Service Manual

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1.Warranty Policies& Claim Procedures

DRYAIR MANUFACTURING CORP. (referred to within as DRYAIR) warranties its new, unused equipment to be free of defects in material and workmanship at the time of delivery to the original retail purchaser.

Warranty Policies

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.
- 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.
- 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.

Extended warranty policy

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).
- Mileage is not covered.
- Glycol is considered a consumable and will not be covered under warranty policy.
- Generators carry their own warranty coverage through their own manufactures. Please refer generator issues to the OEM. Contact information may be found in the Service & Operators Manual under Optional Equipment.

Owner 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.

Manufacture obligations

- DRYAIR reserves the right to continually improve 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 Procedure

- All warranty credits must be processed with the DRYAIR Warranty Claim Form.
- All warranty parts, unless otherwise specified, are to be returned to DRYAIR 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
DRYAIR Manufacturing Corp.
410 Douglas Rd
Bradner. Ohio
43406
Ph. 419-467-9902

Canada
DRYAIR Manufacturing Corp.
400 Service Road
Box 126
St. Brieux, SK
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 $85.00/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

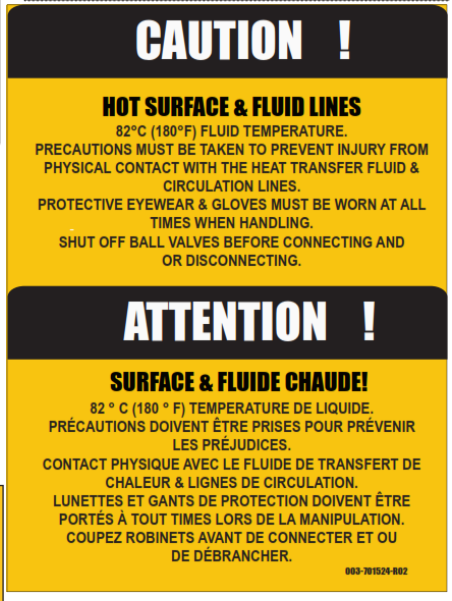
  - Electrical Components -0.5hr
    - Relays
    - Switches
    - Thermostats
    - Breakers
  - Electric Motor Changes -1hr
    - Hose Reel
  - Plumbing Components -1hr
    - Flow Reverser
    - Flow Switch
    - Valves
  - Glycol Pump Changes -2hrs

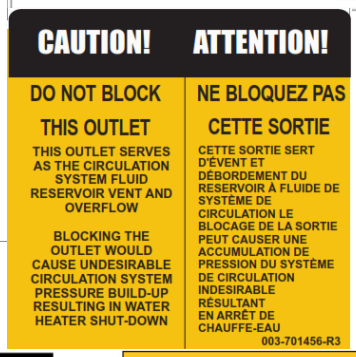
Note: Other labor charges will be at the discretion of DRYAIR

2.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 (Figure 2-1).
- 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.
- It strongly recommended

Trailer Safety

- Ensure that all the tires are inflated to the manufactures specification.
- Check the tire tread on all tires for indications of wear, or misalignment.
- Test the signal lights, brake lights, and park lights for proper operation.
- All Dryair trailers are equipped with electric brakes that require a controller in the tow vehicle.
    - The operator must make sure that the brakes are functioning correctly.
- Before towing the operator of the tow vehicle must ensure that the trailer is hooked correctly to the tow vehicle including;
    - Safety chains
    - Brake away cable
    - Lights
- Reduce your speed.

Heat Transfer Fluid

Absolutely NO use of ethylene glycol or automotive antifreeze. Warranty will be voided if use of improper heat transfer fluid. Must use PROPLYENE GLYCOL ONLY.

For complete "heat transfer fluid" information, refer to the Material Safety Data Sheets for “Dowfrost HTF” & "Boss Chill PG" in this section.

MSDS Information

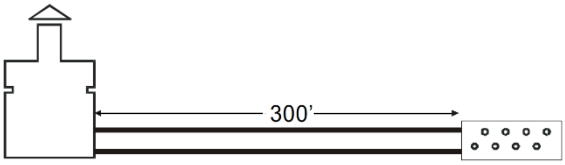
For MSDS information regarding Glycol please see the appendix.

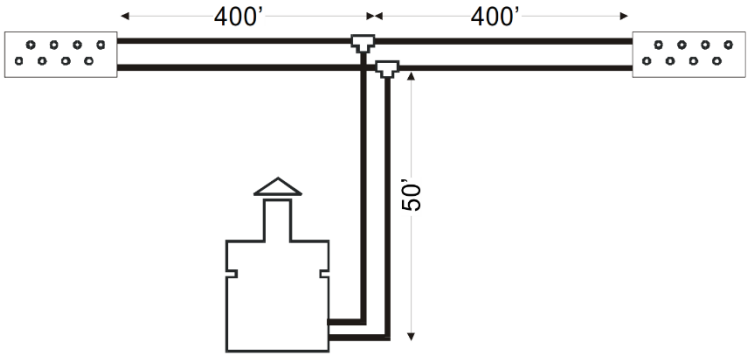
3.Generic Information

Recommended Maximum Hose Lengths

"Central Heating Unit" to "Manifold"

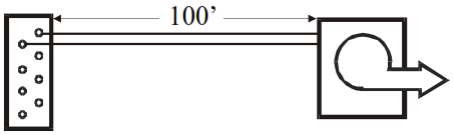
- One way – 300 feet (Figure 3-1)
- Two way – 400 feet each way (Figure 3-2).





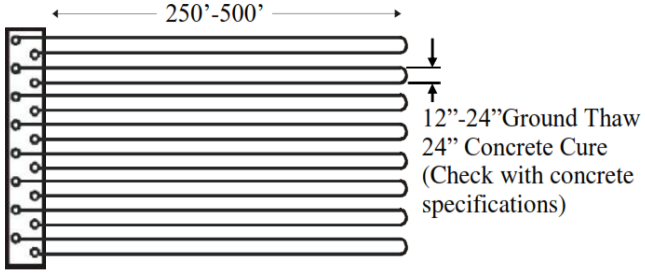
"Manifold" to "Portable Heat Exchanger"

- 100 feet (Figure 3-3).



Ground Thaw Loops

- 500 foot loops
- Max up to 1000 feet by using two hoses together (Figure 3-4).



ADD DIAGRAM OF UNIT GOING UP 70 FT THEN ALSO GOING UP WITH PLATE HEAT EXCHANGER.

Formulas & General Information

Hose length required for ground thaw or concrete curing.

$$L_H = \frac{SF}{H_{SP}}$$

Where: L_H= Hose Length required to cover area.
SF= Area of ground to be thawed or concrete to cure.
H_{SP}= Hose spacing in feet;

- 1.5' Ground Thawing @ 84 BTU/ft typically
- 2' Curing Concrete @ 50 BTU/ft typically

Example:
An area of 7500ft^2 to be thawed.

$$L_H = \frac{7500\ ft^2}{1.5\ ft}$$

$$5000\ ft = \frac{7500\ ft^2}{1.5\ ft}$$

What size of GTS would be required?

$$Machine = L_h \times 84 \frac{BTU}{ft}$$

$$Machine = 5000\ ft \times 84 \frac{BTU}{ft}$$

$$420{,}000 BTU = 5000\ ft \times 84 \frac{BTU}{ft}$$

This indicates that a GTS600 would do the job. However extra hoses may be required.

Glycol weight calculation;

$$W_G = SG \times 1 \frac{Kg}{liter}$$

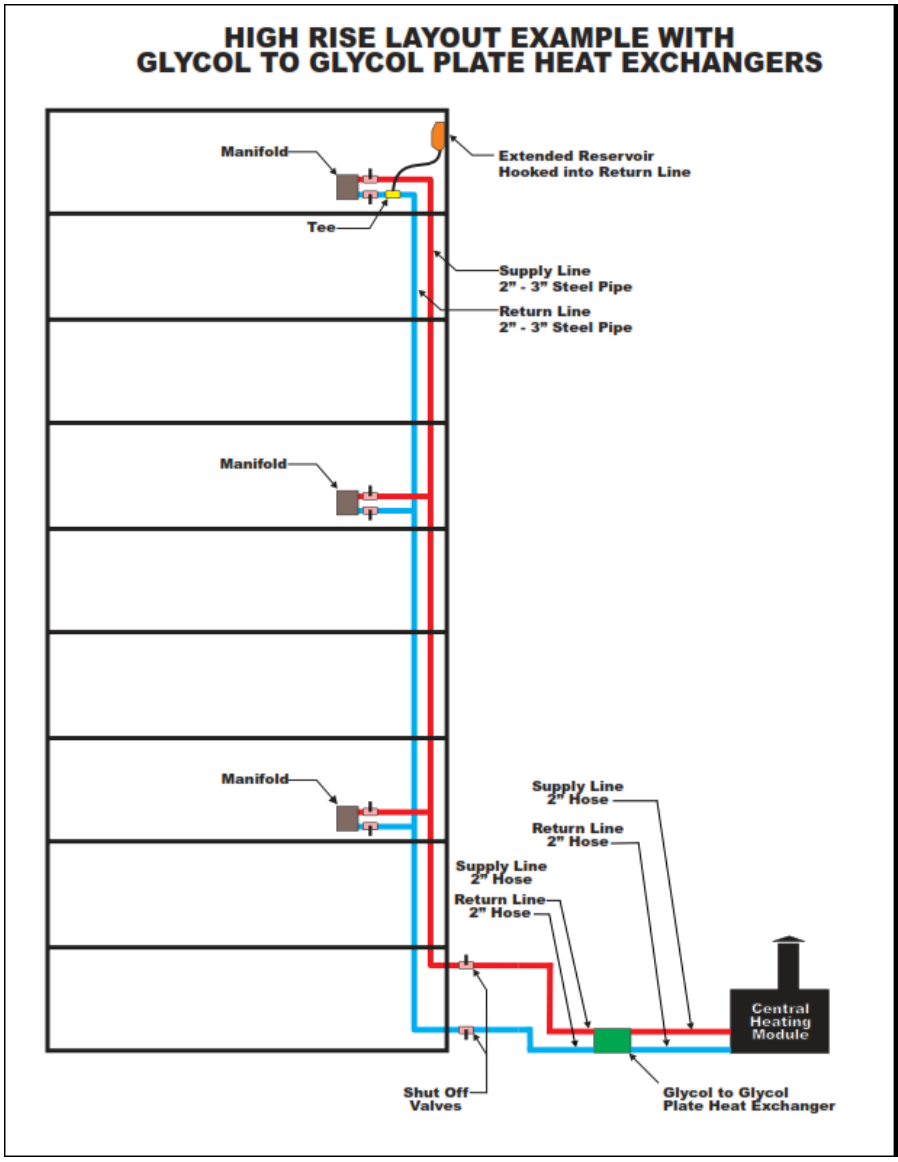
$$W_G = SG \times 8.345 \frac{lbs}{USGallon}$$

Where: W_G= Weight of Glycol
SG= Specific Gravity of Glycol
(From the MSDS of the Glycol product)

This section will cover a typical setup using a complete DRYAIR system.

Because this is a closed system it is possible to go vertically up to 70ft from the heat source. This makes it ideal in a multi-story construction application.

Connections to the primary side are accomplished by 2in camlock style fittings.



Fuel Consumption

Table 3-1 Fuel Consumption

Model #	btu/hr input	gallons/hour	liters/hour	cuM/hour	cuF/hour
2000-1200 Natural Gas	1,233,000	N/A	N/A	34.86	1,233
2000-1200 Propane	1,134,360	12.4	46.9	N/A	N/A
2000-0250 NG	248,000	N/A	N/A	7	248
2000-0250 Propane	248,480	2.7	10.3	N/A	N/A
2100-0300 Oil Fired	223,000	1.75	6.6	N/A	N/A
2100-0600 Oil Fired	620,200	4.4	16.7	N/A	N/A
2100-0900 Oil Fired	896,000	6.4	24.2	N/A	N/A
200 GTS Oil Fired	212,800	1.52	5.75	N/A	N/A
400 GTS Oil Fired	348,000	2.45	9.13	N/A	N/A
650 GTS Oil Fired	620,200	4.4	16.7	N/A	N/A

Heat Transfer Fluid (HTF)

Brands

The HTF is a 60/40 mixture of Propylene Glycol and pure water.

- Dowfrost (Propylene Glycol)
- Boss Chill PG (Propylene Glycol)

Fluid Maintenance

The HTF solution must be checked at least once a year in accordance with the manufacturer's recommendations. A base line analysis should be performed within two to four weeks of initial mixing. This measurement will be used to verify that the fill was completed properly, and will serve as a reference point for comparison with future test results. As a bare minimum, the solution should be analyzed for glycol concentration, solution pH and general quality. Dryair recommends that a complete flush and HTF replacement every five years.

Concentration Testing

The refractometer (Figure 3-5) is used to check the freeze point of the HTF. Concentration can be easily and accurately checked using a handheld refractometer. Most quality instruments will test glycol concentrations from 0 to 55% directly, are portable, and require no complicated adjustments for temperature. System concentration should not vary significantly from test to test.

Figure 3-1 Refractometer

Solution pH Testing

While high quality HTF solutions may last in excess of 20 years, hard use, improper maintenance or chemical contaminants will significantly shorten fluid life. Fluid pH serves as a good barometer for the condition of the HTF and is best measured with a field pH meter. This method is significantly more accurate than litmus paper tests. The pH tester (Figure 3-6) is used to check the pH level of the heat transfer fluid. Below is a pH chart. For Dryair product, anything below 7 is unacceptable.

Figure 3-2 pH Tester

Table 3-2 pH

pH		Description
< 5.5		Strongly acid
5.5 - 5.9	=	Medium acid
6.0 - 6.4	=	Slightly acid
6.5 - 6.9	=	Very slightly acid
7	=	Neutral
7.1 - 7.5	=	Very slightly alkaline
7.6 - 8.0	=	Slightly alkaline
8.1 - 8.5	=	Medium alkaline
> 8.5		Strongly alkaline

System Flushing

Should the system require cleansing after removing old or damaged HTF, flush the system with a heated 1-2% solution of trisodium phosphate for 2 to 4 hours, then drain and rinse thoroughly. Flushing the system after any plumbing repair/replacement is also highly recommended in order to remove excess pipe dope and cutting oils.

Mixing Ratios

Table 3-3 Mixing Ratios

Percent Propylene Glycol		Freezing Point	
By Mass	By Volume	°F	°C
0.0	0.0	32.0	0.0
10.0	9.6	26.1	-3.2
20.0	19.4	17.9	-7.8
30.0	29.4	6.7	-14.0
40.0	39.6	-8.1	-22.3
50.0	49.9	-28.9	-33.8
60.0	60.0	-54.9	-48.3

Adjusting Solution Concentration

To increase the concentration of the solution in the system, determine the percent of glycol in solution (from the table above) and apply the following equation:

$$Q_a = \frac{V_s(P_d - P_t)}{(100 - P_t)}$$

Q_a = Quantity, in gallons, to be added
V_s = System volume
P_d = Percent of solution desired
P_t = Percent of solution by test (initial percent)

Note: Drain two times (2X) the determined number of gallons from the system (tank should be empty). Add the quantity of concentrate glycol to the reservoir tank and replace the drained glycol (may not be able to replace all the drained glycol depending on the number of gallons required to reach the desired concentration).

