

PORTABLE HEATING SYSTEM

Operation & Maintenance Guide

031125

Water Heater Module

Model 1200, Cabinet Style, Raypak, Natural Gas or Propane Fired

Portable Heat Exchangers

Model 80, 200 and 600

DRYAIR Inc.

Operation & Maintenance Guide

031125

DRYAIR INC.

606 Highway Drive

St. Brieux, SK., Canada, S0K 3V0

Tel: 306-275-4848 Toll Free: 1-888-750-1700

Fax: 306-275-4664

dryair@dryair.ca

DRYAIR INC.

1095 N. Main Street

Bowling Green, Ohio, USA, 43402

Tel: 419-354-8546 Toll Free: 1-866-354-8546

Fax: 419-354-9706

dryair@dryair.us

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Warranty Policy

DRYAIR Inc. (referred to within as DRYAIR) warrants its new, unused equipment to be free of defects in material and workmanship at the time of delivery to the first retail purchaser.

Basic warranty policy

- DRYAIR will repair or replace, at its option, without charge, any defective part of the equipment for a period of twelve (12) months from delivery to the first retail purchaser, F.O.B St. Brieux, SK., Canada or Bowling Green, Ohio.
- Mileage is not covered. Any parts that are covered by an extended warranty published by DRYAIR are an exception to the Basic Warranty policy and are to be warranted as per the details of the Extended Warranty Policy.
- Labor is covered as per DRYAIR flat labor rate.
- The Warranty Policy, terms and conditions, may change from time to time without prior notice.
- Warranty terms and conditions are transferable in the event of the sale to a second owner.
- Replacement parts will be warranted for 90 days from the repair date. Bill of sale must accompany the warranty claim.

Extended warranty policy

Water heater heat exchanger

- An extended warranty is available on the heat exchanger unit of the water heater assembly. The available warranty for a part, under the extended warranty policy, is prorated by 20% per year.
- (Shipment date is the date to be used for the commencement of the warranty period).
- Coverage schedule
 - Year 1 -100%
 - Year 2 -80%
 - Year 3 -60%
 - Year 4 -40%
 - Year 5 -20%

Exceptions to the warranty policies

- Under no circumstance shall the owner be entitled to recover costs for incidental, special or consequential damages such as, but not limited to: loss of profit or revenue, other commercial losses, inconvenience and/or replacement equipment rental cost.
- Maintenance, repair or service items not related to warrantable defects.
- Loss or damage during shipping.
- Failure resulting from lack of or improper maintenance.
- Damage caused by operator abuse, negligence or improper operation.
- Damage resulting from improper voltage supply.
- Damage from improper installation. Installation done by other than the manufacturer.
- Non-defective items replaced at the request of the customer.
- Damage due to accidents.
- Damage resulting from improper fuel supply (i.e. pressure or contamination).
- Damage resulting from cracked or broken lines occurring during transport.
- Damage resulting from use of inadequate or improper fluids (i.e., glycol or oil).

Owner's obligations

- It is the responsibility of the owner, at the owner's expense, to transport the equipment to the service facility of an authorized DRYAIR distributor/dealer or alternately to reimburse the distributor/dealer, for any traveling expenses incurred in fulfilling this warranty.
- The terms of this Warranty Policy are subject to provincial and state legislation. DRYAIR reserves the right to make modifications in accordance with provincial and state legislation without prior notice or obligation.
- It is the responsibility of the owner to read, understand and implement the maintenance, safety and operational guidelines as laid out in the Operation and Maintenance Guide.
- All parts to be tagged with warranty claim number and shipped prepaid to DRYAIR within 30 days.

Manufacturer obligations

- DRYAIR reserves the right to continually improve and/or change the product's parts or specifications at any time without notice or obligation.
- The terms of this Warranty Policy are subject to provincial and state legislation. DRYAIR reserves the right to make modifications in accordance with provincial and state legislation without prior notice or obligation.

Warranty Claim Procedures

- All warranty credits must be processed with the DRYAIR Warranty Claim Form.
- All warranty parts, unless otherwise specified, are to be returned to DRYAIR Inc. along with a completed Warranty Claim Form.

Note: Prior to returning warranty parts, please call for an authorization number and shipping instructions from the Warranty department in Canada.

- Location of Warranty Depots

USA	Canada
DRYAIR Inc	DRYAIR Inc.
1095 N. Main Street	606 Highway Drive
Bowling Green, OH	Box 126
43402	St. Brieux, SK
Ph. 1 (866) 354-8546	S0K 3V0
	Ph. 1 (888) 750-1700

- Each warranty claim should only refer to one Serial or Production Schedule numbered unit.
- Warranty parts are to be tagged with warranty claim number.
- When claiming for warranty labor, the allowable warranty labor rate will be \$45.00/hour. The factory reserves the right to adjust the number of hours claimed where deemed necessary.
- The factory may at times specify allowable labor for certain warranty procedures.
- Mileage and travel time, to and from the customer are not eligible for warranty credit.
- Freight charges for warranty parts are not eligible for warranty credit.
- Labor flat rates for component changes
 - Electrical components - .5 hour
 - Plumbing components - 1 hour
 - Electric motor changes - 1 hour

Note: Other labor charges will be at the discretion of DRYAIR.

Introduction

DRYAIR 2000 - Providing you with safe & economical heating and dehumidification solutions.

Congratulations on your selection of a DRYAIR 2000 portable heating system. DRYAIR 2000's unique system will provide you with the most economical, versatile and safe heating and dehumidification solutions.

Manual Guide

ICON KEY

 **Valuable Information**

 **Caution!**

 **Optional**

 **Helpful Hint**

Conventions for this manual include the assistance icons listed in the left margin table. These icons will appear in the left margin next to a paragraph. They are designed to call your attention to the paragraph they are next to. The valuable information icon will be used to highlight those items that will make your use of the DRYAIR 2000 system more effective. The optional icon will be used to highlight optional features or procedures. You may or may not wish to use these features.

Please pay strict attention to the “Caution!” icon. This icon is used to highlight a system or procedure that may be hazardous. Failure to observe these cautions may result in damage to the system and may void the warranty if not observed and, in the worst case, may result in personal

injury.

This Operation and Maintenance Guide is designed to help maximize your benefit from the DRYAIR 2000 system. It also provides comprehensive service information. The system information presented in this manual is provided in eight sections. See “Table of Contents” on page iii for section breakdowns and reference

- | | |
|---------------------|--------------------|
| 1) Introduction | 5) Troubleshooting |
| 2) Installation | 6) Maintenance |
| 3) Initial Start-up | 7) Safety Concerns |
| 4) Operation | 8) Appendix |

NOTE: Be sure to read each section for a comprehensive understanding of your new system. Instructions and procedures presented in all these sections must be followed to ensure reliability and the operating efficiency of your heating system.

Manual List

- This Operation and Maintenance Guide.
- Component Suppliers Manuals – located with this manual

Products Covered by this Manual

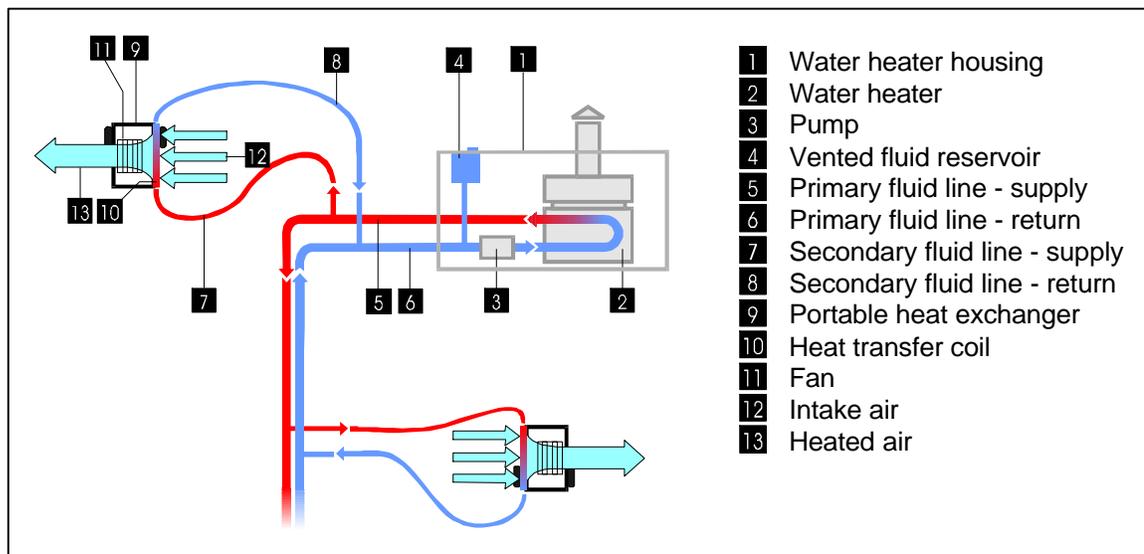
This manual covers the installation, operation and maintenance of the following DRYAIR 2000 model components:

- Model 1200 RAYPAK natural gas & propane gas fired water heater module.
- Portable heat exchangers – Model 80, 200 and 600
- Heat transfer fluid circulation system

How the System Works

- In its simplest form, The DRYAIR 2000 system uses a natural gas or propane hydronic water heater (item 2) to heat a heat transfer fluid/glycol.
- The hot fluid is pumped (item 3) through a fluid circulation system loop (items 5, 6, 7, 8) to remote locations.
- The fluid circulation system is a low pressure, open fluid loop with an atmospherically vented fluid reservoir (item 4).
- Portable heat exchangers (item 9) are located at remote locations along the fluid circulation system loop.
- A portable heat exchanger is comprised of a wheeled structure enclosing a heat transfer coil (item 10), fan (item 11) and thermostatic temperature controls.
- Hot fluid flows through the heat transfer coil, where heat is transferred to the air (items 12, 13) being drawn through the coil by the fan.
- The coil is specially designed for optimum heat transfer, without adding any moisture or fuel combustion by-products to the air!

Figure 1 - basic system

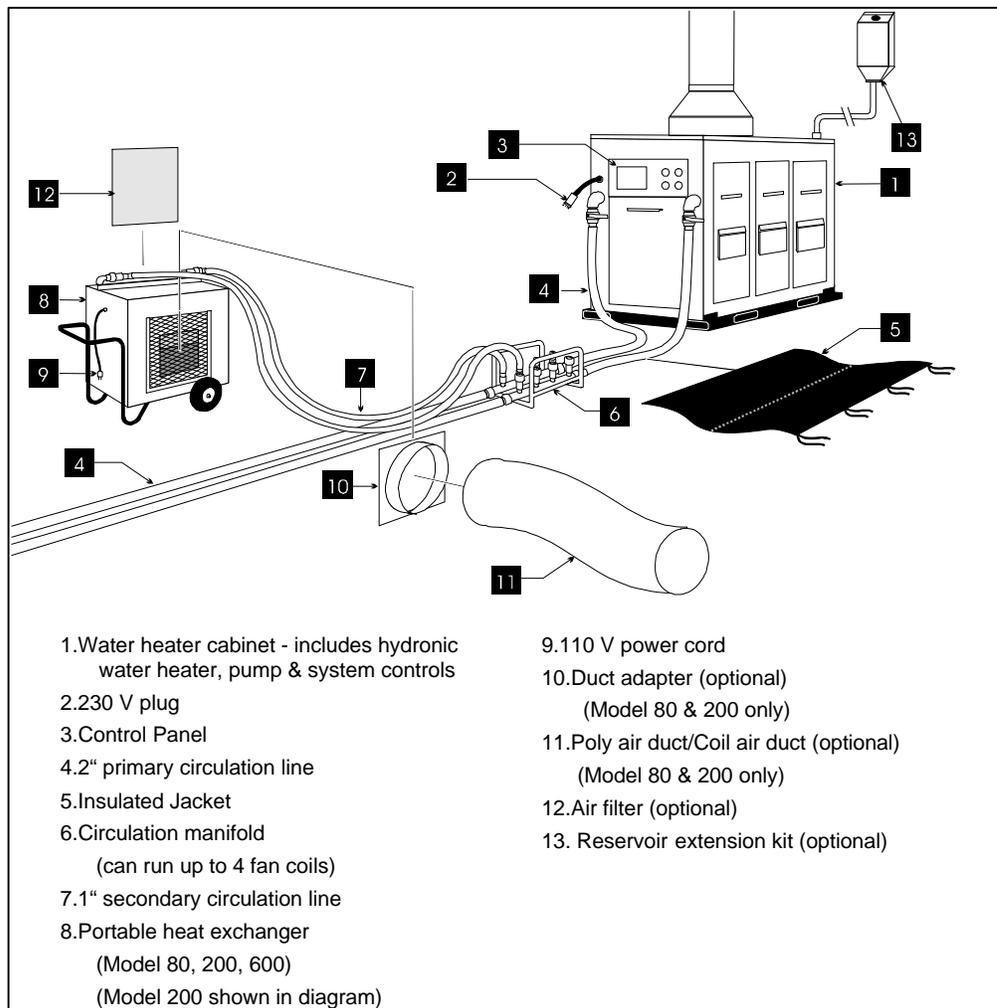


Installation



- Check all the specifications and requirements to be sure the site is adequately serviced.
- Installation configurations for the DRYAIR 2000 system are many and varied. The flexibility afforded by the modular nature of the system enables one to be installed on any site.
- A DRYAIR 2000 heating system consists of a combination of components. All systems include the following:
 - 1) one cabinet with hydronic water heater, pump and controls
 - 2) a heat transfer fluid circulation system
 - 3) one or more portable heat exchanger units

Figure 2 - general system component



Water Heater Cabinet

1. Handling the Cabinet

- 1.1. The cabinet can be moved with a forklift and is accessible from four sides.
- 1.2. Be careful when lifting, moving, or placing your Dryair system for you can cause internal damage to your water heater.
- 1.3. An optional module frame with four corner lifting eyelets is also available.
- 1.4. When utilizing a cable or sling lift, it is important that all four lifting eyelets be used in conjunction.



2. Cabinet Positioning

- 2.1. Be sure to observe all local gas, electrical codes and fire regulations.
- 2.2. Cabinet must be leveled and not set on any type of combustible material.
- 2.3. If the cabinet is mounted on a Dryair trailer, you can level the cabinet by using the four corner jacks located on the trailer.
- 2.4. Make sure to consider down drafting which can be caused by tall buildings, high winds or when the top of the chimney is level with the eve. Allow a 3 foot minimum clearance for all sides except the header connection side, which requires at least 6 feet.
- 2.5. Do not install the water heater cabinet in a location that blocks or can block, fully or partially, the combustion air intakes which are located on front and back of system.
- 2.6. Consider cabinet positioning in relation to portable heat exchanger positioning.
- 2.7. Elevated portable heat exchangers should be lower than the fill tank (fluid reservoir) in the water heater cabinet. If this is not observed, the following can occur:
 - 2.7.1. Insufficient fluid in the system
Fluid will drain back to the fill tank from the over-elevated portable heat exchangers when the pump is shut off. The fill tank will show adequate fluid but, when the pump is started, extra fluid will be required to recharge the over-elevated portable heat exchangers and the system will then have insufficient fluid reservoir.
 - 2.7.2. Fluid overflow
If, while the pump is running, fluid is added to maintain proper fluid levels, overflow at the fill tank will occur when the pump is shut off. This would occur because of the drain back from the over-elevated portable heat exchangers.
- 2.8. If the portable heat exchangers must be higher than the fill tank (fluid reservoir) in the Water Heater Cabinet, an “optional reservoir extension kit” is available
 - 2.8.1. The extension kit can be attached to the water heater cabinet fill tank and positioned at a higher elevation than the portable heat exchangers.
 - 2.8.2. The maximum height that the extension reservoir can be positioned above the cabinet fluid reservoir is 120 feet. If more height is required, the cabinet itself will have to be elevated to a higher position.
 - 2.8.3. See “Optional Reservoir Extension Kit” on page 2-4 for optional reservoir extension kit installation instructions.



