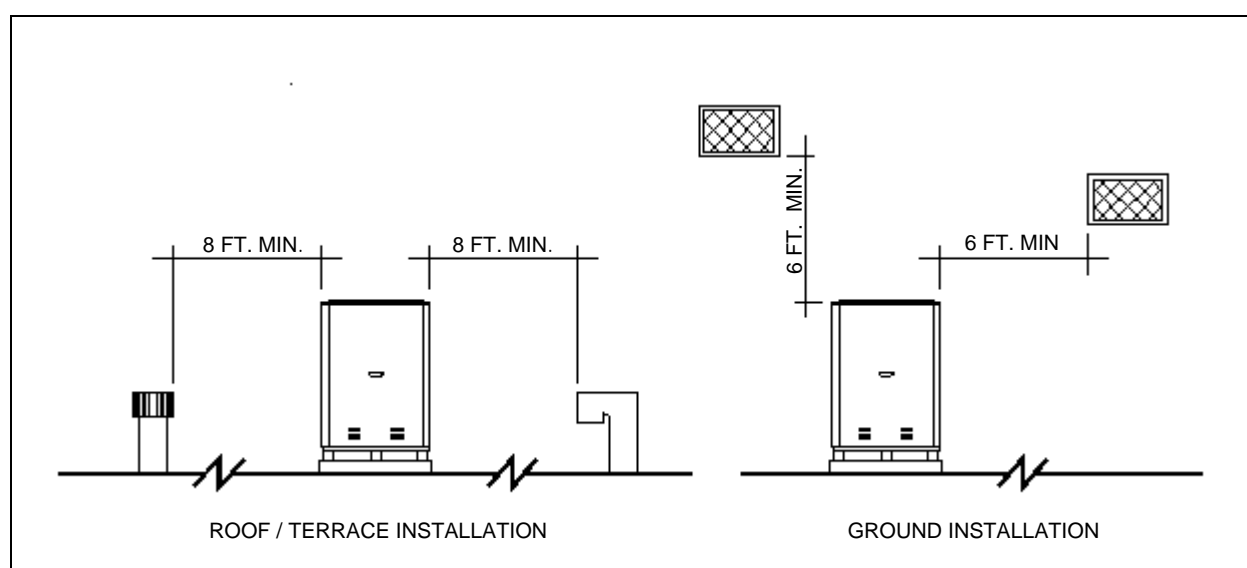


Figure 8 –CLEARANCES FROM VENT OUTLETS, CHIMNEY FLUES AND AIR INTAKE OPENINGS

GROUND INSTALLATION

Ground level units should be supported on a LEVEL concrete pad with a minimum thickness of 4" and slightly larger than the unit base (see Figure 9 for typical slab dimensions). Local soil conditions will actually dictate the slab thickness required to prevent shifting.

Do not allow the concrete slab touch the foundation of a structure. Unit operational noises can be transmitted inside the structure if they are connected.

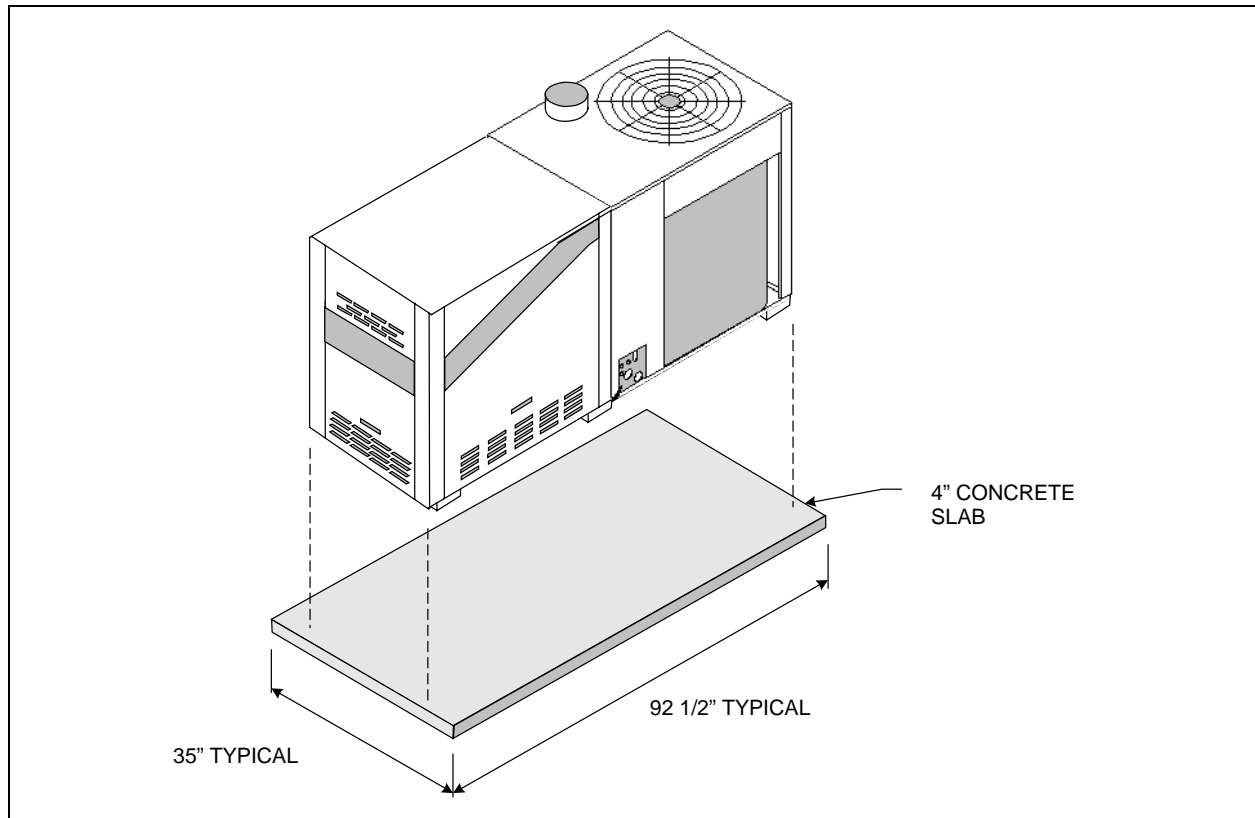


Figure 9 –DIMENSIONS AND THE POSITION OF THE CONCRETE SUPPORTS

ROOF / TERRACE INSTALLATION

If the unit must be lifted by a hoist for installation, leave it on the crate base. Attach hoist lines to the crate base and use spreader bars to prevent the hoist lines from damaging unit's cabinet panels.

Both the unit and the supporting base weight should be sufficiently supported by the roof joists.

Provide for a gangway all around the unit for maintenance purposes.

WARNING: IF ROOF MOUNTED A FIRE PROOF BARRIER IS NEEDED BETWEEN CHILLER AND ROOF

Installation on roofs directly above sleeping quarters should be avoided if possible. If not possible, special consideration must be given to the transmission characteristics of the building structure. The use of vibration isolators under the equipment (acoustically insulated bases) and approved flexible connections (vibration-dampening pipefittings) between the unit and the system piping is recommended.

LEVELING

The unit should be level both front to back and side to side. Place a level on the top of the unit to check for level. If the unit is not level, metal shims are recommended for use under proper corners to obtain level. If the shim(s) thickness exceeds 1/2", support shims should be inserted under the center of the unit.

4 HYDRONIC AND OIL/GAS INSTALLATION

4.1 WATER PIPING DESIGN AND INSTALLATION

Piping for the chiller is to be designed and installed as a closed hydronic circuit.

The following items (not supplied) must be installed close to the unit (see the Figure 10):

- FLEXIBLE CONNECTIONS to avoid vibration transmission to the chiller water lines.
- PRESSURE / TEMPERATURE TAPS in the inlet and outlet chiller water lines to set and measure proper water flow and water temperatures.
- CHILLED WATER FILTER mounted in the water inlet line to remove debris from the chiller water lines.
- REGULATION VALVES for adjusting proper water flow rate.
- WATER PUMP properly sized for system.
- EXPANSION TANK must be properly sized based on the hydronic system size, maximum thermal expansion, and maximum water pressure.
- FILL VALVE for filling, draining or flushing the hydronic system.
- AIR BLEED set at the highest point in the hydronic system for removal of air.

WARNING

To ensure the correct operation of the unit and to avoid the water freezing, add 20% by volume of glycol (antifreeze) to the circulation water. Add more glycol as needed for the minimum external temperature of the installation zone (see Table 1).

When using an automatic water charge system, the glycol percentage must be checked once a year.

There must be correct chilled water flow when the unit is operating and during the shut down period (215 seconds, between turning the burner off and complete shutdown of the appliance).

Piping (diameters of tubes etc.) must be sized appropriately in order to ensure the correct chilled water flow necessary for the proper operation of the unit. The water lines should also be sized so the maximum velocity of the water/glycol solution in the lines does not exceed 6 feet per second to avoid excessive noise.

When rigid pipes are used, it is recommended to use flexible connections between the unit and piping to avoid vibration transmission.

All piping must be properly insulated according to federal and local codes to avoid thermal losses and condensate on the water lines. All seams and joints should be carefully made so as to be air and watertight.

For size of water connections on the unit, refer to TECHNICAL DATA sheet in SECTION 2.

Connections at the coil or heat exchanger must be performed in accordance with the recommendations of the coil or heat exchanger manufacturer. For best performance, the supply-chilled water line must attach to the side of the coil or heat exchanger nearest the exit of the leaving cooled medium.

If the heat exchanger is an air coil, the air coil must be installed downstream from the furnace to avoid condensation in the furnace. Additionally if the heat exchanger is an air coil, a "P" trap must be provided to drain condensate. The height of the "P" trap must be sufficient to ensure drainage of condensate. Any horizontal run of the condensate drain line must slope $\frac{1}{4}$ " for each running foot and not be smaller than $\frac{3}{4}$ " I.P.S. to assure the condensate will drain by gravity. The condensate drain line must be insulated and ran to a suitable drain.

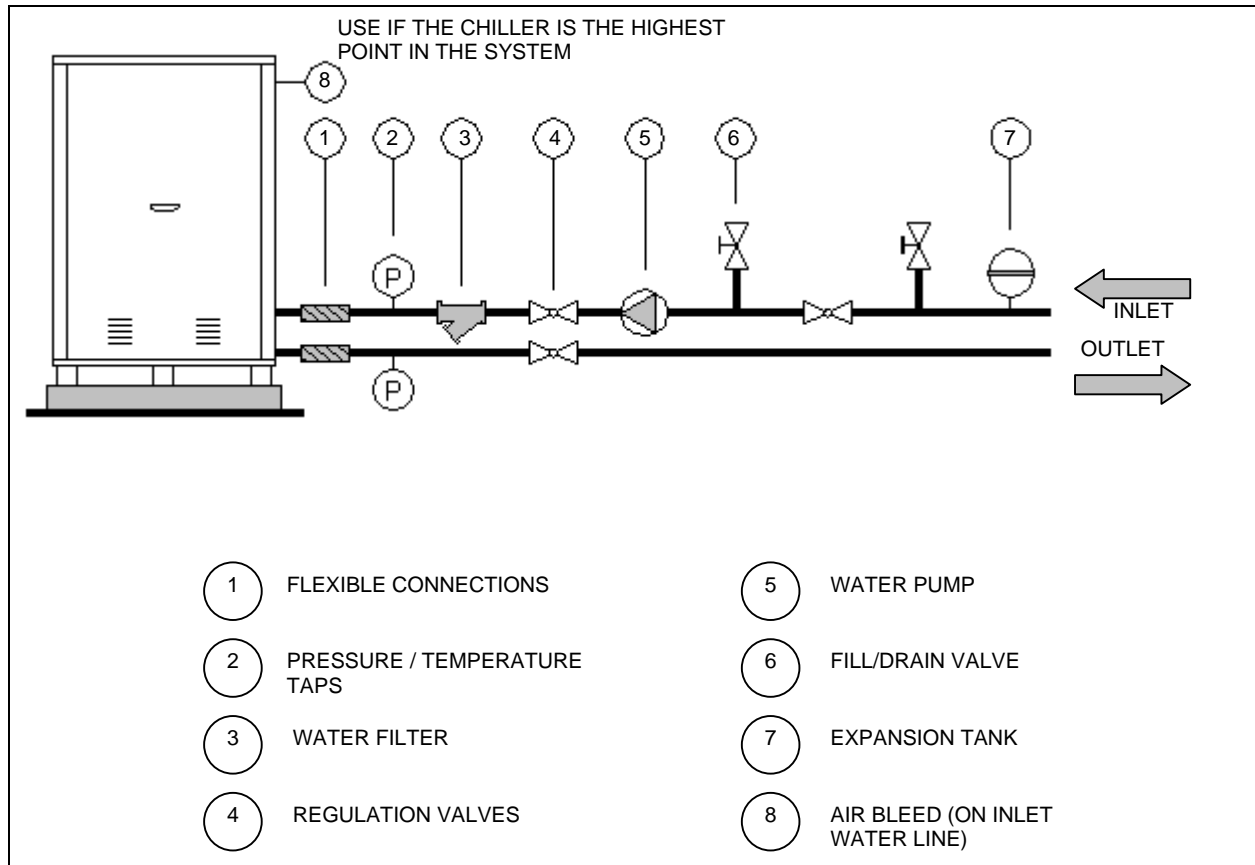


Figure 10 – WATER PIPING DIAGRAM FOR A SINGLE UNIT

4.2 SIZING A SYSTEM PUMP

When sizing a pump, there are two pieces of information that must be found in order to select the appropriate pump:

1. Flow rate (GPM, gallons per minute)
2. Pressure drop (P.D.)

The OWC-5 has a GPM flow rating of 12 (2.4GPM per Ton) with pressure drop of 13.0 feet of head.

Pressure Drop can be determined by several methods. The equivalent length method is the one demonstrated in this document. It converts all valves and fittings in to equivalent length of straight pipe. The pressure drop is determined by the system design (pipe sizes, fittings, equipment). There are two main units of measure for the pressure, Feet of Head and Pounds per Square Inch (psi). These two units of measure are related by equation 1:

Equation 1: 1psi=2.31 Feet of Head

To determine the pressure drop using the equivalent length method, follow these steps:

1. Add up all straight runs of pipe both supply and return.
2. Count all types of fittings by pipe size and pressure drop.
3. Find corresponding "Equivalent Length" of fittings on Table 2.
4. Multiply number of fittings by equivalent length.
5. Add total length of pipe and equivalent length of fitting together to get "Total Length of Pipe".
6. Multiply equivalent length of pipe by friction loss. See Table 3.
7. Find Pressure Drop of Equipment (Chiller and Air Handler). If needed, convert to feet of head by using equation 1. Pressure Drop for OWC-5 is 13 feet of head.

8. Add answers obtained in Steps 6 and 7 together. This is your system "Total Feet of Head"
9. It is recommended that a safety factor of 5 feet of head be added to the number. Round up to the nearest whole number.

Equation 2: Equivalent length of pipe(ft) X Friction Loss = Total Feet of Head

100 Feet of Pipe

Equivalent Feet of Straight Pipe for Valves and Fittings+							
Valve or Fitting	Nominal Pipe Size in Inches						
	¾"	1"	1-¼"	1-½"	2"	2-½"	3"
Standard 90° Elbow	2.5	3.0	4.0	5.0	7.0	8.0	10.0
Standard 45° Elbow	1.5	1.8	2.4	3.0	4.0	5.0	6.0
Standard 180° Elbow	3.2	4.1	5.6	6.3	8.2	10	12
Long Radius 90° Elbow	1.4	1.7	2.3	2.6	3.3	4.1	5.0
Miter 90° Elbow	4.0	5.0	7.0	8.0	10.0	12.0	15.0
Miter 45° Elbow	0.9	1.0	1.5	1.8	2.3	2.8	3.2
Sudden Enlargement	1.5	2.0	3.0	3.6	4.8	6.1	8.0
Sudden Contraction	1.0	1.2	1.8	2.2	3.0	3.8	4.9
Square Head Plug Cock	1.3	1.6	2.1	2.5	3.2	3.8	4.8
Gate Valve*	0.5	0.6	0.8	1.0	1.3	1.6	2.0
Ball Valve*	0.3	0.3	0.4	0.5	0.7	0.8	1.0
Globe Valve or Globe Lift Check Valve*	20.0	25.0	35.0	45.0	55.0	65.0	80.0

Table 2 – Equivalent Feet of Straight Pipe for Valves and Fittings

* All valves figured as full open

+ All valves are generalized, check with manufacturer for exact information.

Friction of 50°F Water (Feet of Head per 100 Feet of Pipe)†				
Flow Rate GPM	Type L Copper Tube		Sch. 40 Plastic Pipe	
	Nominal Size	Friction Loss	Nominal Size	Friction Loss
1	½"	2.40	½"	0.50
2	½"	8.04	½"	2.43
3	¾"	2.93	½"	3.27
4	¾"	4.92	½"	5.57
5	¾"	7.31	¾"	4.52
6	1"	2.70	¾"	3.01
7	1"	3.54	1"	1.36
8	1"	4.50	1"	1.58
9	1"	5.58	1"	2.12
10	1"	6.70	1"	2.63
12	1-¼"	3.38	1"	3.77
14	1-¼"	4.48	1-¼"	1.50
16	1-¼"	5.65	1-¼"	1.70
18	1-¼"	7.02	1-¼"	2.00
20	1-¼"	8.43	1-¼"	2.43
22	1-½"	4.52	1-¼"	2.85
24	1-½"	5.30	1-¼"	3.35
26	1-½"	6.10	1-¼"	4.00
28	1-½"	6.97	1-½"	2.00
30	1-½"	7.58	1-½"	2.43
32	1-½"	8.92	1-½"	2.70
34	2"	2.30	1-½"	3.08
36	2"	2.55	1-½"	3.40
38	2"	2.80	1-½"	3.70
40	2"	3.36	1-½"	4.13
42	2"	3.34	1-½"	4.40
44	2"	3.64	1-½"	4.90
46	2"	3.93	1-½"	5.37
48	2"	4.27	2"	1.70
50	2"	5.01	2"	1.83
60	2"	6.95	2"	2.57
70	2"	9.16	2"	3.41
80	2-½"	4.12	2"	4.37
90	2-½"	5.09	2-½"	2.29
100	2-½"	6.14	2-½"	2.78

Table 3 – Water Friction Loss

† Values may vary with different manufactures.

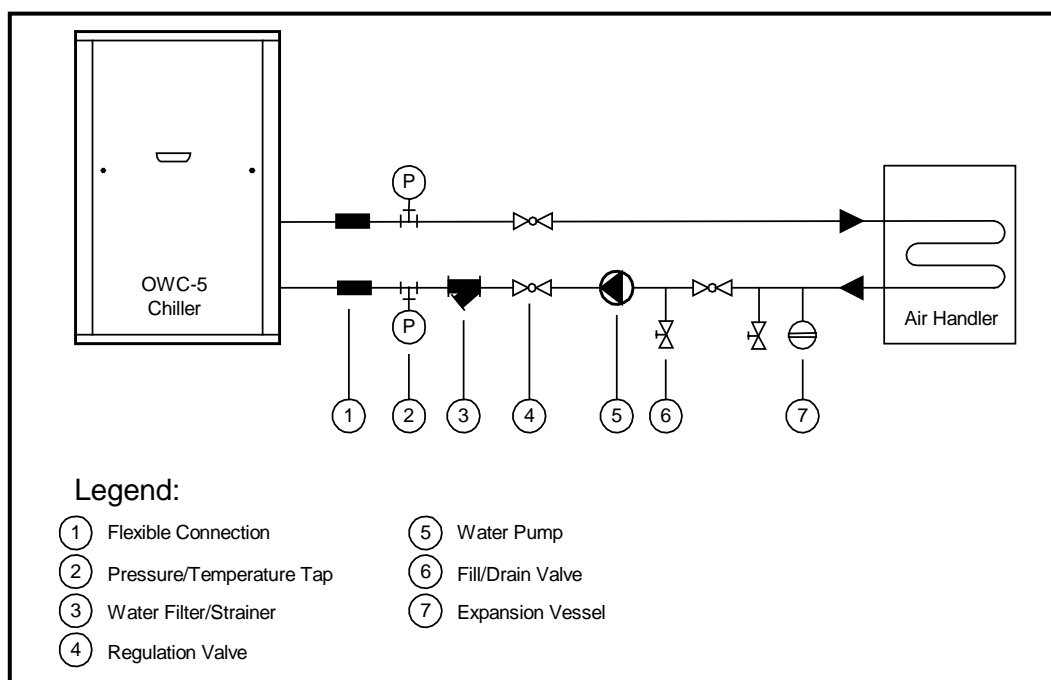


Figure 11 – Piping detail with Air Handler

Size the pump for the system shown in Figure 11. The supply piping is 75' long PVC. The air handler has a 5 ton chilled water coil with a pressure drop of 2.9 psi.