Heat Exchanger (CME) Volumes

Table 3-4 Heat Exchanger Volumes

Model	Gallons (US)	Liters
2000-1200	18.5	70
2100-0900	55.5	210
2100-0600	37	140
300 GTS	21	80
400 GTS	25	94
200 GTS	21	80
650 GTS	40	151

Table 3-5 Hose Volumes

Hose Size & Length	Gallons	Liters
2" X 50'	8.05	30.47
1 1/2" X 50'	4.62	17.49
1 1/4" X 50'	3.265	12.36
1" X 50'	2.15	8.12
3/4" X 50'	1.26	4.77
3/4" X 375'	9.41	35.62
3/4" X 750'	18.83	71.28
5/8” X 500”	7.97	30.16

Portable Heat Exchanger Volumes

Table 3-6 Potable Heat Exchanger Volumes

Model #	US gallons	liters
80	0.2	0.85
200	0.5	1.98
600	1.728	6.54
MultMax	2.56	9.94

ADD HERE UNIT VOLUMES .

4.DRYAIR Components

Heat Exchangers

Elevation Concerns

High Altitude - Ratings of gas utilization equipment are based on sea level operation and shall not be changed for operations at elevations up to 2000 ft (600 m). For operation at elevations above 2000 ft (600 m), equipment rating shall be reduced at the rate of 4% for each 1000 ft (300 m) above sea level before selecting appropriately sized equipment.

Setting up for Higher Elevations

Adjustment of the gas systems should only be done by a qualified gas technician using proper test equipment.

Model: 2000-1200

This Model is fairly easy to convert for higher elevations. Dryair offers complete burner tray conversions to accommodate high altitude usage. Dryair also carries four different orifices (Fig 4-1) for the 2000-1200 depending on elevation and if the machine is set-up for propane or natural gas or a complete burner tray is also available with the correct orifices already installed.

Figure 4-2 2000-1200 Orifices

Model: 2100-xxxx DG, FLEX gas

Natural gas / Propane;

These models use a Riello burner which require a few more adjustments based on output gases. Therefore a Flue Gas Analyzer (Fig 4-2) will be necessary to set the machine properly. Proper CO2, O2, and CO readings must be taken and be within regulating code requirements. More information for adjustments can be found; http://www.riello.ca/products/residential-burners/gas/40-series or the included Riello Manual.

Figure 4-4 Flue Gas Analyzer

Figure 4-3 Spot Smoke Tester

Figure 4-1 Smoke Scales

Model: 2100-0300, 2100-0600, 2100-0900, & FLEX oil

At a minimum a Spot Smoke Tester (Fig 4-3) and a Flue Gas Analyzer will be required. This is necessary to ensure that the soot that is created using oil fired burners is at an absolute minimum and the proper CO2, O2, and CO readings will be within regulating code requirements. Factory settings for standard elevation is based on table 7 with a smoke spot of '0' (Fig 4-4). It is advised to be as close to these readings as possible. More information for adjustments can be found; http://www.riello.ca/products/residential-burners/residential-oil/40-f-series or the included Riello Manual.

Table 4-1 Flue Gas Analyzer Results

	Summer Fuel	Winter Fuel
FT (Flue Temp.)	<650ºF	<635ºF
O_2	3.2%±0.5%	4.3%±0.5%
CO	<50ppm	<50ppm
EFF	>80%	>80%
CO_2	13%±0.5%	12.5%±0.5%
EX/A	15%-25%	20%-30%

Note: The information below only applies to the United States Model 2000-1200 units (Canada has a Unified Gas Code not listed below).

State "Gas" Codes for Control & Safety Devices (CSD)

G-1 CSD-1 Construction Code
G-2 IRI (Industrial Risk Insurers)
G-4 Illinois School Code (BOCA Code)
G-5 Long Island Code (LILCO)
G-6 Minnesota Code
G-7 New Mexico Code
G-8 Washington State Code
G-9 Kentucky Code
G-10 United States Post Office
G-12 California Code
G-13 Double Block & Bleed with Commercial Grade Ignition (C2A)

Reconditioning Procedures

Before firing and verifying operation of the water heater there are a few tasks that must be performed first.

- Wash the unit, removing all road debris (road salt & tar).
- Clean the screen in the Y-strainer. Remove the screen from the Y-Strainer and clean with a soft bristle brush and water. (See Y-Strainer in Plumbing Components Section).
- Check all Hoses for cracks or leaks and replace as necessary

Model: 2000-1200

- Visually inspect the water heater's heat exchanger utilizing a mirror and a trouble light. Inspect the heat exchanger for any debris plugging up the copper finned tubes. If the heat exchanger is plugged it must be cleaned. (See Water Heater's Heat Exchanger Cleaning Procedure for cleaning).
- Visually inspect the fire bricks/refractory boards with a mirror and verify that none are broken.

Model: All Diesel Fired Units (2100 series and GTS units)

- Visually inspect the water heater's heat exchanger utilizing a mirror and a trouble light. The burner must be removed to perform this procedure. Inspect the heat exchanger tubes for any debris. If the heat exchanger is plugged it must be cleaned. (See Water Heater's Heat Exchanger Cleaning Procedure for cleaning).

- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the system is operating in.
- Check the heat transfer fluid's pH level utilizing a pH tester. If the pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the heat exchanger will take place over a period of time.
- Check the kamlocks for damaged or worn gaskets.
- Fire the water heater with a couple portable heat exchangers hooked up to pull heat off. Verify operation of central heating unit.

Trailered Units

- Wash all road and work site debris from machine.
- Check all trailer lights and trailer brakes.
- Inspect tires and replace as necessary.
- Ensure that the trailer axels and wheel bearings are properly serviced.

Water Heater's Heat Exchanger Cleaning Procedure

Model: 2000-1200

- Remove the burner tray (1-1) and the roof flashing/chimney assembly (1-2) to expose the heat exchanger (1-3). This will allow proper access to blowing out the heat exchanger (1-1).
- Clean heat exchanger (1-3) utilizing air with a high pressure blow gun. Blow the heat exchanger (1-3) from bottom up and then from bottom down to remove all debris.

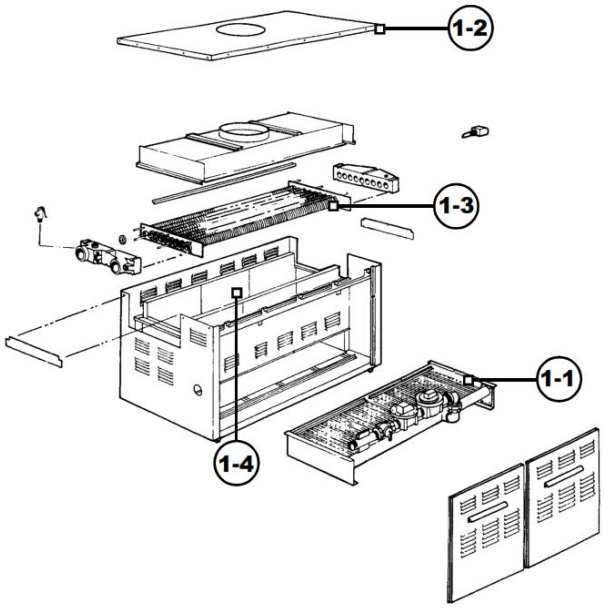


Figure 4-5 2000-1200 Exploded

Note: Be careful not to blow high pressure air on to the fire bricks/refractory board (1-4). This may cause them to chip and break apart. This procedure should be performed outdoors. Wear a dust mask and safety glasses when performing this task.

Model: All Diesel Fired Units

(heat exchanger varies between units)

- Remove the enclosure.
- Remove the burner from the water heater (2-1)
- Remove the plate (2-2) from the bottom of the water heater, if required.
- Remove the refractory board (2-3) from the water heater by reaching into the burner hole and lightly tapping the board with your hand until it drops down, if required.
- Remove the flue collar (2-4) to expose the burner tubes (2-5).
- Remove all flue baffles (2-6), if required.
- Clean burner tubes (2-5) with a steel round brush or a rag on a piece of rod.
- When cleaning model 300 unit item 2-7 will need to be replaced
- Vacuum all debris.

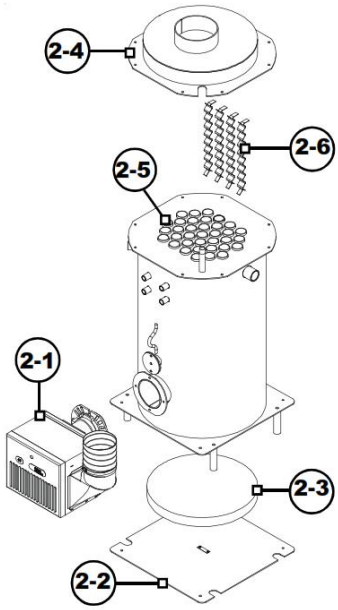


Figure 4-7 2100-xxxx Exploded

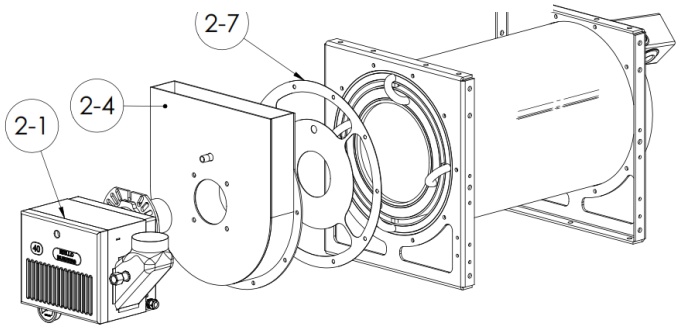


Figure 4-6 2100-0300 Exploded

SERVICE TIPS

Gas burners – During the pre-season service be sure to check the burners for any signs of corrosion. This may be an indicator of worn parts which would reduce efficiency.

Table 4-2 Service Tips

Central Heating Unit & Burner	Burner Tube Position (tube base to front flange)	Burner Nozzle Size (sea level)	Turbulator Head	Air Shutter Settings	Fuel Pressure Settings		
				Low Fire	High Fire	Low Fire	High Fire
Model 300 GTS Oil Fired c/w F10	1.0”	1.75x60 W	3.5	-	4.0	-	145 PSI
Model 600/600 GTS Oil Fired c/w F20 Burner	1"	3.50x60B	2.5	2.8	4.0	100 PSI	160 PSI
Model 900/900 Flex Oil Fired c/w F20 Burner	1.5”	5.00x60B	4.0	3.0	8.0	100 PSI	145 PSI
Model 650 GTS Oil Fired F20 Burner	1”	3.50x60B	2.5	2.8	4.0	100 PSI	160 PSI
Model 200 GTS Oil Fired F5 Burner	1”	1.2 x 60A	3.5		3.75		160 PSI
Model 400/400 GTS Oil Fired F10 burner	1”	1.75x60B	3.5		5.5		200 PSI

SMOKE TESTING

- Periodic smoke tests (Fig 4-3) will show any signs of maintenance requirements or adjustments to the burner. All smoke tests should result in a ‘0’ or a ‘1’ (Fig 4-4) at most. Anything more than that will result in a loss in efficiency due to the sooting.

FUEL PUMP

- Do not exceed 11.44 inches of vacuum. With 3/8" copper tubing, the rule of thumb is 1 foot vertical lift equals 1" vacuum, or 10 ft. horizontal run equals 1" of vacuum.

NOZZLES

- Nozzles of solid or semi solid spray pattern with angles of 60/80° may be used on Mectron series burners (Model No. M3, M5, M10, M15, M20).

- Nozzles of semi solid or hollow spray pattern with angle of spray 60/80° may be used on Riello F40 series model no. 3, and 5. Semi solid or solid spray patterns with 60° angles of spray may be used on burner models 10, 15, 20.
- Nozzles are rated at 100 PSI, so increasing the nozzle supply pressure over 100 PSI will increase the flow rate. The increased flow rate can be calculated by multiplying the square root of the pressure change times the nozzle size.
- Increased pump pressure will narrow and lengthen a spray pattern. Oil atomization will be improved with higher pump pressure.
- If the oil supply is cold, reducing the nozzle size and increasing the pump pressure, will improve ignition capabilities and combustion.

DRAFT

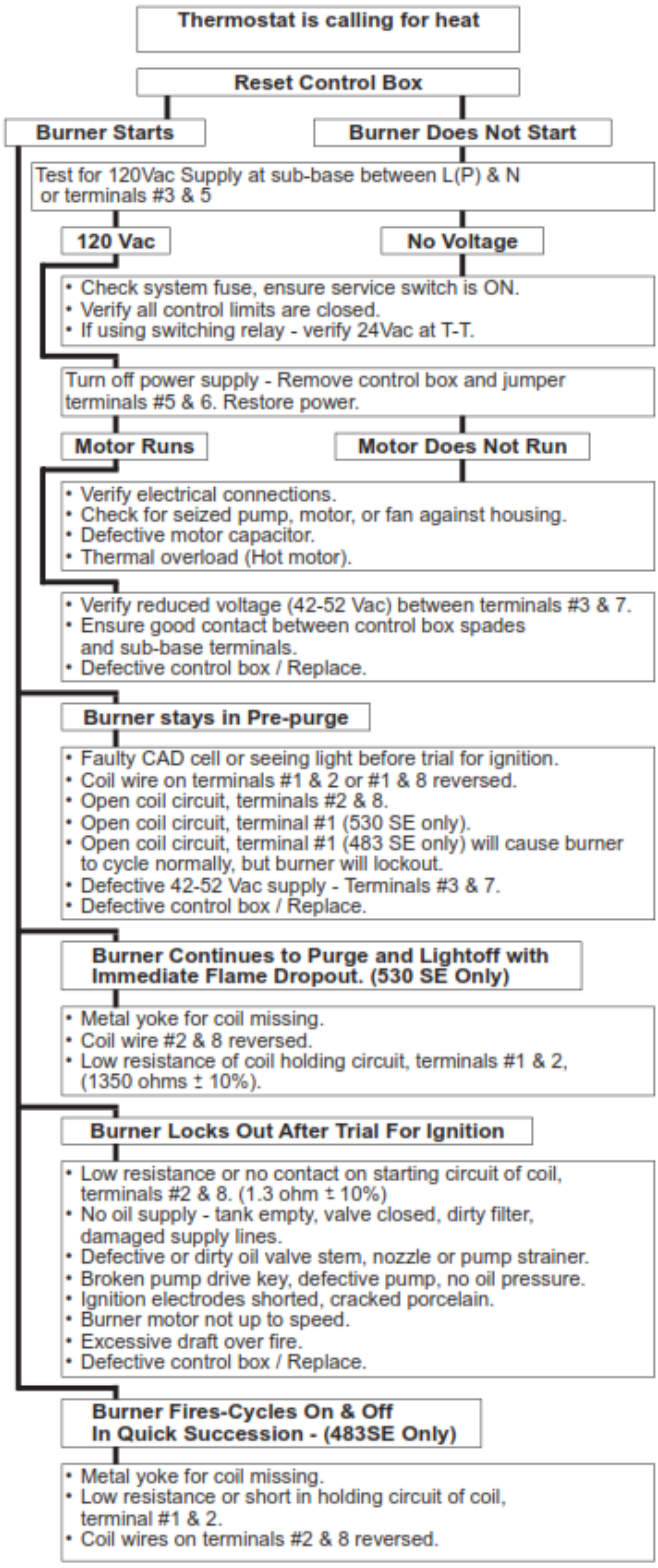
- Riello burners are designed to operate in a positive pressure condition in the combustion zone.
- As a retrofit burner, the draft or pressure in the combustion zone of the appliance is very important to the operation and efficiency of the application.
- Overfire or combustion chamber pressure must be measured, as all the adjustment charts in this manual are based on zero overfire pressure. If there is more or less draft in the combustion chamber, then adjustments other than those described in this manual will have to be made, using proper combustion test equipment.
- All installations of Riello retrofit burners require a barometric damper (draft regulator) unless the appliance is certified to operate without one.
- The breeching size of an appliance may be reduced one pipe size.
- All combustion tests should be taken in the center of the flue pipe, approximately 16" to 18" from the breeching outlet, upstream of the barometric damper.
- Ensure that there are no air leaks into the flue between the test sample probe and appliance, as they will dilute your sample and reduce the CO2 reading. Stack temperature and smoke readings will also be affected.
- The burner should be adjusted to obtain a Bacharach smoke reading of zero to a trace.
- On a wet base boiler application, CO2 readings of 11.5% to 12.5% should be obtained.
- On combustion chamber applications, CO2 reading of 12% to 13% should be obtained.