3. Fuel Setup

3.1. Natural Gas

- 3.1.1. The installation of natural gas fuel lines to the DRYAIR water heater cabinet must be performed by a licensed gas tradesman, and must conform to all local natural gas codes for water heater appliance installations.
- 3.1.2. Be sure the gas service is adequate to feed the water heater cabinet you are installing.
- 3.1.3. Refer to "Figure 42 - inputs, outputs & temp. ranges" on page 8-12 to determine water heater capacities



- 
- 3.1.4. Refer to “Figure 43 - gas supply – natural gas” and “Figure 44 - gas supply - propane (LP)” on page 8-12 for gas requirements.
 - 3.1.5. Confirm this data by double-checking the “Water Heater Data Plate” (Figure 10 - system start-up, item 12, on page 3-1) for the gas requirements for your model.
 - 3.1.6. Connect the gas main to the gas line connection (Figure 10 - system start-up, item 20, on page 3-1) on the DRYAIR 2000 water heater cabinet.
 - 3.1.7. In areas where permitted by code, flexible connection hose could be used with multiple access fittings on the gas main.
 - 3.1.8. The water heater cabinet can be moved to a location near the access port and connected with approved gas hose and connectors.
 - 3.1.9. Always check for gas leaks around fittings and connectors before proceeding to the electrical connections.

3.2. Propane (LP) Gas

- 3.2.1. The DRYAIR 2000 propane gas water heaters are equipped from the factory with external mounted, step down propane gas regulator valves adequate to reduce inlet pressures (tank to module) from 8 P.S.I. down to the water heater requirements of 11”WC. This is adequate for most regions. If your propane supply is not in the 8 P.S.I. range, contact DRYAIR 2000 for assistance, or your gas supplier for a correctly sized regulator valve.
- 3.2.2. Be sure the gas service is adequate to feed the water heater cabinet you are installing.
- 3.2.3. A “Propane Line Vaporizer” (available through your propane supply outlet) is required for the proper operation of this system.
- 3.2.4. To use the DRYAIR system without a vaporizer will result in inadequate and inconsistent fuel delivery. DRYAIR will not be responsible for the system’s operation if a vaporizer is not used.
- 3.2.5. Connect the propane supply line to the inlet of the gas regulator located on the water heater cabinet. Open the fuel supply and check for leaks. Close off the fuel supply.



4. Electrical Connection

- 4.1. Before making any electrical connections, be sure that the electric power supply and the gas supply are off.
- 4.2. The water heater module requires 110/220VAC power to operate the pump. The water heater controls and ignition pilot are operated from an 115VAC supply. The module is factory wired so the only connection to be made is a 110/220VAC main feed to the circuit breakers inside the water heater cabinet.
- 4.3. The main feed wiring must be adequately sized to carry the minimum capacity shown on the water heater cabinet’s rating label.
- 4.4. All electrical connections, connectors and wire must be CSA approved, and installed according to local laws and codes.
- 4.5. A 4-wire hook-up is required for all systems to work properly. Warranty is void if the wiring hook-up is not done correctly.

5. Optional Reservoir Extension Kit



Note: In some jurisdictions the use of an extended reservoir may technically cause the water heater to be designated as a pressure vessel, due to the head pressure exerted on the water heater's heat exchanger. In this case, a qualified technician must apply for a permit.
An inspection fee will more than likely be applied to this application.

- 5.1. An extended reservoir is used when placing portable heat exchangers higher than the water heater reservoir. The reservoir extension kit includes a poly tank with mounting brackets and a 2x1 bushing with a 1" hose barb assembly which will be connected to the water heater reservoir.
- 5.2. To hook up the extended reservoir remove the "HTF" level gauge from the reservoir on the water heater and replace it with the 2" x 1" bushing complete with a 1" hose barb assembly.
- 5.3. Plug the overflow vent hose with a 3/4" hose barb and a 3/4 cap assembly.
- 5.4. Hook the 1" hose to the extended reservoir and the water heater reservoir using gear clamps.
- 5.5. Check for leaks.



Note: No potential shut off valves can be located in between the extended reservoir and the reservoir on the water heater.
An open, atmospherically vented fluid system must be maintained.

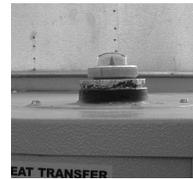


Figure 4 – "HTF" level gauge



Figure 3 - optional extended reservoir



Figure 5 – overflow vent hose

Fluid Circulation System

1. Positioning Specs

- 1.1. Keep 2" hose out of high traffic areas.
- 1.2. When placing your manifolds, the **male** quick coupler is always your **supply** side.

2. Hose Length Limitations

- 2.1. 2" hose No more than 300 feet one way
No more than 400 feet two ways
- 2.2. 3/4", 1", and 1 1/4" hose No more than 250 feet to the portable heat exchangers

3. Connection

- 3.1. Connection of the 2" primary circulation line involves attaching the 2" circulation lines to the kamlock fitting on the water heater cabinet (*Figure 6 - two inch circulation line to water heater cabinet connection*) and circulation manifolds (*Figure 7 - two inch circulation line to circulation manifold connection, on page 2-5*) Isolation valves and kamlock quick couplers are attached to both ends of the 2" circulation lines to enable quick coupling. This allows the isolation of the 2" lines and retaining of the "HTF" fluid in the lines. Set-up and dismantling of the circulation system is much quicker.
- 3.2. Make sure that the isolation valves are closed and the pump is turned off before uncoupling the kamlock. Failure to do so may put you at risk of injury from eye or skin exposure to hot glycol.
- 3.3. Portable Manifolds are typically located inside structure being heated, but can be placed outside if required.
- 3.4. Multiple circulation manifolds can be positioned at choice locations along the 2" circulation system.
- 3.5. Attach the ¾", 1", 1 ¼" secondary circulation lines to the circulation manifold (*Figure 8 - ¾", 1" and 1 ¼" circulation line to circulation manifold connection*). Quick couplers similar to those used with hydraulic systems are used. The coupling and uncoupling of ¾", 1", and 1 ¼" circulation lines can be accomplished with the system under pressure.
- 3.6. If outside lines must be insulated, use insulated jacket. (*Figure 2 - general system component item 5 on page 2-1*)



Figure 6 - two inch circulation line to water heater cabinet connection



Figure 7 - two inch circulation line to circulation manifold connection



Figure 8 - ¾", 1" and 1 ¼" circulation line to circulation manifold connection

4. Heat Transfer Fluid (HTF)

4.1. Fluid Specifications

- The pure "HTF" fluid "Dowfrost ® HTF" or "Boss Chill PG" used in the DRYAIR 2000 system is made up of a blend of 95% Propylene glycol, <5% Dipotassium phosphate and de-ionized water. It is not automobile antifreeze.
- DRYAIR 2000 mixed "HTF" fluid is made up of 50% "Dowfrost ® HTF" or "Boss Chill PG" heat transfer fluid and 50% water, by weight. Freeze protection down to -33 °C.

CAUTION! At no time should you use automobile antifreeze in your DRYAIR system. The use of automobile antifreeze will void your DRYAIR warranty.

4.2. Handling Precautions

- **Ventilation:**
Good general ventilation should be sufficient for most conditions.
- **Respiratory protection:**
No respiratory protection should be needed.
- **Skin protection:**
For brief contact, no precautions other than clean body-covering clothing should be needed. Use impervious gloves when prolonged or frequently repeated contact should occur.
- **Eye protection:**
Use safety glasses.

4.3. MSDS Status

Canadian Regulations

- **WHMIS information:**
The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is not a “Controlled Product” under WHMIS.
- **Canadian TDG Information:**
For guidance, the Transportation of Dangerous Classification for this product is not regulated.

U.S. Regulations

- **SARA 313 Information**
To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.
- **SARA Hazard Category:**
This product has been reviewed according to the EPA “Hazard Categories” promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:
Not to have met any hazard category.



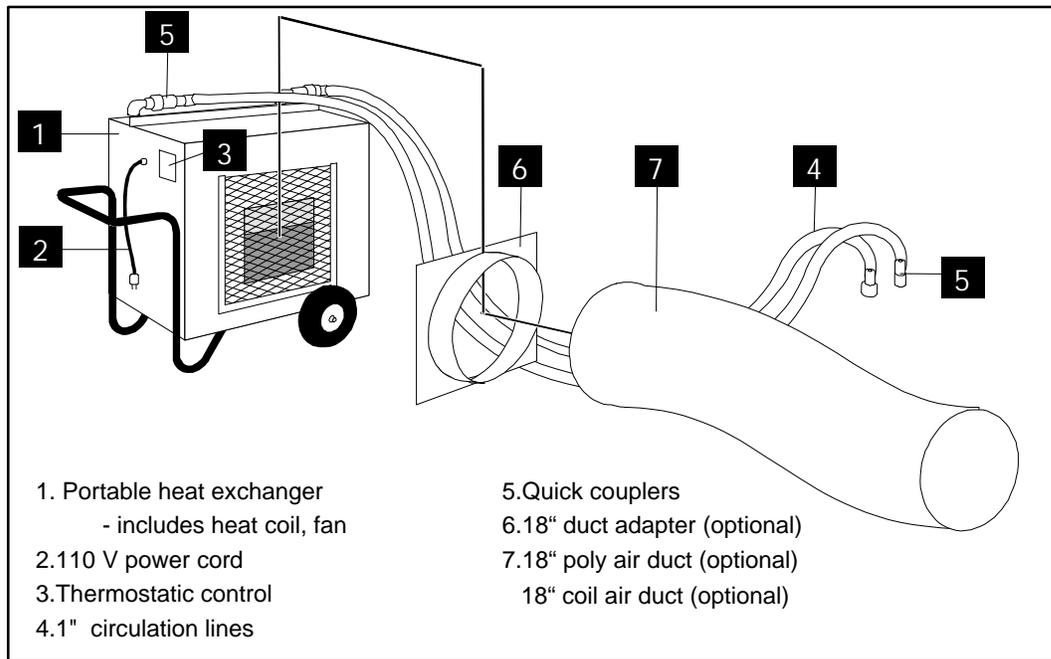
Note! Refer to the “Material Safety Data Sheet” section on page 7-2, for complete information.

Portable Heat Exchangers

There are only electrical power, air tube (optional), and heat transfer fluid connections to make at the Portable Heat Exchanger. Each unit can be placed into position by one person, and the connections made in only a few minutes.

- Each portable heat exchanger is shipped complete with fluid charge.
- The fan motor has no switch and is operated by connection to a power supply.
- Temperature control Model 80 and 200 - thermostat, power interrupt on the fan motor.
Model 600 – ball valve flow control to increase or decrease the transfer of heat.

Figure 9 - portable heat exchanger - model 200



1. Positioning

- 1.1. Portable heat exchangers must have a clearance of 1 ½ feet on air intake side.

2. Electrical Connections

- 2.1. The Portable heat exchangers require a 110V, 15 amp power supply.
- 2.2. Each unit is factory equipped with a two foot 110V appliance cable and plug.
- 2.3. A maximum of 100 feet with #14 AWG cord can be run to each portable heat exchanger.

3. Fluid Connections

- 3.1. Connect the portable heat exchangers to the ¾", 1", and 1 ¼" circulation lines and then to the circulation manifold using quick couplers.
- 3.2. The couplers are installed with the supply line as a male and the return line as a female. This configuration avoids reversing the fluid connections by accident.



4. Optional Air Ducts

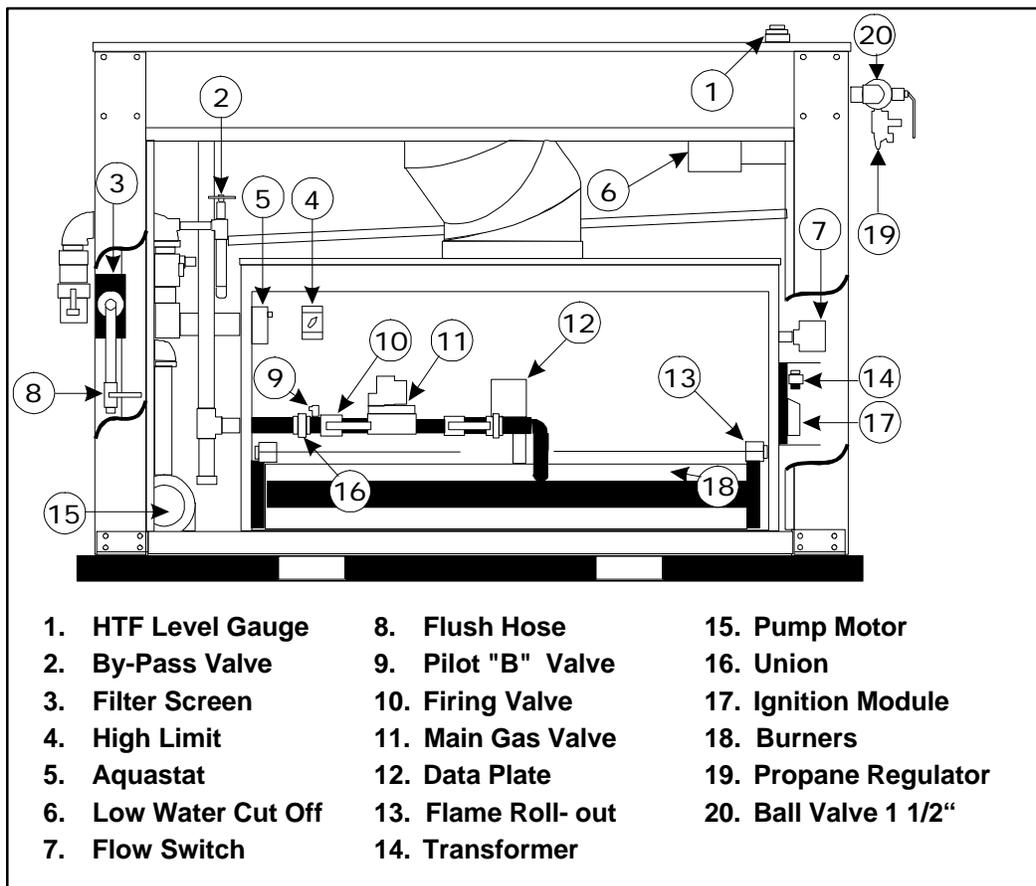
- 4.1. A duct adapter (Figure 9 - portable heat exchanger - model 200, item 6 on page 2-7) is available to adapt to the following;
- 4.2. on-site air distribution ducting
- 4.3. optional poly or coil air ducts
- 4.4. Model 80 requires a 10" adapter
- 4.5. Model 200 requires a 18" adapter
- 4.6. Model 600 is not capable of using an air duct adapter
- 4.7. Optional poly or coil air ducts (Figure 9 - portable heat exchanger - model 200, item 7) are available for use with the Model 80 and Model 200 portable heat exchangers.
- 4.8. Model 80 requires 10" poly or coil air duct
- 4.9. Model 200 requires 18" poly or coil air duct
- 4.10. Model 600 is not capable of using an air duct adapter
- 4.11. Both poly and coil air ducts are available by the foot.

Initial Start-up

Note! It is very important that the following steps be observed when starting the system for the first time.