Solution:

First you will need to determine the GPM of the system. The Omni OWC-5 has a flow rate of 12.0 GPM and a pressure drop of 13 feet of head. This is the first piece of information that is needed to size a pump. With this information, the pipe size can be found from Table 3. You will find that 12 GPM has a recommend size of 1" Plastic Pipe with a friction loss of 3.77 feet of head per 100' of pipe.

Now you need to find the pressure drop of the system. To get the total system pressure, you will need to find the following information:

Feet of head from piping + Feet of head from chiller + Feet of head from coils + Feet of head from fittings

Let's do them in order. You already know that there is 75' of PVC pipe for the supply line. This number needs to be doubled to include the return piping as well. You have 150' of 1" PVC pipe with a friction loss of 3.77 feet of head per 100' of pipe. Using Equation 2, you get,

$$\frac{150' \times 3.77}{100'} = 5.7 \text{ feet of head from piping.}$$

We know the pressure drop of the OWC-5 is 13 feet of head. The pressure drop of the air handler coil is 2.9 psi. You will first need to convert this into feet of head using the relationship 1psi = 2.31 feet of head. Multiply 2.9 by 2.31 and it equals 6.7 feet of head.

The last pressure drop you will need is that of the fittings. You need to look at the system and get the total number of fittings by type and size. The sizes and pressure drops are all the same in this example. A listing of the materials and the corresponding equivalent lengths as shown in Table 3 are as follows:

5 - 1" Tees with through flow	0.9 feet each	4.5 feet total
3 - 1" Ball Valves	0.3 feet each	0.9 feet total
1 - 1" Strainer	5.0 feet each	5.0 feet total
2 - 1" Flexible Connection	Negligible	0.0 feet total

Adding all the equivalent feet together you will get 10.4 feet. If you multiply this by the 3.77 feet of head per 100' (Equation 2), you will find an additional 0.39 feet of head.

You add these calculated numbers together to get.

$$5.7 + 13.0 + 6.7 + 0.4 = \mathbf{25.8 \text{ feet of head.}}$$

After adding the recommended 5 feet of head for a safety factor and rounding up you will get the final answer of 31.

When you go to any pump representative just tell them 12 GPM and 31 feet of head. They can usually take it from there. There may be some additional questions about the type of pump but that will depend on the project.

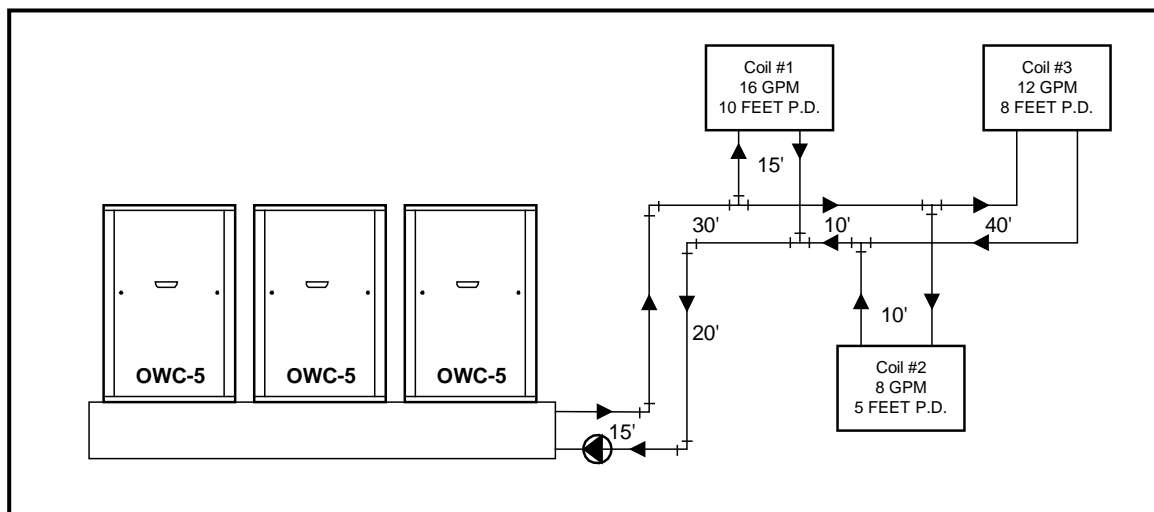


Figure 12 – Piping detail with Air Handler

Size the pump for the system shown in Figure 12. The piping will be copper. This example will focus on an application that has more than one air handler or fan coil. The valves have been left out but tees and elbow will be counted.

Solution:

You can determine the GPM of the system by adding the coil GPMs together. Next you will need to find pipe sizes and friction losses from Table 3.

Starting at Coil #3:

12 GPM → 1¼" Copper pipe with 3.38 feet of head per 100' friction loss

8 GPM → 1" Copper pipe with 4.5 feet of head per 100' friction loss

12 GPM + 8 GPM = 20 GPM → 1¼" Copper pipe with 8.43 feet of head per 100' friction loss

16 GPM → 1¼" Copper pipe with 5.65 feet of head per 100' friction loss

12 GPM + 8 GPM + 16 GPM = 36 GPM → 2" Copper pipe with 2.55 feet of head per 100' friction loss

Now you know all the pipe sizes and their friction losses. You also know the friction loss of all the equipment from Figure 12 and Table 3. You will need to find the equivalent length of pipe for all tees and elbows.

2" 90° Elbow → 7.0' of pipe

2" Tee – Thru → 2.0' of pipe

2" Tee – Branch → 10.0' of pipe

1¼" 90° Elbow → 4.0' of pipe

1¼" Tee – Thru → 1.2' of pipe

1¼" Tee – Branch → 6.0' of pipe

Now, you will need to find the pressure drop is in each loop. To find a loop you start at the chiller go to the coil and then back to the chiller. You will then use the largest value. The calculation for the loop to Coil #3 is shown.

$$\begin{array}{lll} 2'' \text{ Pipe} \rightarrow (15' + 20' + 30') * 2 = 130' & 2'' \text{ Elbow} \rightarrow 7' * 4 = 28' & 2'' \text{ Tee} - \text{Thru} \rightarrow 2' * 2 = 4' \\ 1\frac{1}{4}'' \text{ Pipe} \rightarrow 10' * 2 = 20' & 1\frac{1}{4}'' \text{ Tee} - \text{Thru} \rightarrow 1.2' * 2 = 2.4' & \\ 1\frac{1}{4}'' \text{ Pipe} \rightarrow (40' + 10') * 2 = 100' & 1\frac{1}{4}'' \text{ Elbow} \rightarrow 4' * 2 = 8' & \end{array}$$

$$\begin{array}{l} 162' \text{ of } 2'' \text{ pipe} * 2.55/100' = \mathbf{4.13 \text{ feet of head}} \quad 22.4' \text{ of } 1\frac{1}{4}'' \text{ pipe} * 8.43/100' = \mathbf{1.89 \text{ feet of head}} \\ 108' \text{ of } 1\frac{1}{4}'' \text{ pipe} * 3.38/100' = \mathbf{3.65 \text{ feet of head}} \end{array}$$

Add in the Coil pressure drop and the Equipment we get **30.7 feet of head**. If you do this for the other two coils and you will get the following: Coil #1 = **29.2 feet of head**; Coil #2 = **25.7 feet of head**. Take the largest number as the feet of head of the pump. When sizing a pump it is usually the drop to the very last coil that determines the feet of head but always do all coils just in case one of the others may determine the feet of head.

Finally, add the 5 feet of head safety factor, round up and get a total of **36 feet of head** for the system.

4.3 SIZING EXPANSION TANK

An expansion tank is required with the new OWC-5 Chiller unit. The expansion tank should be installed at the suction side of the system pump. A diaphragm type expansion tank is recommended (tank should be ASME certified for sizes above 30 gallons) and should be sized specifically for each job based on its characteristics.

NOTE: The following sizing instructions are for example purposes only. Econoheat Inc. does not endorse or specify any particular product brands.

- | | |
|---|---------------|
| 1. Total system water content (see Tables 4 and 5) | _____ gallons |
| 2. Minimum system temperature, operating (normally 45°F) | _____ °F |
| 3. Maximum system temperature, ambient* | _____ °F |
| 4. Minimum operating pressure at tank (static plus 4 PSI) | _____ PSIG |
| 5. Maximum operating pressure at tank** | _____ PSIG |
| 6. Find and enter "Net Expansion Factor" (use Table 6) | _____ |
| 7. Amount of expanded water (Line 1 x Line 6) | _____ gallons |
| 8. Find the "Acceptance Volume" | _____ |
| 9. Minimum "Total Volume" (Line 7 ÷ Line 8) | _____ gallons |

***An ambient temperature of at least 100°F should be used unless this temperature could be exceeded in the installed area.**

****Relief Valve Pressure minus 10 PSIG for safety (e.g. 75psig – 10 psig)**

Volume of Water in Piping Gallons per Linear Foot		
Nominal Pipe Size I.D.	Type L Copper	Other Piping
½"	0.012	0.016
¾"	0.025	0.028
1"	0.043	0.045
1-¼"	0.065	0.078
1-½"	0.092	0.105
2"	0.161	0.172
2-½"	0.250	0.250
3"	0.357	0.385
4"	0.625	0.667
5"	1.000	1.000
6"	1.400	1.500
8"	2.430	2.630
10"	3.780	4.200
12"	5.400	5.900

Table 4 – Pipe Sizing

Major System Components		
Equipment	Size	Approximate Volume Gallons
"A" Coils	1.67 tons	0.8
	3 tons	1.0
	4 tons	1.5
	5 tons	2.0
Duct Coils	3 tons	1.0
	4 tons	1.5
	5 tons	2.0
Fan Coil Units	1.67 tons	1.0
	3 tons	1.0
	4 tons	1.5
	5 tons	2.0

Table 5 – Water Volume

Maximum System Temperature	Minimum System Temperature						
	40°F	50°F	60°F	70°F	80°F	90°F	100°F
60°F	0.00055	0.00490	-	-	-	-	-
70°F	0.00149	0.00143	0.00094	-	-	-	-
80°F	0.00260	0.00254	0.00204	0.00111	-	-	-
90°F	0.00405	0.00399	0.00350	0.00256	0.00145	-	-
100°F	0.00575	0.00569	0.00520	0.00426	0.00315	0.00170	-
110°F	0.00771	0.00765	0.00716	0.00622	0.00511	0.00366	0.00196
120°F	0.01000	0.00990	0.00950	0.00860	0.00740	0.00600	0.00430
130°F	0.01240	0.01230	0.01180	0.01090	0.00980	0.00830	0.00660
140°F	0.01500	0.01490	0.01450	0.01350	0.01240	0.01100	0.00930
150°F	0.01790	0.01780	0.01730	0.01640	0.01530	0.01330	0.01210
160°F	0.02090	0.02080	0.02040	0.01940	0.01810	0.01650	0.01480
170°F	0.02420	0.02410	0.02360	0.02270	0.02160	0.02010	0.01840
180°F	0.02760	0.02750	0.02710	0.02610	0.02500	0.02360	0.02190
190°F	0.03130	0.03120	0.03070	0.02980	0.02870	0.02720	0.02550
200°F	0.03510	0.03500	0.03460	0.03360	0.03250	0.03110	0.02940
210°F	0.03910	0.03900	0.03860	0.03760	0.03650	0.03510	0.03340
220°F	0.04340	0.04330	0.04280	0.04190	0.04080	0.03930	0.03760
230°F	0.04760	0.04750	0.04710	0.04610	0.04500	0.04360	0.04190
240°F	0.05220	0.05210	0.05170	0.05070	0.04960	0.04820	0.04650

Table 6 – Net Expansion Factor

Note: For 50/50 Ethylene Glycol multiply Expansion Factor by 2

For 50/50 Propylene Glycol multiply Expansion Factor by 3

Maximum Operating Pressure PSIG	Minimum Operating Pressure, PSIG										
	5	10	12	15	20	30	40	50	60	70	80
27	0.527	0.408	0.360	0.288	0.168	-	-	-	-	-	-
30	0.560	0.447	0.403	0.336	0.224	-	-	-	-	-	-
35	0.604	0.503	0.463	0.403	0.302	0.101	-	-	-	-	-
40	0.640	0.548	0.512	0.457	0.366	0.183	-	-	-	-	-
45	0.670	0.586	0.553	0.503	0.419	0.251	0.084	-	-	-	-
50	0.696	0.618	0.587	0.541	0.464	0.309	0.155	-	-	-	-
55	0.717	0.646	0.617	0.574	0.502	0.359	0.215	0.072	-	-	-
60	0.736	0.669	0.643	0.602	0.536	0.402	0.268	0.134	-	-	-
65	0.753	0.690	0.665	0.627	0.565	0.439	0.314	0.188	0.062	-	-
70	0.767	0.708	0.685	0.649	0.590	0.472	0.354	0.236	0.118	-	-
75	0.780	0.725	0.702	0.669	0.613	0.502	0.390	0.279	0.167	0.056	-
80	0.792	0.739	0.718	0.686	0.634	0.528	0.422	0.317	0.211	0.106	-
90	0.812	0.764	0.745	0.716	0.669	0.573	0.478	0.382	0.287	0.191	0.096
100	0.828	0.785	0.767	0.741	0.698	0.610	0.523	0.436	0.347	0.261	0.174
110	0.842	0.802	0.786	0.762	0.723	0.642	0.561	0.481	0.401	0.321	0.241

Table 7 –

The connections for water and gas piping are located at the service plate on the right-side panel of the chiller (see Figure 13).

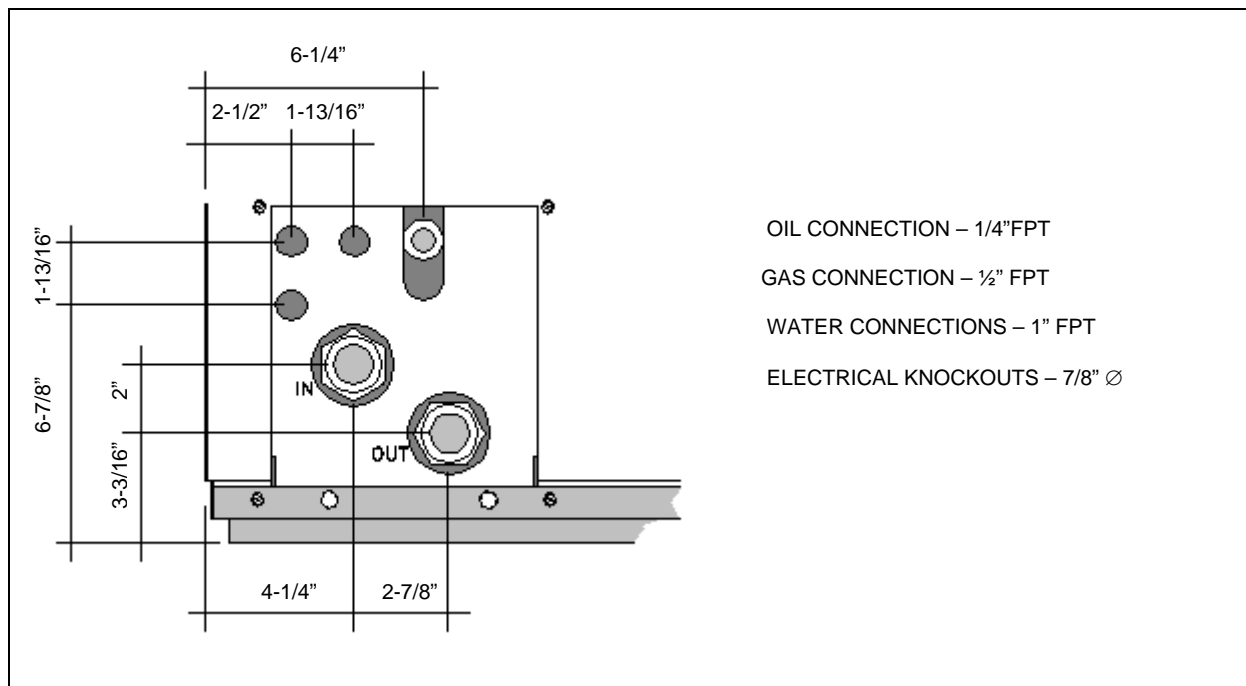


Figure 13 – SERVICE PLATE DIMENSIONS

4.4 GAS SUPPLY PIPING

All gas piping must conform to the latest edition of **National Fuel Gas Code ANSI Z223.1** and all local gas piping codes. In Canada, the gas piping must conform to the **CGA Standard CAN1 B149.1** and **.2, "Installation Code for Gas Burning Appliances & Equipment"** and local codes. Your gas utility must be contacted regarding local requirements, type and size of gas lines. Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the chiller, when it underwent the tests specified in the standards shown on the rating plate.

For Natural Gas the minimum inlet gas pressure to the chiller is 5" W.C. and the maximum is 14" W.C. For Propane Gas the minimum inlet gas pressure to the chiller is 11" W.C. and the maximum is 14" W.C.

For size of gas connection to the unit, see Figure 13.

WARNING

Gas supply pressure higher than stated above could damage the gas valve, resulting in a fire hazard.

Vertical gas piping must be trapped and a means provided to drain condensate that may accumulate in the piping during the cold season (see Figure 14). Insulation may also be necessary for the gas piping to prevent excessive accumulations of condensate.

An approved union should be installed in the gas line near the unit and down stream of any external shut-off valve that may be required by local codes.

Use an approved sealing compound resistant to propane gas on all male pipe threads.

The chiller and its gas connections must be leaked tested before placing the chiller in operation.

The chiller and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of the gas piping system at test pressures **in excess of 1/2 psig**.

The chiller must be isolated from the gas supply piping system by closing its individual shut-off valve during any pressure testing of the gas piping system at test pressures **equal to or less than 1/2 psig**.