STACK TEMPERATURE CONDITIONS

- To check stack temperature it will be necessary to use a Flue Gas Analyzer (Fig 4-1).
- The overfire draft of an appliance can increase or decrease stack temperatures. A high overfire draft will cause the combustion gases to be pulled through the appliance, increasing stack temperature.

- Too much excess air, which contains nitrogen, an inert gas, will absorb heat and carry it out the flue, increasing stack temperature.
- An increased flow time through the appliance heat exchanger will increase thermal efficiency and lower stack temperatures.
- Check to see if there are any secondary air leaks in the appliance (example: inspection door open). Any such leaks will increase stack temperature.

Riello F40 Trouble Shooting Chart



Hose Reel

Reconditioning Procedure

Model: HR6000 & HR3000

- Wash the unit, removing all road debris (road salt & tar).
- Oil the chain.
- Check the oil level in gear box.
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed from the precharged hose
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the hose or corrosion of the heat exchanger will take place in the water heater the hoses are connected to.
- Verify operation of hose reel.

Model: HRA 4000/6000

- Wash the unit, removing all road debris (road salt & tar).
- Check the belt for wear
- Check the sheave for rust or wear, clean or replace as required.
- Check the oil level in gear box.
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed from the precharged hose
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the hose or corrosion of the heat exchanger will take place in the water heater the hoses are connected to.
- Verify operation of hose reel.

Plate Heat Exchanger

Reconditioning Procedure

- Wash the unit, removing all dirt etc...
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed at a quick connect joint.
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the metallic components will take place over a period of time.
- Verify operation of plate heat exchanger.

Mixing/Booster

Reconditioning Procedure

- Wash the unit, removing all dirt etc...
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed at a quick connect joint.
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the metallic components will take place over a period of time.
- Verify operation of mixing/booster.

Portable Heat Exchangers

Reconditioning Procedure

Model: 80, 200,200HD, & 600

- Wash the unit, removing all road debris (road salt & tar).
- Clean rad using air to blow out any debris and then wash out with water. Gentle air and water pressure must be used to avoid damage to the aluminum fins. Be careful not to get water on the blower motor.
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed at a quick connect joint.
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the metallic components will take place over a period of time.

Manifolds

Reconditioning Procedure

Note: There are various types of manifold configurations.

- Wash the unit, removing all road debris (road salt & tar).
- Check kamlocks for worn or broken gaskets. Replace if necessary.
- Check operation of ball valves. Verify that ball valve is fully closing and fully opening. If not, replace ball valve.
- Check quick couplers for broken O-rings. Replace if necessary.
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A test sample must be removed at a quick connect joint.

- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the metallic components will take place over a period of time.

Hoses

Reconditioning Procedure

Note: Hoses are either equipped with ball valves or quick couplers depending on application.

- Wash the hoses, removing all mud, dirt etc...
- Visually check hoses for breaks and possible leak points.
- Check kamlocks for worn or broken gaskets. Replace if necessary.
- Check operation of ball valves. Verify that ball valve is fully closing and fully opening. If not, replace ball valve.
- Check quick couplers for broken O-rings. Replace if necessary.
- Check the heat transfer fluid's freeze point utilizing a refractometer. Verify that it is at the proper level for the area the systems are operating in. A fluid sample can be removed at the coupler end.
- Check the heat transfer fluid's pH level utilizing a pH tester. If pH level is below 7, the heat transfer fluid must be removed from the system or corrosion of the heat exchanger will take place over a period of time.

5.Plumbing Components

(some units may not be equipped with y-strainer or have had the screen removed. Use either way is permitted)

Y-Strainer

The "Y" strainer contains a screen, which will stop any debris in the system from damaging any plumbing components.

The "Y" strainer (Figure 5-2) and screen (Figure 5-1) located inside the "Y" strainer require regular maintenance every 1000 hours of operation or prior to every installation (whichever occurs first).

Figure 5-2 'Y'- Strainer

Figure 5-1 Strainer Screen

- 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 heat transfer fluid should be adequate.

NOTE: Be certain not to run the reservoir empty, as this would allow air to enter the system.

- The extracted heat transfer fluid can be reused. 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.

Safety Relief Valve

The safety relief valve (Figure 5-3) on the water heater's heat exchanger is a 60 p.s.i. ASME relief valve.

This valve opens when the fluid circuit pressure exceeds 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 and zero pressure in the heat exchanger.

Figure 5-3 Safety Relief Valve

Pressure Bypass Valve

The pressure bypass valve (Figure 5-4) 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.

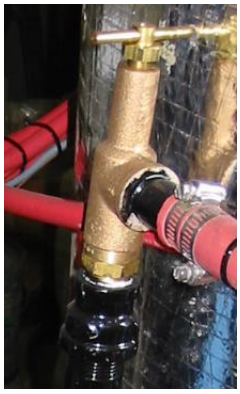


Figure 5-4 Pressure Bypass Valve

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, this valve may be adjusted.

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

Drain Valve

Use the drain valve (Figure 5-5) any time you need to remove fluid in order to perform service work on the system.

Isolate your system by closing off the heat transfer fluid ball valves that 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 (may require 2 or 3 5-gallon pails).

By keeping the fluid clean, you can reuse it once the service work has been completed.

Figure 5-5 Drain Valve

Cold Start Fluid Pre-Heater **(if equipped)**

The cold start fluid pre-heater (Figure 5-6) is utilized to preheat the heat transfer fluid prior to firing of the burner. This will avoid the rough, inefficient combustion results associated with cold start-ups. This preheater operates on the same electrical circuit as the system pump. When the pump switch is in the "off" position, the preheater is energized. It has a built in switch that will shut off when entering fluid reaches 180 deg F.

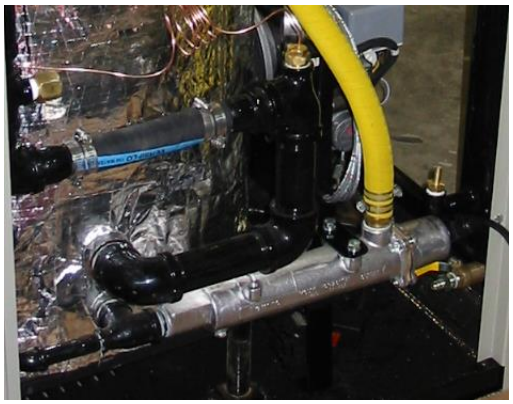


Figure 5-6 Cold Start Fluid Pre-Heater

Thermostatic Control Valve

The thermostatic control valves (Fig 5-8) maintain a required temperature. The thermostatic control valves are adjusted during the testing/calibration procedures and **should not** be adjusted or tampered with!

Figure 5-7 Thermostatic Control Valve

Automatic Air Bleed Vent

The automatic air vent (Fig 5-7) is utilized to remove any air from the heat transfer fluid loop**. Some units are not equipped with a air bleed vent but are in turn vented through the glycol tank over flow. Over flow must not be blocked at any time.**

Figure 5-8 Automatic Air Bleed Vent

Flow Reverser Valves

Model: 2100-0600 & 2100-0900

The flow from these units are reversed using two three way valves that operate automatically by power actuators (Figure 5-9). These help in creating an even ground thaw or an even concrete cure. This will save time and money. These actuators are on a timer that can be adjusted by the end user depending on application. The end user should be aware of the valves location before and during the application process to ensure of the valves operation. If it appears that the valves have not changed position, in the time allotted by the timer, check that the timer is functioning correctly first by referring to Flow Reverser in the electrical section of this manual, then refer to the procedure below.

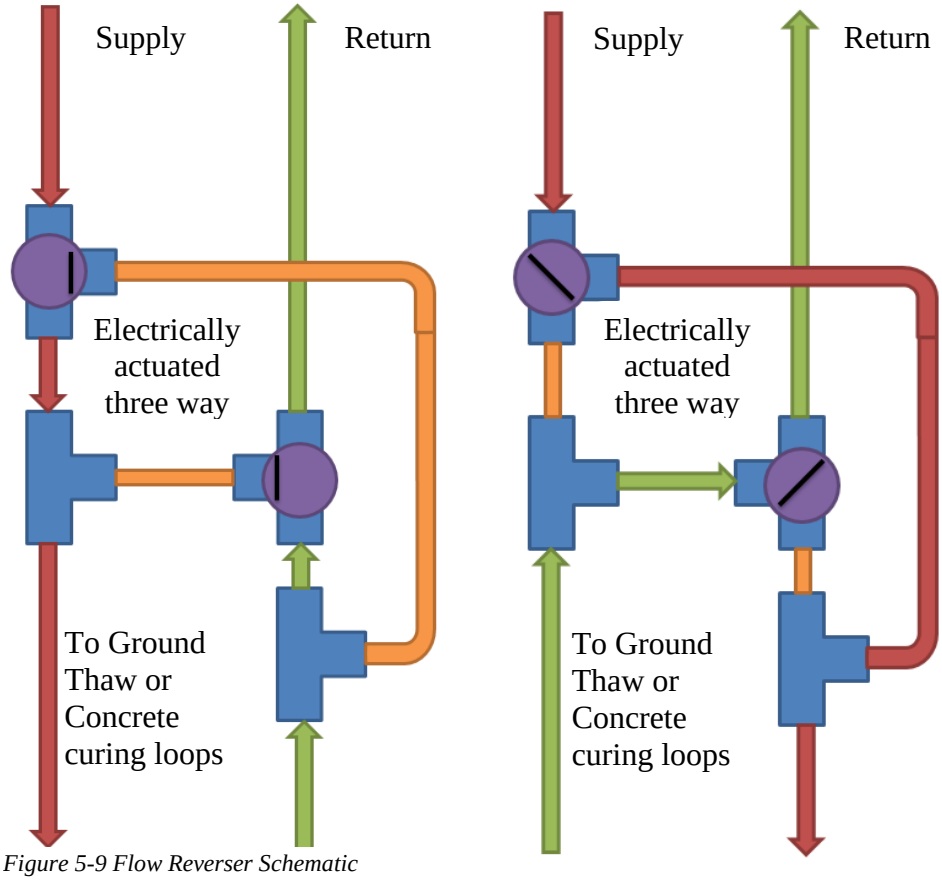


Figure 5-9 Flow Reverser Schematic

Follow the QR codes to see more on our Flow Reversing System

Pt 1 Flow Reverser Maintenance & Repair

Pt 2 Flow Reverser Maintenance & Repair

Pt 3 Flow Reverser Maintenance & Repair

Servicing the three way valves

1. Ensure that the system is off and no pressure on either side of the valves.
2. Take note of the dial location as this will be important in the reassembly (Fig 5-10).

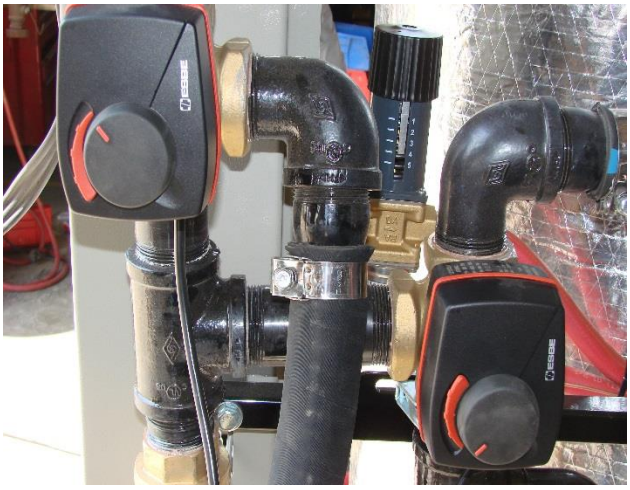


Figure 5-10 Flow Reverser in Default Position

3. Carefully remove the dials by pulling or lightly prying on them (Fig 5-11).
4. Remove the screw from the center of the actuator.

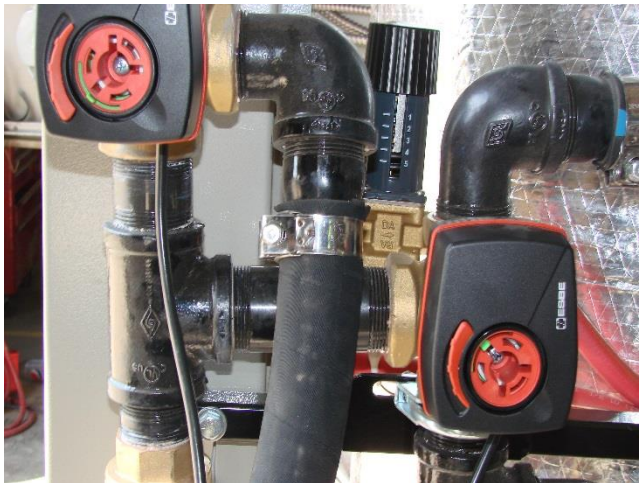


Figure 5-11 Flow Reverser with Indicator Caps Removed

5. By pulling lightly on the actuator pull it off of the valve stem, again taking note to the notch on one side of the valve stem. (Fig 5-12)

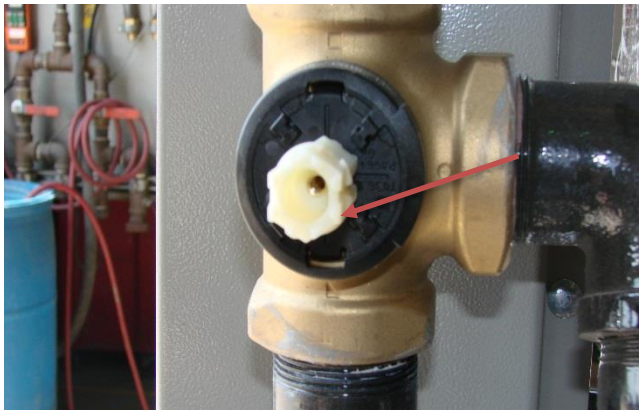


Figure 5-12 Valve Stem

6. Lift off the outer protective cap (Fig 5-13).

Figure 5-13 Valve with Protective Cap in Place

7. Rotate the retaining nut either direction to align the lock tabs (Fig 5-14 & 5-15).

Figure 5-14 Lock Washer (Locked)

Figure 5-15 Lock Washer (Unlocked)

8. With the locking washer removed, carefully remove the valve stem taking care not to damage the O-Ring (Fig 5-16 & 5-17).
9. Inspect the valve stem for damage
10. Using the valve stem, check to see if the valve can move easily. If so, insert a screw into the center of the valve to aid in pulling out the valve, using caution not to damage the O-Rings on the valve. If the valve does not move, remove from system and check for blockage.
11. Replace dameged O-Rings, lubricate with glycol.
12. Reassemble in reverse order matching the valve direction to their original position

Figure 5-16 Valve Stem in Place

Figure 5-17 Valve Stem Removed

Model: 200GTS/300GTS/400GTS/650GTS

The flow from these units are reversed using one four-way valve (Figure 5-18) that operate automatically by a power actuator. Like the 2100-0600 and 2100-0900 this helps in creating an even ground thaw or an even concrete cure. This will save time and money. The actuator is activated by a timer that can be adjusted by the end user depending on application. The end user should be aware of the valves location before and during the application process to ensure of the valves operation. If it appears that the valves have not changed position, in the time allotted by the timer, check that the timer is functioning correctly first by referring to Flow Reverser in the electrical section of this manual, then refer to the procedure below. The steps for servicing the valve is the same as the three way valves. Again, care must be taken to knowing the valves location prior to starting any service to the valve.