Propane & Natural Gas System

Figure 10 - system start-up



1. Before Proceeding

Before proceeding with the “Initial Start-up” procedures, confirm the following:

- 1.1. Confirm that the “Cabinet Positioning” procedures on page 2-2 have been completed properly
- 1.2. Confirm that the “Fuel Setup” procedures on page 2-2 have been completed properly.
- 1.3. Confirm that the “Electrical Connection” procedures on page 2-3 have been completed properly
- 1.4. Confirm that the chimney has been removed from the chimney holder and placed into position “*as shown in Figure 41 – dimensions - Water heater cabinet on page 8-11*” and fastened on by screws.

2. Electrical Check & Power-up

- 2.1. Make sure the gas supply is closed off and all electrical switches are off.
- 2.2. Supply power to the system.
- 2.3. Turn on all breakers.



3. Fluid Circulation System Start-up

- The DRYAIR 2000 Water Heater Cabinets, Portable heat exchangers and 2”, 1 ¼”, 1” or ¾” circulation line are shipped pre-filled with heat transfer fluid.

3.1. Purging Air from System

3.1.1. Primary Circulation lines - 2” lines

- 3.1.1.1. Confirm that all valves are open in the fluid transfer system and the fluid tank is filled to a proper operating level. (¼ to ¾ full)
- 3.1.1.2. Make sure no 1 ¼”, 1”, and ¾” circulation lines are hooked up to manifolds.
- 3.1.1.3. Connect a circulation loop “figure 11” (1” circulation line) into the last circulation manifold in the circulation system.
- 3.1.1.4. Make sure the 2” “supply” line and the 2” “return” line are hooked up to the cabinet.
- 3.1.1.5. Open the air elimination valve “figure 12” to the open position. This will release the air from the system.
- 3.1.1.6. Turn the supply and return valves in the open position and start the pump.
- 3.1.1.7. Make sure the reservoir stays at least ½ full at all times.
- 3.1.1.8. Circulate until there is no air left in the system. To determine that all your air is out of the system, the system pressure will maintain a steady p.s.i. reading.
- 3.1.1.9. Check for leaks or improperly attached 2” Kamlocks.
- 3.1.1.10. Remove circulation loop.

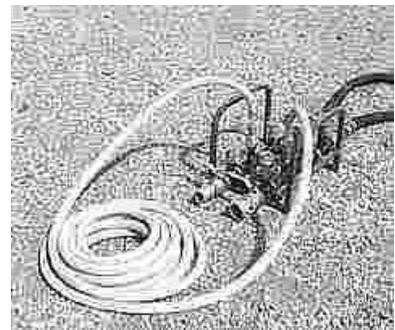


Figure 11 - circulation loop



Figure 12 - air elimination valve

3.1.2. Secondary Circulation Lines - 1 ¼", 1" and ¾" lines

- 3.1.2.1. Hook up all the secondary circulation lines to the portable heat exchangers and circulation manifold.
- 3.1.2.2. Allow the fluid to circulate for 10 minutes or more while connected to a portable heat exchanger. This will purge any air remaining in the circuit.
- 3.1.2.3. Close elimination valve so only 10% of flow is passing through the loop.
- 3.1.2.4. When the circulation and purging process is complete, top up the reservoir (¼ to ¾ full) with heat transfer fluid.
- 3.1.2.5. Check for leaks or improperly attached quick couplers.

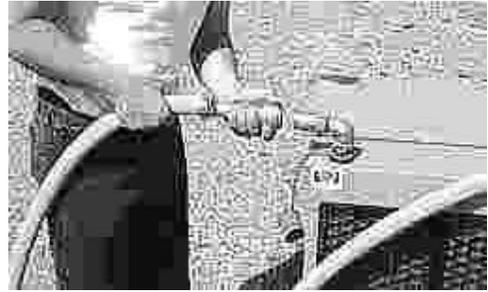


Figure 13 - connecting circulation lines to portable heat exchanger



Figure 14 - connecting circulation lines to circulation manifolds

4. Water Heater Initial Firing

See Figure 10 - system start-up on page 3-1 for item references from this section

4.1. Bleed gas line

- 4.1.1. With door panels removed from the front of cabinet and the heating unit, loosen the gas line union (item 20) and open exterior gas line valve (item 19) only enough to purge air from gas line.
- 4.1.2. Tighten union again and allow 15 minutes for possible gas accumulations to ventilate from the enclosure.



CAUTION: Propane gas is heavier than air. In the event of a leak or odor of gas is noticed, immediately turn off all power switches and the main gas supply to the water heater cabinet. Ventilate the water heater cabinet. Find and correct the leak before turning on any power or trying to re-light the water heater.

- 4.1.3. Open the exterior gas line valve completely. Soap-test the union for leaks.
- 4.1.4. Open the firing valve (item 10) & pilot "B" valve (item 9) on the gas train.
- 4.1.5. Turn on all the breaker switches on the control panel.

- 4.2. Turn on pump
 - 4.2.1. Flip the pump toggle switch on and run the pump to confirm that there is no air left in the fluid transfer system.
 - 4.2.2. The “System Pressure” gauge (should hold at a steady reading of between 25 to 35 p.s.i.).
- 4.3. Check the setting of the aquastat (item5). Confirm that the setting is between 140°F and 190°F.
- 4.4. Check the setting of the high limit switch (item 4). Confirm that the setting is between 200°F to 210°F.

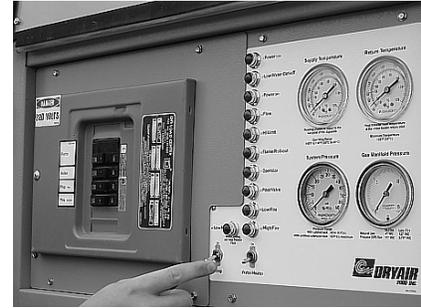


Figure 15 - turning on breakers switches and pump toggle switch

- 4.5. Confirm that there are no portable heat exchanger fans in operation.
- 4.6. Fire Water Heater

- 4.6.1. Flip the water heater’s toggle switch on.
- 4.6.2. All the indicator lights should be on, except the operator light which will come on when the burner is on.
- 4.6.3. The spark igniter will immediately begin its attempt to light the pilot. It will continue this for 15 seconds or until the pilot lights.
- 4.6.4. After 15 seconds it will lock out if the pilot flame has not yet been established. (This could happen due to air in the pilot line).
- 4.6.5. If the pilot flame has not been established, turn the water heater’s toggle switch off and back on again to re-initiate an attempt to light.
- 4.6.6. As soon as a pilot flame is established, the main gas valve will open and the burners will light. The burners will continue on high fire until the fluid in the system reaches the set temperature. The flame will now extinguish. When the fluid cools a few degrees below the set point, the burners will ignite on low fire. If the set point temperature can’t be achieved and maintained with low fire, the aquastat will call for high fire until the set temperature is achieved. It will then switch back to low and the cycle will repeat. If the low fire mode is capable of achieving and maintaining the set point temperature, the aquastat will not switch up to high, but will instead cycle the burners between low and off.

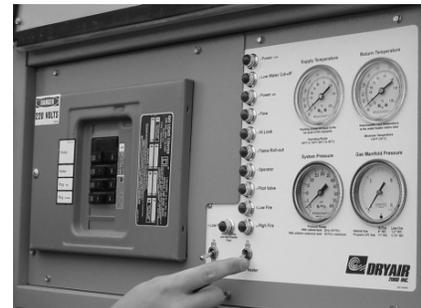


Figure 16 - turning on water heater toggle switch

- 4.7. Confirm gas pressures
 - 4.7.1. Check the gauge on the control panel labeled “gas manifold”.
 - Propanehigh fire - 11” W.C. & low fire – 2.75”W.C.**
 - Natural gashigh fire –4” W.C. & low fire – 1.2” W.C.**



CAUTION! A minimum return temperature of 130°F must be maintained. Operating the water heater with a return temperature below 130°F for an extended period of time will cause condensation of the water heater heat exchanger which will lead to water heater heat exchanger sooting and eventual system shut-down. Condensation of the water heater heat exchanger will eventually lead to heat exchanger corrosion damage and eventual failure.

5. Raising “HTF” fluid to Set Temp

- First, make sure that none of the portable heat exchanger fans are in operation. The portable heat exchanger fans must be turned on in succession.

5.1. Cold Structure

- 5.1.1. Plug in the first portable heat exchanger fan and verify that the fan is running.
- 5.1.2. With the first portable heat exchanger fan running, monitor the “return temperature” gauge at the control panel.
- 5.1.3. When the “return temperature” rises above 130°F, plug in another portable heat exchanger fan.
- 5.1.4. Repeat the first 3 steps with another portable heat exchanger until the “return temperature” does not rise to above 130°F. At this point, The water heater will be operating at full capacity and will be unable to maintain the minimum temperature of 130°F
- 5.1.5. Disconnect the last portable heat exchanger fan and the return temperature will again rise above 130°F.

5.2. As the Structure Warms Up

- 5.2.1. More portable heat exchangers may be added at a later date as the temperature in the structure rises.
- 5.2.2. If more portable heat exchangers are added, repeat the steps in the previous “Cold Structure” section.

Operation



Be sure to entirely read and understand this section before trying to start and run your new DRYAIR 2000 system!

It is important that you follow the “start up” and procedures for your system very carefully. If these procedures are not followed the system will not perform to its fullest potential and system failure may eventually result.

Water Heater Cabinet

1. Controls

The DRYAIR 2000 system has one manual set control required for normal operation. There are also several controls that are factory set, and normally do not require adjustment. Any adjustments that you may make will require some patience before the system has fully settled.

1.1. Aquastat

- Temperature control is provided by the aquastat (Figure 31 - control panel & water heater cabinet , item 23 on page 5-1)
- This thermostat controls the maximum supply water temperature (factory adjusted to 180°F).
- The aquastat sensor is located on the water heater outlet piping.
- The aquastat is used as a primary high temperature limit control.



Figure 17 -aquastat



Note: It is essential to the proper operation of your system that the Aquastat setting is lower than the High Limit Thermostat setting. The DRYAIR 2000 circulation system cannot withstand fluid temperatures in excess of 200°F for extended periods of time. Do not adjust the Aquastat to a higher temperature than 200°F.

1.2. High Limit Thermostat

- A second level of control is provided by the high limit thermostat aquastat (Figure 31 - control panel & water heater cabinet , item 22 on page 5-1)
- This control will override all other temperature controls if its set point (factory set to 200°F) is exceeded.
- The high limit temperature cut out is a CGA required safety switch set to shut down the water heater if the fluid temperature exceeds the set point.
- Canada Models will automatically reset once the fluid temperature cools to below its set point.
- U.S. Models need to be reset by pushing the reset button.
- It is essential to the proper operation of your system that the Hi Limit Thermostat setting is higher than the Aquastat setting.



Figure 18 -Canada high limit switch



Figure 19 -U.S. high limit switch

1.3. Pump On/Off Toggle Switch

- The pump on/off toggle switch is used to operate the pump which is located on the electrical panel.
- Turn this switch on first, before turning on the water heater.

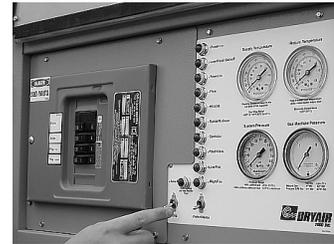


Figure 20 -pump on/off toggle switch

1.4. Water Heater On/Off Toggle Switch

- The Water Heater On/Off Switch turns on the water heater's control system.
- It is located on the electrical panel.
- When the water heater electronics are turned on and the water heater fires all the indicator lights will be on.
- The high fire light will go out if the water heater is operating on low fire. The Low Fire, High Fire, Pilot Valve, and Operator lights will go out if the burners are not operating.

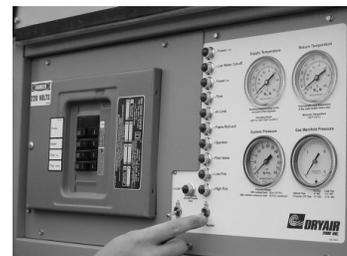


Figure 21 -water heater on/off toggle switch

1.5. Flame/Heat Roll-out Switch

- The Flame/Heat Roll-out Switch (Figure 31 - control panel & water heater cabinet , item 34 on page 5-1) is a safety control which has a 60" capillary tube strung across the front of the water heater.
- Should the water heater experience a flame roll-out or an abnormal rise in cabinet temperature, the switch will cause the water heater to shut down.
- This switch must be manually reset.
- Should a flame/heat roll-out situation occur, reset the flame/heat roll-out switch, turn off the ON/OFF switch, and wait for 5 minutes. Turn the ON/OFF switch back on.
- If the problem persists, initiate "Troubleshooting" procedures.

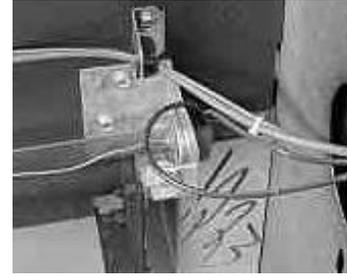


Figure 22 - flame/heat roll-out switch

1.6. Low Water Cut-out Switch

- The Low Water Cut-Out Switch (Figure 31 - control panel & water heater cabinet , item 25 on page 5-1) is a safety control located at the bottom of the heat transfer fluid reservoir.
- Should the fluid level in the reservoir be allowed to drop below the cut-out switch, the water heater and pump will shut down.
- The switch will automatically reset, and will allow the water heater to operate normally when the fluid reservoir is topped up.



Figure 23 - low water cut-out switch

1.7. Water Flow Switch

- The Water Flow Switch (Figure 31 - control panel & water heater cabinet , item 26 on page 5-1) is mounted to the water heater manifold.
- Should the pump become unable to provide the required minimum fluid flow rate, the water flow switch will shut down the water heater.
- The water heater will operate normally once fluid flow has been re-established.



Figure 24 - water flow switch

1.8. Thermostatic Control Valve

- Tempering valve (factory adjusted)
- The Thermostatic Control Valve tempers that fluid entering the water heater to help maintain a fluid temperature of 130°F.
- The water heater cannot operate for extended periods of time with fluid entering below 130°F. Corrosive condensation can form on the combustion side of the heat exchanger and may result in perforation.



Figure 25 - thermostatic control valve



Note: If you notice a fluid temperature on the water heater return gauge lower than 130°F, adjustments may be necessary. Contact your Dealer for instructions.

1.9. Pressure Bypass Valve

- The Pressure Relief Valve (Figure 31 - control panel & water heater cabinet , item 19 on page 5-1) maintains a minimum fluid flow through the water heater as outside circuits are closed off.
- It also ensures that fluid flow through the external circuits is optimum for the number of portable heat exchangers operating.
- This valve is factory set, and does not need adjustment under normal operation.
- In the event that fluid flow is not adequate to close the flow switch, but the pump is operating and at least one external circuit is open (portable heat exchanger connected and operating), this valve may be adjusted.



Figure 26 - pressure bypass valve

- Open slowly until enough flow is present to operate the water heater and there is a difference in temperature from the return header temperature gauge and the supply fluid temperature gauge of 30°F or less.

Safety Relief Valve

1.10. Safety Relief Valve

- 60 p.s.i. ASME
- This valve opens when circuit pressures exceed 60 p.s.i.
- Although this valve is required, it has no function with the DRYAIR system. The DRYAIR system is an open fluid loop with an atmospherically vented fluid tank.