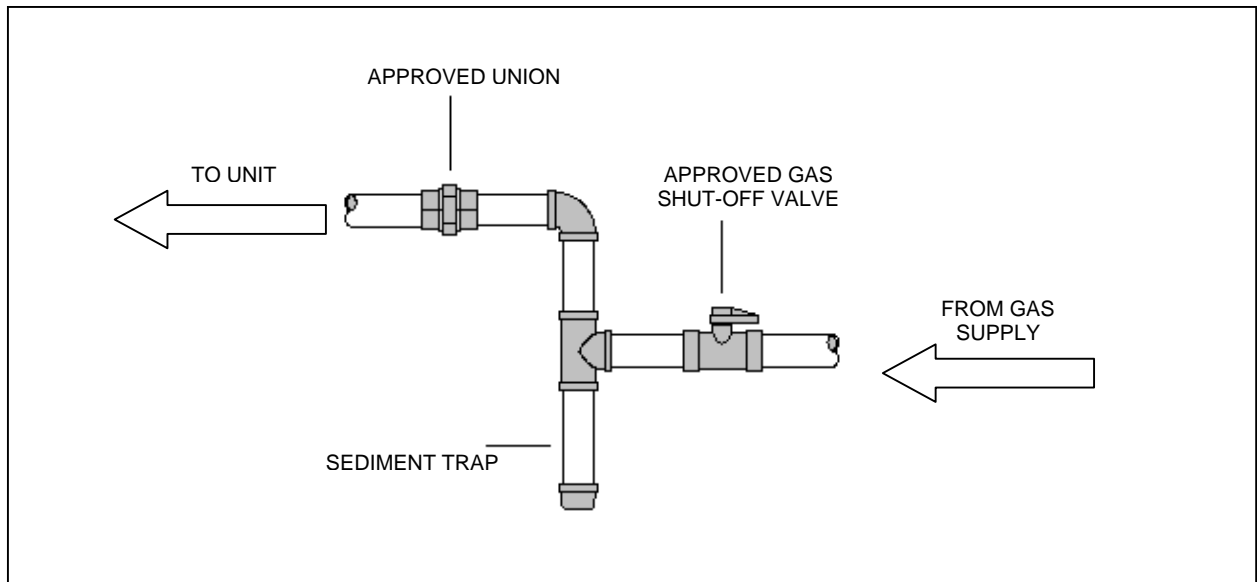


Figure 14 – TYPICAL GAS CONNECTION

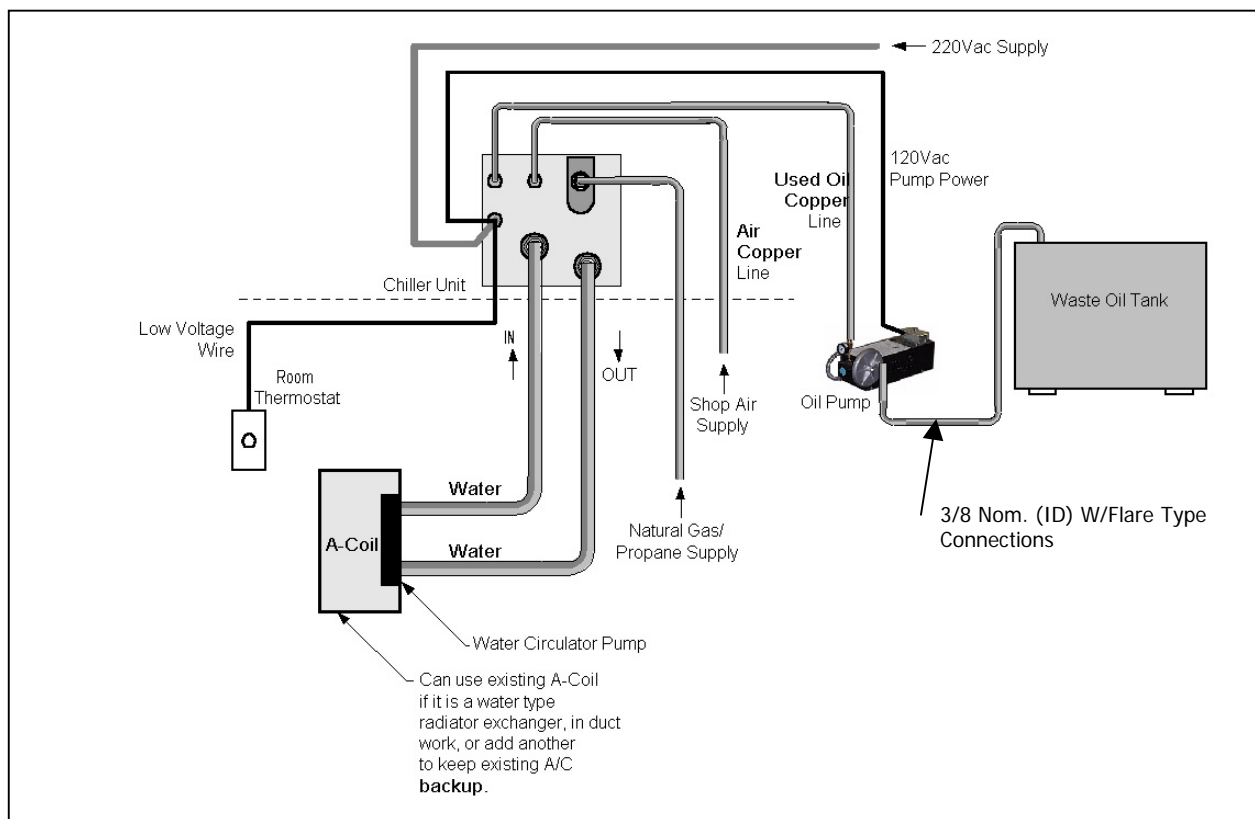


Figure 15 – TYPICAL AC CONNECTIONS

5 ELECTRICAL CONNECTION

5.1 POWER SUPPLY

All wiring should be installed in accordance with the latest edition of the **National Electrical Codes, ANSI/NFPA No. 70, CSA Standard C22.1** when installed in Canada, and with any local codes.

The unit's electrical system is pre-wired for single-phase, 208/230 volt and 60Hz operation. The control box includes a 208/230/24 volt transformer to supply low voltage to the control system. The high voltage or line connections to be made at the time of installation consists of connecting 208/230 volt, 60 Hz to the high voltage terminal strip of the control panel. A fused disconnect switch should be installed in the 208/230 volt supply line within sight of and not over 50 feet from the unit (see Figure 16).

NOTE

- An error in wiring installation could cause problems during the unit's operation and could damage the electrical components of the appliance.
- The unit must be electrically grounded in accordance with national requirements.
- **The power supply line must not be used to turn the unit "ON" or "OFF". The dedicated control switch in the R-Y line is for this purpose.**
- Disconnect the power supply lines only when assured that unit is completely shut off.

WARNING

DO NOT OPERATE the unit unless the chilled water system is filled with water and antifreeze.

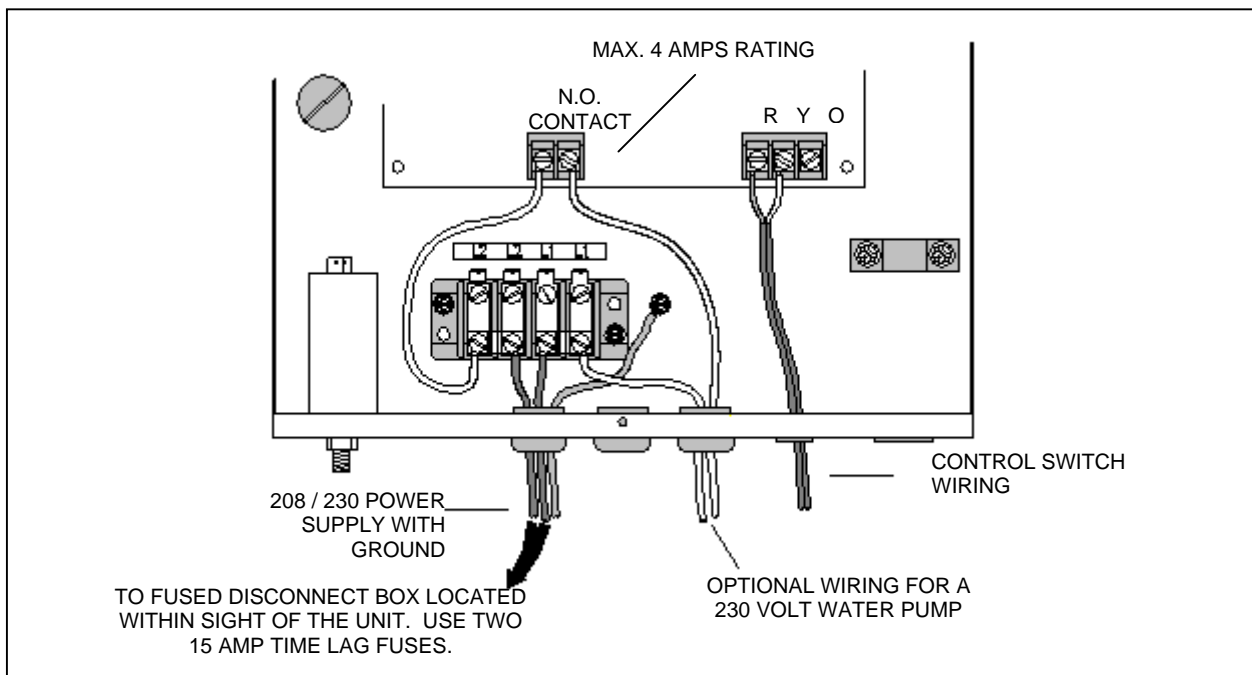


Figure 16 – TYPICAL CONNECTIONS TO BE DONE BY INSTALLER AT THE UNIT

WARNING

If power for the water pump is taken from the high voltage terminal block located in the electrical control box, as show in Figure 16, the minimum circuit ampacity for the unit must be increased above that listed in the TECHNICAL DATA sheet in SECTION 2 to accommodate the additional current draw of the water pump installed. **The maximum current carrying capacity of the N.O. Contact is 4A.** If the current is above 4A, use an additional relay controlled by N.O. Contact on the S-50 board.

5.2 PUMP WIRING

CONTROLLED BY THE UNIT

When the hydronic system's water pump is controlled by the unit, the installer must keep in mind the circuit ampacity, the required water pump voltage, and the current carrying capacity of the N.O. Contact on the electronic control board.

NOTE

When controlled by the S-50 board, the water pump operates while the control switch is closed. The N.O. Contact will open 215 seconds after the control switch opens.

- Wiring a 230 volt water pump with a current requirement less than 4 amperes, see Figure 19.
- Wiring a 230 volt water pump with a current requirement greater than 4 amperes, see Figure 17.
- Wiring a 115 volt water pump with a current requirement less than 4 amperes, see Figure 18.

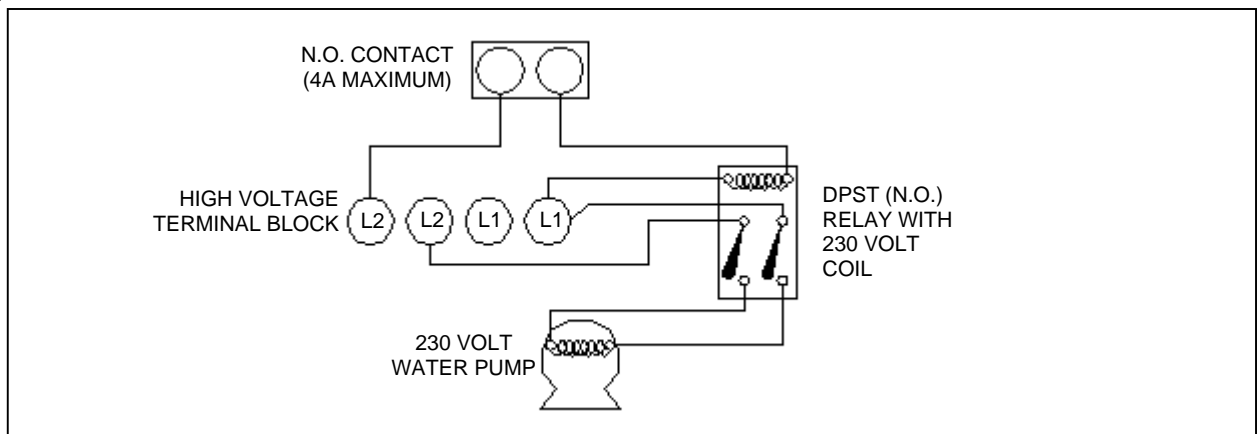


Figure 17 – WIRING A 230 VOLT WATER PUMP THAT EXCEEDS ELECTRONIC BOARD'S 4A RATING

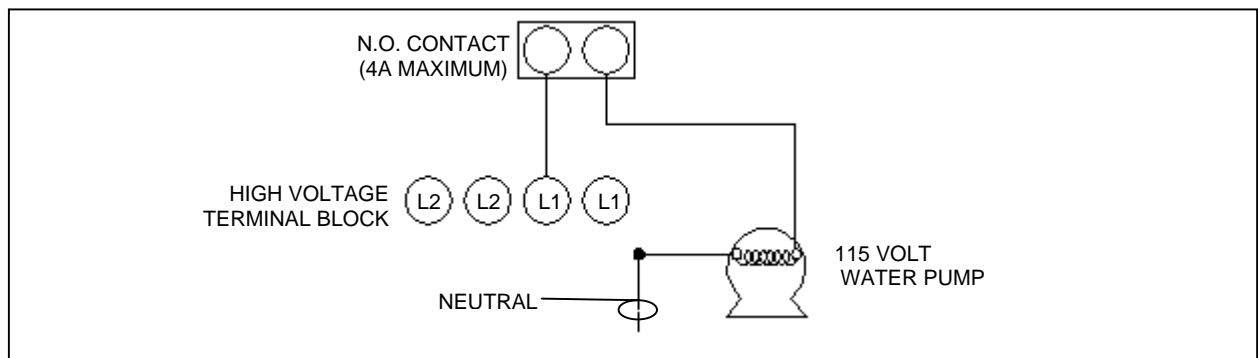


Figure 18 – WIRING A 115 VOLT WATER PUMP THAT MEETS ELECTRONIC BOARD'S 4A RATING

EXTERIOR CONTROL

When the unit does not control the hydronic system's water pump, the installer must ensure that the pump and the unit start at the same time. Also, the pump must continue to run during the unit's cycle down time (215 seconds after the opening of the control switch). See Figure 19.

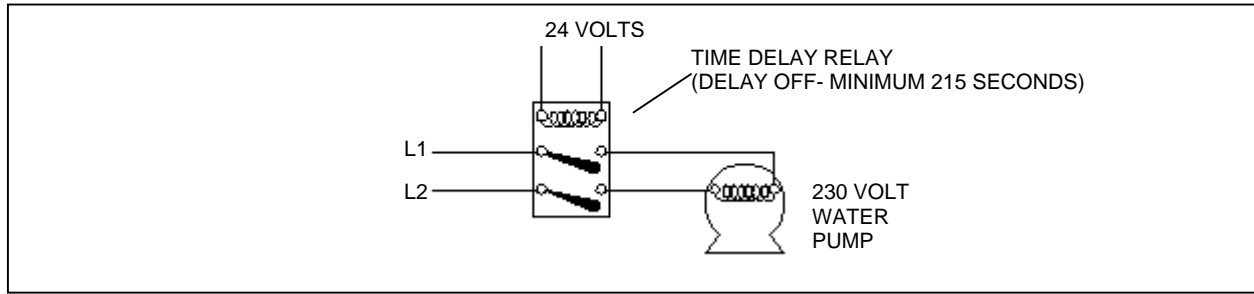


Figure 19 – EXTERIOR CONTROL WIRING FOR A 230 VOLT WATER PUMP

5.3 CONTROL SWITCH WIRING

A control switch that provides an ON / OFF function is to be connected to the R and Y on the S-50 board (see Figure 16). This wiring will carry 24-volt current and it is recommended to use a cable with the correct number of color-coded 18 gauge wires.

Fan, control, or isolation relays must have a 24-volt AC coil, which does not present more than a 0.25 amp load to the control circuit (see Figure 20, Figure 21, and Figure 22).

WARNING

An isolation relay (Kit No. 18010-116) MUST be used to separate the chiller's transformer from any additional equipment having a transformer or damage to the S-50 board will occur.

THERMOSTAT WIRING

Special consideration should be given to the control wiring when the chiller is used in an air conditioning application. For details on wiring additional components, ALWAYS consult the component manufacturer's wiring instructions. The following diagrams give general layouts that can be used:

- Single thermostat for heating and cooling control on a furnace. This system offers constant fan operation at any time, even with power "OFF" to the chiller. It is readily adaptable to a furnace that has a fan relay or can be adapted to a "heating only" furnace with the addition of a fan relay and wiring the furnace controls as shown. Note: An isolation relay must be used in this application.

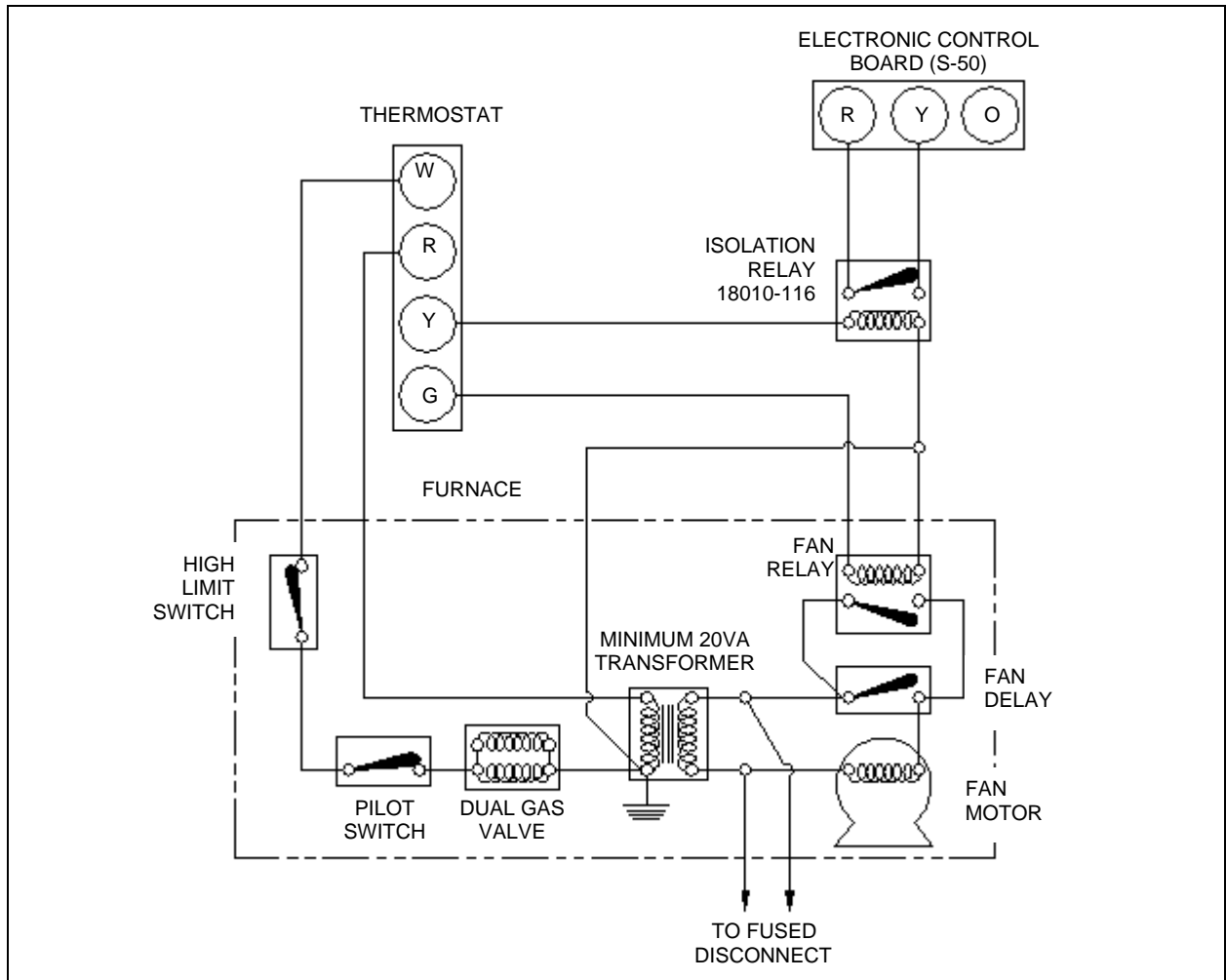


Figure 20 – SINGLE THERMOSTAT USED FOR BOTH HEATING AND COOLING CONTROL ON A FURNACE

- Separate thermostats for heating and cooling control on a furnace. This system does not offer constant fan operation on heating unless the power is "ON" to the chiller and the fan switch on the cooling thermostat is in the "ON" position.