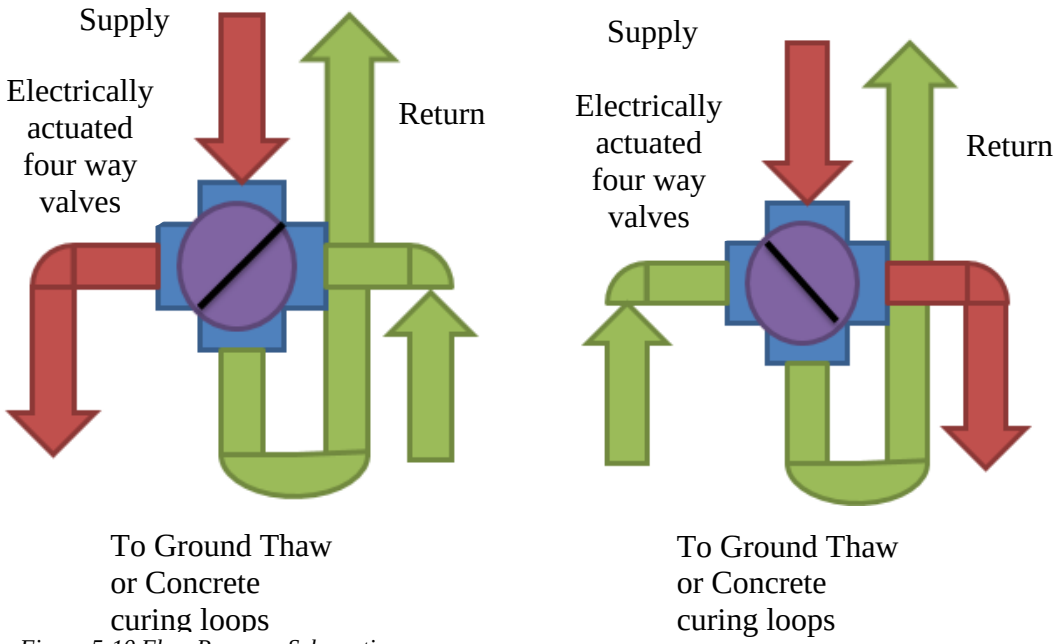


Figure 5-10 Flow Reverser Schematic

Follow the QR codes to see more on our Flow Reversing System

Pt 1 Flow Reverser Maintenance & Repair

Pt 2 Flow Reverser Maintenance & Repair

Pt 3 Flow Reverser Maintenance & Repair

6.Electrical Components

Flow Reverser

The flow reverser has an electrical component that should be checked first before the mechanical/plumbing side of the valve. This will prevent air getting into the system or the creation of leaks.

Model: All GTS Units

1. Ensure that there is power to machine, that the 20amp breaker is not tripped, and the reverser switch is turned on.
2. To check the wiring of the flow reverser first, locate the three wires coming from the actuator (Figure 6-1).
3. Check to ensure that;
    a. They are making good connection.
    b. They are wired as the diagram indicates
4. Check for 24VAC between;
    a. The Red and White or
    b. The Red and Black
5. If Power can be found then remove the actuator and watch for movement.
6. If the actuator moves then the valve is stuck, refer to Flow Reverser Plumbing.
7. If no power can be found here remove the panel by removing the four screws indicated (Fig 6-2).

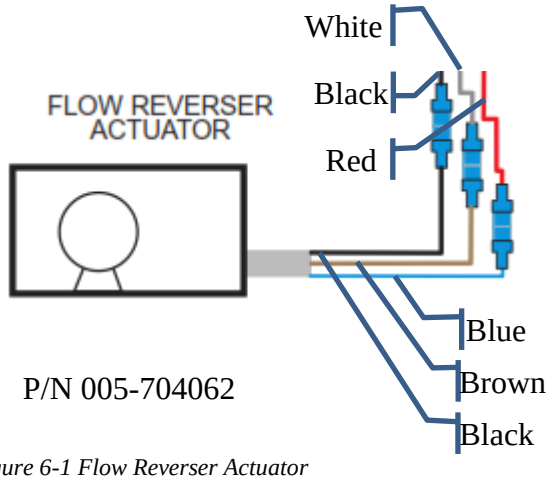


Figure 6-1 Flow Reverser Actuator Wiring

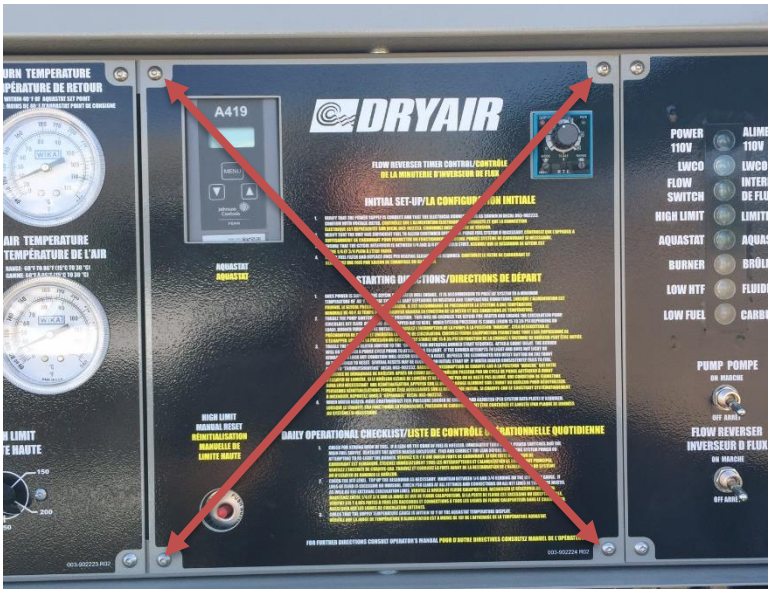
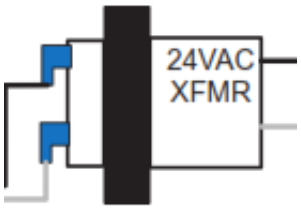


Figure 6-2 Electrical Panel

8. Locate the 24VAC transformer inside the panel (Figure 6-3).
9. Check for voltage on both sides of the transformer as indicated below.
10. If there is 120VAC coming into the transformer and nothing on the other side, replace transformer.

24VAC



120VAC

Figure 6-3 Transformer Wiring

11. If power on both sides of the transformer;
    a. check for 24VAC between terminal #1 (Figure 6-4) and #3 on the timer (Figure 6-5).or
    b. check for 24VAC between terminal #1 (Fig 6-4) and #4 on the timer (Fig 6-5).
12. If 24VAC can not be found on either of these check for 24VAC across #1 on the timer and #1 (Fig 6-4). If 24VAC present replace the Timer.

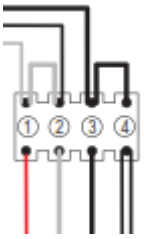


Figure 6-4 Short Electrical Strip

Figure 6-5 Timer Wiring

.

Model: 2100-0600 & 2100-0900

1. Ensure that there is power to machine, all the breakers are turned on, the reverser switch is turned on, and the heater switch is turned on.
2. To check the wiring of the flow reverser first, locate the three wires coming from each of the actuators.
3. Check to ensure that;
    a. They are making good connection.
    b. They are wired as the diagram indicates (Figure 6-6).

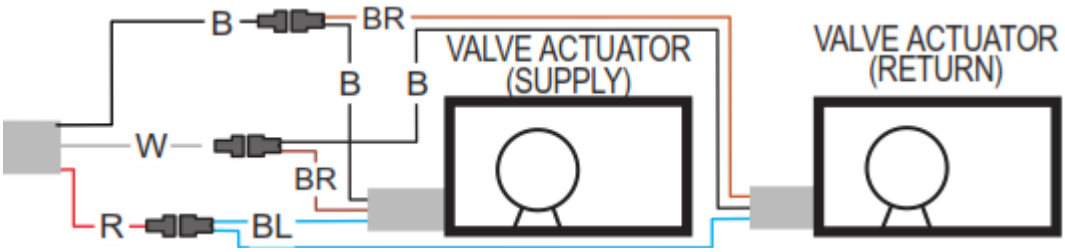


Figure 6-6 Flow Reverser Actuator Wiring

P/N 005-704062

4. Check for 24VAC between;
    a. The Red and White or
    b. The Red and Black
5. If Power can be found then remove the actuator and watch for movement.
6. If the actuator moves then the valve is stuck, refer to Flow Reverser Plumbing.

7. If no power can be found here remove the panel by removing the four screws indicated (Figure 6-7).

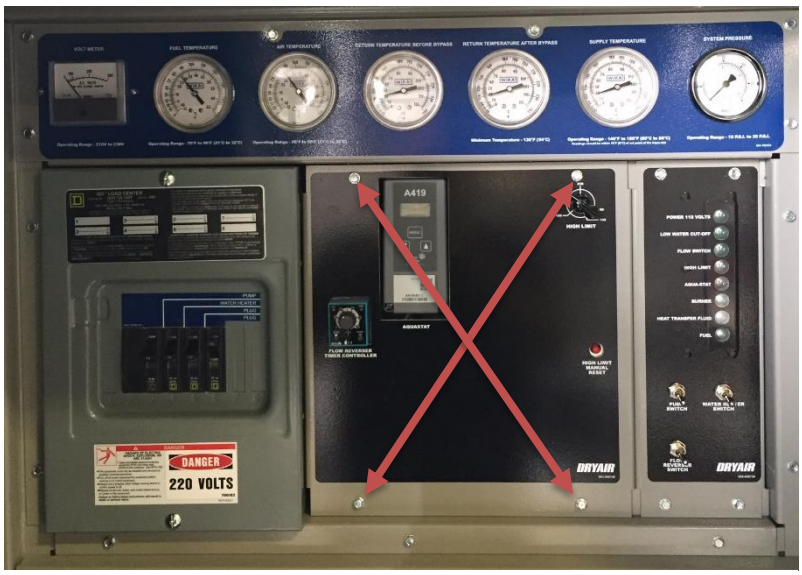


Figure 6-7 Electrical Panel

8. Locate the 24VAC transformer inside the panel (Figure 6-8).
9. Check for voltage on both sides of the transformer as indicated.
10. If there is 120VAC coming into the transformer and nothing on the other side, replace transformer.
11. If power on both sides of the transformer check out;
    a. check for 24VAC between terminal #4 (Figure 6-9) and #3 on the timer (Figure 6-10).or
    b. check for 24VAC between terminal #4 (Figure 6-9) and #4 on the timer (Figure 6-10).
12. If 24VAC can not be found on either of these check for 24VAC across #1 on the timer and #4 (Figure 6-9). If 24VAC present replace the Timer

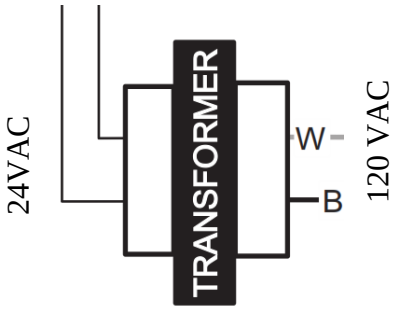


Figure 6-8 Transformer Wiring

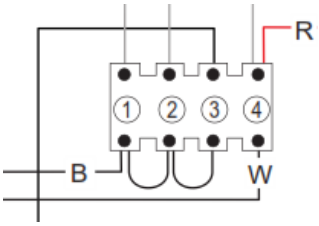
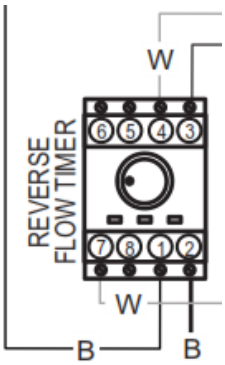


Figure 6-9 Short Electrical Strip



P/N 005-900673

Figure 6-10 Timer Wiring

Aquastats (A421 will replace A419)

Although most Aquastats can go much higher, it is highly recommended that the MAXIMUM temperature of the heat exchanger NOT EXCEED 180ºF.

A421 Series Electronic Temperature Control

P/N 005-900676

The A421 series controls feature a lockable front-panel touchpad for setup and adjustment, and an LCD for viewing the temperature and status of other functions. An LED indicates the controls' output relay On/Off status (Figure 6-11).

Figure 6-11 A421

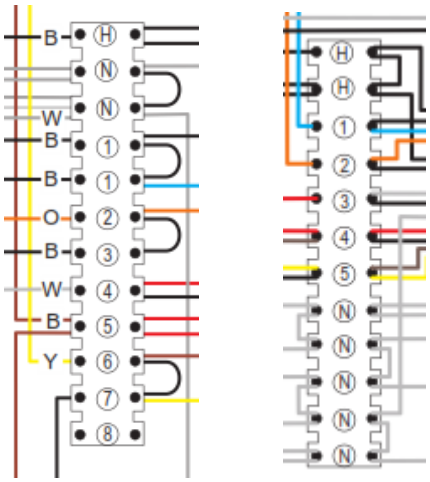
Model: 2100-0600 & 2100-0900

Check for 120VAC between Letter 'N' and #6 (Figure 6-12) on the terminal strip. If no power.is found check;

a. That setting on the aqua-stat is at the desired setting (Table 6-1).
b. Well Sensor (electronic), and verify that it is intact and positioned properly in its well.
c. If a) and b) check out, replace both the Aqua-Stat and Well Sensor.

Model: 2100-0300

1. Check for 120VAC between Letter 'N' and #5 *(Fig 6-13)* on the terminal strip. If no power.is found check;
   a. That setting on the aqua-stat is at desired operating temperature.
   b. Well Sensor (electronic), and verify that it is intact and positioned properly in its well (Refer to Sensor Check & Table 6-3).
   c. If a) and b) check out, replace both the Aqua-Stat and Well Sensor.



Terminal strip from 2100-0600 & 2100-0900

Terminal strip from 2100-0300

Figure 6-12 Long Electrical Strips

Table 6-1 A421 Settings

Parameter Code	Parameter Description (Menu)	Range of Usable Values	Factory Default Value
Un	Temperature Units (Advanced only)	°F or °C	°F
OFF	Relay Off Temperature (Basic, Advanced, and Restricted)	-40 to 212 °F (-40 to 100 °C)	175°F
On	Relay On Temperature (Basic and Advanced)	-40 to 212°F (-40 to 100°C)	174°F
ASd	Anti-Short Cycle Delay (Basic and Advanced)	0 to 12 (minutes)	0 (minute)
tSb	Temperature Setback (Advanced only)	-50 to 50°F (-30 to 30°C)	0°F
So	Sensor Offset Adjustment (Advanced only)	-5 to 5°F (-3 to 3°C)	0°F
HtS	High Temperature Stop (Advanced only)	-40 to 212°F (-40 to 100°C)	180°F
LtS	Low Temperature Stop (Advanced only)	-40 to 212°F (-40 to 100 °C)	80°F
SF	Sensor Failure Action (Basic and Advanced)	0 = output relay de-energized 1 = output relay energized	0 (output relay energized)
bLL	LCD Backlight Brightness Level Adjustment (Advanced only)	0 to 10; 0 = backlight off, 10 = brightest backlight setting	10 (brightest backlight)

A419 Series Electronic Temperature Control

P/N 005-900676

The A419 (Figure 6-13) shares some of the same features as the A421 and will be phased out in future models. Refer to the trouble shooting guide for the A421.

Table 6-2 A419 Setting

Function	Range	Factory Setting
***SP*: Setpoint**	-30 to 212°F (-34 to 100°C)	175
***dIF*: Differential**	1 to 30° (F or C)	1
***ASd*: Anti-short Cycle Delay**	0 to 12 minutes	0
***OFS*: Temperature Offset**	0 to 50° (F or C)	0
***SF*:Sensor Failure Operation**	0 = output de-energized 1 = output energized	1

Figure 6-13 A419

Aquastat (1st Stage)

The 1st stage aqua-stat controls the water heater's outgoing water temperature.