Figure 27 - safety relief valve

1.11. Drain Valve

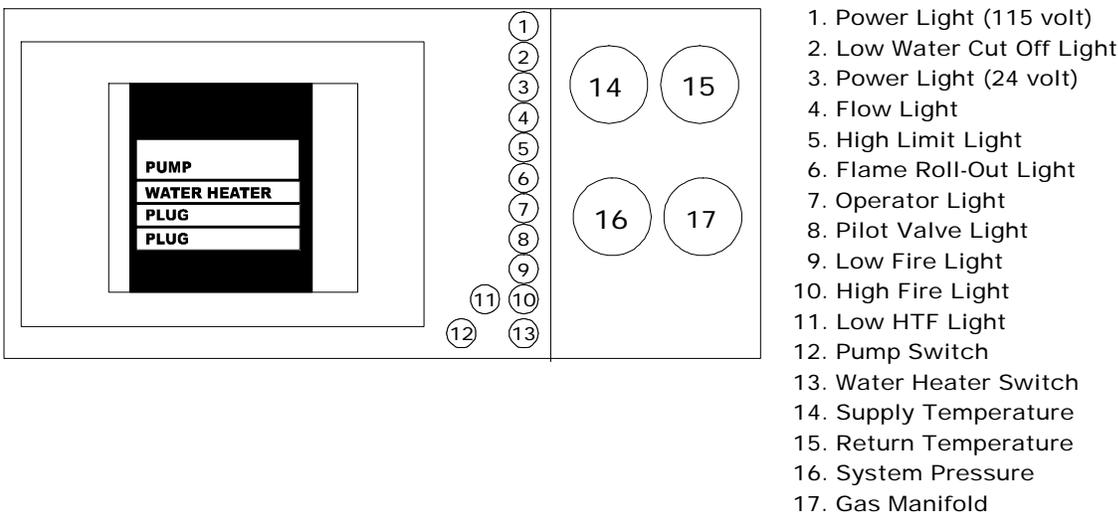
- Use the Drain Valve any time you need to remove fluid from the system for service work.
- Isolate your system by closing off the 2" Ball valves which are located on the outside of cabinet.
- Connect a garden hose to the fitting and drain the heat transfer fluid into a clean plastic container.
- By keeping the fluid clean, you can re-use it once the service work has been completed.



Figure 28 - drain valve

2. System Indicators

Figure 29 – system indicators



2.1. Indicator Lights

- There are 10 lights on the control panel. They indicate the status of a sequence of functions while the unit is running; 1) Power (115 volt) 2) Low Water Cut Off 3) Power (24 volt) 4) Flow 5) High Limit 6) Flame Roll-Out 7) Operator 8) Pilot Valve 9) Low Fire 10) High Fire
- These are not alarm lights, which indicate faults in the system. Instead they indicate that the particular component is functioning.
- The lights are positioned in the same sequence that the switches are installed in the control circuit.
- Each light indicates the status of its corresponding switch.
- By analyzing which lights are on and which lights are not, a fault can be determined quicker and easier.
- Refer to “Troubleshooting” on page 5-1 to use indicator lights for troubleshooting.
- There is a red indicator light which flashes when the system is low on heat transfer fluid.

2.2. Gauges

The DRYAIR 2000 RAYPAK water heater & system is equipped with the following gauges.

System Pressure

- Figure 29 – system indicators, item 16, on page 4-5.
- Measures the pressure of the “HTF” fluid within the water heater/”HTF” fluid circulation loop.

Manifold Gas Pressure

- Figure 29 – system indicators, item 17, on page 4-5.
- Measures the pressure of the gas at the burner manifold location.
- This pressure must be within the ranges specified on the manufacturer’s “Data Plate” (Figure 10 - system start-up, item 12, on page3-1)

Supply Temperature

- Figure 29 – system indicators, item 14, on page 4-5.
- Measures the temperature of the “HTF” fluid at the supply side of the water heater.
- The temperature must be maintained between 140°F (60°C) and 200°F (93°C).
- This temperature is adjustable utilizing the “Aquatstat”.

Return Temperature

- Figure 29 – system indicators, item 15, on page 4-5.
- This gauge reads the temperature of the “HTF” fluid at the return side of the water heater.
- This temperature must not drop below 130°F (49°C).

If you notice a fluid temperature on the “Return Temperature” gauge lower than 130°F, adjustments may be necessary. Contact your Dealer for instructions.

Portable Heat Exchanger

1. Controls

Thermostatic Control - Model 80 & 200

- The thermostatic control is adjusted with a screw driver.
- Simply adjust to the desired temperature.
- When the desired temperature is reached, the thermostatic control will shut off the fan, thus shutting down heat transfer from the coil.
- Demand for heat will re-activate the fan.



Figure 30 - thermostatic control

Troubleshooting

- There are 10 lights on the control panel, which indicate the status of a sequence of functions while the unit is running.

NOTE: SERVICE TECHNICIANS - For more troubleshooting on the water heater, refer to the "Raypak Manual" which you find included with this manual.

Water Heater & Circulation System

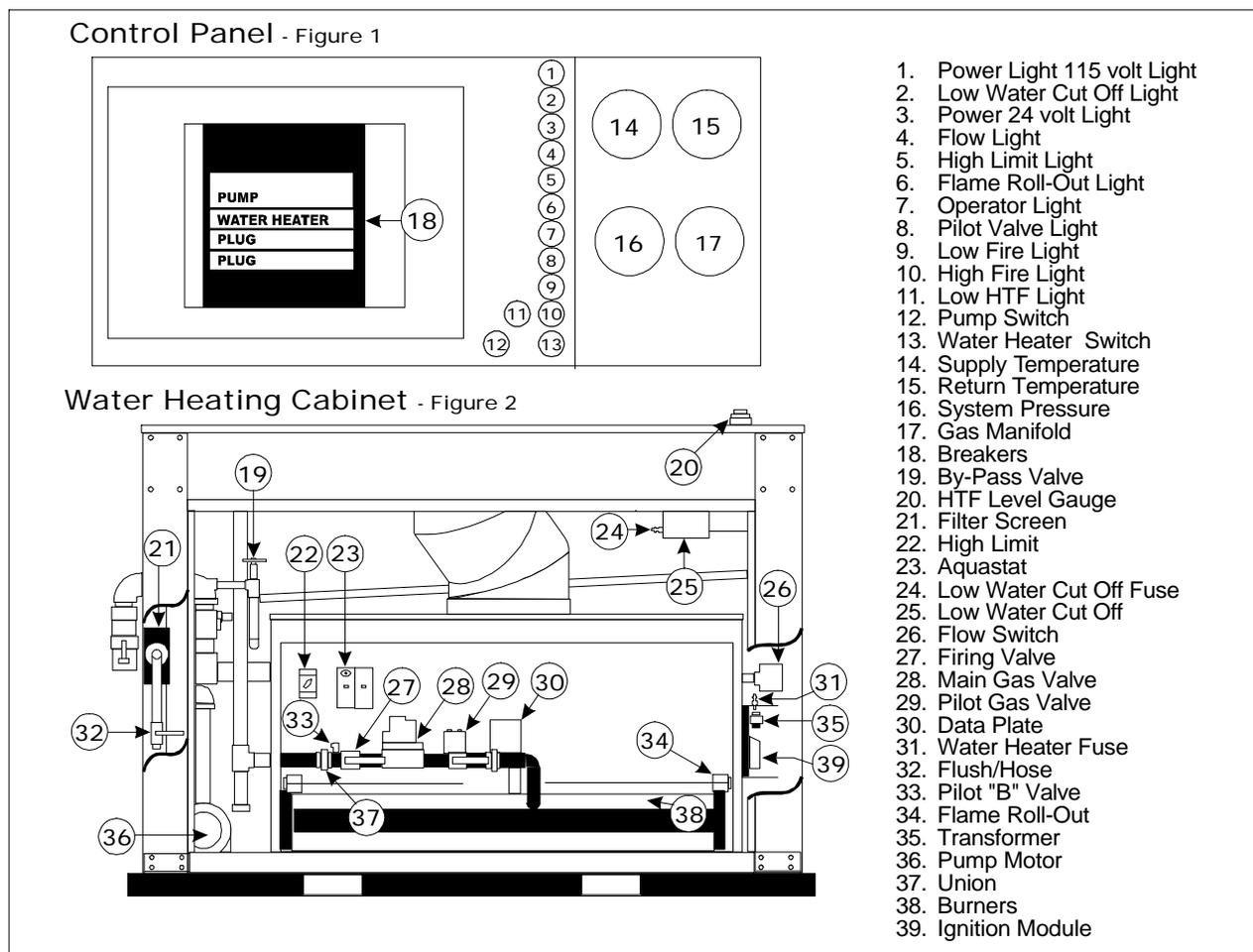


Figure 31 - control panel & water heater cabinet

1. System operating properly but one or more lights are off
One or more lights are disconnected or burnt out
 - Check lights and change if necessary.
2. No Lights On
No power at out-going side of water heater toggle switch
 - Check that the circuit breaker (item 18) for the water heater has been switched on.
 - Check that the toggle switch (item 13) for the water heater has been turned on.
 - Check that the correct power supply has been connected to the unit.
 - Investigate power source and be certain that the power characteristics are correct. (115-230 volt, 30 amp, single phase, 4-conductor, 0'-100'-10 AWG, over 100'-8 AWG)
3. On - 1, Off - 2,3,4,5,6,7,8,9,10
No power at Terminal #4 on low water cut-off (item 25)
 - Check fluid level (item 20) in fluid reservoir and add if necessary.
 - Check low water cut-off (item 25). Replace low water cut-off if defective.
 - No power at Low Water Cut-Off. Check fuse (24) located on Low Water Cut-Off.
4. On - 1,2 , Off - 3,4,5,6,7,8,9,10
No power at 24 volt side of transformer (35)
 - Check for 115 volts in and 24 volts out. If no 115 volts in check water heater toggle switch (13) and the fuse (31). If no 24 volts out, replace transformer.
5. On - 1,2,3, Off - 4,5,6,7,8,9,10
No power at out-going side of flow switch (item 19).
 - a) Pump not running.
 - Check pump breaker (item 18) and toggle switch (item 12) on control panel.
 - Check for 230 volts at pump motor (item 36). If correct power is confirmed at motor, but pump won't run, pump will have to be replaced.
 - b) Inadequate flow.
 - Check that all valves are open in the fluid-transfer loop.
 - Check filter screen (item 21) which may be plugged. Use flush hose/valve (item 32) attachment into a bucket, while pump is running, for a quick flush. Eventually the system may have to be drained and the filter screen removed and cleaned by hand.
 - Check that the pressure by-pass valve (item 19) is open, if fluid-receiving units are closed off.
 - c) Defective Flow Switch (26)

If a) and b) check out good, the flow switch will need to be re-calibrated, or replaced.
6. On - 1,2,3,4, Off - 5,6,7,8,9,10
No power at out-going side of high limit switch (22)

High limit switch (22) set too low.

 - Check setting of switch. It should be at least 10°F higher than the set point of the aqua-stat (23), but not higher than 205°F.

Defective high limit switch (22).

 - Check for 24 volts going in and out of switch. If there is power in, but not out and the switch setting is found to be correct, replace switch.

7. On - 1,2,3,4,5, Off - 6,7,8,9,10

No power at out-going side of flame roll-out switches (34).

Flame has contacted the copper capillary tubes.

- Check manual re-set buttons on the two switches and re-set. If they are tripped, restart system and watch for a flame roll-out.
- Check for blockage in the heat exchanger in the form of foreign debris or soot build up. (See operators' manual for proper cleaning procedure.)
- Check the entire vent system for possible blockage or restriction and correct any problems.

8. On - 1,2,3,4,5,6, Off - 7,8,9,10

No power at out-going side of aquastat (23) (Stage 1)

a) No call for heat.

- Check whether the temperature of the fluid is at, or above, set-point temperature. If it is above the set-point temperature, wait until the heat transfer fluid cools below the set point of the aquastat (23) to see if the switch will close and call for heat again.
- Set point of aquastat may be set too low.

b) Defective Aquastat (23).

- Verify that the scenario in a) is not the cause.
- Check for 24 volts in and out of switch. If there is power in, but no power out, replace the aquastat. (Stage 1)

9. On - 1,2,3,4,5,6,7, Off - 8,9,10

No power at pilot valve (29)

Defective Ignition Module (39)

- Check for power at terminal #3 (PV) on Ignition Module. If no 24 volts, replace Ignition Module.

10. On - 1,2,3,4,5,6,7,8, Off - 9,10

No power at main gas valve (28)

Defective Ignition Module (39)

- Check for power between terminals MV/PV and PV at main gas valve. If no 24 volts replace Ignition Module.

Pilot Failure

- If pilot has not lit but spark is present, check all manual valves in the gas line to be sure they are open, including the small pilot "B" valve (33). Verify that gas is present as far as the pilot burner. This may involve purging air from the line and checking for plugged pilot orifice.
- If no spark was present at pilot electrodes, check pilot burner for good ground. Check condition of high voltage ignition wire and clean pilot ignition electrodes.

11. On - 1,2,3,4,5,6,7,8,9, Off - 10

No power at MV on gas valve (28) Burner should be operating on low fire.

- If low fire cannot maintain set point; replace aquastat (23) (Stage 2)
- If burners are not on at all; replace main gas valve (28) or redundant valve (located to the left of the main gas valve).

12. All Lights On

The aquastat (23) is calling for heat but the burners are not operating.

Pilot failure.

- Replace main gas valve (28) or redundant valve (located to the left of the main gas valve).

Portable Heat Exchanger

1. Fan does not start

No power.

- Check that power supply is connected and breakers are on.
- Check the power connection cable (appliance cable).

2. Fans running but no heat

If fluid inlet is cold

- Check that all valves (portable heat exchanger valves and circulation system valves back to water heater) are open and fluid is circulating. If valves are closed, open valves to initiate flow. If valves are open and there is circulation but the fluid is cold, the problem is at the water heater. Refer to “Troubleshooting - Water Heater & Circulation System” on page 5-1

Fluid inlet is hot but the outlet is cold and still no heat.

- Check portable heat exchanger coil for flow obstructions. If flow is obstructed, disconnect the module from the circulation system and flush.

3. Heat transfer fluid is leaking

- Check all connection fittings and hoses. Tighten as required.
- Shut down the fan and check the coil for leaks. Replace coil if leaks are found

Maintenance



The DRYAIR 2000 is designed to be a low maintenance system. All assemblies are assembled using extensively tested and certified components. Following these maintenance procedures will ensure the maximum benefit and lowest downtime for the system.

The daily maintenance schedule is designed to be a quick system check and ensures a low risk of operating interruptions.

Daily Checklist

1. Water Heater Cabinet

1.1. Check for strong odor of gas.

- In the event of a leak or odor of gas is noticed, immediately turn off all power switches and the main gas supply to the water heater cabinet.
- Ventilate the water heater cabinet.
- Find and correct the leak before turning on any power or trying to re-light the water heater.
- Soap-test the union for leaks

1.2. Check “HTF” fluid level every day

- Top up as necessary.
- Fluid level should be as follows:
 - When using only cabinet reservoir – maintain between $\frac{1}{4}$ and $\frac{3}{4}$ on the “HTF” level gauge
 - When using an optional reservoir - maintain at $\frac{1}{2}$ full (visual reading taken through translucent optional reservoir tank)
 - For fluid specifications and handling precautions, refer to the “Fluid Specifications” and “Handling Precautions” sections on page 2-5
 - If loss of fluid is excessive, check for leaks at all fittings and connections in the water heater cabinet as well as the fluid circulation system.