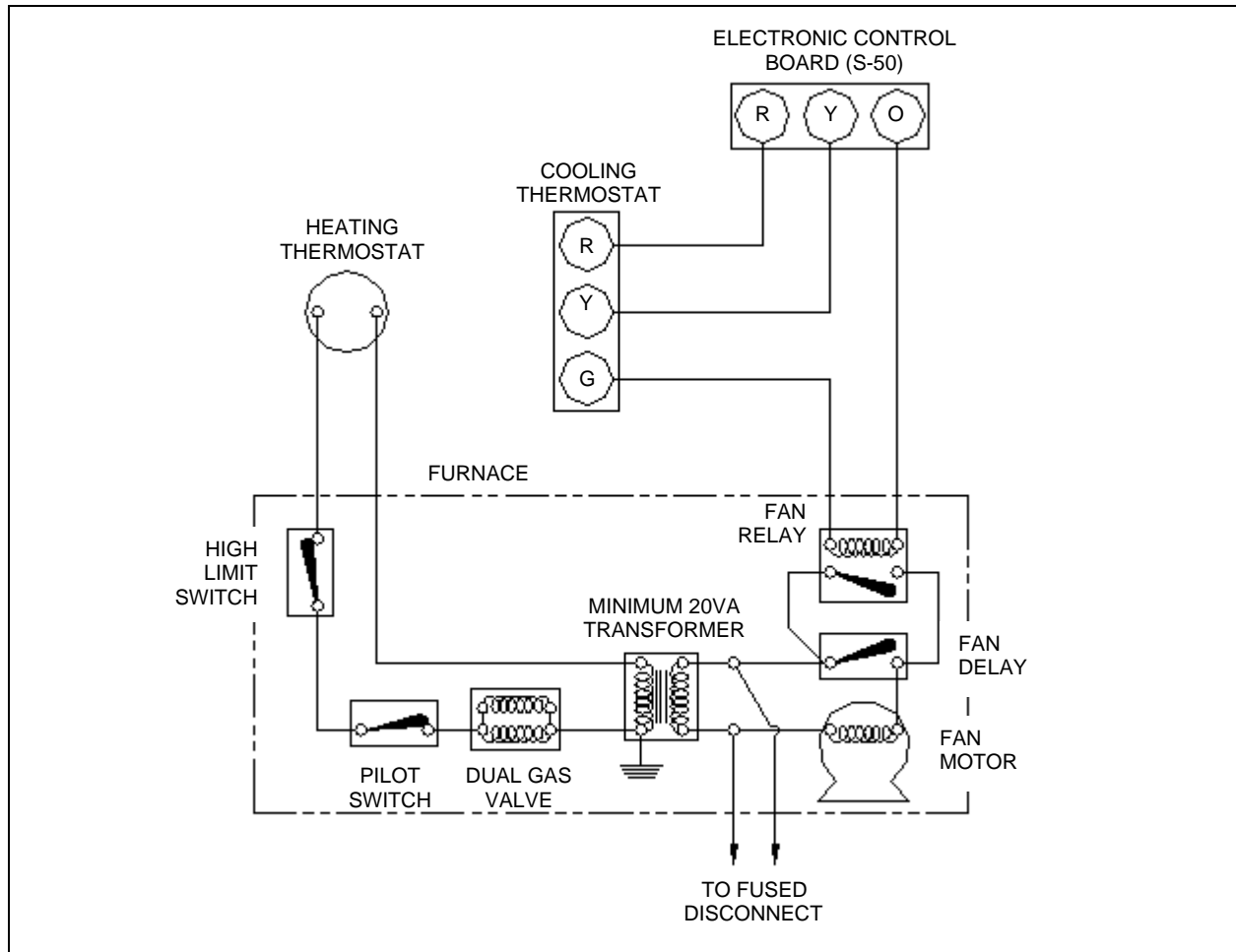


Figure 21 – SEPARATE THERMOSTATS USED FOR HEATING AND COOLING CONTROL ON A FURNACE

- Single thermostat used for cooling control on a fan coil unit. Refer to fan coil manufacturer's instructions for an exact wiring schematic.

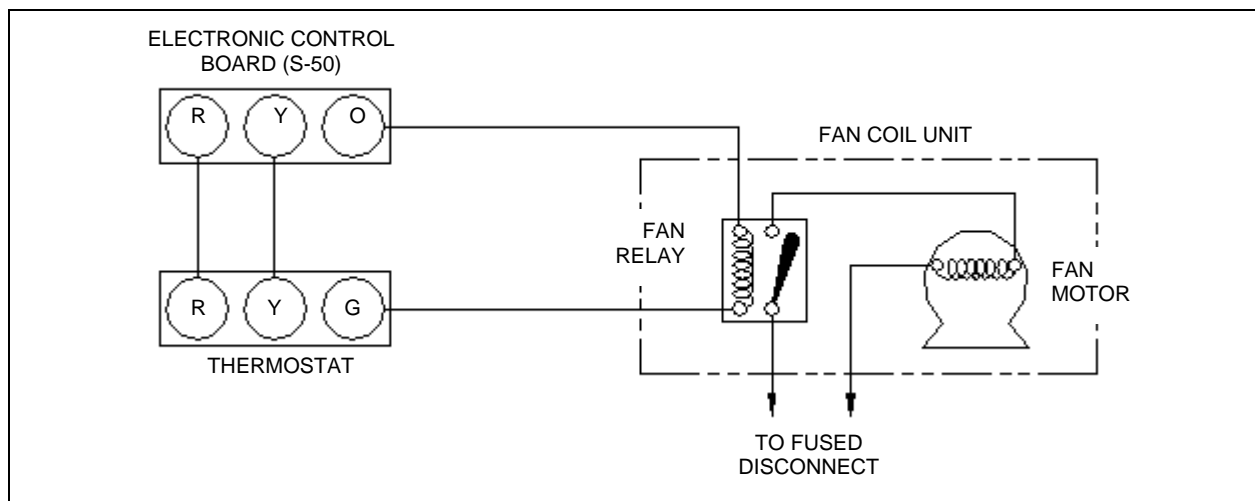


Figure 22 – SINGLE THERMOSTAT USED FOR COOLING ON A FAN COIL UNIT

THERMOSTAT LOCATION

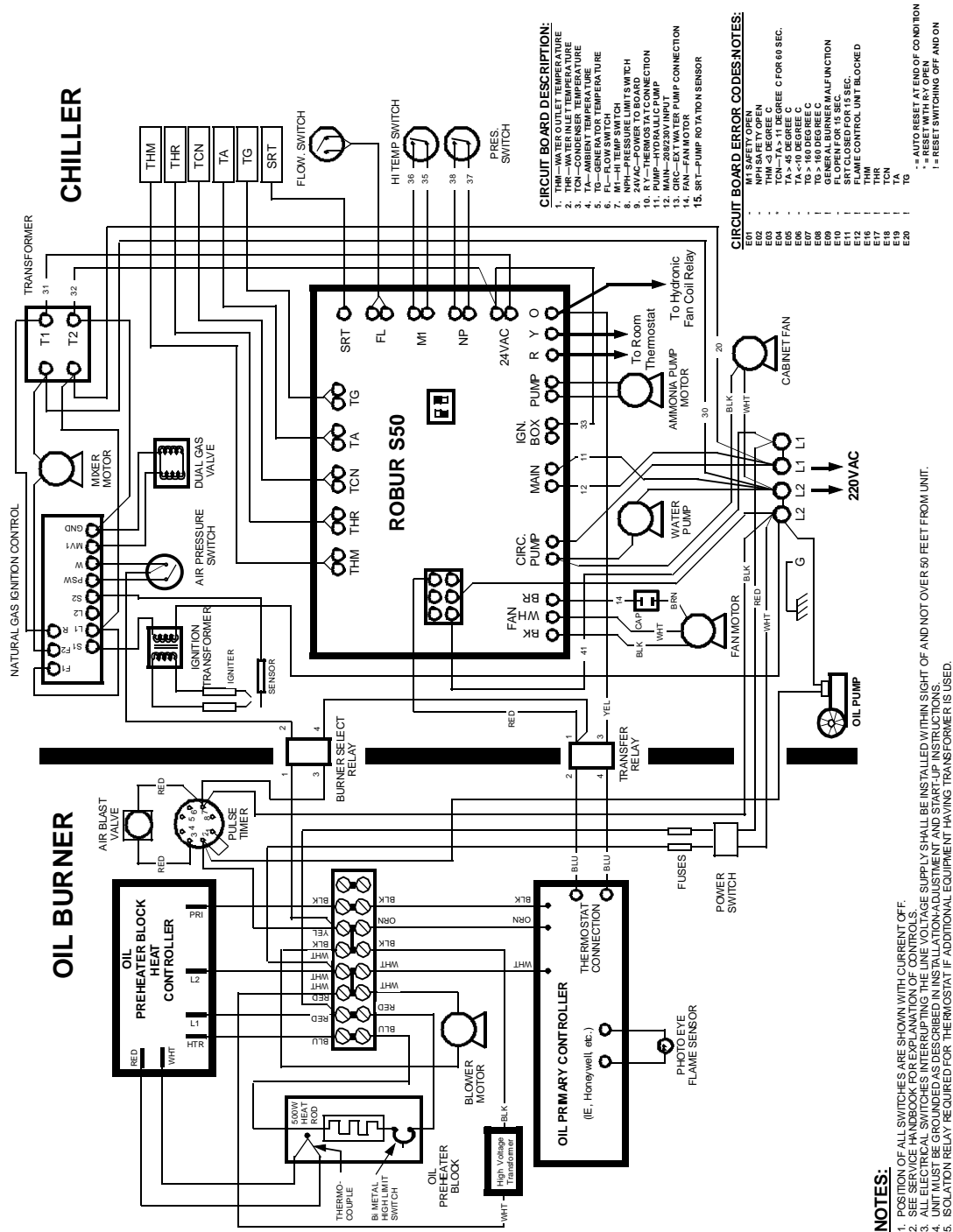
If the control switch is a thermostat, the thermostat should be located on an inside wall about 54 inches above the floor. It should be located so that it will not be affected by any of the following items:

- Discharge air from a supply grille
- Drafts
- Direct sunlight through a window or glass door
- Electrical Appliances such as television, radio or lamps.

The thermostat should be located so that it senses the average temperature of the conditioned space. The thermostat should be mounted according to the manufacturer's instructions (packaged with the thermostat). **THERMOSTATS USING A MERCURY BULB SWITCH MUST BE LEVEL.** The heating anticipator for a thermostat that is used to control an Air Cooled Chiller in conjunction with a heating unit, must be set as required by the heating unit load.

5.4 CHILLER WIRING

If any of the original wire as supplied with the unit must be replaced, it must be replaced with thermoplastic 105°C wire, except igniter wire 230°C, flame sensor, ground, high temperature and pressure switch wires 200°C or equivalents (see Figure 23). **Label all wires prior to disconnection when servicing the controls.** Wiring errors can cause improper and dangerous operation.



6 START-UP AND ADJUSTMENT

WARNING

This unit should be started-up by an Authorized Technician according to the manufacturer's instructions. The end-user is not authorized to perform start-up and adjustment operations.

The owner's satisfaction is directly related to the correct installation, proper adjustments, and application of the unit. Authorized Technicians must perform the proper system adjustments.

NOTE

The length of the warranty is dependent upon the installation and start-up of the unit by Authorized Technicians. See warranty card for complete details.

DANGEROUS SITUATIONS FOR THE UNIT AND/OR PERSONS

If during the first start-up one of the following conditions is found:

- Unit installed indoors
- The unit turned on and off by using the main electrical switch (not using control switch)
- Antifreeze not added to the water
- Unit damaged or defective due to transport and/or installation

UNUSUAL INSTALLATION CONDITIONS FOR THE UNIT AND/OR PERSONS

All situations or installations in contradiction to the directions/instructions of the manufacturer can or may result in incorrect unit operation.

6.1 DETERMINING VOLUMES OF HYDRONIC SYSTEM AND ANTIFREEZE

WARNING

To ensure correct operation of the unit and to avoid the water freezing, add 20% by volume of inhibited glycol (antifreeze) to the circulation water. Add more glycol as needed for the minimum external temperature of the installation zone (see Table 10).

Listed below are recommendations concerning antifreeze to be used:

- Inhibited permanent type antifreeze(propylene or ethylene glycol)
- No sealants in the mixture
- Preferable the color is not blue or green.

The volume of the hydronic circuit must be calculated to figure the volume of antifreeze required for freeze protection. The approximate volume can be calculated by knowing the equivalent feet of pipe and by using the tables below.

Consider all valves, pumps and fittings in water lines to hold the same volume as equivalent length of pipe.

Example of a volume calculation:

OWC-5	1.30 Gallons
5 Ton Duct Coil	2.00 Gallons
40 FT of 1-1/4" Pipe	<u>3.08 Gallons</u> (40 Divided by 100 multiplied by 7.7)
Total Volume of Hydronic Circuit	6.38 Gallons

Volume of Antifreeze required to achieve 20% by volume concentration

6.38 Gallons X 0.20 = 1.28 Gallons.

PIPE SIZE (INCHES)	GALLONS PER 100 FT PIPE
3/4"	2.8
1"	4.1
1-1/4"	7.7
1-1/2"	10.7

**Table 8 – PIPE SIZE VS. GALLONS
PER 100 FEET OF PIPE**

EQUIPMENT	SIZE	VOLUME (GALLONS)
ACF60	5 TON	1.3
"A" COIL	1.5 TON	0.8
"A" COIL	2 TON	0.8
"A" COIL	3 TON	1.0
"A" COIL	4 TON	1.5
"A" COIL	5 TON	2.0
DUCT COIL	2 TON	0.8
DUCT COIL	3 TON	1.0
DUCT COIL	4 TON	1.5
DUCT COIL	5 TON	2.0
FAN COIL	2 TON	0.8
FAN COIL	3 TON	1.0
FAN COIL	4 TON	1.5
FAN COIL	5 TON	2.0
FAN COIL	5 TON	2.0

Table 9 – APPROXIMATE VOLUMES OF TYPICAL EQUIPMENT

NOTE

The volumes of the coils listed above are approximations only. For exact volume of the coils used, consult the coil manufacturer's specifications.

6.2 FILLING THE WATER PIPING

WARNING

To ensure correct operation of the unit and to avoid the water freezing, add 20% by volume of inhibited glycol (antifreeze) to the circulation water. Add more glycol as needed for the minimum external temperature of the installation zone (see Table 10).

The method described below is **only one of several ways** that can be used to fill the hydronic circuit. A container to mix water and glycol and a water pump to drive the mixture into the hydronic system is required.

1. Open air bleed(s) located at the highest point in the system.
2. Connect the hose between the charging pump and Valve A. Connect a hose to Valve C and place the other end of this hose into the mixing container (see Figure 24).
3. Mix the desired concentration and volume of water/glycol in the container. If the container will not hold the volume required to fill hydronic circuit, multiple "batches" must be made.
4. Close Valve B. Open Valve A and Valve C. Start charging pump to push the water/glycol mixture into the hydronic system. Air will be removed through the hose on Valve C as the hydronic system fills. Continue to fill the system until the water/glycol mixture returns to the mixing container via the hose on Valve C.
5. If the volume in the mixing container is adequate to fill the hydronic system, skip to Step 14. If the volume in the mixing container is inadequate to fill the hydronic system, close Valve A prior to air entering the charging pump and shut the charging pump off.
6. Make a new container of water/glycol mixture.
7. Start the charging pump and open Valve A to continue filling hydronic system. Repeat Steps 4 through 6 as needed until hydronic system is filled or until charging pump is incapable of adding any additional mixture due to pump discharge head limitations.

8. If the system is filled, skip to Step 14. If the system is not full, turn on the hydronic system's pump but do not start the unit. Jumping the N.O. CIRC. contacts on the electronic control board can start the hydronic system's pump (if controlled by the electronic control board).
9. "Throttle" Valve B, if necessary to continue filling the hydronic system if the system does not start filling after the hydronic system pump was started.
10. If the volume in the mixing container is not sufficient to fill the hydronic system, close Valve A prior to air entering the charging pump and shut both pumps off.
11. Mix new container of water and glycol mixture.
12. Start both pumps and open Valve A.
13. Repeat Steps 9 through 11 until the system is filled and all air is removed from the hydronic system.
14. Close Valve A and Valve C. Shut off all pumps. Open Valve B.
15. Close any manual air bleed valves.
16. Start pumps and open Valve A.
17. Add additional glycol/water mixture until the highest point in the hydronic system has a pressure of at least 4 psig. If the unit is located at the highest point in the system, then pressure at the high point of system should be least 10 psig.
18. Close Valve A and shut down both pumps.
19. Disconnect the charging pump and the mixing container.
20. The hydronic system is now charged.

One way to determine the pressure at the high point of the system is as follows:

1. Shut the pump off and wait for the water/glycol mixture to stop flowing.
 2. Measure the water pressure at the unit using the pressure/temperature taps.
 3. Measure the vertical distance between the pressure taps and the highest point in the system.
 4. Divide the vertical distance (measured in Step 3) by 2.3. (1psig = 2.3 ft.)
- Take the pressure measured at the taps and subtract the answer from Step 4. This equals the pressure at the high point of the system.

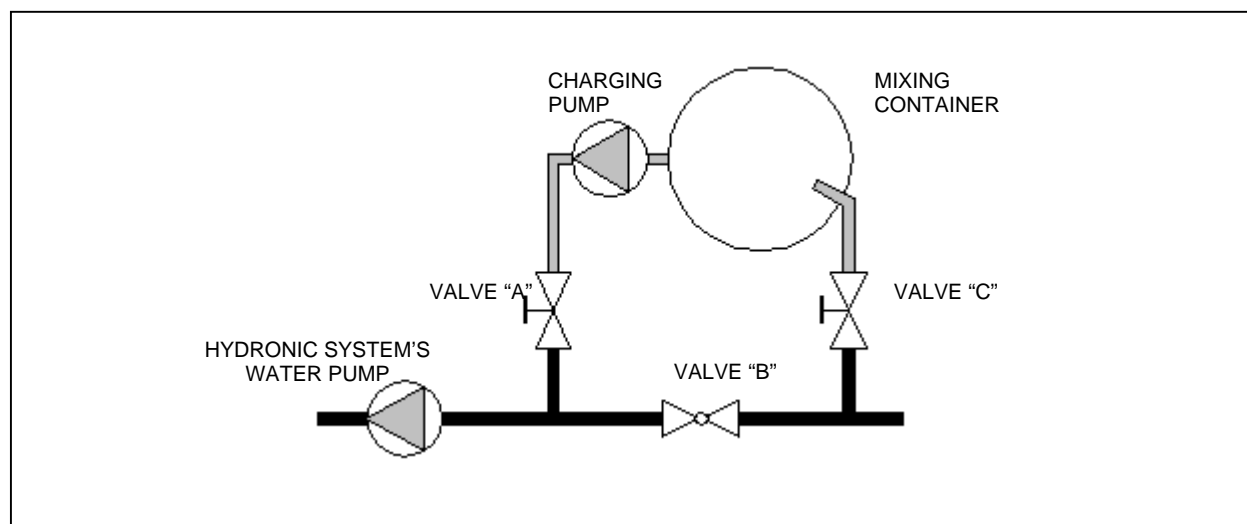
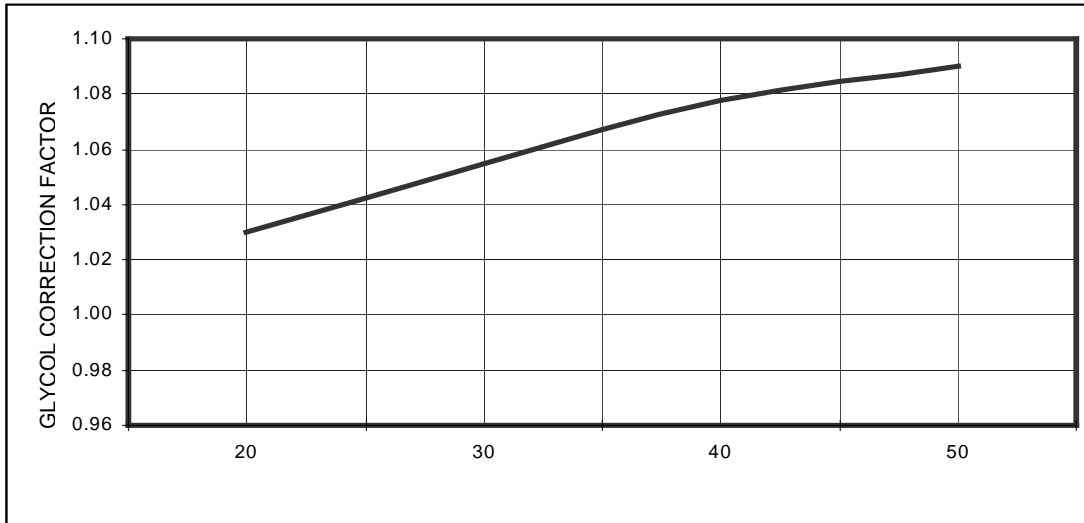


Figure 24 – COMPONENTS USED IN FILLING THE HYDRONIC SYSTEM

TYPE OF ANTIFREEZE	APPROXIMATE PERCENTAGE OF ANTIFREEZE BY VOLUME			
	20	30	40	50
PROPYLENE	18°F	6°F	-10°F	-34°F
ETHYLENE	16°F	4°F	-12°F	-35°F

Table 10 – FREEZING POINTS OBTAINED BY VARIOUS CONCENTRATIONS OF ANTIFREEZE

Inhibited Propylene or Ethylene Glycol added to the water changes its thermal-physical properties, particularly its density, viscosity and mean specific heat. Graph 2 gives the correction factors for the hydronic system's pressure drop as a function of glycol percentage added to the water. The graph is accurate for water temperatures between 45°F and 55°F. It is important to consider the correction factor for the sizing of the water pipes and water circulation pump. For the unit's internal pressure drop, refer to Graph 1. Example: Total System Pressure Drop x Glycol Correction Factor = Actual Total System Pressure Drop.