Model - Johnson (A350A/B) Electronic Temperature Control (Figure 6-14)
P/N 006-702126

Check and verify that there is 24 volts between terminal COM & 24V terminals located on the top left side of the control.

Model 2000-0250 & 2000-1200

Check for 24 volts at terminal COM which is located at the bottom of the control to verify that power is entering the control.

Check for 24 volts at terminal NO which is located at the bottom of the control when the control calls for heat. The red indicator light will be on when the control calls for heat.

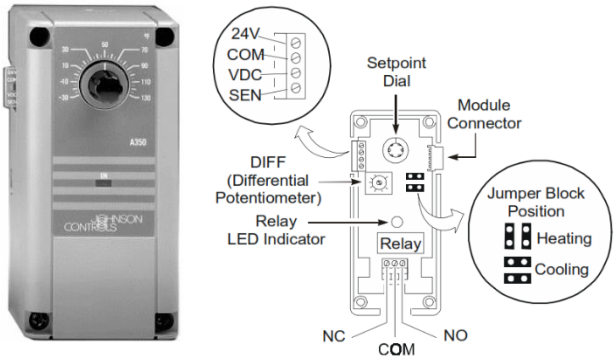


Figure 6-14 Johnson (A350A/B) Electronic Temperature Control

Model 2100-0600 & 2100-0900

Check for 120 volts at terminal COM (located at the bottom of the control) to verify that power is entering the control.

Check for 120 volts at terminal NO (located at the bottom of the control) when the control calls for heat. The red indicator light (Relay LED Indicator) will be on when control calls for heat.

Note; If there is no power on terminal NO when the control calls for heat, the control is faulty and requires replacement (replace temperature control and sensor).

Aquastat (2nd Stage)

The 2nd stage aqua-stat controls the water heater's high fire.

Note: This control is only used on the Model 2000-1200

Model - Johnson (S350C Temperature Slave Stage Module) (Figure 6-15)
P/N 006-702127

Model 2000-1200

Check for 24 volts at terminal COM which is located at the bottom of the control to verify that power is entering the control.

Check for 24 volts at terminal NO (located at the bottom of the control) when the control calls for heat. The red indicator light (Relay Energized LED Indicator) will be on when the control calls for heat.

If there is no power on terminal NO when the control calls for heat the control is faulty and requires replacement (replace temperature control and sensor).

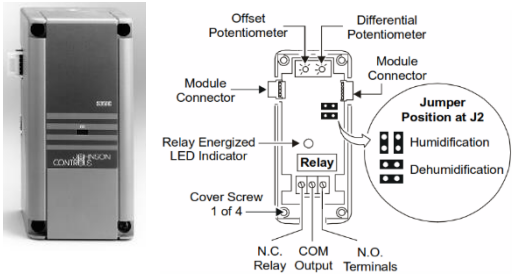


Figure 6-15 Johnson (S350C Temperature Slave Stage Module)

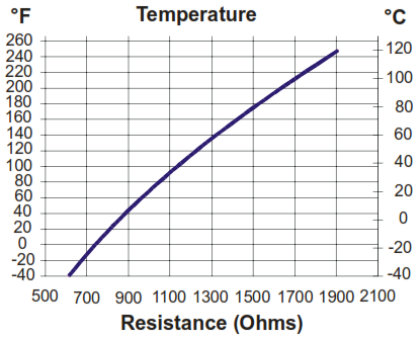
Sensor Check

P/N 006-702391, or 005-703932 (depending on length)

Check temperature sensor for proper resistance

1. Disconnect the sensor from the control. Using an ohmmeter, measure the resistance across the two sensor leads (see Temperature/Resistance Graph to right).
2. Verify supply temperature reading. Utilize the graph below to verify sensor conformance.

Table 6-3 Sensor Readings



Flame Roll-Out Switch (Figure 6-17)

P/N 005-702295

The flame roll out switch shuts down the water heater when flame roll out occurs. Flame roll out occurs when the heating appliance's heat exchanger is plugged or the central heating unit is in a position where it is prone to down drafting.

Figure 6-16 Flame Roll Out Switch

Model - Thermodisc (10H14)

Check for 24 volts entering and leaving switch.

There is a reset button on the center of the switch. Used on 2000 series units.

Flow Switch (Figure 6-18)

The flow switch will shut down the water heater if fluid flow is insufficient.

Figure 6-17 Flow Switch

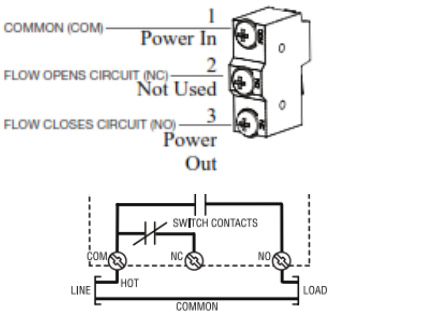


Figure 6-18 Flow Switch Power Connections

Model -WATTS (FS-200-W series)

P/N 006-700778

To verify that control is operating properly the power check must be done with the central heating unit running.

Model 2000-0250 & 2000-1200

Check for 24 volts between 1 & Ground. Check for 24 volts between 3 & Ground (Figure 6-19).

Model 2100-0300, 2100-0600 & 2100-0900

Check for 120 volts between 1 & Ground (Figure 6-18). Check for 120 volts between 3 & Ground. If there is no power between 3 & Ground, check the Y-strainer screen for debris and that the pump is operating properly before verifying that the flow switch is faulty.

Model 200 and 650 GTS (see image below)

Check for 120V between NO and ground. Check for 120V between COM and ground. If no power check that unit pump is turned on and that hose connections have been made to manifold. If no power and pump and hose connections are correct, flow switch is faulty, replace switch.

Figure 6-19 Flow Switch model 200/650 GTS

Hi limit control Manual

Reset (Figure 6-20)

P/N 006-702140

The high limit shuts down the water heater when excessive temperatures of 200ºF are reached.

Note: When tripped, the manual reset button must be pressed to reset the high limit controller.

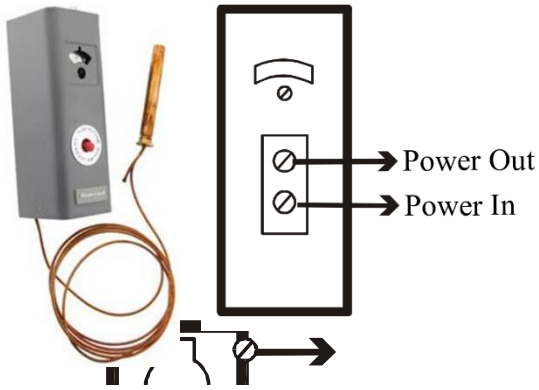


Figure 6-20 High Limit Control (Manual Reset)

Model 2000-1200 (all United States water heaters) & 2000-0250

Check for 24 volts power entering the control

Check for 24 volts power leaving the control.

2100-0300, 2100-0600 & 2100-0900

Check for 120 volts power entering the control.

Check for 120 volts power leaving the control.

If power is entering the High Limit control and not leaving then replace the "High Limit Controller"

High Limit Control (Automatic Reset) (Figure 6-21)

P/N 006-701532

The high limit shuts down the water heater when temperatures in excess of 200ºF (93ºC) are reached (set point is adjustable - 200ºF is recommended).

Model - Ranco (G1-11452)

Model 2000-1200, 2000-0250

Check for 24 volts power entering the control. Check for 24 volts power leaving the control.

Model 2100 Series and all GTS units

Check for 120 volts power entering the control. Check for 120 volts power leaving the control.

If power is entering the High Limit Control and not leaving then replace the "High Limit Controller"

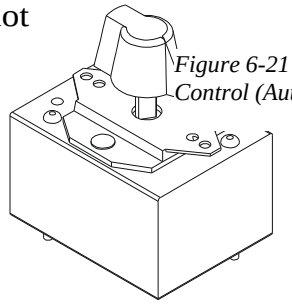


Figure 6-21 High Limit Control (Automatic Reset)

Ignition Module (Figure 6-22)

P/N 006-701212

The ignition module sparks the igniter, powers up the pilot valve, and powers up the main gas valve.

Model - Honeywell (SH8600 & SH8610 Ignition Module)

Note: Make sure water heater is functioning before performing power check.

Check for 24 volts between MV/PV & 24V.
Check for 24 volts between MV/PV & PV.
Check for 24 volts between MV/PV & MV.

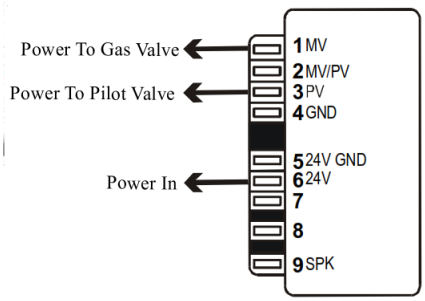


Figure 6-22 Ignition Module

Low Pressure Switch

P/N 006-702313

The low pressure switch prevents under firing operation with inadequate gas pressure.

Note: Verify that the reset button is not tripped when performing the power check.

Check for 24 volts between neutral & COM.
Check for 24 volts between neutral & NC

Low Water Cut-Off

P/N 006-700191

The low water cut-off shuts off the pump and water heater when heat transfer fluid drops below low water cut-off sensor (below a safe operating level) in reservoir.

Sensor Check

Note: Verify that there is sufficient fluid (1/4 cold, 3/4 hot on "HTF" Level Gauge) in the tank before performing sensor check.

To check the sensor, remove the wire from the end of the sensor, the pump and water heater should shut down.

Note: Verify that there is fluid in the tank before performing any electrical tests.

Model – Safgard 650 (Figure 6-23)
(Most Common LWCO)

Check for 120 volts between 2 & 1.

Check for 120 volts between 2 & P2.

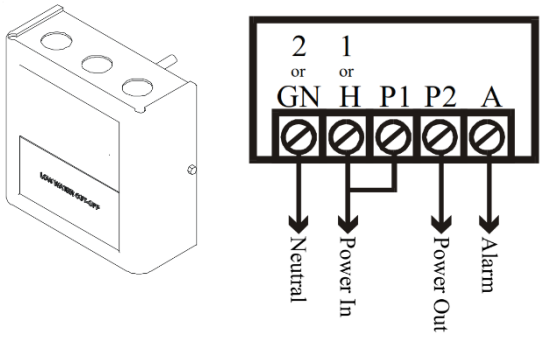


Figure 6-23 Model – Safgard 650

Model - Guard Dog (PS-851-M-120) (Figure 6-24)

Note: This low water cut-off is only on the Model 2000-1200 G6. To verify that control is operating properly the power check must be done when the water heater is fired and in operation.

Check for 120 volts between 1 & 2.

Power In: Check for 24 volts between 5 & ground

Power Out: Check for 24 volts between 3 & ground

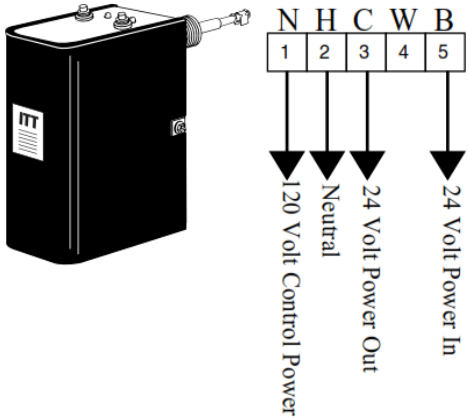


Figure 6-24 Model - Guard Dog (PS-851-M-120)

Low Water Cut Off (200/300/400/650 GTS units)

Check for fluid in reservior tank. If fluid is present check for 24V power in and out of the sensor. If no power, check the wiring schematic for correct orientation of the float valve. If in correct postion and still no power, check for 24V on the transformer. If power out of transformer change float valve. If no power out of 24V transformer, check for 120V in, if 120V in repalce the transformer.

Main Gas Valve (2 Stage) (Figure 6-25)

The main gas valve controls the gas entering the burner tray.

Model - Honeywell (V8944B) & (V8944C)

P/N 006-701527

Check for 24 volts between MV & MV/PV. Check for 24 volts between PV & MV/PV.

Note: If there is power at the terminals noted and no gas is feeding through gas valve, check and verify that the gas pressures are correct (verify the High/ Low Pressure Switches have not been tripped, if tripped reset switches).

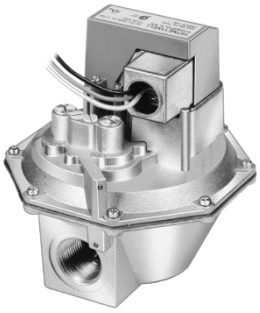


Figure 6-25 Honeywell (V8944B) & (V8944C)

Micro Switch (Figure 6-26)

The micro switch powers up the hose reel motor when the automatic feed arm is engaged.

Model - Micro Switch BZE6-2RN2
P/N 002-702089

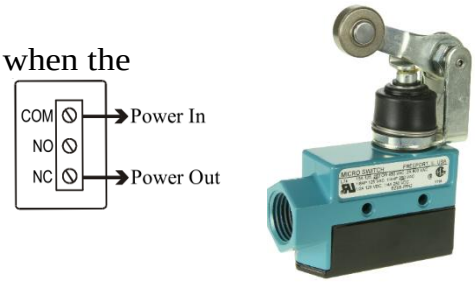


Figure 6-26 Micro Switch BZE6-2RN2

Pilot Valve (Figure 6-27)

The pilot valve controls the gas feed to the pilot.

Check for 24 volts between the two terminals. If no power check for 24V at PV on ignition module. If power at pilot valve, contact Dryair for assistance.

Model - Basotrol H91WG-1
P/N 006-701218

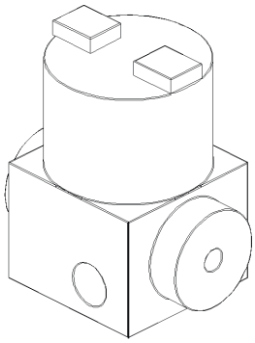


Figure 6-27 Basotrol H91WG-1

Proportional Temperature Control (Figure 6-28)

The proportional temperature control manages the Mixing Booster's outgoing water temperature.

Check for 24 volts between 24 volts terminal & terminal C.

Model - Johnson A350PS-1C
P/N 005-702929

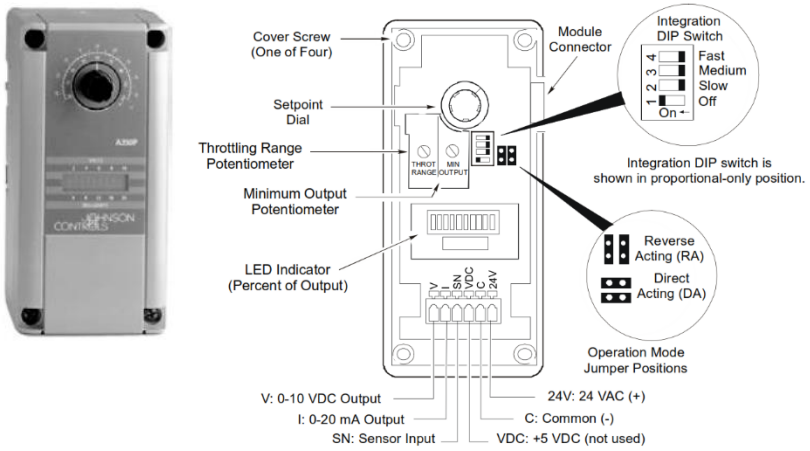


Figure 6-28 Johnson A350PS-1C

Pumps (Figure 6-29)

P/N 012-800055 (2000-1200, 2100-0900)
P/N 012-800054 (2100-0600/600GTS/650GTS)
P/N 012-800052 (2100-0400/200GTS/300GTS/400GTS)
The pump circulates the heat transfer fluid in the fluid circulation system.