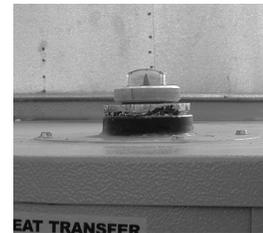


Figure 32 - “HTF” level gauge

1.3. Check the operation of the pilot and gas burner.

- For intermittent electric pilot models, verify the pilot cycles on and off normally once per day.
- On propane versions, the pilot should be on constantly.
- For natural gas models, the pilot will light only when the water heater is required to fire the burner.

1.4. Check the light panel for any limit cut-outs.

2. Portable Heat Exchangers

2.1. Check the air filter daily

- If applicable (not supplied by DRYAIR).
- Replace if a paper filter is used
- Wash if a foam washable filter is used.

2.2. Check the heat coil for cleanliness or clogging.

- Clean as required.
- Note: do not use high pressure air or water to clean the coil as this will cause damage to the coil fins.

2.3. Check all fluid fittings and connections daily.

- Tighten or replace as required.

Seasonal Checklist

1. Water Heater Cabinet

- Water Heaters operated continuously should be inspected every 6 months.
- Seasonal or intermittently operated water heaters should be inspected at the end of each operating season.
- Water heaters that have not run for more than 60 days should have a complete inspection and must be started up as if they were new.

Heat Exchanger

Water side

- Disconnect the circulation system and remove the header casting, exposing the ends of the tubes.
- Make sure they are clear of scale on the inside and there are no restrictions to fluid flow. If scale is apparent, use a stiff wire brush or mild muriatic acid solution to clean to bare metal. To prevent scale re-occurrence, check for proper water flow, and correct "HTF" fluid type and blend.

Fire side

- Remove and support the chimney, then remove the draft hood and inspect the copper fins for carbon build-up.
- If cleaning is required, remove the water heater top, inner flue cover, and burner drawer. Clean with a high pressure air gun and a SOFT NON-METALLIC brush. Carbon particles are explosive and a spark could ignite them.
- While the water heater is open, check for cracks or deterioration of the fire brick. Replace if required.
- If the tubes show signs of warping or deterioration, contact a service representative or the factory for advice. Tube warping or deterioration may be caused by low water flow or chemical corrosion (impure or non-specified Heat Transfer Fluid).

Burner and Pilot

- Turn off the gas main.
- Disconnect the pilot tubing and the thermocouple or flame sensing wire.
- Break the main gas union and pull out the burner drawer. If any parts of the burners or their retainers are damaged or worn, replace them.
- For water heaters out of service for more than 60 days, disassemble and clean the pilot with a soft brush. Make sure it is clear of any obstruction.
- For electric ignition pilots, check the spark gap (see water heater manufacturer's manual) and flame sensor.
- Check the pilot porcelain for cracks or damage.
- Check pilot ignition and sensor wires for deterioration and replace as necessary.
- Re-assemble the water heater and follow start-up instructions.

2. Circulation Pump

- The pump requires no special maintenance other than that specified in the manufacturer's pump manual provided as part of the literature package with each DRYAIR 2000 system.



Figure 33 - circulation pump

3. "Y" Strainer

- The strainer requires regular maintenance every 200 hours of operation.
- Remove the end plug from the end of the strainer outlet valve
- Position a 5 gallon container at the outlet valve.
- With the pump running, crack the strainer valve a number of times. A quick on/off action of the valve will provide the short bursts required to backwash and clean the strainer. The removal of a couple of gallons of HTF should be adequate.
- Note: Be certain not to run the reservoir empty as this would allow air to enter the system.
- The removed "HTF" fluid can be re-used. Before pouring the fluid back into the reservoir, the fluid must be filtered to remove impurities. Filtering the fluid through a cotton cloth or paper is adequate.



Figure 34 - "Y" strainer



Figure 35 - backwash & clean strainer

4. Aquastat

- Verify the operation of the aquastat by checking the temperature of "HTF" fluid leaving the water heater when the burner is off.
- Turn the aquastat set point down to the temperature noted.
- If the burner does not turn on, continue reducing the aquastat set point until the burner turns on or a "click" is heard at the aquastat housing. Note the setting of the aquastat.
- Read the temperature of the fluid once the burner turns off. If the difference between the set point and the actual temperature is more than 10°F, replace the aquastat.
- If a click is heard but the burner does not turn on, check the wiring from the aquastat to the control box, then have the main gas valve tested.



Figure 36 - aquastat

5. Water flow Switch

- Test by turning off the pump while the burner is on. The burner should immediately turn off.

6. Flame Roll-out Switch

- Test by exposing it to heat by holding a match or lighter below the capillary tube while the system is running. This should cause the system to shut down.

Storage

1. Hardware

- Exercise reasonable care when handling.
- Water heater cabinet can be stored outdoors
- Portable heat exchangers should be stored out of the elements.

2. Hose & Poly

- To extend the life of the rubber and poly components of the system, (hoses and air tubes), it is recommended that they be stored out of the sun when not in use.

3. Heat Transfer Fluid

- Exercise reasonable care when handling.
- Be careful not to spill on hot fibrous insulation. Combustion may occur.

Safety Concerns

General Safety Guidelines

- Make certain that the operator reads and understands all the information in this manual.
- All unauthorized people must be kept away from the equipment when in operation.
- Maintain instructional and safety decals. Replace damaged decals.
- All guards must be in place when the equipment is in operation.

Water Heater Module

CAUTION! The water heater is a heating appliance.

- When dealing with any heating appliance, observe all posted warnings and cautions.
- Keep children and pets away from all piping and fuel accessories.
- The water heater housing panels must be kept closed when the system is operating. This prevents drafts from affecting water heater operation.

Heat Transfer Fluid

Follow the following precautions and measures when working with “heat transfer fluid” (“DOWFROST* HTF” & “BOSS CHILL PG”).

Fluid handling precautions

- Ventilation..... Good general ventilation should be sufficient for most conditions.
- Respiratory protection..... No respiratory protection should be needed.
- Skin protection For brief contact, no precautions other than clean body-covering clothing should be needed.
..... Use impervious gloves when prolonged or frequently repeated contact should occur.
- Eye Protection Use safety glasses.

First aid measures

- Eyes..... Flush eyes with plenty of water.
- Skin Wash off in flowing water or shower.
- Ingestion Induce vomiting if large amounts are ingested.
..... Consult medical personnel.
- Inhalation Remove to fresh air if effects occur.
..... Consult a physician.
- Note to physician No specific antidote.
..... Supportive care.
..... Treatment based on judgment of the physician in response to reactions of the patient.

For complete “heat transfer fluid” information, refer to the Material Safety Data Sheets for “Dowfrost HTF” & “Boss Chill PG” on the following page.

Material Safety Data Sheet

BOSS CHILL PG

MSDS

Canadian Centre for Occupational Health and Safety

Issue: 2001-4 (November, 2001)

MATERIAL SAFETY DATA

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Product Name: PROPYLENE GLYCOL INDUSTRIAL
Product Code: 70511
Effective Date: 03/23/03 Date Printed 10/09/03 MSD: 000248
Company Identification: The Dow Chemical Company, Midland, MI 48674
Emergency Telephone Number: 24-HOUR EMERGENCY PHONE NUMBER 989-636-4400
Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Propylene glycol CAS# 000057-55-6 99%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Colorless, odorless liquid. Toxic fumes released in fire situations.
POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)
EYE: May cause slight transient eye irritation. Corneal injury is unlikely. Mists may cause eye irritation.
SKIN: Prolonged contact is essentially nonirritating to skin. A single prolonged skin exposure is not likely to result in the material being absorbed through skin in harmful amounts. Repeated exposures may cause flaking and softening of skin. May be absorbed in potentially harmful amounts when applied in large quantities to severe burns (second or third degree) over large areas of the body as part of a cream or other topical application. Absorption under such circumstances can elevate serum osmolality and may result in osmotic shock.
INGESTION: Single dose oral toxicity is considered to be extremely low. No hazards anticipated from swallowing small amounts incidental to normal handling operations.
INHALATION: At room temperature, vapors are minimal due physical properties. Mists may cause irritation of upper respiratory tract.
SYSTEMATIC: (OTHER TARGET ORGAN) EFFECTS: Repeated excessive ingestion may cause central nervous system effects.
CANCER INFORMATION: Did not cause cancer in long-term animal studies.
TERATOLOGY (BIRTH DEFECTS):..... Birth defects are unlikely. Exposures having no adverse effects on the mother should have no effect on the fetus.
REPRODUCTIVE EFFECTS: In animal studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYE: Flush eyes with plenty of water.
SKIN: Wash off in flowing water or shower.
INGESTION: No adverse effects anticipated by this route of exposure incidental to proper industrial handling.
INHALATION:..... Remove to fresh air if effects occur. Consult a physician
NOTE TO PHYSICIAN: ...No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

FLASH POINT:.....218°F, 103°C
METHOD USED:PMCC
FAMMABLE LIMITS.....LFT: 2.6%
UFL: 12.5%

HANZARDOUS COMBUSTION PRODUCTS: During a fire, smoke may contain the original material in addition to unidentified toxic and/or irritating compounds. Hazardous combustion products may include and are not limited to: aldehydes, carbon monoxide.

OTHER FLAMMABLITY INFORMATION: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Spills of these organic liquids on hot fibrous insulations may lead to lowering of the auto ignition temperatures possibly resulting in spontaneous combustion.

EXTINGUISHING MEDIA: Water fog or fine spray, carbon dioxide, dry chemical, foam. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Do not use direct water stream. Will spread fire.

MEDIA TO BE AVOIDED: Do not use direct water stream.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire-fighting clothing (including fire-fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURE (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Isolate area.

PROTECT THE ENVIRONMENT: Contain liquid to prevent contamination of soil, surface water or ground water.

CLEANUP: For small spills, clean up with absorbent material. Collect material in suitable and properly labeled open containers. For large spills, dike and pump into suitable and properly labeled containers.

7. HANDLING AND STORAGE

HANDLING: Product handled hot may require additional ventilation or local exhaust. Product on surfaces can cause slippery conditions.

STORAGE: Keep containers tightly closed when not in use. Store in stainless steel, aluminum, Plasite 3066 lined containers or 316 stainless steel. Store below 121°C, 250° F.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTOLS: Provide general and/or local exhaust ventilation to control airborne levels below exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use safety glasses. Safety glasses should be sufficient for most operations; however, for misty operations wear chemical goggles.

SKIN PROTECTION: For brief contact, no precautions other than clean body-covering clothing should be needed. Use impervious gloves when prolonged or frequently repeated contact could occur.

REPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiration protection is required for certain operations, use an approved air-purifying respirator. In misty atmospheres, use an approved mist respirator.

EXPOSURE GUILDLINE(S): Propylene glycol: AIHA WEEL is 50 ppm total, 10 mg/m³ aerosol only.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless liquid

ODOR:..... Odorless

VAPOR PRESSURE: 0.08 mmHg @ 20°C, 68°F

VAPOR DESITY: 2.62

BOILING POINT: 370°F, 188°C

SOLUNILITY IN WATER: . Complete

SPECIFIC GRAVITY: 1.038 @ 20/20°C, 68°F

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.

CONDITIONS TO AVOID: Avoid temperatures above 121°C/250°F. Product can decompose at elevated temperatures.

INCOMPATIBILITY WITH OTHER MATERIALS: Avoid contact with oxidizing materials.

HAZAROUS DECOMPOSITION PRODUCTS: When available oxygen is limited, as in a fire or heated to very high temperatures by hot wire or plate, carbon monoxide and other hazardous compounds such as aldehydes might be generated,

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in section 1)

SKIN: the LD50 for skin absorption in rabbits is greater than 10,000 mg/kg.

INGESTION: The oral LD50 for Female rats is about 20,000-34,000mg/kg.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): Results of in vitro (test tube) mutagenicity tests have been negative. Results of mutagenicity tests in animals have been negative.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT AND PARTITIONING: Based largely or completely on information for similar material (s), i.e. propylene glycol. Bioconcentration potential is low (BCF less than 100 or Log Pow less than 3).

DEGRATION AND PRESISTENCE: Based largely or completely on information for similar material (s), i.e. propylene glycol. Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD greater than 40%).

ECOTOXICITY: Based largely or completely on information for similar material (s), i.e. propylene glycol. Material is practically non-toxic to aquatic organisms on an acute basis (LC50 greater than 100 mg/L in most sensitive species).

13. DISPOSAL CONSIDERATION (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESS OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information on Ingredients).

FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: recycler, reclaimer, incinerator or waste water treatment system.

As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Centre at (800) 258-2436 or (517) 832-1556 for further details.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORT:

This product is not regulated by D.O.T. when shipped domestically by land

CANADIAN TDG INFORMATION:

For TDG regulatory information, if required, consult transportation regulations, product shipping papers, or your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive—selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specified information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA

Title III) and is considered, under applicable definitions, to meet the following categories: Not to have met any hazard category.

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

REGULATORY INFORMATION:

<u>CHEMICAL NAME</u>	<u>CAS NUMBER</u>	<u>LIST</u>
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1, 2-PROPANEDIOL	00057-55-6	PA1
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PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

CANADIAN REGULATIONS

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) classification for this product is: This product is not a "Controlled Product" under WHMIS.

16. OTHER INFORMATION

MSDS STATUS: Revised Section 13, Disposal.

* or ® Indicates a Trademark of The Dow Chemical Company

The Information Herein Is Given In Good Faith, But No Warranty, Express or Implied, Is Made. Consult The Dow Chemical Company For Further Information.

Material Safety Data Sheet

DOWFROST* HEAT TRANSFER FLUID

MSDS

Canadian Centre for Occupational Health and Safety

Issue: 05/09/2002

Received: 09/10/2003

*****MATERIAL SAFETY DATA*****

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

PRODUCT NAME: DOWFROST* HEAT TRANSFER FLUID
MSDS#: 1376
EFFECTIVE DATE: 05/09/2002
COMPANY IDENTIFICATION: The Dow Chemical Company, Midland, MI 48674
EMERGENCY TELEPHONE NUMBER: 24-HOUR EMERGENCY TELEPHONE NUMBER: (989)636-4400
Customer Information Number: 1-800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Propylene glycol	CAS# 000057-55-6	> 99%
Demineralized water	CAS# 007732-18-5	< 5%
Dipotassium hydrogen phosphate	CAS#007758-11-4	< 5%

3. HAZARDS DENTRIFICATION

EMERGENCY OVERVIEW: Colorless, liquid, mild odor. No significant hazards for emergency response are known.

POTENTIAL HEALTH EFFECTS: (See Section 11 for toxicological information and additional information about potential health effects.)

EFFECTS OF SINGLE ACUTE OVEREXPOSURE

INHALATION: At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of upper respiratory tract (nose and throat).

EYE CONTACT: May cause slight temporary eye irritation. Corneal injury is unlikely.

SKIN CONTACT: Prolonged contact is essentially nonirritating to skin. Repeated contact may cause flaking and softening of skin.

SKIN ABSORPTION: Prolonged skin contact is unlikely to result in absorption of harmful amounts.

SWALLOWING: Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts

POTENTIAL ENVIRONMENTAL EFFECTS (See Section 12 for Ecological Information)

4. FIRST AID

INHALATION: Move person to fresh air; if effects occur, consult a physician.

EYE: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effect occur, consult a physician, preferably an ophthalmologist.

SKIN: Wash skin with plenty of water

INGESTION: No emergency medical treatment necessary.