Graph 2 – PRESSURE DROP CORRECTION FOR GLYCOL CONCENTRATION

6.3 GAS PRESSURE ADJUSTMENT

The manufacturer supplies the units already adjusted for a particular type of gas. The type of gas can be checked and easily identified by looking at the rating plate on the side of the unit. Nevertheless, before starting the unit it is necessary to check and adjust if necessary the gas input to the burner. Using the table below, locate the proper manifold pressure according to the local gas heating value (BTU content per cubic foot) and specific gravity. This table is based on the correct natural gas input for the model by manifold pressure in inches of water column (in WC).

BTU CONTENT PER CU. FT.	SPECIFIC GRAVITY OF NATURAL GAS			
	55	6	65	7
950	3.2	3.6	3.9	4.3
975	3.0	3.3	3.7	4.0
1000	2.8	3.1	3.5	3.8
1025	2.6	3.0	3.3	3.6
1050	2.5	2.8	3.1	3.4
1075	2.3	2.6	2.9	3.2
1100	2.2	2.5	2.7	3.0
1125	2.0	2.3	2.5	2.7

PERCENTAGE OF ANTIFREEZE BY VOLUME

Table 11 - MANIFOLD PRESSURE BASED ON GAS INPUT OF 96,500 BTU/HR USING 1113 ORIFICE.

The conditions referred to by the table above are for the guidance of the installer and the CSA design certification does not cover the conditions described therein.

Note: For Propane Gas Models, follow the same instructions as given below for natural gas. The manifold pressure for propane gas should be 10.0" W.C. and adjustment is made at the gas valve regulator. Manifold pressure at 96,500 Btu/Hr. input using 1133 orifice.

1. Turn main gas valve knob to the "OFF" position.
2. Remove the plug on outlet end of gas valve (see Figure 25) and attach pressure tap and manometer.
3. Turn power "ON," and close control switch.
4. Wait for the burner to start up. Due to the presence of air inside the piping, it may be that the burner does not start at the first three attempts and failing to do so the ignition system is locked out. If this happens reset the ignition system by opening the control switch for 5 minutes and then re-closing. Repeat until all the air is purged from the piping and the burner ignites.
5. When the burner ignites read the manometer and compare to the required pressure in Table 4.
6. If necessary change the manifold pressure using the gas valve regulator. The regulator is built into the gas valve. Remove the seal screw and turn adjusting screw clockwise to increase pressure or counter clockwise to reduce pressure. Replace seal screw after adjustment.
7. Open control switch and make sure unit is off.
8. Remove manometer and pressure tap. Replace plug in gas valve.
9. Turn unit on by closing control switch. Check all gas connections with soap for leaks.

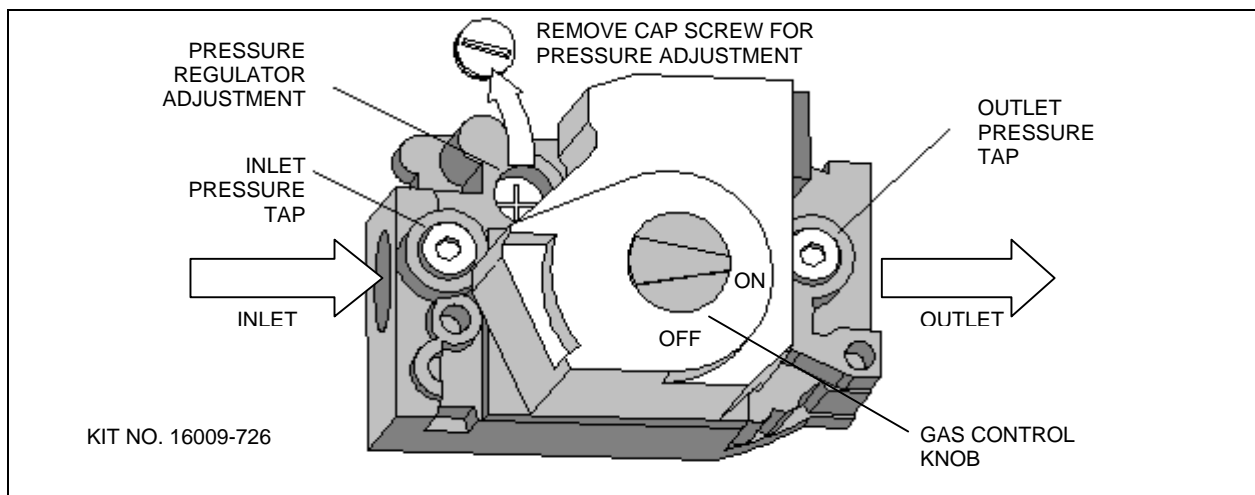


Figure 25 – GAS VALVE

6.4 USED OIL BURNER ADJUSTMENTS

1. **IMPORTANT-** Prior to starting the unit, pre-fill the filter and fuel line with oil to assist priming procedure. Oil pump motor turns at low RPM's and would take significant time to complete priming process if not pre-filled.
2. Making sure the thermostat is turned off, apply power to the Chiller unit. Switch burner main power switch to ON position. After allowing the oil pre-heater time to establish temperature setpoint, approximately 5 minutes. Jump the "T" terminals on the Oil Primary (Figure 26). Once the burner is running, temporarily jump the "F" terminals on the Oil Primary. This will allow the burner to run during the pump priming process.
3. Priming the oil pump: Open bleeder valve one turn until all air is expelled (Figure 29). This may need to be done twice to insure all air is removed. **IMPORTANT:** When fully purged and flame is established remove temporarily jumpers on "F" and "T" terminals of the Oil Primary to allow safety features of the unit to operate properly.
4. Adjust air supply of integrated air compressor to 12 - 13 P.S.I. This is factory preset, however, due to freight handling settings may be compromised.
5. Adjust oil pump motor speed at adjuster post to read 1.5 PSI on the oil gauge located on the burner.

6. Combustion air band should be open approximately 1/2" or until flame is clear yellow, not orange. Opening the air band too far may cause delayed in starting or even prevent the flame from starting.

6.5 CHILLED WATER TEMPERATURE REGULATION

The electronic control board permits the regulation of the unit's outlet chilled water temperature.

To adjust the outlet water temperature set point, use the chilled water thermostat on the electronic control board (see detail C of Figure 2). The set point range of the outlet water temperature is between 37°F (rotated completely counter-clockwise) and 55°F (rotated completely clockwise).

The design temperature difference, ΔT , between inlet and outlet chilled water is 10°F at rated conditions.

The recommended chilled water temperature for commercial/domestic use is 55°F for inlet water temperature and 45°F for outlet water temperature. The chilled water thermostat is set in the central position of the scale for the above mention temperatures. Rotate clockwise to increase the outlet chilled water temperature setting or counterclockwise to decrease it. The new outlet chilled water temperature set point will be indicated on the electronic control board display for 15 seconds after the adjustment.

The factory default outlet chilled water temperature set point is 42°F.

NOTE

When power is first applied to the unit, "CAP" will appear on the display. After few seconds "H60" will appear. When the "H60" disappears, the outlet chilled water temperature set point displays for the next 15 seconds.

After the set point disappears, the display shows the actual temperature of the inlet water and ΔT between inlet and outlet water temperatures.

The LED diodes (see detail B of Figure 2) indicate:

RED LIGHT	Inlet water temperature
GREEN LIGHT	Temperature difference between inlet and outlet water lines

7 USED OIL BURNER

PRECAUTIONS:

- Used oil may contain many foreign materials. Used oil may also contain gasoline, therefore, specific precautions on the handling and storage of used oils are to be observed when using, cleaning and maintaining this burner. **Use a screen in a funnel when pouring oil into storage tank to catch foreign material, i.e., gasket material and sealant fibers, etc.**
- **WARNING: This appliance is not designed for use indoor or in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons.**
- Use only used crank case oil, gear lube oil, hydraulic oils, automatic transmission fluid or #1 and #2 furnace oil. DO NOT use old contaminated oils that have been stored in underground tanks or outside barrels for long periods. Excessive water and sludge may be present, causing quick filter failure. **DO NOT USE NEW MOTOR OILS**, they will not burn thoroughly.
- This appliance is designed for commercial or industrial use only.

WARNING

ONLY Authorized Technicians strictly complying with the manufacturer's instructions and the local standards should perform installation, maintenance and service on the unit's internal components. Installation and use of this used oil burning appliance shall be in accordance

with the standard for the Installation of Oil Burning Equipment – ANSI/NFPA 31 – 1987, and National Electric Code – ANSI/NFPA 70 – 1990 and the requirements of the inspection authorities having jurisdiction.

7.1 OIL BURNER TECHNOLOGY

The patented burner technology improves the efficiency of the oil burn process by continuous stabilization of the oil viscosity. This is accomplished by precisely controlling the pre-heating of the oil and air prior to introduction to the combustion chamber delivering optimum atomization (spray).

During the initial power up process the burner is locked out from energizing until the oil has been pre-heated up to setpoint, approx. 3 to 5 minutes duration. Once the oil has been heated up, power is then applied to burner components and oil pump.

Burner Components

- **Igniter Transformer:** Supplies high voltage to the electrodes generating electrical arc igniting the oil
- **Oil Valve:** energizes when burner is running and de-energizes when burner is not running eliminating bleed back of oil out of the Pre-heater block.
- **Air Band:** Adjusts amount of air introduced into the combustion chamber. (section 6.4.6)
- **Oil Primary:** Controls the oil burner ignition. Checks for flame in the combustion chamber, if no flame is detected within 45 seconds, the oil primary will shutdown the oil burner. To restart the unit, reset the red button on the oil primary.
- **Oil Pre-Heater Block:** Pre-heats the oil and air before entering combustion chamber.
- **Photo Eye:** Senses flame in combustion chamber and signals oil primary when no flame is present.
- **Igniter Springs:** Transfers the high voltage from the igniter transformer to the electrodes (when door is closed)
- **Air Pressure Gauge:** Displays air pressure supplied by onboard air compressor.
- **Air Compressor:** Supplies air used within pre-heater block to aid in atomization of the oil.
- **Air Muffler/Filter:** Filters air and muffles the sound generated by the compressor.
- **Pre-Heater Control Board:** Precisely controls temperature of the Oil Pre-Heater Block and controls safety feature of not allowing burner to energize until oil has established operating thermo setpoint or shutdown burner if Pre-Heater Block temperature falls below shutdown thermo setpoint.
- **Electrodes:** Provides continuous high voltage electrical arc from electrode to electrode igniting the waste oil as it is being sprayed out of the nozzle.
- **Nozzle:** Low pressure nozzle for oil spray pattern.
- **Flame Cone:** Specially engineered flame cone forces the flame into a swirl pattern improving the burn thoroughness.
- **Burner Motor:** Multitask motor turns the burner blower and integrated air compressor.
- **Oil Pressure Gauge:** Displays oil pressure at the burner. Adjust flame length in the chiller combustion chamber viewed through the inspection port located directly above the burner gun assembly by increasing CW or decreasing CCW the adjuster located on the oil delivery pump. The adjuster increases or decreases the pump motors RPM which increases or decreases the delivery of fuel to the burner. When you increase or decrease the fuel to the burner you will notice the flame length will increase or decrease. **Adjust flame length** so flame is just slightly less than halfway down main combustion chamber tube.

IMPORTANT:

Once adjusted for correct flame length, take note of oil gauge setting for bench mark pressure reading needed when burning the specific fuel mixture generated by the owner. PLEASE NOTE- Once flame is set the oil pressure gauge can read various pressures when different viscosities of oils are used. The oil pressure gauge is an indicator of where the PSI reading will be when that oil viscosity is being burned. The oil gauge is used for servicing diagnostics assistance.

- **Power Indicator:** Indicates when power is present at the burner.
- **Run Indicator:** Indicates that the burner is ready for operation after the initial pre-heat time of approx. 5 minutes from initial power up.

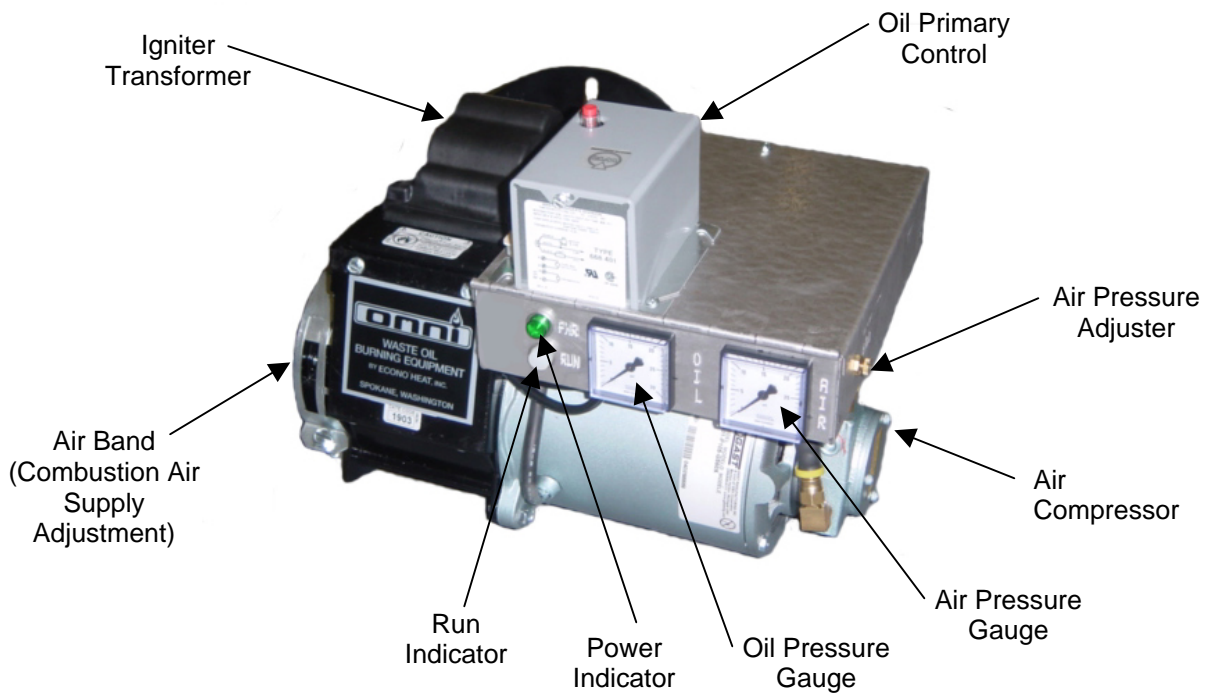


Figure 26 – Oil Burner (Closed)

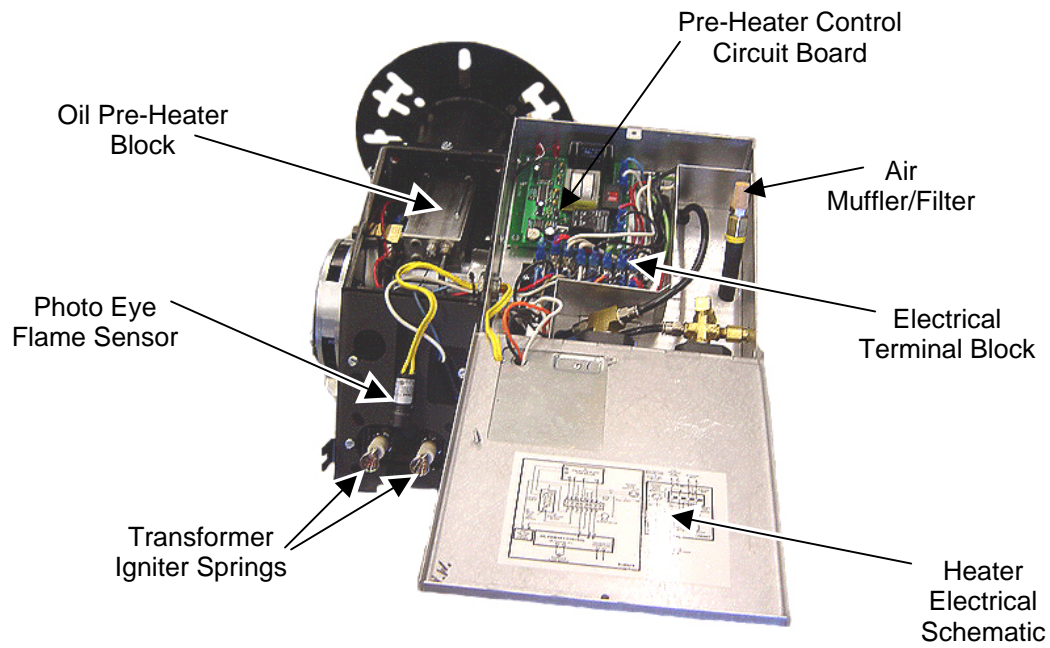


Figure 27 – Oil Burner (Opened)

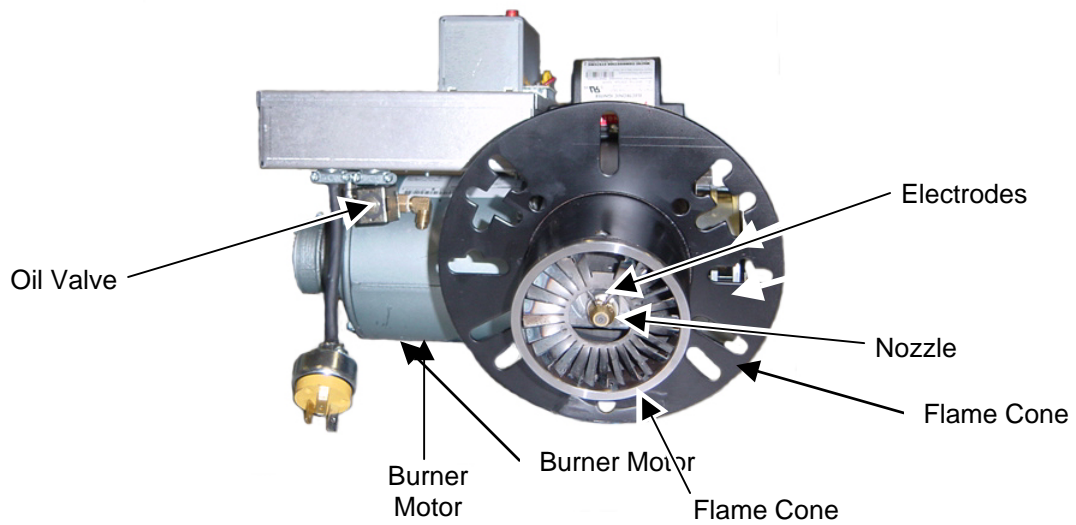


Figure 28 – Oil Burner (Front View)