Model - NPE
Model - 2000-1200, 2100-0600, 2100-0900 and the Plate Heat Exchanger.
Check for 220 volts at L1 and L2.
Model - 2000-0250, 2100-0300, and the Mixing/Booster.
Check for 110 volts between L1 & L2.

Figure 6-29 Goulds Pumps

Redundant Valve 100% Shut Off

`The redundant valve eliminates any chance of gas to enter the burner tray when the water heater isn't calling for heat.

Check for 24 volts between the two terminals.
Model - Honeywell V88A 1618 (Figure 6-30)
P/N 006-701874

Note: If there is power at valve and there is no gas going through valve, verify that the bleed vent tubes is not plugged.

Model - Honeywell V5055C-1059 (Gas code G6 NG-PN) (Figure 6-31)
P/N 006-702318

Figure 6-30 Honeywell V88A

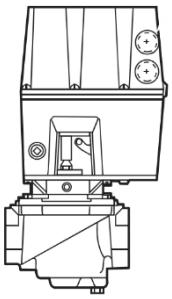


Figure 6-31 Honeywell V5055

Solenoid Valve 100% Shut Off

The solenoid valve alleviates any chance of gas to enter the burner tray when the water heater isn't calling for heat.

Check for 24 volts between the two terminals.

Model - ASCO (S261SF02N3GJ7)

P/N 006-702317

Thermostat (Figure 6-32)

The thermostat controls the ambient air temperature in the building by cutting power to the fan blower.

Check for 120 volt power between terminals 1 & 3 and Neutral or Ground.

Model - Johnson A19ABA
P/N 005-701111

Figure 6-32 Johnson A19ABA

Transformer

The transformer converts 110 volt power to 24 volt power.

Check for 110 volts entering and 24 volts leaving control.

Model - Primary 120V 50/60 Hz, Secondary 24 V 40 VA, Class 2
P\N 006-701213

Valve Actuator (Figure 6-33)

The valve actuator operates and controls the 3 way mixing valve.

Power Check

Check for 24 volts between T6 & T5.

Model - Honeywell ML7984
P\N 005-702255

Figure 6-33 Honeywell ML7984

Adjustable FrequencyDrive

P/N 012-701545

The adjustable frequency drive converts 1 phase power to 3 phase power, controls the motor speed and the forward and reverse.

Model - Penta Power (KBVF) (Figure 6-34)

Check for 110 volts between L1 & L2.

Table 6-4 VFD Trouble shooting

LED	Drive Status	Color and Flash Sequence	Flash Rate	Color and Sequence[4] After Recovered Fault
ST (Status)	Normal Operation (Run)	Green	1 Sec. On / Off	—
	Overload (120% – 160% Full Load)	Red	On Continuously	Green
	I^2t (Drive Timed Out)	Red	0.25 Sec. On / Off	—
	Short Circuit	Red	1 Sec. On / Off	—
	Undervoltage	Red / Yellow	0.25 Sec. On / Off	Red / Yellow / Green[5]
	Overvoltage	Red / Yellow	1 Sec. On / Off	Red / Yellow / Green[5]
	Stop	Yellow	On Continuously	—
	Phase Loss Detection[1,2]	Yellow	0.04 Sec. On / 0.06 Sec. Off	—
	Communication Error[3]	Green / Red	1 Sec. On / Off	Green
PWR (Power)	Buss and Logic Power Supply	Green	On Continuously	—

Notes: 1. Phase Loss Detection: Models KBVF-23P, 24P, 29, 45, 48. 2. Requires AC line restart. 3. With DIVF Modbus Communication Module Installed. 4. All LED flash rates, after recovered faults, are 1 Sec. On / Off. 5. Drive will require manual restart to return the Status LED color to its normal flashing green.

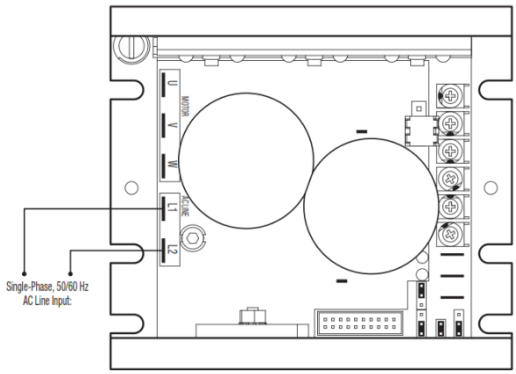


Figure 6-34 Penta Power (KBVF)

Figure 6-35 ATV11

Trouble shooting for drive is done utilizing the indicator lights located on the bottom left corner of the drive. Below is the trouble shooting chart.

Model - ATV11Fault reset (Figure 6-35)

Used to clear the stored fault and restart the drive if the cause of the fault has disappeared. The fault is cleared by transition of the logic input LI which is assigned to this function.

Factory setting: function inactive.

The reset conditions after a reset to zero are the same as those of a normal power-up.

The following faults can be reset: drive thermal overload, motor thermal overload, line supply overvoltage, overvoltage on deceleration, over speed, line phase loss, line supply under voltage.

Automatic restart

Enables the drive to be restarted automatically after locking following a fault if this fault has disappeared and if the other operating conditions permit a restart.

This restart is performed by a series of automatic attempts separated by increasingly longer waiting periods: 1 s,
5 s, 10 s, and then 1 minute for the following periods.

If the drive has not restarted after 6 minutes, the drive locks and the procedure is abandoned until the drive is powered down and back up again. Factory setting: function inactive.
Restart authorized with the following faults: drive thermal overload, motor thermal overload, and line supply overvoltage, overvoltage on deceleration, line phase loss, and line supply under voltage.

If the function is enabled, the drive's safety relay remains activated until one of these faults appears. This function requires the speed reference and the direction of the operation to be maintained, and is only compatible with 2-wire level control.
Maximum operating altitude = 1000 m (3280 ft.) without derating. Above this, derate the current by 1% per additional 100 m (328 ft.) Maximum relative humidity = 5-93% non-condensing and without dripping, per IEC 60068-2-3

HRA 4000/6000 (belt drive hose reels)

Reel Direction Modes

Mode 1 - Powered Load
Mode 2 - Freewheeling Unload
Mode 3 - Powered Unload
Mode 4 - Cold Starting

Mode 1 - Powered Load

The LOAD mode is achieved when the MOTOR OPERATION toggle switch is in the LOAD position and the belt is sufficiently tightened to transmit power from the motor/gearbox to the hose reel spool.
The foot switch is momentary and will only operate when it is depressed.
The hose must be directed manually into position on the hose reel.
The hose reel speed may be varied by means of the MOTOR SPEED dial.

Mode 2 - Freewheel Unload

The BELT TENSION switch controls the linear actuator, which positions the pivot arm, on the end of which is an idler sheave that depresses the drive belt. This adjusts the belt tension. With the belt loosened the hose reel may freewheel.
It is important to maintain sufficient tension on the belt to allow a degree of braking on the hose reel spool while unrolling hose. The hose reel spool possesses a variable amount of inertia depending on its mass and its angular velocity.

This necessitates gradually loosening the belt as the hose is unloaded: less spool inertia (from decreased mass) requires less braking.

Note that for transport of the hose reel it is advisable to maintain sufficient tension on the hose reel to arrest any rotation of the hose reel spool caused by motion of the unit.

Mode 3 - Powered Unload

The UNLOAD mode is achieved when the MOTOR OPERATION toggle switch is in the UNLOAD position and the belt is sufficiently tightened to transmit power from the motor/gearbox to the hose reel spool. The foot switch is momentary and will only operate when it is depressed.

Mode 4 - Cold Starting

It is advisable that when beginning operation below 18°F (-8°C) that the belt tension be temporarily loosened far enough that motor rotation will not cause spool rotation and that the motor be powered for a minimum of 5 minutes. This will allow the oil in the gearbox to warm up and to allow smooth low-temperature operation.

Re-tension the belt following system warm-up and begin your desired operation.

7.Optional Equipment

Generators

Dryair typically offers two different generators. The Multiquip DAC7000 and Kubota GL7000. They are both of similar size and capacity. They both also operate using diesel fuel which makes either of them a good choice as the portable units that utilize them also operate with diesel fuel.

Multiquip DA7000

- A copy of their warranty policy can be found here;
  - http://service.multiquip.com/pdfs/MQWarrantPackage0115.pdf
  - For immediate service help relating to this Generator contact information provided below;
  - http://service.multiquip.com
  - CE Tech hotline 1-888-661-8992
    - This hotline is available to all of our customer Monday - Friday 5AM to 5PM (PST).

Kubota GL7000

- A copy of their warranty policy can be found here;
  - http://www.kubotaengine.com/support

Canada

KUBOTA CANADA LTD.
Engine Division :
5900 14th Avenue, Markham, Ontario L3S 4K4, Canada
Phone: 905-294-7477 / Fax: 905-294-1554

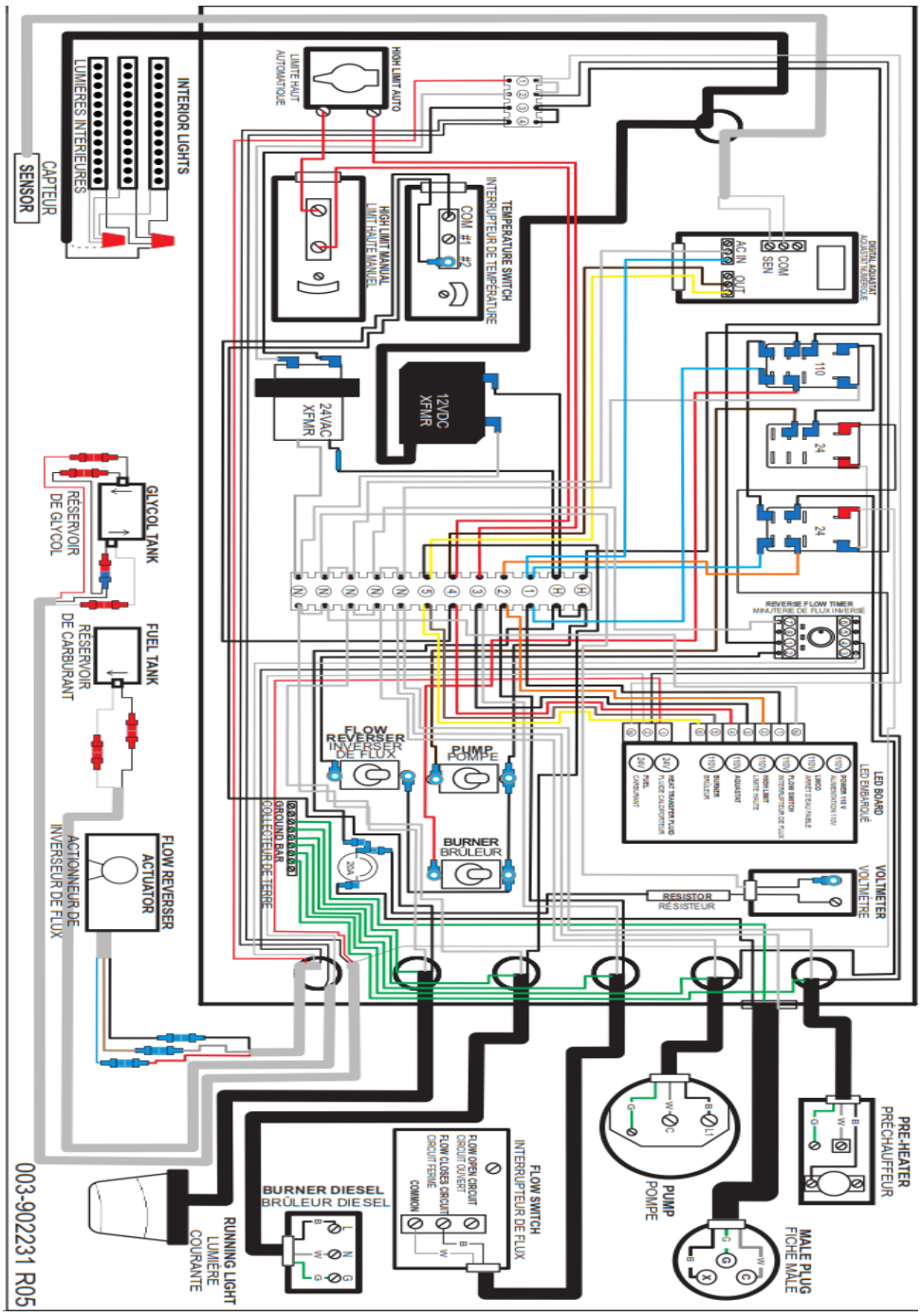
U.S.A., Puerto Rico, Caribbean Islands, Panama, Haiti

KUBOTA ENGINE AMERICA CORPORATION
505 Schelter Road, Lincolnshire, IL 60069
Phone: 847-955-2500 / Fax: 847-955-2699

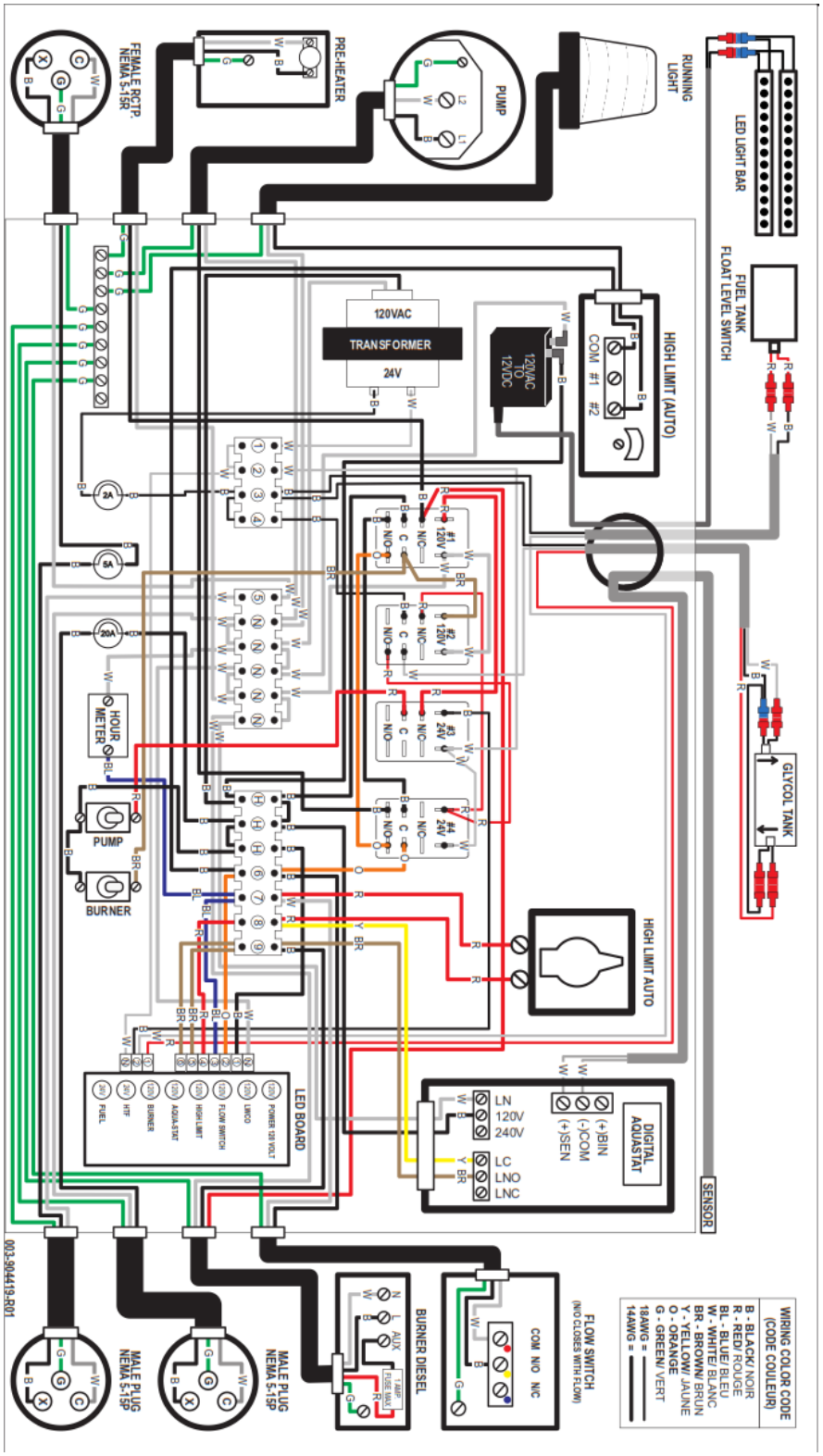
8.Appendix

Electrical Schematics (newest revision level, some wiring may differ for the following electrical schematics. If older schematics are needed contact DRYAIR service department.