NOTE TO PHYSICIAN: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the condition of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES (Refer to section 9, PHYSICAL AND CHEMICAL PROPERTIES)

EXTINGUISHING MEDIA: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Do not use direct water stream. May spread fire. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

FIRE FIGHTING PROCEDURES: Keep people away. Isolate fire area and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from a protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with

water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire-fighting clothing (including fire-fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Liquid mist of this product can burn. Flammable concentrations of vapor can accumulate at temperatures above flash point; see Section 9.

HAZARDOUS COMBUSTION PRODUCTS: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

6. ACCIDENTAL RELEASE MEASURE

SMALL SPILLS: Absorb with materials such as: cat litter, sawdust, vermiculite, Zorb-all. Collect in suitable and properly labeled containers.

LARGE SPILLS: Dike area to contain spill. Recover spilled material if possible. See Section 13, Disposal Considerations for additional information.

PERSONAL PRECAUTIONS: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

ENVIRONMENTAL PRECAUTIONS: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

7. HANDLING AND STORAGE

HANDLING

GENERAL HANDLING: See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

VENTILATION: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

OTHER PRECAUTIONS: Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

STORAGE: 121°C (250° F). Do not store in: galvanized steel.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

EXPOSURE LIMITS

<u>COMPONENT</u>	<u>EXPOSURE LIMITS</u>	<u>SKIN FORM</u>
Propylene glycol	10mg/m3 TWA8 AIHA WEEL	Aerosol
	50 ppm TWA8 AIHA WEEL	Total Particulate fume

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

PERSONAL PROTECTION

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline.

PROTECTION: When respiratory protection is required for certain operations, use an approved air-purifying respirator. In dusty or misty atmospheres, use an approved particulate respirator.

EYE PROTECTION: Use safety glasses.

OTHER PROTECTIVE EQUIPMENT: No precautions other than body-covering clothing should be needed. Use gloves chemically resistant to this material.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE:Liquid

APPEARANCE:.....Colorless

ODOR:Mild

FLASH POINT - Closed Cup:102°C 216°F Tag closed cup ASTM D 56 (Propylene glycol)

FLAMMABLE LIMITS IN AIR: Lower 2.6%(V) 100°C (Propylene glycol)

.....Upper 12.5%(V) 130°C (Propylene glycol)

AUTOIGNITION TEMP:416°C 780°F

VAPOR PRESSURE:0.7 mmHg @ 20°C, 68°F

BOILING POINT (760 mmHg): 162°C (323°F)

VAPOR DENSITY (air=1):.....2.6

SPECIFIC GRAVITY (H2O=1):1.05 20°C/20°C

FREEZING POINT:<=-51°C <=-60°F

MELTING POINT:.....*Not applicable (for liquids)*

SOLUBILITY IN WATER (by weight): 100% 20°C

pH:.....9-11 (5% solution in water)

EVAPORATION RATE (Butyl Acetate=1): 0.07
PERCENT VOLATILES:.....98 Wt%

10. STABILITY AND REACTIVITY

STABILITY/INSTABILITY: Thermally stable at recommended temperatures and pressures.

CONDITIONS TO AVOID: Product can oxidize at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems

INCOMPATIBLE MATERIALS: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

THERMAL DECOMPOSITION: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aldehydes. Alcohols. Ethers.

HAZARDOUS POLYMERIZATION: Will not occur

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY:

Peroral: Rat; female; LD50 = 20300 mg/kg

Percutaneous: Based on information for a similar material:

Rabbit; LD50 = > 10000 mg/kg

DEVELOPMENT TOXICITY: Contains component(s) which did not cause birth defects or any fetal effects in lab animals., The component(s) is/are: propylene glycol.

REPRODUCTIVE TOXICITY: Contains component(s) which did not interfere with reproduction in animal studies., Contains component(s) which did not interfere with fertility in animal studies., The component(s) is/are: Propylene glycol.

CHRONIC TOXICITY AND CARCINOGENICITY: Similar formulations did not cause cancer in laboratory animals.

GENETIC TOXICOLOGY:

In Vitro: In Vitro mutagenicity studies were negative.

In Vivo: Mutagenicity studies in animals were negative for component(s) tested

SIGNIFICANT DATA WITH POSSIBLE RELEVANCE TO HUMANS: In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE: Based largely or completely on information for: Propylene glycol. Material is readily biodegradable.

Passes OECD test(s) for ready biodegradability. Degradation is expected in the atmospheric environment within minutes to hours.

ECOTOXICITY: Based largely or completely on information for: Propylene glycol. Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50 . 100mg/L in most sensitive species tested).

FURTHER INFORMATION: Based largely or completely on information for: Propylene glycol. Bioconcentration potential is low (BCF < 100 or Log Pow < 3). Potential for mobility in soil is very high (Koc between 0 and 50).

13. DISPOSAL CONSIDERATION (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESS OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information on Ingredients). FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: recycler, reclaimer, incinerator or other thermal destructive device. As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Centre at 1-800-258-2436 or 0-989-832-1556 (U.S.), or 1-800-331-6451 (Canada) for further details.

14. TRANSPORT INFORMATION

NON-BULK Proper Shipping Name: NOT REGULATED

BULK Proper Shipping Name: NOT REGULATED

The information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transportation organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION (Not meant to be all-inclusive—selected regulations represented)

FEDERAL/NATIONAL

OSHS Hazard Communication Standard

This product is not a “Hazardous Chemical” as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right To Know Act) Section 313
To the best of our knowledge this product does not contain chemicals at levels which require reporting under this statute.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right To Know Act) Section 302
To the best of our knowledge this product does not contain chemicals at levels which require reporting under this statute.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right To Know Act) Section 311 & 312

Delayed (Chronic) Health Hazard:	NO
Fire Hazard:	NO
Immediate (Acute) Health Hazard:	NO
Reactive Hazard:	NO
Sudden Release of pressure Hazard:	NO

Toxic Substance Control Act (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements.

CEPA - Domestic Substances List (DSL)

to All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

European Inventory of Existing Commercial Chemical Substances (EINECS)

The components of this product are on the EINECS inventory or are exempt from EINECS inventory requirements.

STATE/LOCAL

Pennsylvania (Worker and Community Right To Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:
The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

COMPONENT	CAS#	AMOUNT
Propylene glycol	57-55-6	96.0000 %

Pennsylvania (Worker and Community Right To Know Act): Pennsylvania Special Hazardous Substances List:
To the best of our knowledge this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
This product contains no listed substances known to the State of California to cause cancer, birth defects of other reproductive harm, at levels which would require a warning under the statute.

California SCAQMD Rule 443.1 (South Coast Air Quality Management District Rule 443.1, Labeling of Material Containing Organic Solvents).

VOC: Vapor pressure 0.66 mmHg @ 20°C
1002 g/l VOC
1030 g/l less water and less exempted solvents

This section provides selected regulatory information on this product including its components. This is not intended to include all regulations. It is the responsibility of the user to know and comply with all applicable rules, regulations and laws relating to the product being used.

16. OTHER INFORMATION

ADDITIONAL INFORMATION

Additional information on this and other Dow products may be obtained by visiting our web page at www.dow.com.
Additional information on this product may be obtained by calling Dow’s Customer Information Group at 1-800-258-2436 (U.S.) or 1-800-331-6451 (Canada)

HAZARD RATING SYSTEM

NFPA rating for this product are: H - 0 F - 0 R - 0
The ratings are part of a specific hazard communication program and should be disregarded where individuals are not trained in the use of this hazard rating system. You should be familiar with the hazard communication programs applicable to your workplace.

RECOMMENDED USES AND RESTRICTIONS

Intended as a heat transfer fluid for closed-loop systems. Dow recommends that you use this product in a manner consistent with the listed use. If your intended use is not consistent with Dow’s Stated use, please contact Dow’s Customer Information Group at 1-800-258-2436 (U.S.) or 1-800-331-6451 (Canada) for more information.

REVISION

Version: 4.1
Revision: 05/09/2002
Most recent revision(s) are noted by the bold, double bars in the left-hand margin throughout this document.

LEGEND

Bacteria/NA	Non Acclimated Bacteria
F	Fire
H	Health
IHG	Industrial Hygiene Guidelines
N/A	Not available
NFPA	National Fire Protection Association
O	Oxidizer
R	Reactivity
TS	Trade secret
VOL/VOL	Volume/Volume
W	Water reactive
W/W	Weight/Weight

NOTICE: Dow urges each customer or recipient of this MSDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this MSDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that its activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of Dow, it is the buyer's/user's duty to determine the condition necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific MSDSs, Dow is not and cannot be responsible for MSDSs obtained from any source other than Dow. If you have obtained a Dow MSDS from a non-Dow source or if you are not sure that a Dow MSDS is current, please contact Dow for the most current version.

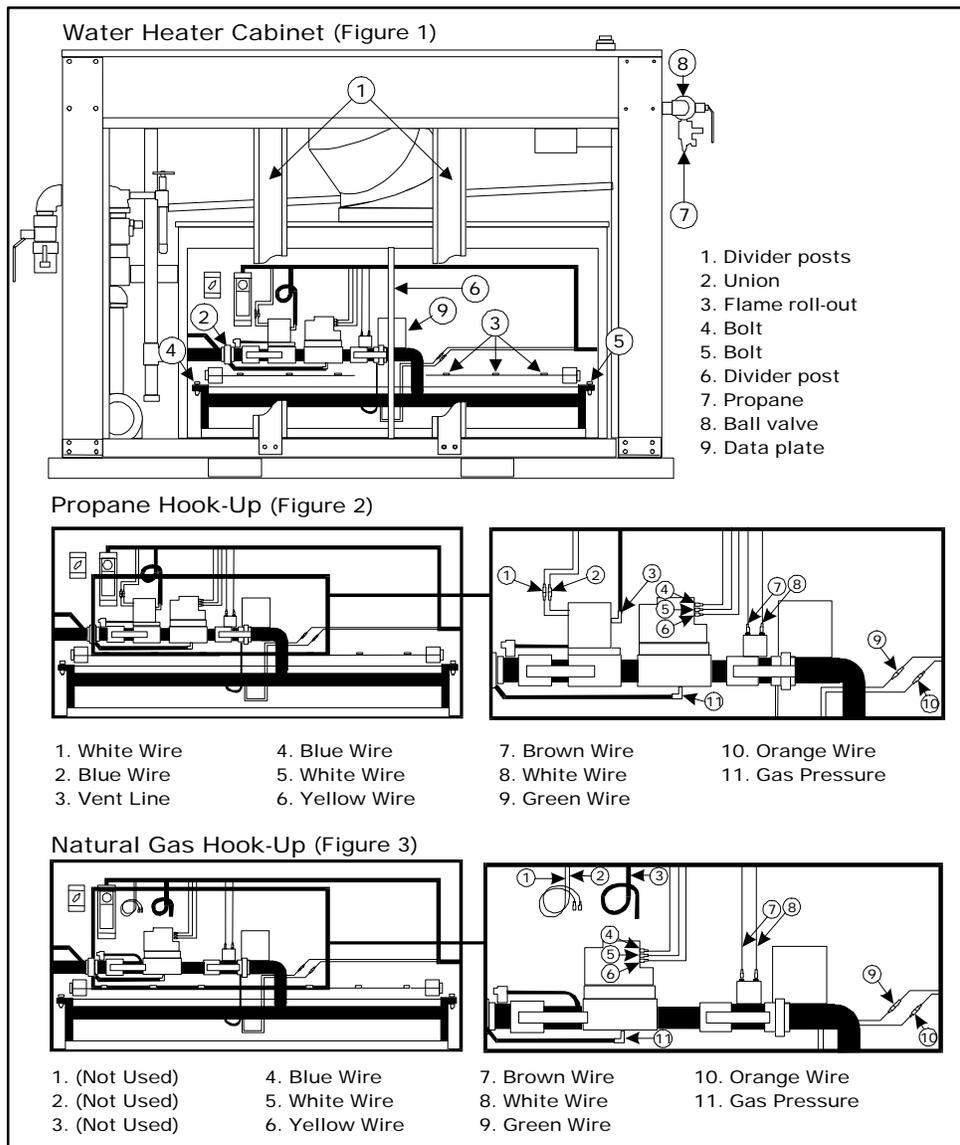
Appendum

Fuel Conversion

Canada

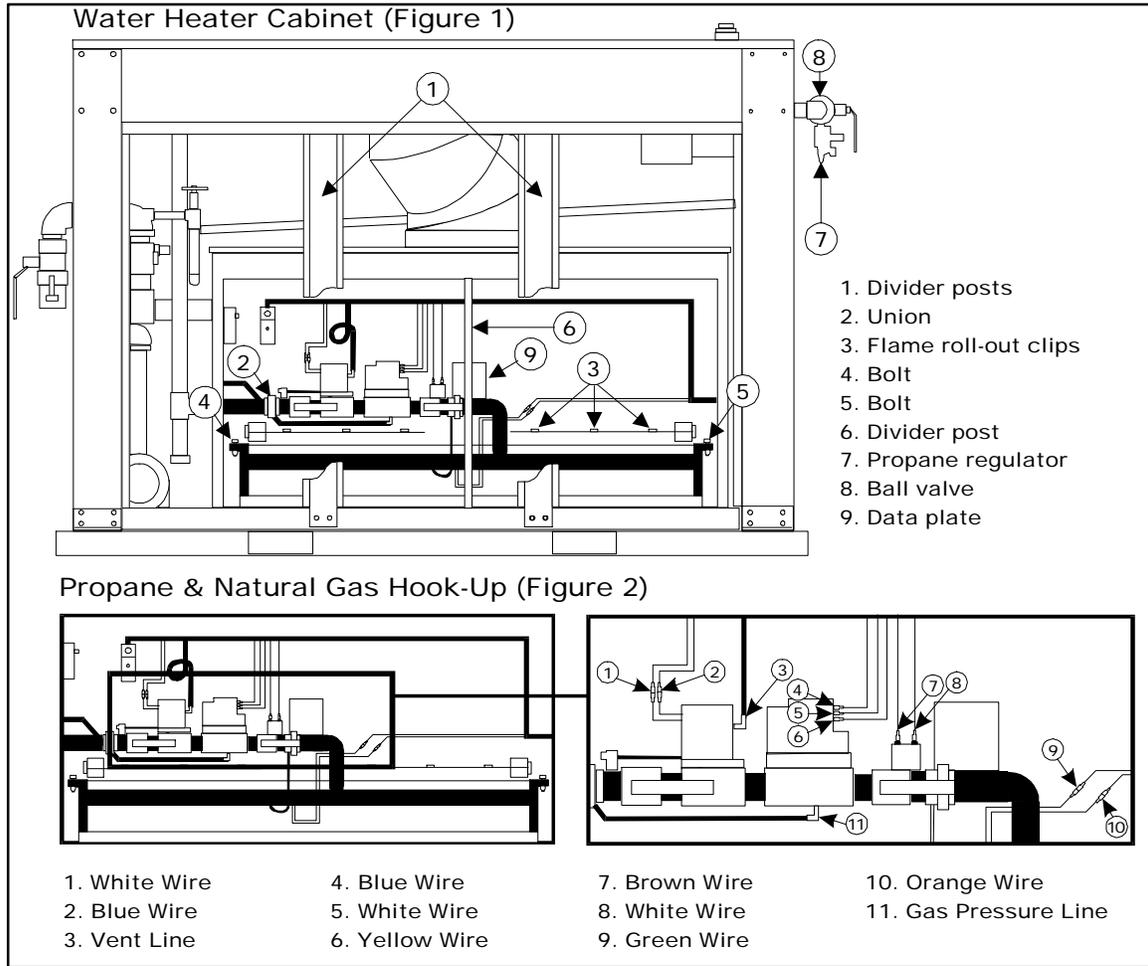
For safety and proper operation of the system, it is imperative that the following conversion procedures be followed.