8 OIL PUMP

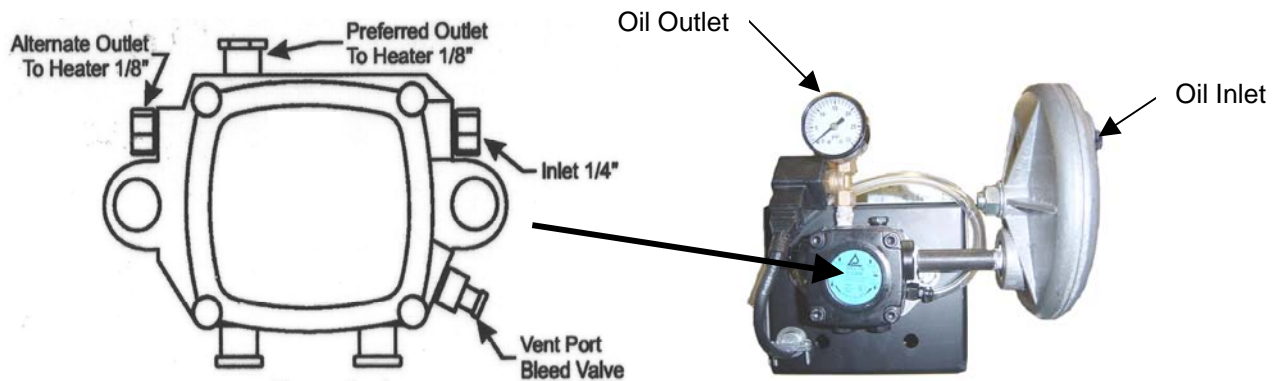


Figure 29 –Oil Pump Diagram

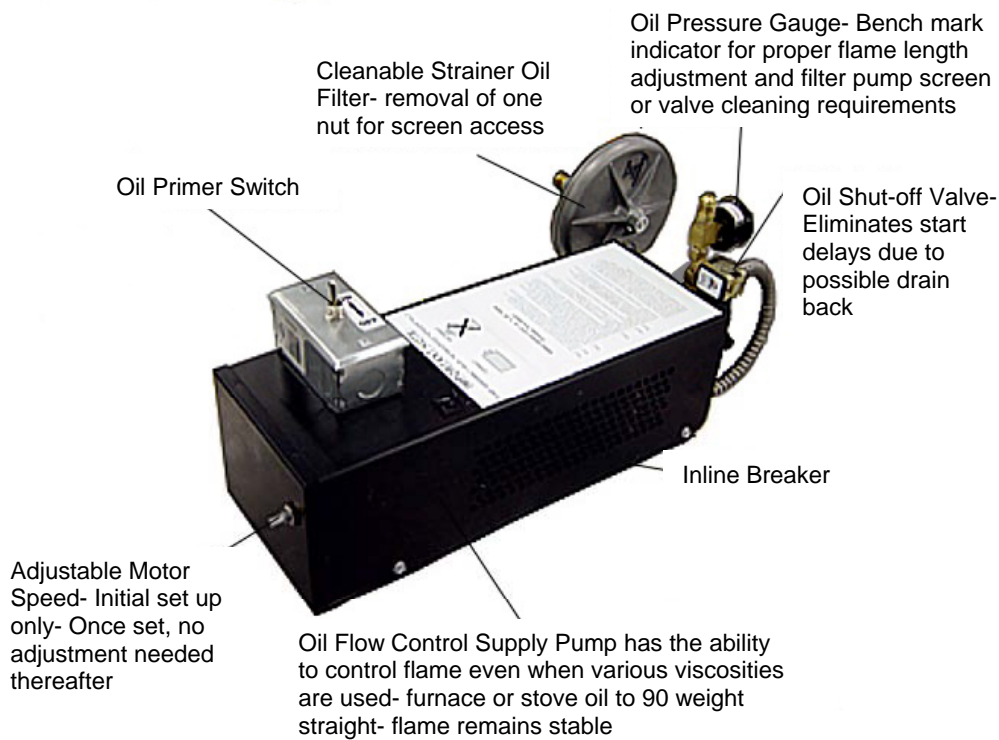


Figure 30 –Oil Pump

9 SERVICE AND MAINTENANCE

Performing correct preventive service and maintenance will help to guarantee long life of the unit with high efficiency and low maintenance costs.

WARNING

ONLY Authorized Technicians strictly complying with the manufacturer's instructions and the local standards should perform maintenance and service on the unit's internal components.

Lubrication of condenser fan, hydraulic pump, and pre-mixer motor is not recommended.

The operations described below must be performed once a year. If the unit is installed on a heavy-duty installation (industrial plants, 24hr operation etc.), it is necessary to increase the frequency of checks and services.

Maintenance to be performed on the unit:

- Cleaning of the condenser /absorber coils
- Cleaning of the burner (oil and gas)
- Cleaning of the generator
- Inspection of flue gas passage
- Change and check hydraulic pump oil level
- Priming procedure
- Check condition of belts
- Check condenser fan height

NOTE

Before any type of service is performed, ALWAYS shut-off the power supply at the main switch.

CLEANING THE CONDENSER/ABSORBER COILS

It is recommended to clean the condenser / absorber coils regularly since the unit's cooling capacity can be greatly reduced by dirt on the coils (see Figure 31). The user, installer or service technician can perform this operation. To clean condenser / absorber coil proceed as follows:

1. Shut off the power and gas supply.
2. Remove the covering panels.
3. Use a brush to remove dirt from the outside and inside of the condenser/absorber coils.
4. Using water pressure, wash the coils from in to out and from top to bottom. Point the hose down between the two coils and wash all the way around. Care should be taken not to spray electrical components or to damage the aluminum fins.
5. Check that all dirt is removed.
6. Replace the panels.
7. Turn on the power and gas supply.
8. Start unit to check for correct operation.

NOTE

Do not use solvents for cleaning the condenser/absorber coils; this could cause damage to the aluminum fins.

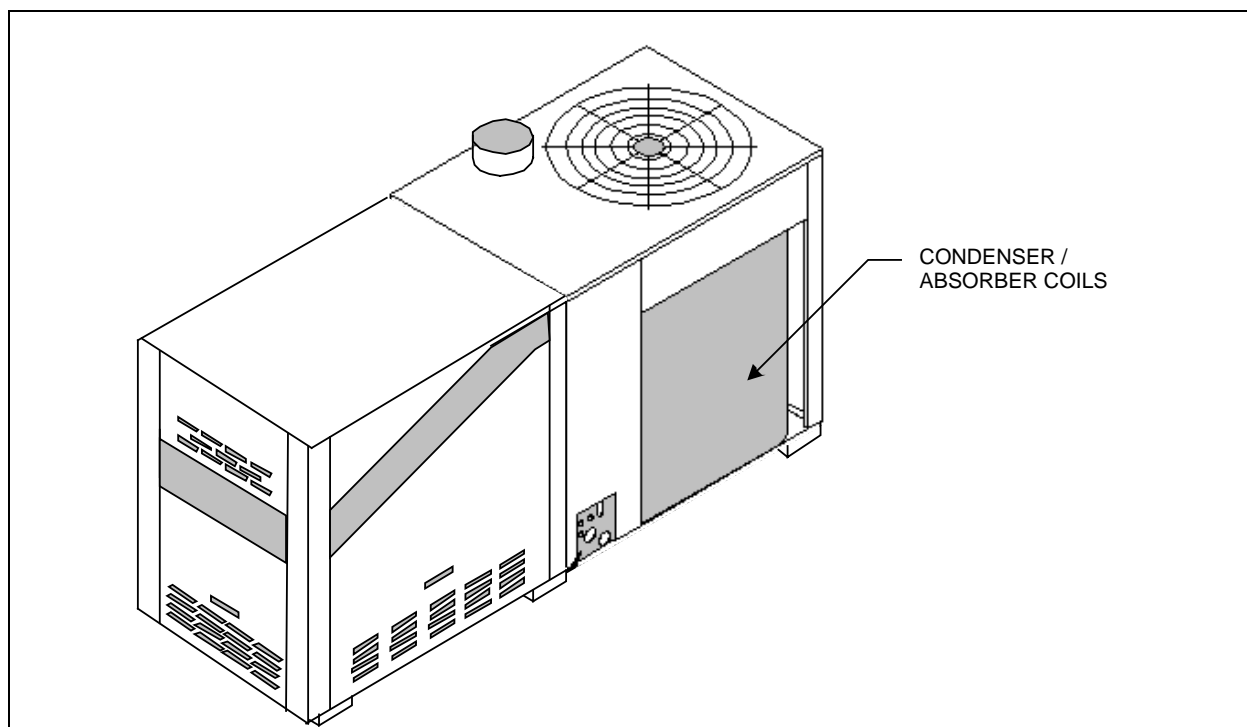


Figure 31 –FINNED CONDENSER / ABSORBER

CLEANING THE BURNER

Tools Needed:

Fiber Bristle Brush
Dust Mask (3M #8710 or equal)
Safety Goggles
Hand Tools

WARNING

ALWAYS wear safety goggles!

1. Shut off gas and electric supply to unit.
2. Remove front panel.
3. Remove bolts and nuts securing premixer blower housing to burner tube flange.
4. Remove screws holding burner and insulation retaining straps.
Note: Wear a dust mask (3M #8710 or equal NOISH/MSHA TC-21C mask) during burner removal, cleaning, and assembly operations.
5. Pry bottom of burner tube out to clear bottom of generator housing. Pull burner down and out to remove from generator housing.
Note: Be careful not to distort or damage the burner tube or the igniter and sensor assemblies in the generator housing.
6. Position burner tube with open end down.
7. Clean burner tube ports with fiber bristle brush and shake any debris out of the tube.
8. Inspect burner tube gasket that seals the burner tube to the generator housing and the burner flange gasket that seals burner to premixer blower housing. Replace either gasket if damaged during burner removal process.

9. Replace burner tube in reverse order of removal.
Note: Make sure the two gaskets are positioned correctly and that generator housing is properly sealed.
10. Turn on gas and electric supply to unit.
11. Start unit and check for correct operation.

CLEANING THE GENERATOR

Tools needed:

Safety Goggles
Dust Mask (3M #8710 or equal)
Soft Bristle Brush
Wire Brush
Hand Tools

WARNING

ALWAYS wear safety goggles!

1. Shut off gas and electric supply to unit.
2. Remove front and top panels.
3. Disconnect wires from ignition transformer mounted on left front panel to control box at the control box end.
4. Remove ignition wires from igniter mounted on combustion chamber.
5. Remove left panel from unit.
6. Remove sensor wire from sensor mounted on generator housing.
7. Remove two screws fastening center partition to air baffle assembly.
8. Remove center partition from unit by pulling partition straight up
9. Remove bolts and nuts securing premix blower housing to burner tube flange.
10. Remove screws holding burner and insulation retaining straps (see Figure 32).
Note: Wear a dust mask (3M #8710 or equal NOISH/MSHA TC-21C mask) during burner and generator housing removal, cleaning and reassemble operations.
11. Pry bottom of burner tube out to clear bottom of generator housing. Pull burner down and out to remove from front generator housing (see Figure 32).
Note: Be careful not to distort or damage the burner tube or the igniter and sensor assemblies in the generator housing.
12. Remove sheet metal screws holding front and rear generator housings together (see Figure 32).
13. Lift front half of generator housing out and place out of way.
14. Lift back half of generator housing up to clear lower partition mounted to base pan and then lean it towards back of unit.
15. Clean insulation in front generator housing with soft bristle brush.
16. Clean generator and back generator housing baffle with wire brush. Clean out all soot and debris from between generator fins.
17. Install rear generator housing first. Make sure bottom edge of housing is properly installed over lower generator housing bracket.
18. Install front half of generator housing by placing the bottom edges of the housing and insulation between the lower insulation and the lower generator bracket.
19. Fasten front and rear generator housings together using sheet metal screws.
20. Inspect burner gasket that seals burner tube to the generator housing and the burner gasket that seals burner to premix blower housing. Replace either gasket if damaged during burner removal.
21. Replace burner tube in reverse order of removal.
Note: Make sure the two gaskets are positioned correctly and that generator housing is properly sealed.

22. Reassemble the remaining parts in reverse order.
23. Turn on gas and electric supply to unit.
24. Start unit and check for correct operation.

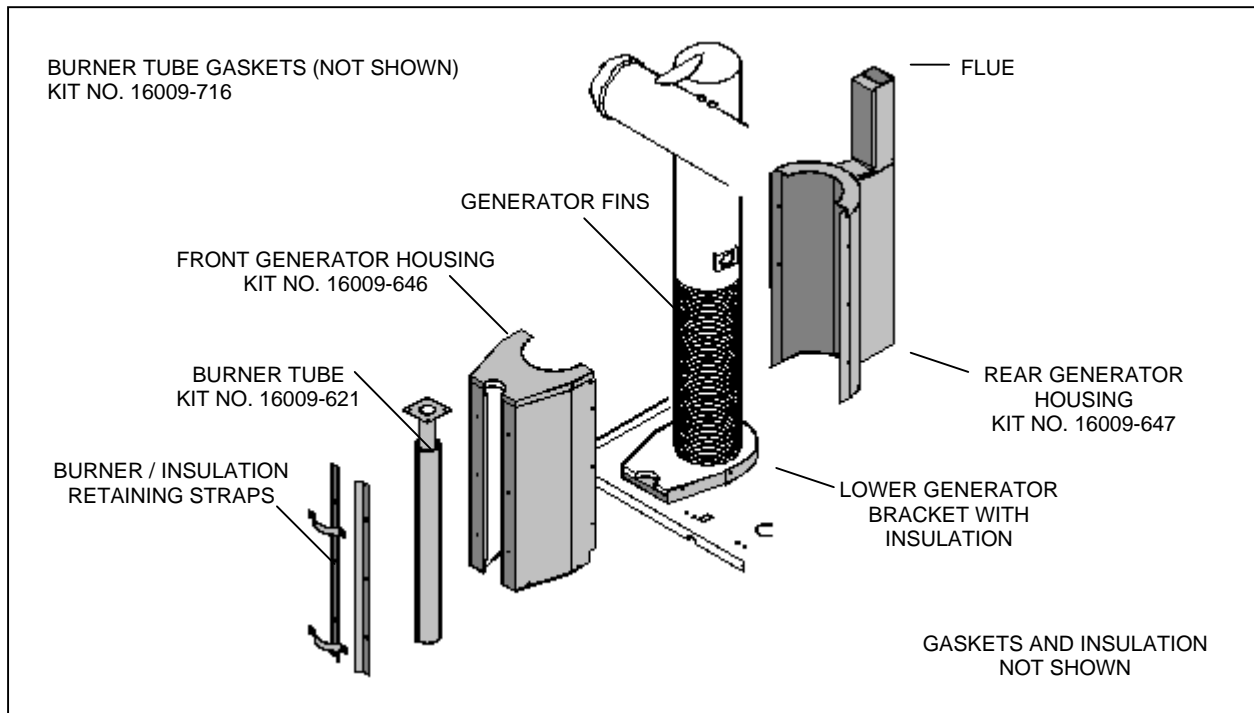


Figure 32 – GENERATOR ASSEMBLY

FLUE GAS PASSAGE INSPECTION AND CLEANING

Early in the year before operating the chiller on cooling, complete the following instructions:

1. Turn off gas and electric supply to the unit.
2. Remove front panel.
3. Remove top panel.
4. Clean the base pan around the generator housing of any debris.
5. Look down the flue opening at the back of the generator housing and clear any debris that may be obstructing the opening (see Figure 32).
6. Look down the air intake chute for combustion air and clear any debris that may be obstructing the opening.
7. Reinstall top panel.
8. Reinstall front door.
9. Turn on gas and electric supply to the unit.
10. Start unit to check for correct operation.

It is recommended that at least once a year a qualified service technician perform routine maintenance on the equipment.

Gas burners do not normally require scheduled servicing; however, deterioration or an accumulation of lint may cause yellowing flame or delayed ignition. Either condition indicates that a service call is required.

CHANGE AND CHECK OIL LEVEL

WARNING

DO NOT disconnect the hydraulic pump from the solution pump while performing any of the tasks listed below. If the hydraulic pump is disconnected from the solution pump, the hydraulic pump must be primed. For the procedure to prime the hydraulic pump, consult the “Priming Procedure”.

Change the oil after first season of operation. Thereafter, change the oil every five years. The procedure to change the oil is as follows:

1. Turn off the gas and electrical supply.
2. Remove the front panel of the unit; the pump cover can remain in place.
3. A hole is located in the bottom of the base pan to allow the positioning of a container for the collection of the old oil.
4. Unscrew the oil drain plug (No. 2 in Figure 33) using a 6mm hex key wrench.
5. Let the oil drain into the waste oil container (the quantity of oil is about 0.5/0.6 quarts).
6. Replace the oil drain plug. Do not over-tighten.
7. Remove the oil fill plug (No. 1 in Figure 33) using a 6mm hex key wrench.
8. Refill with 0.6 quarts of Servel oil or approved equivalent. Let any excess oil drain from fill plug opening.
9. Replace the oil fill plug. Do not over-tighten.
10. Turn on gas and electrical supply to unit and check for correct hydraulic pump operation.

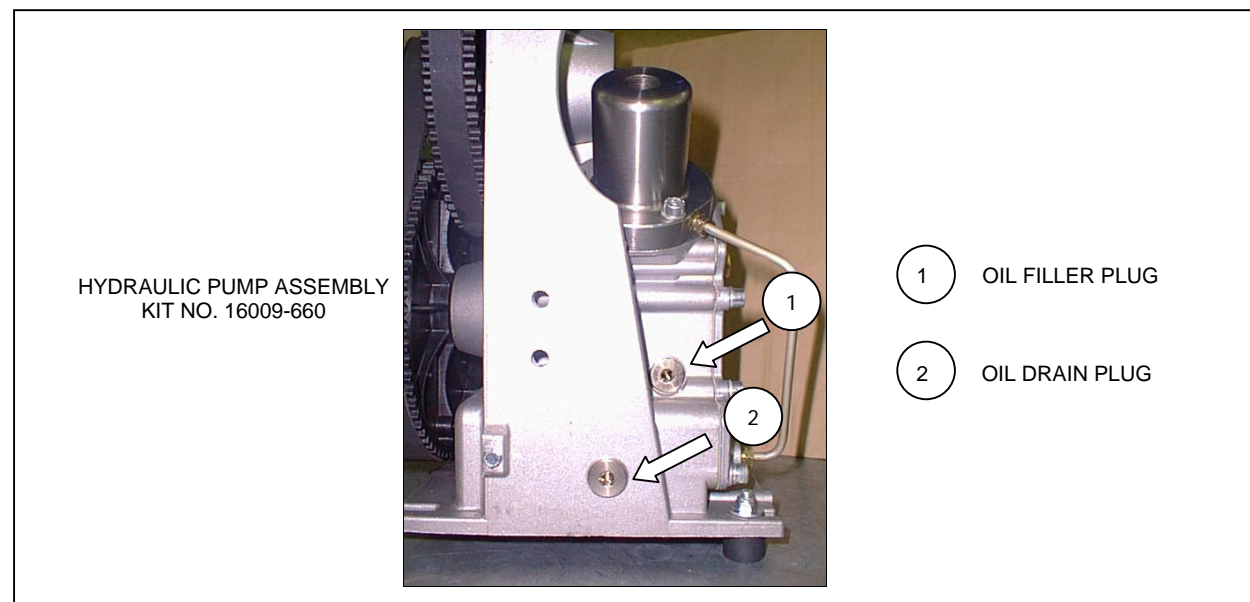


Figure 33 – RIGHT SIDE OF THE HYDRAULIC PUMP

PRIMING PROCEDURE

1. Turn off gas and power supply to the unit.
2. Turn the lower pulley to where the white mark is in the 9 o'clock position (i.e. horizontal).
3. Remove the hydraulic hose's flared-fitting from the hydraulic pump cylinder. Keep the loose end of the hose up, so the oil does not drain out. Fill hose with oil if necessary.
4. Fill the pump cylinder to the top with oil.
5. Tighten the hose's flared-fitting onto the hydraulic pump cylinder.
6. Turn the pulley clockwise to where the white mark is in the 6 o'clock position (the bottom-dead-center BDC as shown in Figure 34).
7. Loosen the hose's flared-fitting from the hydraulic pump. **DO NOT REMOVE.**
8. Slowly turn the pulley clockwise to the 12 o'clock position (the top-dead center TDC) or until oil emerges around the fitting.
9. Tighten the hose's flared fitting.