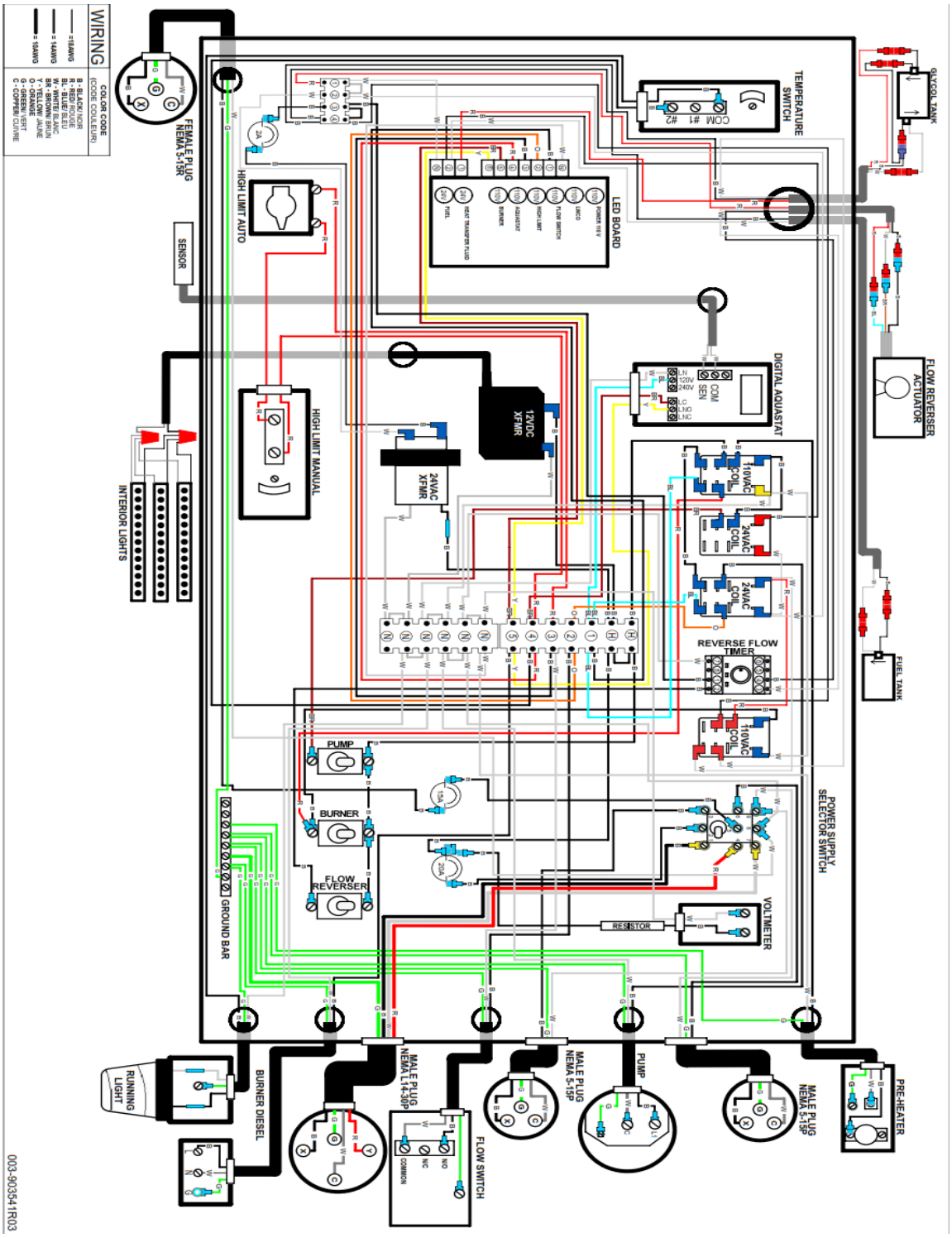
Model GTS 2100-0300



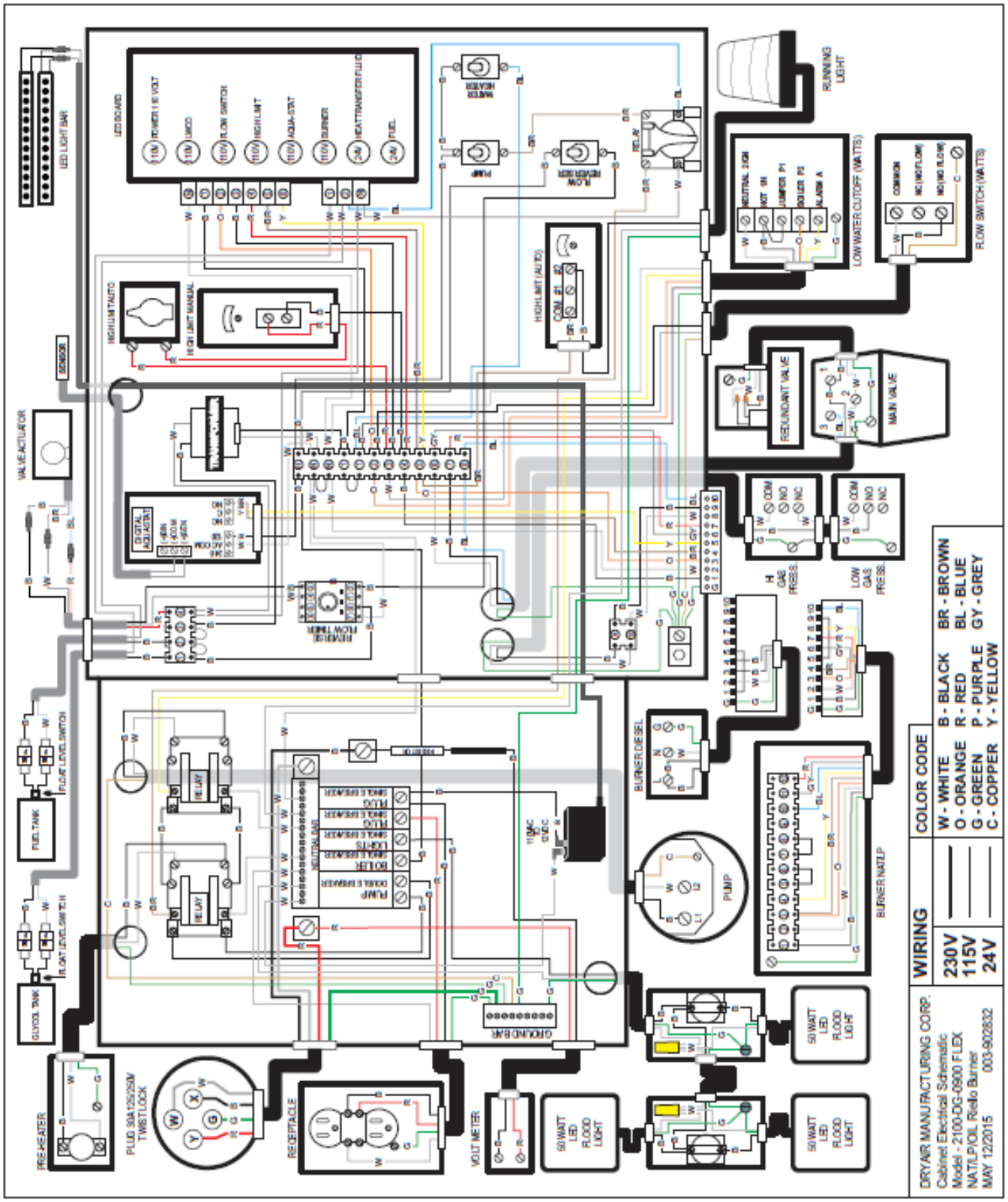
Model 200 GTS



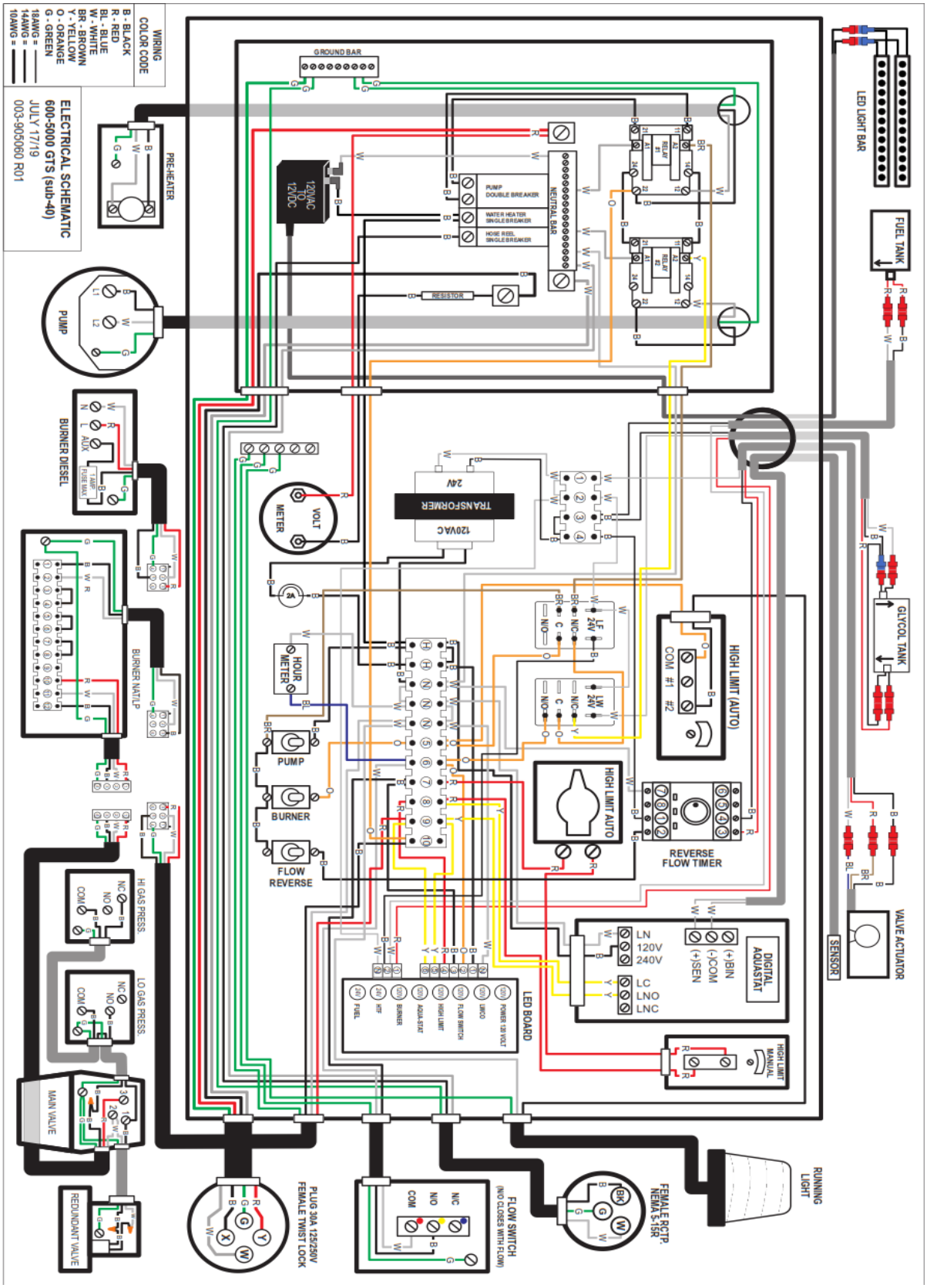
Model 400 GTS



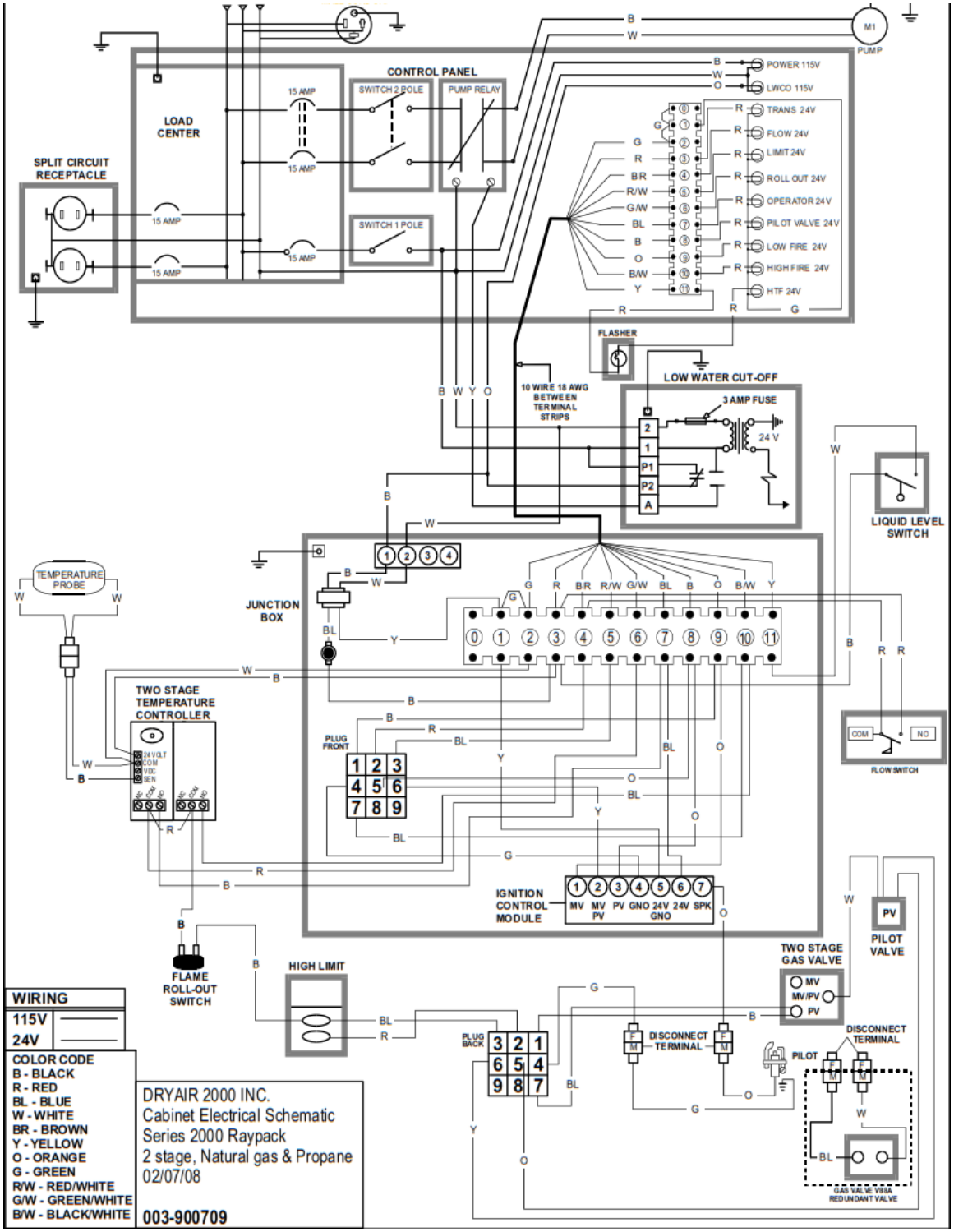
Model 2100-0900 FLEX



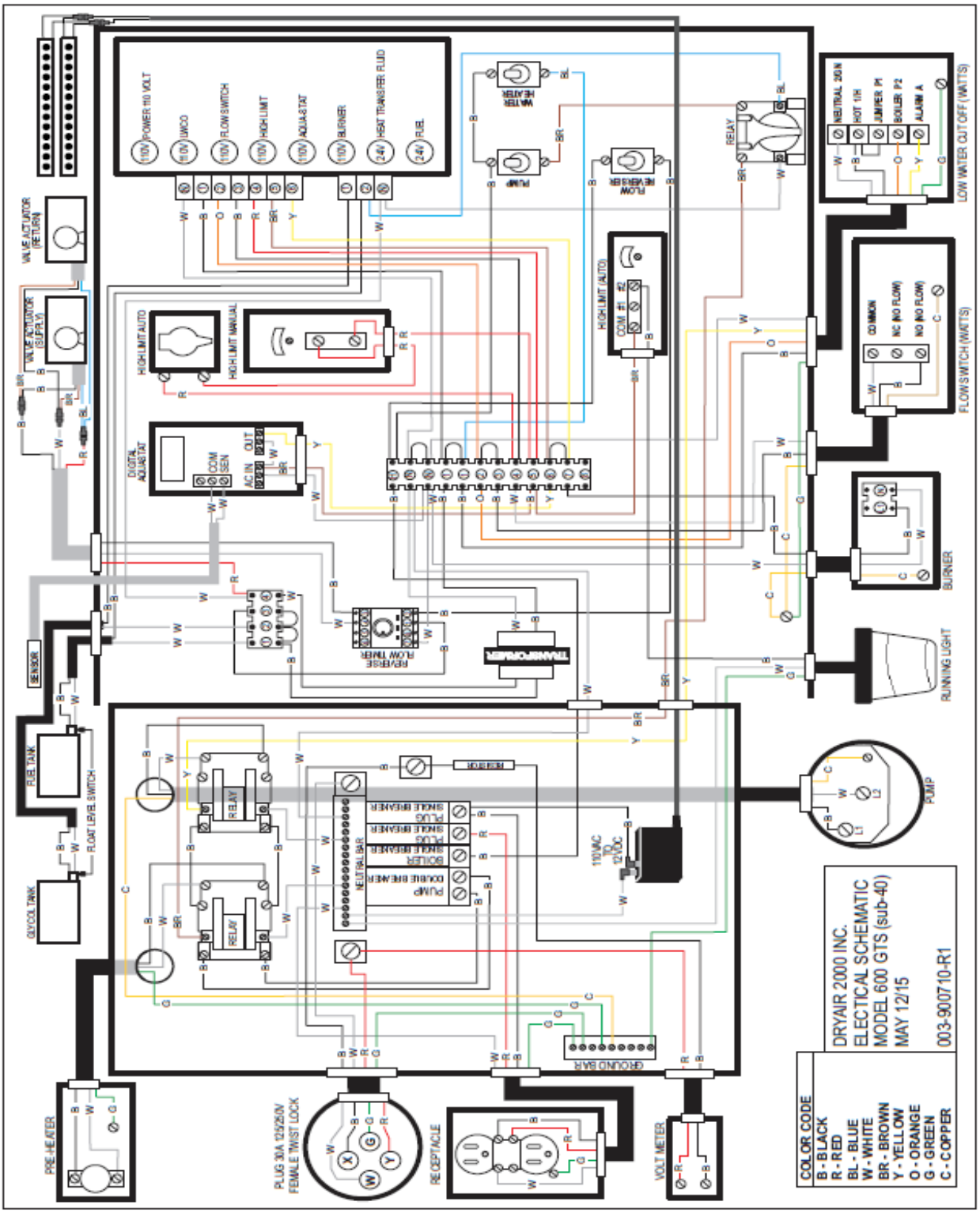
Model 650 GTS



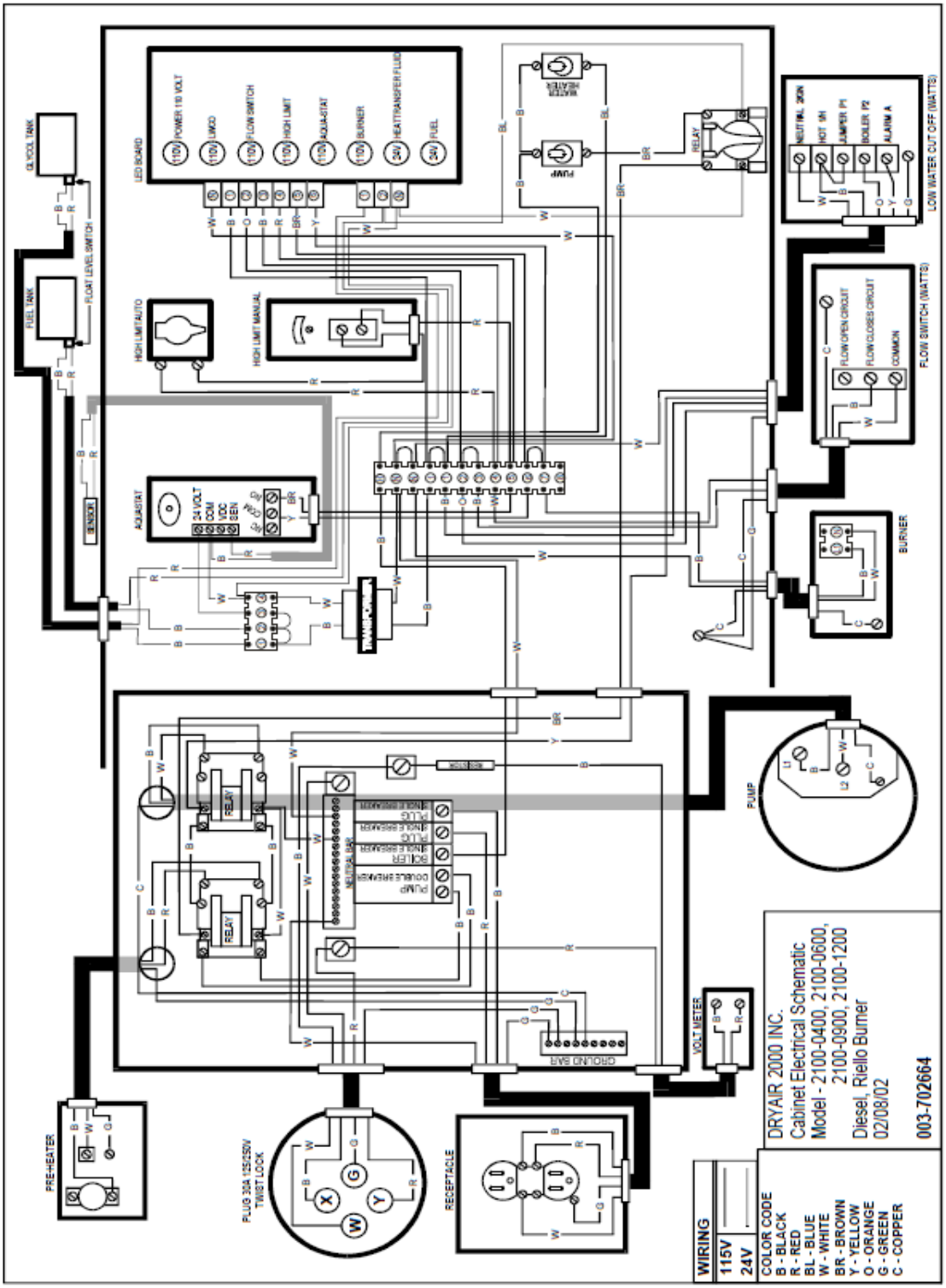