Figure 37 - burner tray conversion - Canada



United States

Figure 38 - burner tray conversion – United States



1. Gas Connection

For licensed gas tradesman

Natural gas to Propane conversion - propane gas regulator valve mounts at location (refer to

- Figure 37 - burner tray conversion, item 7, on page 1).
- For fuel requirements, refer to “Fuel ” on page 2-2 of the “Dryair Operation & Maintenance Guide”.

Important! Any work on natural gas and propane fuel lines must be performed by a licensed gas tradesman, and must conform to all local gas codes for water heater appliance installations. Refer to “Fuel on page 2-2 of the “Dryair Operation & Maintenance Guide” for system requirements.



2. Removing and Re-installing Burner Tray

For item references from this section, see;

- “*Figure 38 - burner tray conversion – United States*” on page 8-1

- “*Figure 38 - burner tray conversion – United States*” on page 8-2

2.1. Check that all conversion kit components are accounted for.

Natural Gas to Propane Kit

- 1) One storage box
- 2) One propane burner tray - check data plate (figure 1, item 9) to confirm burner tray specs
- 3) One step down, external mounted, propane gas regulator valve (figure 1, item 7)
- Valve should be adequate to reduce inlet pressures (tank to module) from 8 P.S.I down to the water heater requirements of 11”WC.

Propane to Natural Gas Kit

- 1) One storage box,
- 2) One natural gas burner tray - check data plate (figure 1, item 9) to confirm burner tray specs.

2.2. The burner/gas train will be removed as a complete assembly.

- It includes manufacturer’s data decal, manifold, orifices, burners, pilot burner assembly, 2-stage natural or propane valve, diaphragm firing valve on propane units only, shut off “A” valve and pilot “B” valve. The diaphragm firing valve will be utilized on both gas trains on the U.S. Models.
- The alternate burner/gas train will be installed as a similar complete assembly.

2.3. The following components must be removed in order to access the burner/gas train.

- Three (3) exterior doors on the front side of the cabinet. (Remove shipping screws)
- Two (2) interior doors. (Remove shipping screws)
- Two (2) divider posts (figure 1, item 1) between exterior doors. 2 bolts at the top & 2 bolts at the bottom will need to be removed.
- One (1) divider post (figure 1, item 6) between interior doors. Exert upward pressure and this post will pop out.

2.4. Make sure that the power supply to the system is disconnected.

2.4.1. The following wire connectors can now be unhooked: (make note of the location to which each terminal is connected)

- The orange ignition cable (figure 2 & 3, item 10) and green ground wire (figure 2 & 3, item 9) which lead down to the pilot assembly.
- The three (3) clip-on connectors (figure 2 & 3, item 4, 5 & 6) that connect wires to the main 2-stage gas valve.
- The two (2) clip-on connectors (figure 2 & 3, items 1 & 2), that connect wires to the diaphragm valve. This valve will be present if the gas train is for propane. If it is a natural gas train, these 2 wires will not be connected to anything. The diaphragm firing valve will be utilized on both gas trains on the U.S. Models.
- The two (2) clip-on connectors (figure 2 & 3, items 7 & 8), that connect wires to the pilot valve.

2.5. Make sure that the gas supply to the system is disconnected.

2.6. The following gas pipe/tube connections can now be unhooked. (Be certain to use a back-up wrench when loosening or re-tightening fittings)

- The 1 ¼” steel union (figure 1, item 2), which connects the main gas supply.
- The ¼” tubing (figure 2 & 3, item 11) which is connected to the outlet port on the under-side of the 2-stage gas valve. You will have to remove the angle compression fitting for use on the alternate gas train. Make note of the port in which this fitting was installed.

- The ¼” tube (figure 2 & 3, item 3) which is connected to the ventilation port of the diaphragm valve. This diaphragm valve will be present only if the existing gas train is propane. If the existing gas train is natural gas, this ¼” tube will not be connected to anything, but you will need to connect it when you install the propane gas train. The diaphragm firing valve will be utilized on both gas trains on the U.S. Models.

Note: CSD1-G6 and CSD1-G5 – Verify that the low and high pressure switches are set properly.

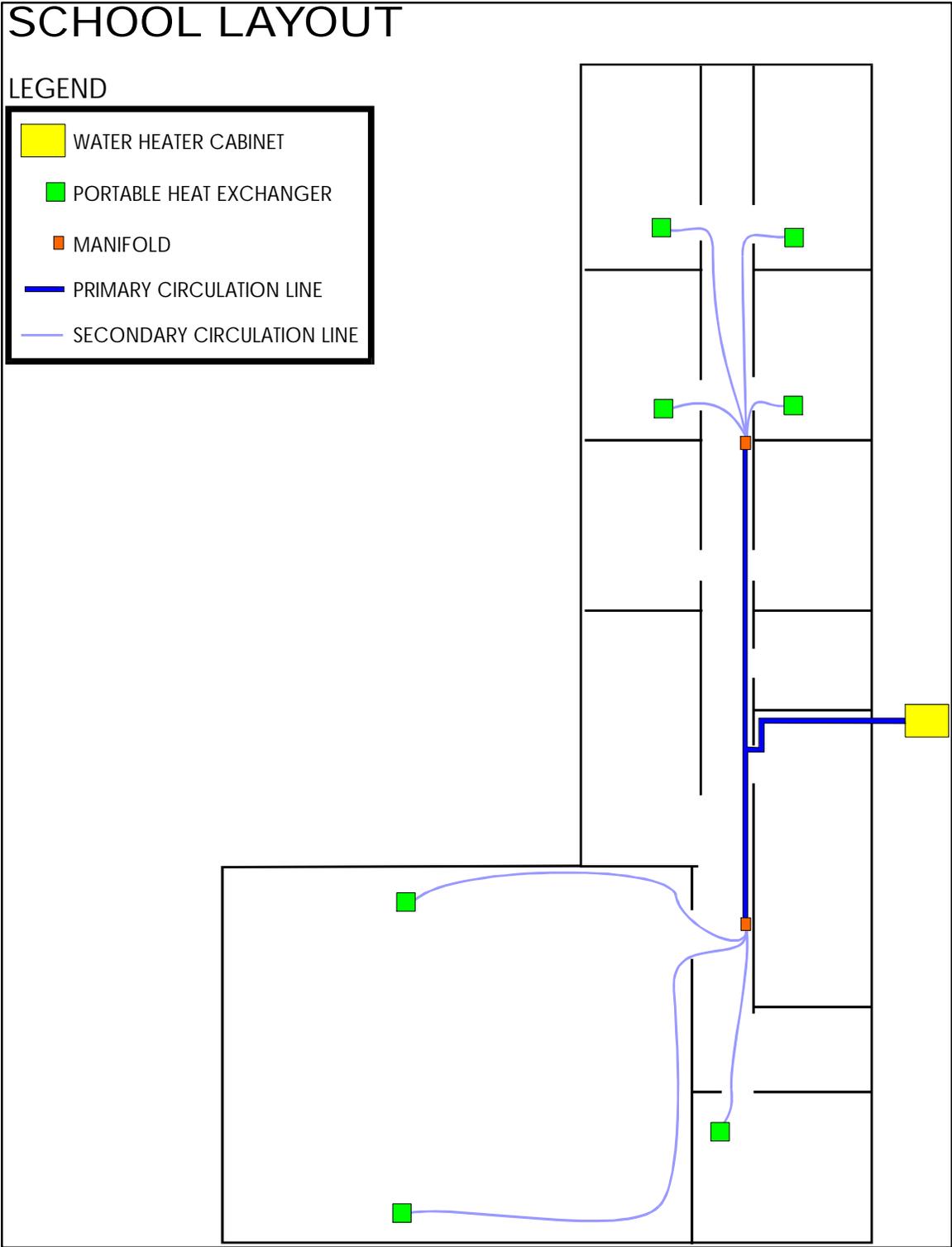
Natural Gas – Low - 3 High – 5.3

Propane – Low – 8 High – 14.5

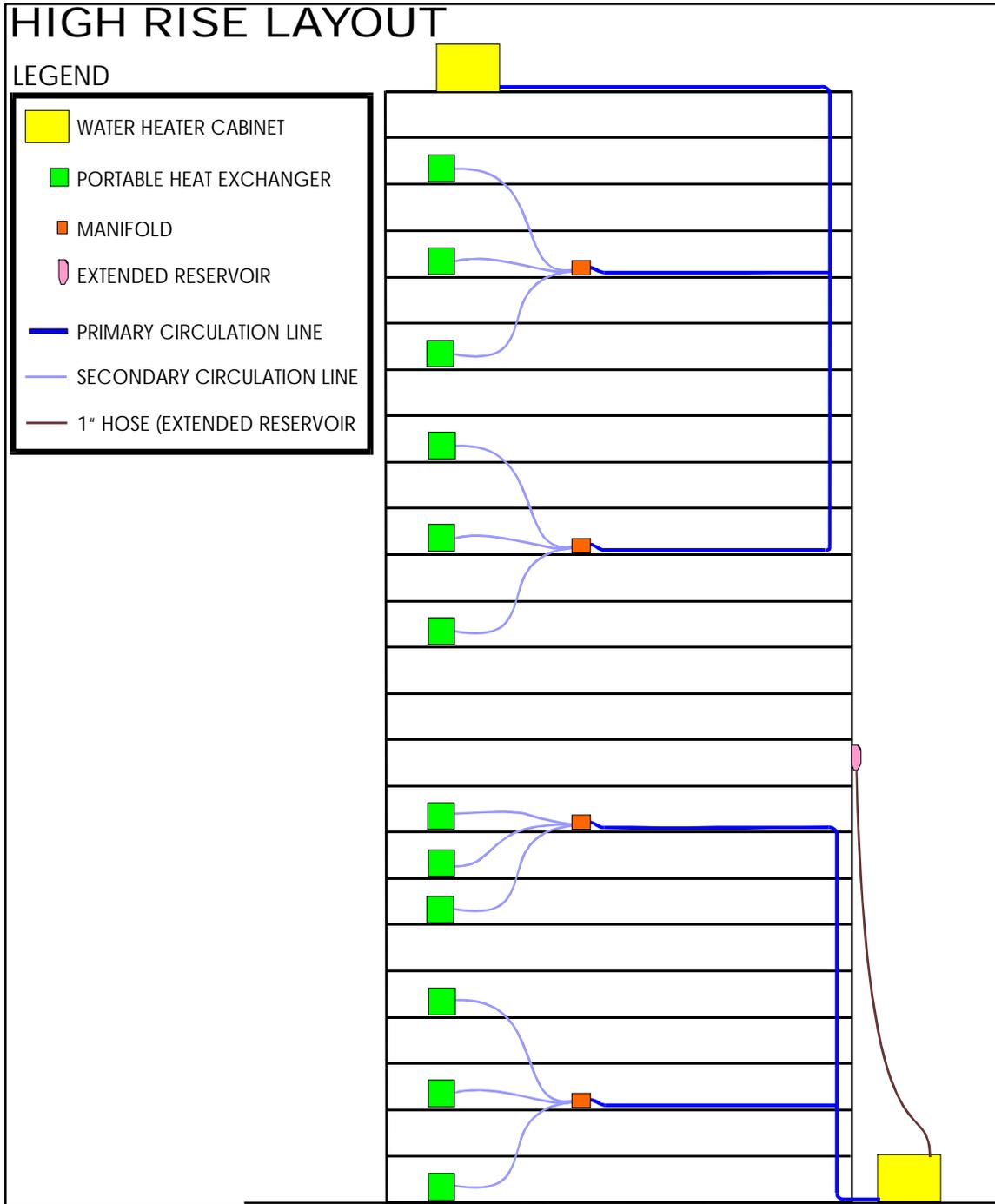
- 2.7. There is one bolt (figure 1, item 4 & 5) at each end of the burner tray frame that must be removed.
- 2.8. The entire burner/gas train can now be easily slid out. Store in a safe, dry place.
- 2.9. The alternate burner/gas train can now be installed by reversing the above procedures.
- 2.10. Observe the following details as well:
 - Be certain the burner/gas train you are about to install is the correct format for the gas type you intend to use.
 - Use an approved grade of thread sealant when installing gas fittings. Soap-test all connections for leaks.
 - Test-run the system to confirm the proper function of all operating and safety controls.
 - Observe all permit and inspection processes as required by the local authority having jurisdiction.