10. Spin the lower pulley clockwise and visually check for the counter-clockwise rotation of the pulley. (The counter-clockwise rotation is caused by internal pump pressure).
11. Repeat steps 6 through 10 until the pulley does spin counter-clockwise due to internal pressures.
12. Check the oil level of the hydraulic pump. Follow steps 7 through 9 of the "CHANGE AND CHECK OIL LEVEL" procedure.
13. Clean the basepan and hydraulic pump of any excess oil.
14. Turn on gas and electrical supply to unit and check for correct hydraulic pump operation.

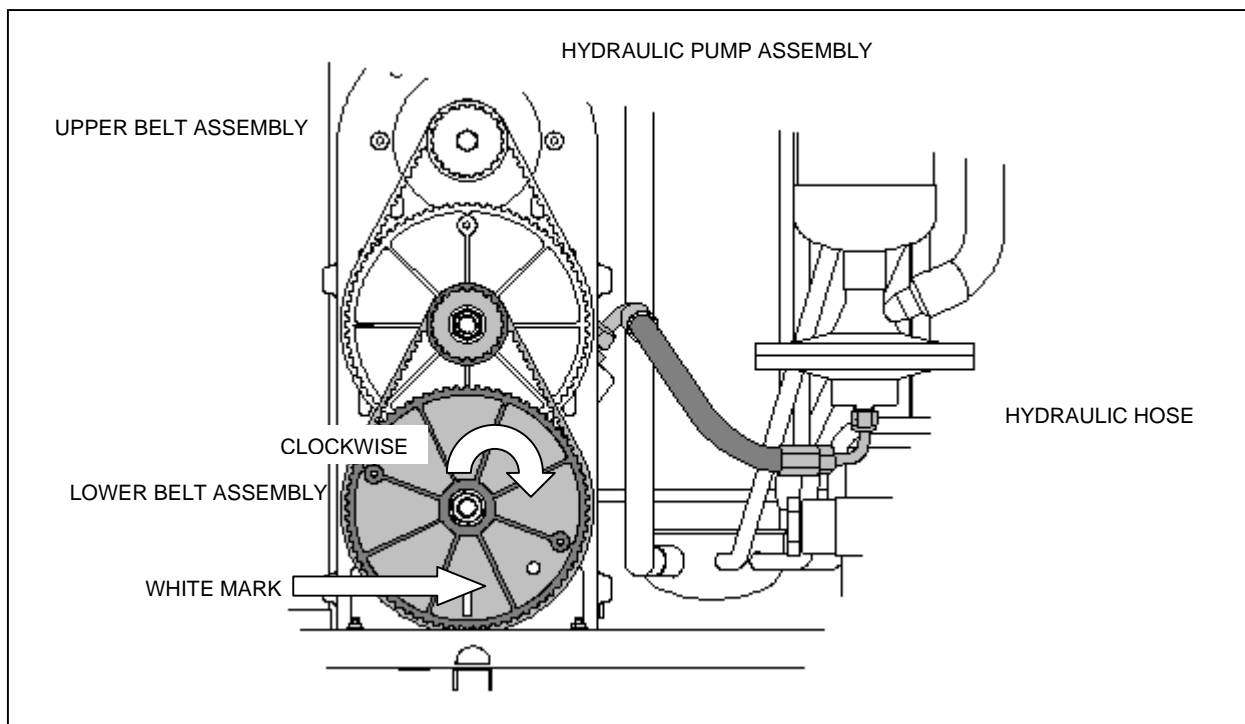


Figure 34 –LOWER PULLEY AT THE 6 O'CLOCK POSITION (BDC)

CHECK CONDITION OF BELTS

When checking condition of belts and pulley, shut-off power to the unit. Check condition of belts for any of the following:

1. Age cracking
2. Wearing of teeth on the belts or pulleys
3. Debris lodged in pulleys
4. Teeth missing on belts or pulleys

If any of the above conditions are present, replace the belt and the mating small pulley. Replace the larger pulley if damaged or worn. Belts should be replaced every 5 years or 5,000 working hours.

CHECK CONDENSER FAN HEIGHT

For proper air flow, the distance between the top edge of the fan blade and the top panel must be between 1-1/4" and 1-1/2". If the fan is at an improper height, adjust the location of the mounting strap around the fan motor.

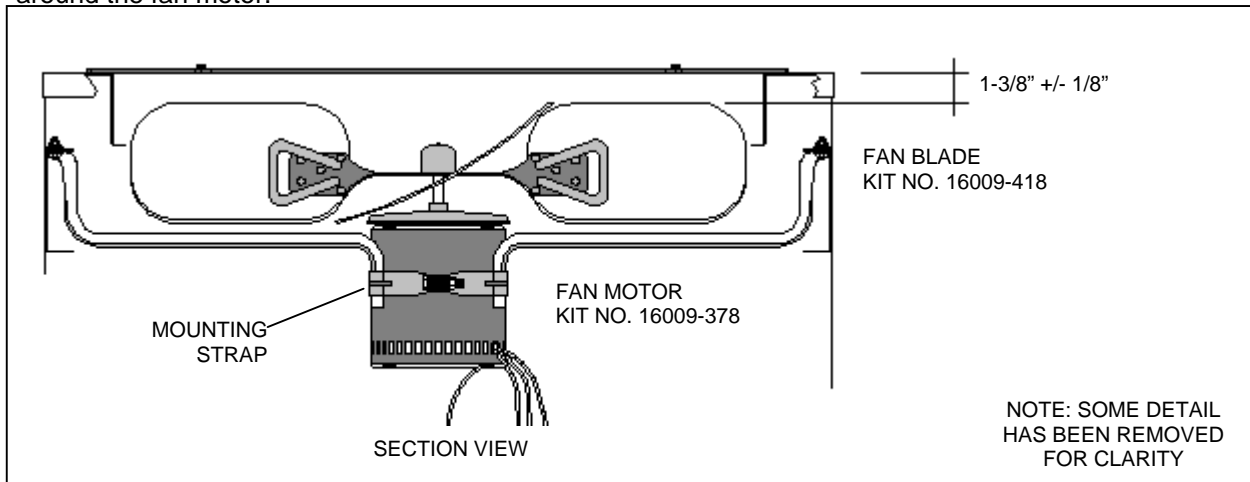


Figure 35 – SECTION VIEW SHOWING PROPER FAN HEIGHT

WASTE OIL BURNER MAINTENANCE AND ADJUSTMENTS

- Waste Oil Burner electrodes are adjusted at time of manufacturing. However, they should be checked periodically and at time of installation to be sure they are set as noted in Figure 36.
- Nozzle position in relation to flame cone/burner tube is critical for low maintenance operation. Periodically check position as per Figure 36. **CAUTION: TURN OFF MAIN ELECTRICAL POWER BEFORE CHECKING OR ADJUSTING ELECTRODE SETTINGS.**

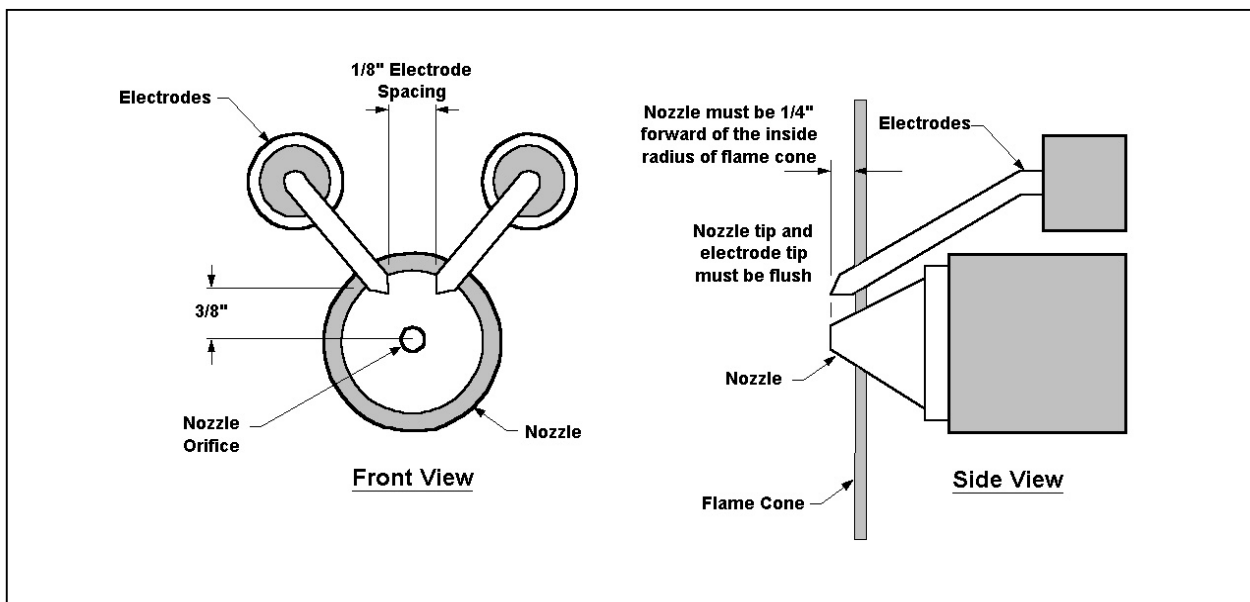


Figure 36 – ELECTRODE AND NOZZLE ADJUSTMENT DETAIL

10 TROUBLE-SHOOTING INSTRUCTIONS

If the appliance is not producing chilled water, check the following items before calling the Authorized Technician:

- Check that power supply exists and that main switch is in the "ON" position.
- Check that gas shut-off valve is open.
- Check that all on/off switches (timer, thermostat ON/OFF switch etc.) are in the position, which requires the function on the unit.

If after all these operations the unit does not start, do not try to repair the unit but call an Authorized Technician.

If a FAULT CODE is displayed, refer to Table 5.

When the chiller is in **FAULT** mode (stopped), electronic board's display will indicate the fault code. The blinking character **E**, followed by two numbers composes the error code. This fault code is visible from the opening on the protection shield of the electronic control board.

CODE	FAULT DESCRIPTION
E01	HIGH TEMPERATURE LIMIT SWITCH (auto reset but requires the high temperature limit switch to be manually reset) High Temperature Limit Switch (M1) is located on the Generator. Check: <ul style="list-style-type: none"> - High Temperature Limit Switch; when "open" (released) press the reset button. - Wires; Disconnected or damaged. Check the wiring and continuity (disconnect the wires from the board when checking).
E02	PRESSURE SWITCH – MAX. PRESSURE SEALED REFRIGERATION UNIT (auto reset but requires the high pressure switch to be manually reset) Pressure Switch (NPH) is located on the rear side of the Leveling Chamber. Check: <ul style="list-style-type: none"> - Pressure switch; When "open" (released) reset it manually. - Wires; Disconnected or damaged. Check the wiring and continuity (disconnect the wires from the board checking).
E03	LOW TEMPERATURE CHILLED WATER CONTROL (auto reset at end of condition) Low Temperature Chilled Water Control is a non-adjustable set point to indicate possible freezing condition. The set point is compared to the outlet water line's thermistor (THM) reading. Check: <ul style="list-style-type: none"> - The chilled water flow rate. - Regulation of chilled water thermostat on electronic board (particularly if minimum chilled water thermostat set point is 37°F).
E04	DEFICIENT CONDENSER / ABSORBER VENTILATION – OVERHEATING (reset by shutting power supply "off" then "on") Safety based on relationship between condenser/absorber temperature (sensor located on the condenser outlet tube, TCN) and external temperature (sensor located at the upper right rear corner of the chiller, TA). Check: <ul style="list-style-type: none"> - Fan operation (smooth rotation, blade position, fastening). - Condenser/absorber's condition; If dirty clean the condenser/absorber coils. - Natural air circulation (roof overhang or overhead obstructions could provoke the problems). - Sensors damaged, reading improperly, position (check position and if reading improperly replace). - Fan power supply; check the fan voltage (white and black wires on the fan) which must be at least 90% of supply voltage to unit at time of fault code (if lower replace electronic control board). TCN thermistor & TA thermistor
E05	EXTERNAL TEMPERATURE OVER 131°F (auto reset at end of condition) External Temperature Probe (TA) is located at the upper right rear corner of the chiller. The external temperature must be under 131°F for operation. Check: <ul style="list-style-type: none"> - Natural air circulation (roof overhang or overhead obstructions could provoke the problem). - The correct position of sensing bulb. - Sensor damaged, reading improperly, position (check position and if reading improperly, replace). TA thermistor
CODE	FAULT DESCRIPTION
E06	EXTERNAL TEMPERATURE BELOW 10°F (auto reset at end of condition) External Temperature Probe (TA) is located at the upper right rear corner of the chiller. The external

	<p>temperature must be above 10°F for operation.</p> <p>Check:</p> <ul style="list-style-type: none"> - Sensor damaged, reading improperly, position (check position and if reading improperly, replace). TA thermistor
E07	<p>GENERATOR LIMIT TEMPERATURE OVER 330°F (auto reset at end of condition)</p> <p>Generator Temperature Probe (TG) is located on the generator near the High Temperature Limit Switch. Could be caused by a power-out or starting the unit at low temperatures (under 50°F). Survey the machine for the next 30 minutes. The third E07 alarm in 60 minutes will stop the chiller and E08 fault code will appear on display.</p>
E08	<p>GENERATOR LIMIT TEMPERATURE 330°F REACHED 3 TIMES IN 1 HOUR (reset by shutting power supply "off" then "on")</p> <p>Generator Temperature Probe (TG) is located on the generator near the High Temperature Limit Switch.</p> <p>Check:</p> <ul style="list-style-type: none"> - Tightness of generator's pressure relief valve. - Gas pressure supplied to the burner. - Sensor damaged, reading improperly, position (check position and if reading improperly, replace). TG thermistor - Combustion chamber leakage. - Turn on the chiller and use gauges to measure the pressures of the sealed refrigerant system.
E09	<p>BURNER MALFUNCTION (reset by shutting power supply "off" then "on")</p> <p>Generator Temperature Probe (TG) is located on the generator near the High Temperature Limit Switch. This fault code indicates the generator temperature did not increase the required amount in the time allotted (15 minutes).</p> <p>Check:</p> <ul style="list-style-type: none"> - Premixer motor. - Differential air pressure switch; check the air tubes, connection to the probes and functionality. - Ignition control box fuse 3.15 A on electronic control board. - Ignition control box power supply (from electronic control board). - Ignition transformer and wire condition - Flame sensor and igniter conditions - Connection, location and functionality (damage) of Generator Temperature Probe. TG thermistor
E10	<p>CHILLED WATER FLOW SWITCH (auto reset at end of condition)</p> <p>Flow switch (FL) is located in returning chilled water line.</p> <p>Check:</p> <ul style="list-style-type: none"> - Water Pump is operating properly; Pump position. Water pump must be located before the chiller (in the inlet chilled water line). - Check the water circulation pump parameters and water flow rate. - If the water in the evaporator is frozen (missing antifreeze), turn off the power supply of the unit and wait 15 to 30 minutes (with circulation pump on if possible). - Flow switch failure (remove and replace with new flow switch). FL Switch - Water leakage from hydronic system.
E11	<p>SOLUTION PUMP ROTATION (reset by shutting power supply "off" then "on")</p> <p>Solution Pump rotation probe (SRT) is located on pump's body.</p> <p>Check:</p> <ul style="list-style-type: none"> - Proper operation of solution pump's electric motor. - Probe's connection wires. - Closing of "REED" switch by rotating the gear (use an electrical tester at the probe connection on the electronic control board for continuity pulses). SRT sensor - If the pump is locked-up or stopped because of mechanical failure or belt breakage.

CODE	FAULT DESCRIPTION
E12	<p>IGNITION CONTROL BOX LOCKOUT (reset by shutting power supply "off" then "on")</p> <p>Ignition control box is located in the electric control box of the chiller.</p>

	<p>Check:</p> <ul style="list-style-type: none"> - Spark igniter (condition of wires, position, and distance between electrodes). - Gas manifold orifice; check the gas pressure on the orifice). - Gas supply pressure before the gas valve. - Flame sensor (condition of wire, position, condition of electrode).
E16	<p>OUTLET CHILLER WATER TEMPERATURE PROBE FAILURE (reset by shutting power supply "off" then "on")</p> <p>Outlet Water Temperature Probe (THM) is located on chiller water outlet tube (thermometer well).</p> <p>Check:</p> <ul style="list-style-type: none"> - Wiring to the electronic control board. - Before replacing the temperature probe, check with a new temperature probe that the fault code disappear from display (connect the wires to THM connector at electronic board). <p>THM thermistor</p>
E17	<p>INLET CHILLER WATER TEMPERATURE PROBE FAILURE (reset by shutting power supply "off" then "on")</p> <p>Inlet Water Temperature Probe (THR) is located on chiller water inlet tube (thermometer well).</p> <p>Check:</p> <ul style="list-style-type: none"> - Wiring to the electronic control board. - Before replacing the temperature probe, check with a new temperature probe that the fault code will disappear from display (connect the wires to THR connector on electronic control board). <p>THR thermistor</p>
E18	<p>CONDENSER TEMPERATURE PROBE FAILURE (reset by shutting power supply "off" then "on")</p> <p>Condenser Temperature Probe (TCN) is located on condenser outlet tube.</p> <p>Check:</p> <ul style="list-style-type: none"> - Wiring to the electronic control board. - Before replacing the temperature probe, check with a new temperature probe that the fault code will disappear from display (connect the wires to TCN connector on electronic control board). <p>TCN thermistor</p>
E19	<p>EXTERNAL TEMPERATURE PROBE FAILURE (reset by shutting power supply "off" then "on")</p> <p>External Temperature Probe (TA) is located at the upper right rear corner of the chiller.</p> <p>Check:</p> <ul style="list-style-type: none"> - Wiring to the electronic control board. - Before replacing the temperature probe, check with a new temperature probe that the fault code will disappear from display (connect the wires to TA connector on electronic control board). <p>TA thermistor</p>
E20	<p>GENERATOR TEMPERATURE PROBE FAILURE (reset by shutting power supply "off" then "on")</p> <p>Generator Temperature Probe (TG) is located on the generator near the High Temperature Limit Switch. Note: The electronic control board does not check this thermistor until 15 minutes after the control switch closes.</p> <p>Check:</p> <ul style="list-style-type: none"> - Wiring to the electronic control board. - Before replacing the temperature probe, check with a new temperature probe that the fault code will disappear from display (connect the wires to TG connector on electronic control board). <p>TG thermistor</p>

Table 5 – FAULT CODES

NOTE

After the exchange of the defective component, the display will automatically reset.