Site Layouts

Example 1



Example 2

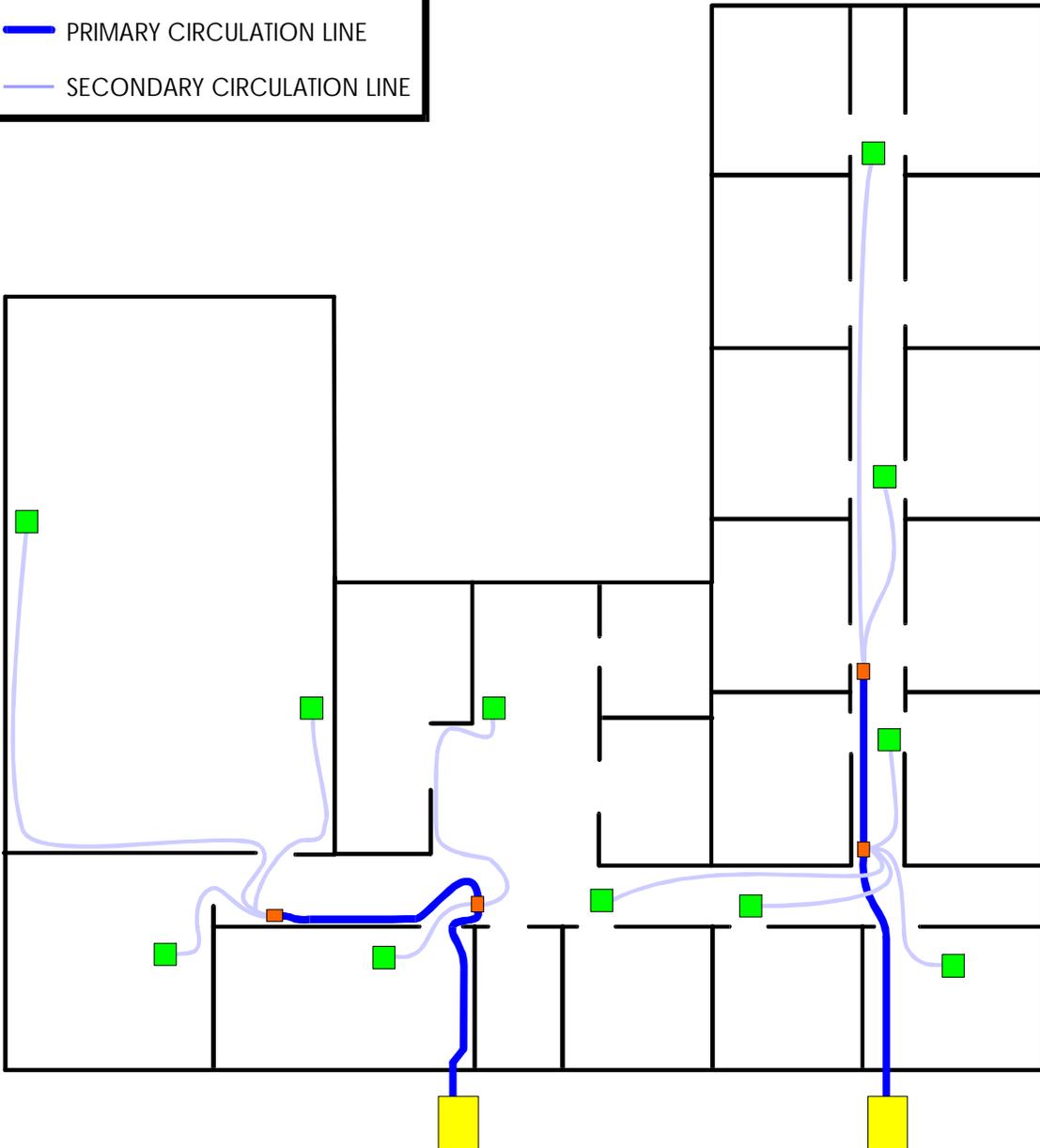


Example 3

LARGE STRUCTURE LAYOUT

LEGEND

	WATER HEATER CABINET
	PORTABLE HEAT EXCHANGER
	MANIFOLD
	PRIMARY CIRCULATION LINE
	SECONDARY CIRCULATION LINE

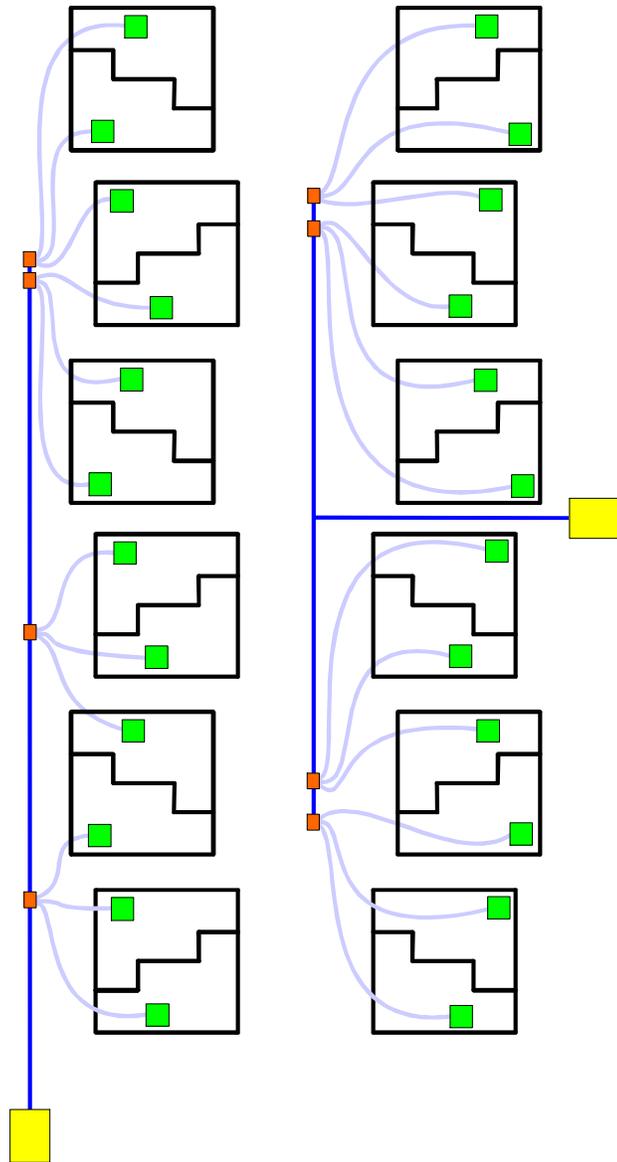


Example 4

TOWN HOUSE LAYOUT

LEGEND

	WATER HEATER CABINET
	PORTABLE HEAT EXCHANGER
	MANIFOLD
	PRIMARY CIRCULATION LINE
	SECONDARY CIRCULATION LINE



Electrical Diagrams

Figure 39 – electrical - water heater cabinet

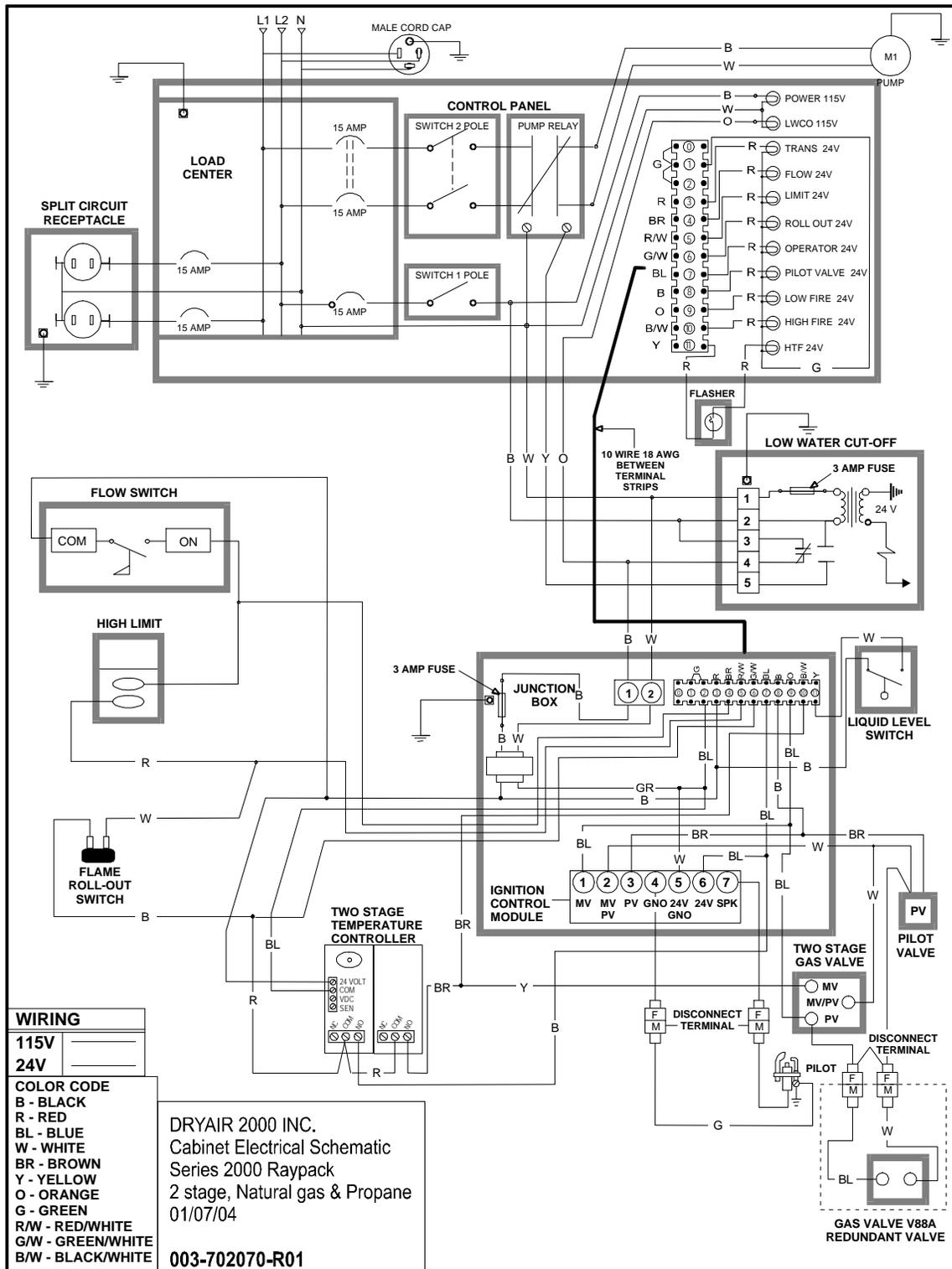


Figure 40 – electrical - portable heat exchanger – 80 & 200 model

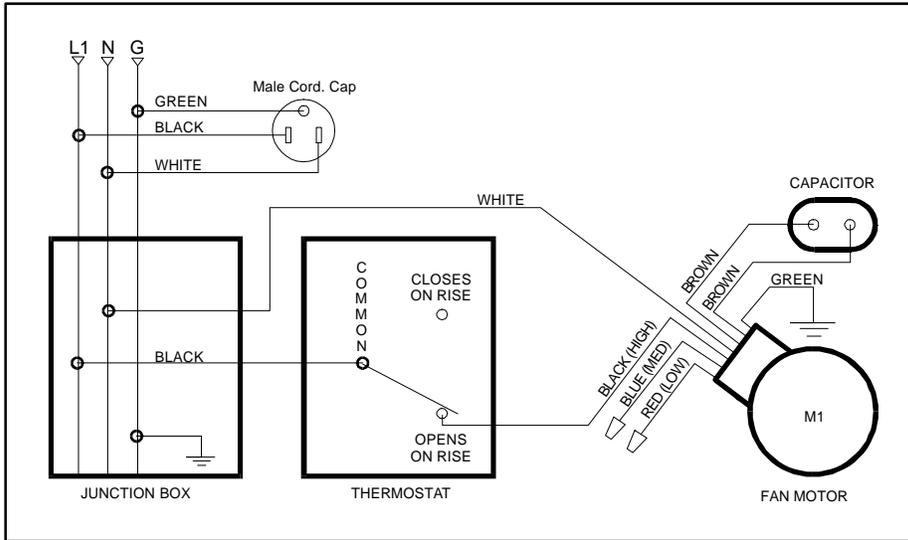
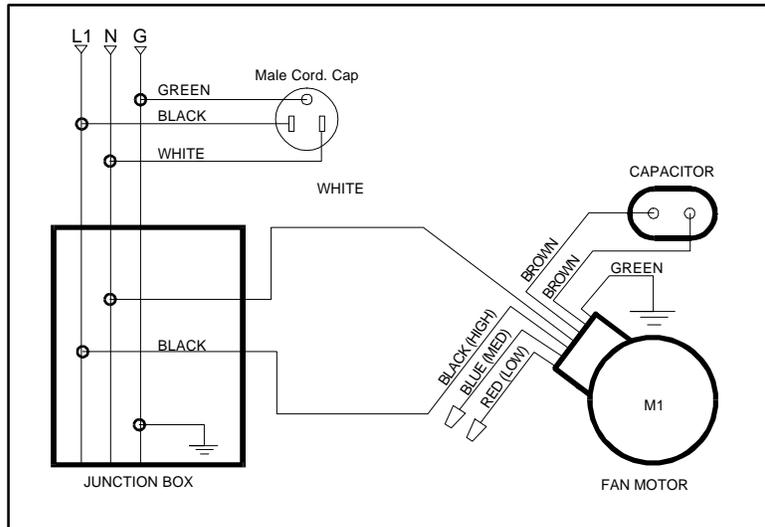
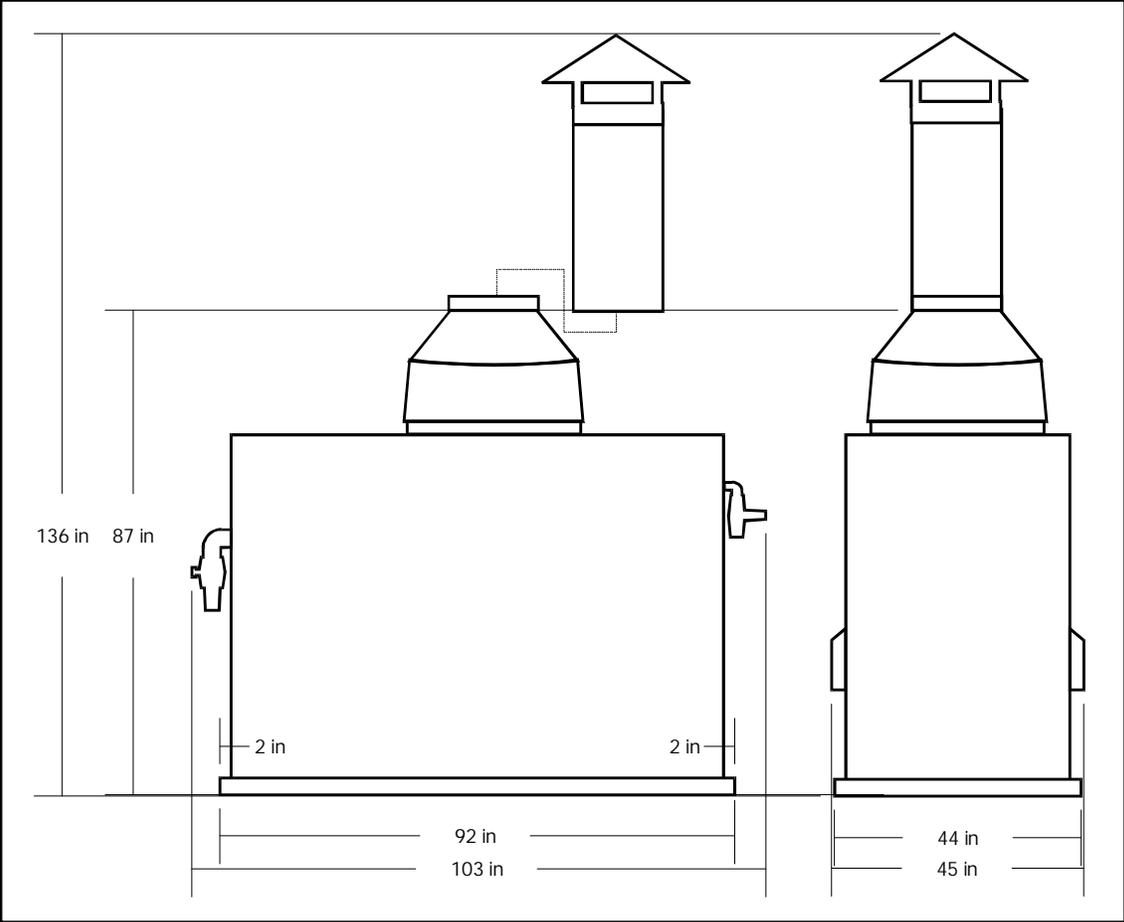


Figure 40 – electrical - portable heat exchanger – 600 model



Product Dimensions

Figure 41 – dimensions - Water heater cabinet



Fuel Spec Charts

Figure 42 - inputs, outputs & temp. ranges

		Raypak 1223 - Natural Gas		Raypak 1223 - Propane	
Gas Input & Output Capacities – Million BTU's / hour					
		Input	Output	Input	Output
	Elevation 0 – 2000 ft.	1222.5	1014.7	1124.7	933.5
	Elevation 2000 ft.- 4500 ft	1100.25	913.23	1012.2	840.1
Water Heater Temperature Range		49 - 93°C (120 - 200°F)		49 - 93°C (120 - 200°F)	
Note: Input & output capacities are as shown utilizing normal fuel calorific values:		1,000 BTU's/cu. ft.		24,197 BTU's/Liter	

Figure 43 - gas supply – natural gas

		Raypak 1223
Natural Gas		
Supply Gas Pressure – Max.		14" W.C.
Supply Gas Pressure – Min.		6"W.C.
Manifold Gas Pressure – Max.		4"W.C.
Manifold Gas Pressure – Min.		3.5"W.C.
Connection		1 ½"

Figure 44 - gas supply - propane (LP)

		Raypak 1223
Propane (LP)Gas		
Primary Regulator Pressure		8 PSI
Secondary Regulator Pressure		11"W.C.
Manifold Gas Pressure – Max.		11"W.C.
Manifold Gas Pressure – Min.		10"W.C.
Connection		Min. ¾"



- This system is calibrated to run efficiently with the gas settings shown in the chart , above, and burning fuel with the following calorific values:
 - Propane – 24,197 BTU's/Liter
 - Natural Gas – 1,000 BTU's/cu. ft.
- If calorific values are other than shown, above, adjustments to the water heater gas pressure could be required. Contact a factory representative for instructions.