If the power supply is interrupted for at least 5 seconds, the electronic control board will reset.

The displaying of the Fault Codes is "First-In, First-Out" (FIFO).

11 ADAPTING TO ANOTHER GAS**NOTE**

ONLY an Authorized Technician can perform the operation described in this section.

If the type of gas indicated does not correspond to the type to be used (natural or propane gas) by unit, it must be converted and adapted to the type of gas to be used. The gas orifice must be changed and the gas valve must be converted.

For this operation proceed as follows (see Figure 37):

1. Turn off the gas and electrical supply and remove front panel.
2. Remove the wires from the gas valve.
3. Remove the gas inlet pipe from gas valve by removing the 4 screws from the valve flange (use 9/64 hex key wrench).
4. Remove 2 nuts of gas valve support (use 7mm wrench).
5. Remove gas valve / gas valve support assembly from unit.
6. Remove gas valve support and o-ring from gas valve by removing 4 screws from gas valve support (use 9/64 hex key wrench).
7. Attach correct gas valve to gas valve support using 4 screws removed in prior step. Place o-ring in correct position to avoid leaks.
8. Replace the brass gas orifice mounted on gas valve support with the correct size gas orifice as listed in **SECTION 6.3 "GAS PRESSURE ADJUSTMENT"** (use 12mm wrench).
9. Install gas valve in unit and secure using 2 nuts to tighten gas valve support.
10. Attach gas inlet pipe to gas valve using 4 screws to secure valve flange and re-attach wires.
11. Turn on the gas and electrical supply.
12. Adjust the gas pressure for the gas to be used following the instructions reported in **SECTION 6.3 "GAS PRESSURE ADJUSTMENT"**.
13. Replace the stickers indicating the type of gas for which the unit is preset with the new one, which indicates the type actually being used.

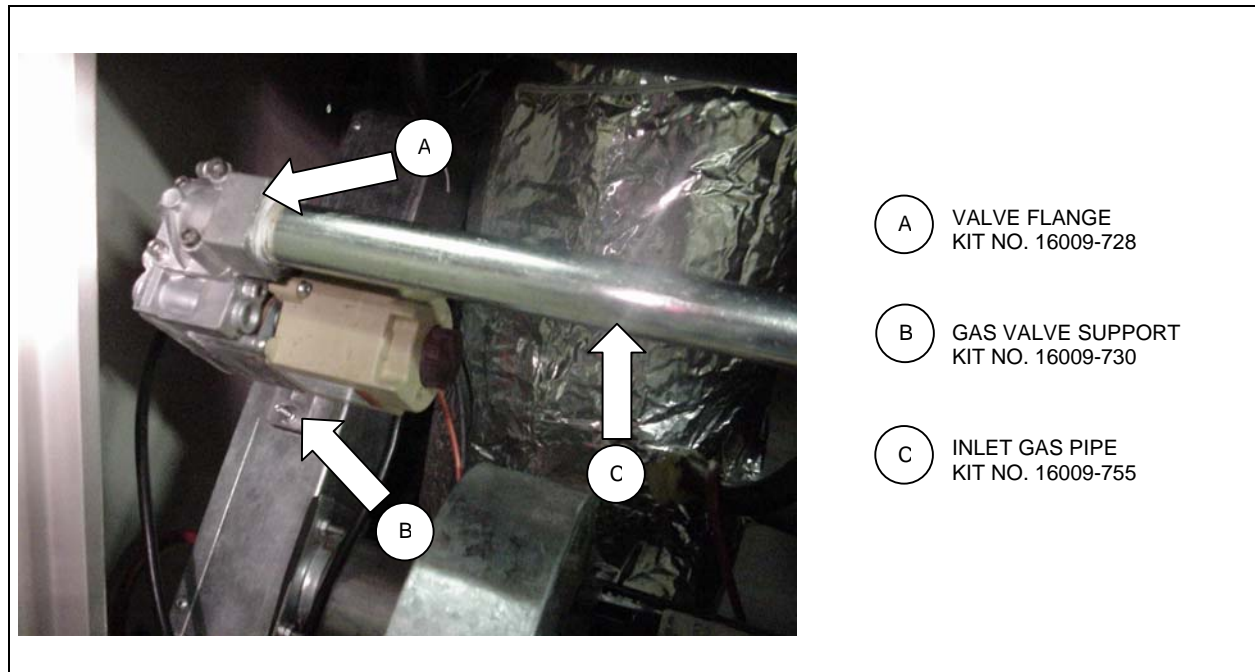


Figure 37 – ADAPTING TO ANOTHER GAS

12 APPENDIX

ELECTRONIC CONTROL BOARD (S-50)

All chiller functions and operations are monitored and controlled by the electronic control board.

When power is supplied to the unit, the electronic control board will initialize the control program. “CAP” will appear on the display. “H60” will appear next, showing that the power supply to the board is 60 hertz. The display will next show the chilled water thermostat set point.

The board will then begin to monitor all thermistors and switches to ensure proper and normal working conditions. If a fault occurs with any of the thermistors and switches, a fault code will appear (see Fault Codes in Figure 23).

If no faults are found and the control switch wired to the R-Y contacts is closed, the electronic control board will start the unit. The hydraulic pump, condenser fan, and water pump (if controlled by the unit) will start. Simultaneously, the electronic control board will energize the ignition control box to begin the ignition sequence (see Ignition Control Box for details).

During operation, the inlet water temperature and temperature differential will appear on the display, indicated respectively by different LEDs (see Section 6.5, Chilled Water Temperature Regulation).

The electronic control board will increase or decrease the condenser fan speed to obtain the designed temperature differential between the external ambient and the condenser outlet. If this maximum allowable temperature differential is not maintained, a fault code will appear (see Figure 23, Fault Codes).

If the control switch is opened, the S-50 board will de-energize the ignition control box and begin cycle down. The hydraulic pump, condenser fan, and water pump (if controlled by the unit) will continue to operate for another 215 seconds.

If the chilled water thermostat set point is reached, the S-50 board will de-energize the ignition control box and begin cycle down. The hydraulic pump and condenser fan will continue to operate for another 215 seconds. The water pump (if controlled from the S-50) will continue to run until the outlet water

temperature is 1°F above the chilled water set point. If the control switch is still closed, the unit will start again.

NOTE

The electronic control board has three 5mm x 20mm fuses for circuit protection. If the electronic control board does not start up or the condenser fan does not run, remove power from the unit and check the condition of the fuses. The S-50 board requires a 10A, 3.15A, and 2A fuse. The size of the fuse is labeled on the electronic control board next to the respective fuse holder (see Figure 39).

WARNING

The **maximum** current carrying capacity of the N.O. Contact is **4A**. Refer to Section 5.2, Pump Wiring.

WARNING

An isolation relay **MUST** be used to separate the unit's transformer from additional equipment having a transformer or damage to the S-50 board will occur. Refer to Section 5.3, Control Switch Wiring. Relay (Kit No. 18010-116)

IGNITION CONTROL BOX

When power is supplied to the unit and consequently to the "R" terminal on the ignition control box, the ignition control will reset, perform a self check routine, initiate full time flame sensing, flash the diagnostic LED for up to four seconds, and enter thermostat scan state. See Figure 38.

When the control switch is closed, the electronic control board will energize the ignition control box starting the ignition sequence (24 volts applied to the "W" terminal on the ignition box).

The ignition control box will check the differential air pressure switch for open contacts.

- If the differential air pressure switch contacts are closed and stay closed for 30 seconds, an air flow fault will appear. The diagnostic LED on the ignition control box indicates this fault. In this mode, the ignition control box will not start the premixer blower.

If the pressure switch contacts are open, the ignition control box will start the premixer blower.

- An air flow fault will occur if the air pressure switch contacts remain open 30 seconds after the premixer blower starts. The diagnostic LED on the ignition control box indicates this fault. In this mode, the ignition control box will keep the premixer blower energized.

If the air pressure switch contacts close after the premixer blower starts (normal operation), a pre-purge delay begins and the ignition sequence continues.

Next, the ignition control box energizes an ignition transformer that generates a high intensity spark at the igniter to ignite the gas/air mixture (see Figure 40). Simultaneously, the gas valve is energized, allowing the flow of gas to the burner.

The ignition control box continuously monitors the flame sensor for ignition. If the flame sensor detects flame, the ignition transformer is de-energized immediately and the gas valve and premixer blower remain energized.

Should the burner fail to light, or flame is not detected during the first trial for ignition, the gas valve and ignition transformer are de-energized and the ignition control box begins an inter-purge delay

before another ignition attempt. The control will attempt two additional ignition trials (total of 3 ignition trials) before going into lockout. Upon lockout, the gas valve will de-energize immediately and the premixer blower will turn off.

The thermostat ("W" terminal), air pressure switch, and burner flame are constantly monitored to assure proper system operation. When the call for flame has ended, i.e. 24volts removed from "W" terminal on ignition control, the gas valve is de-energized immediately. The ignition control then senses loss of flame and de-energizes the premixer blower.

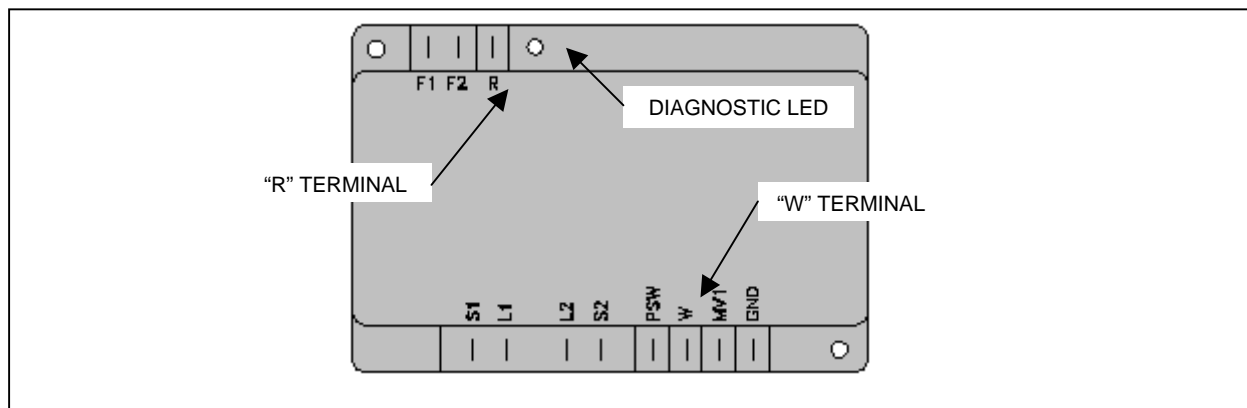


Figure 38 – IGNITION CONTROL BOX

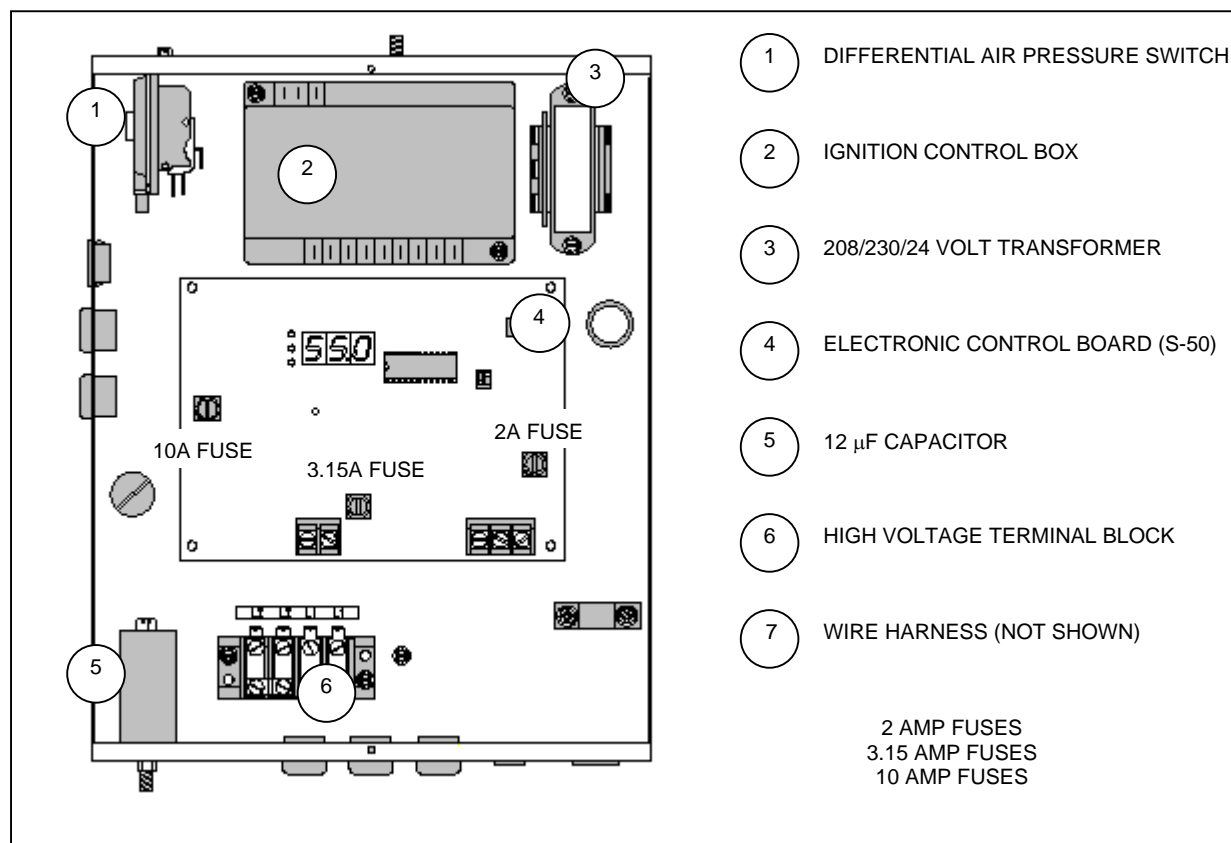


Figure 39 – ELECTRICAL CONTROL BOX COMPONENTS

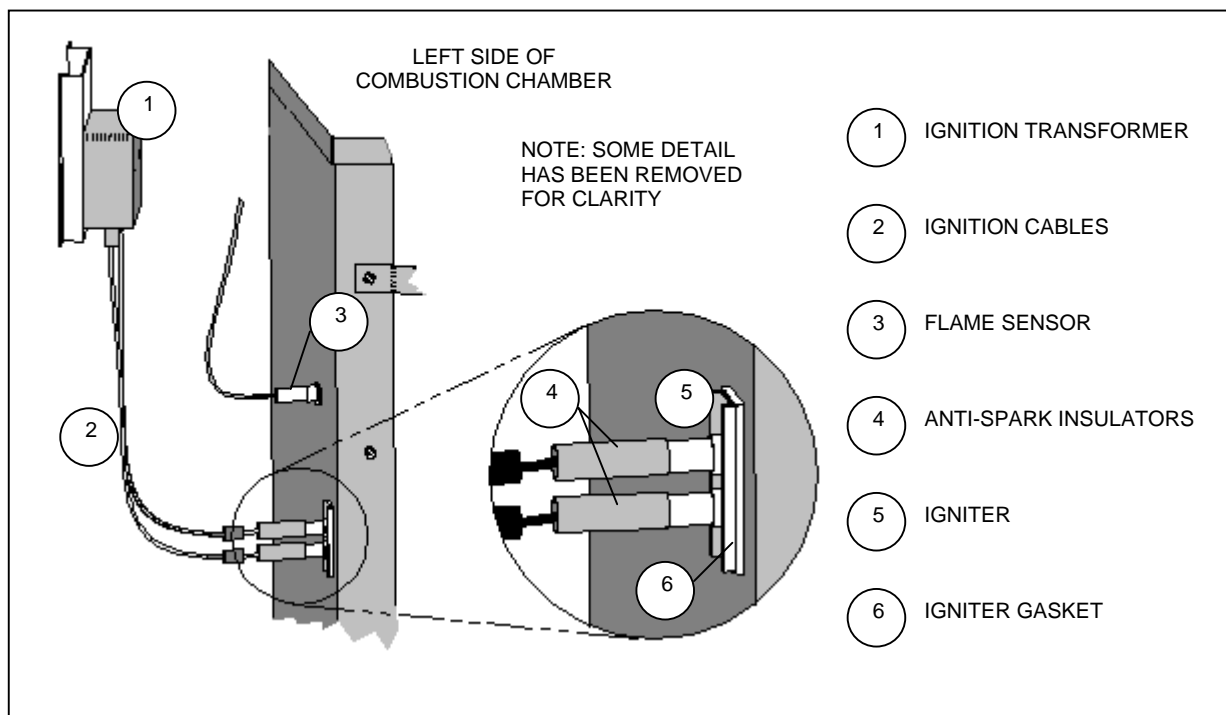


Figure 40 – IGNITION TRANSFORMER, IGNITER ASSEMBLY, AND FLAME SENSOR

EconoHeat^{Inc.}

Omni Waste Oil Chiller

Limited Warranty

Econo Heat (manufacturer) warrants to the purchaser of waste oil chiller will be free from defects in materials and workmanship for the durations specified below, which duration begins on the date of delivery to the customer. Customer is responsible for maintaining proof of date of delivery.

If return is deemed necessary for warranty evaluation and determination of repair or replacement, chiller is to be sent to the factory with freight prepaid. Econo Heat reserves the right to determine appropriate action for repair or replacement.

No parts will be accepted by Econo Heat without RA# (return authorization number) clearly marked on outside of shipping package. Obtaining RA# requires model and serial numbers, description of part being replaced and nature of defect. Call factory to receive RA#.

Warranty Covers:

Air Cooled Absorption Water Chiller

1. Three Years full repair or replacement (Parts Only)

Waste Oil Burner and Combustion Chamber

1. Combustion Chamber and Heat Exchanger five (5) years *full repair or replacement, additional five (5) years prorated. (Parts Only)
2. Oil Heater Block, twenty (20) years. (Parts Only)
3. Oil Heater Block Controller PCB, three (3) years. (Parts Only)
4. All other components, one (1) year. (Parts Only)

This warranty is void if:

1. Warranty registration card is not returned within thirty (30) days of purchase.
2. Any part or component subject to abuse or altered from original manufactures specifications.
3. Installation not in accordance with instructions.
4. Has not been properly maintained, operated or has been misused.
5. Wiring not in accordance with diagram furnished with chiller.
6. Chiller is operated in the presence of chlorinated vapors.

Warranty is limited to the original purchaser.

The above warranty is in lieu of all other warranties expressed or implied. Econo Heat does not authorize any person or representative to make or assume any other obligation or liability that is not in accordance with above warranty. **Econo Heat is not responsible for any labor cost unless prior authorization in writing has been obtained.**

NOTE: Combustion Chamber Warranty is specific to material and workmanship. Workmanship means Econo Heat warranties the welds are good and will hold. Material means they won't corrode through due to sulfur in the ash that accumulates during operation. Warranty does not apply to units that experience overheating stress cracks. These are not incurred because the materials are inadequate for the application nor are they a result of a weld broke lose because of bad penetration. Which is easily recognized by the material being left underneath the weld. These cracks occur as a direct result of improper draft, either by inadequate initial installation and setup which requires (1) establishing a proper draft during installation (2) back draft has occurred due to ash buildup, backing up hot gas passageways either in the exchangers, the stack, or both. (3) Over firing by setting oil supply pressure too high (see manual for proper setting) these are all cases of thermal overload.

* Under normal use only. If misuse or abuse is deemed apparent after inspection, warranty is void.

WARRANTY CARD

Please fill out, tear off and return to manufacturer

Return following warranty information to manufacturer within thirty (30) days of purchase or warranty will not be valid. (Please print or type).

Date of Purchase _____

Serial # _____ Model _____

Customer Name _____

Address _____

City _____ State _____ Zip Code _____

Dealer _____

Address _____

City _____ State _____ Zip Code _____

Installed at _____