Model CHU 2000-1200



Model 600/900 GTS Diesel only



Model CHU 2100-0600, 2100-0900 (stand alone unit)



Model Steam Plate – HESF 1000

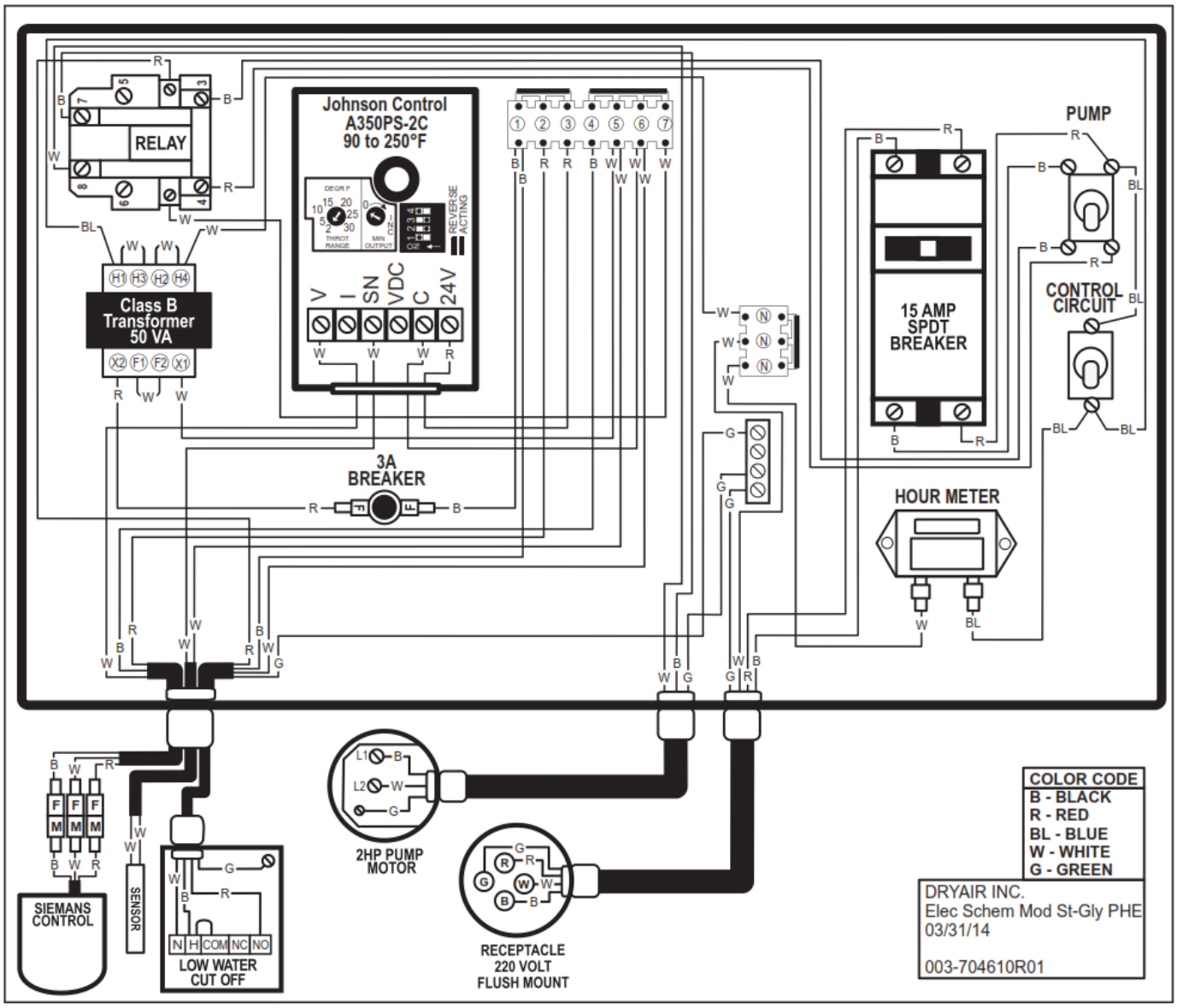
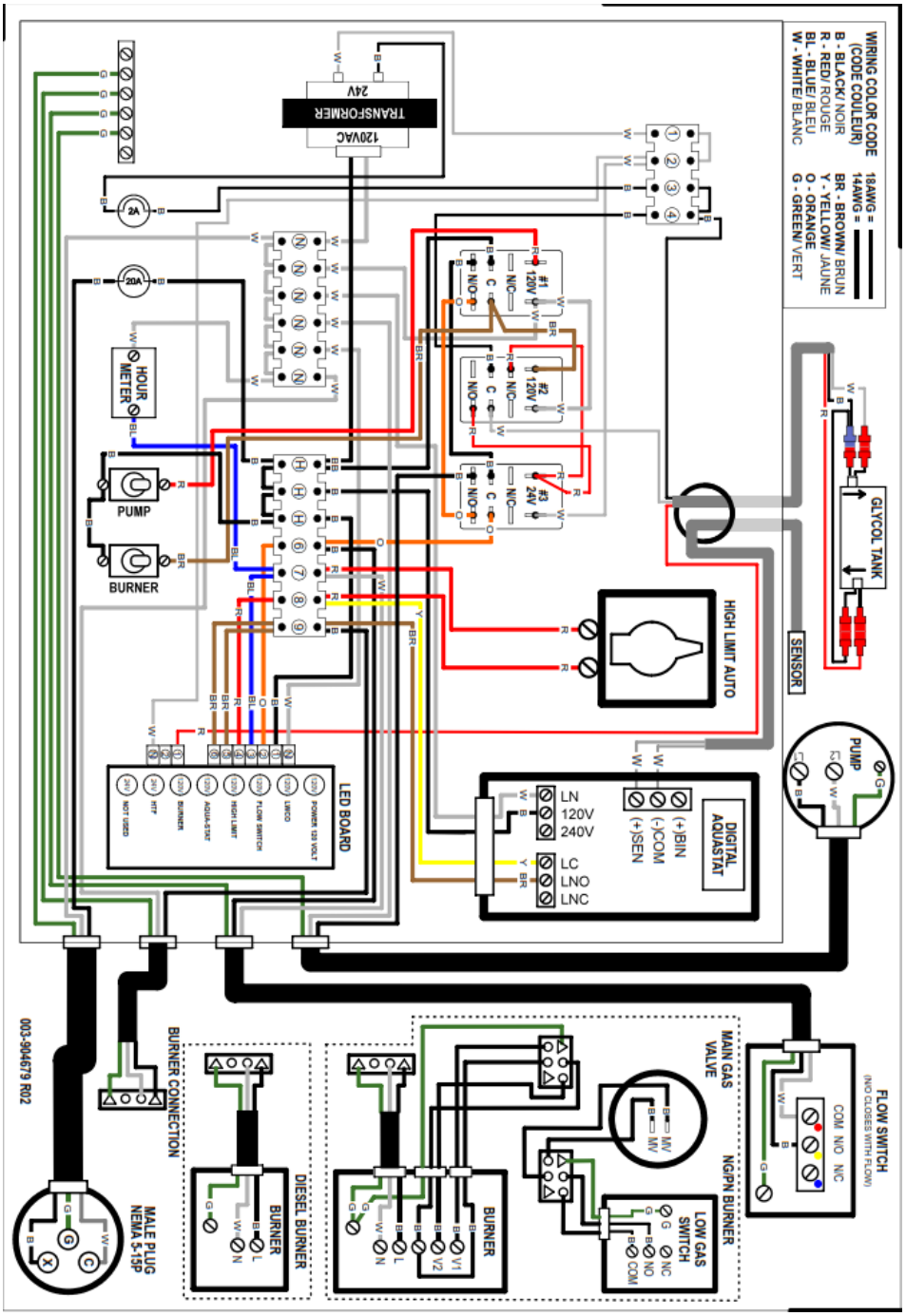


Figure 8-2 Model Steam Plate – HESF 1000

Model 2100-0400 CHU



Model HE200 Fan Coil

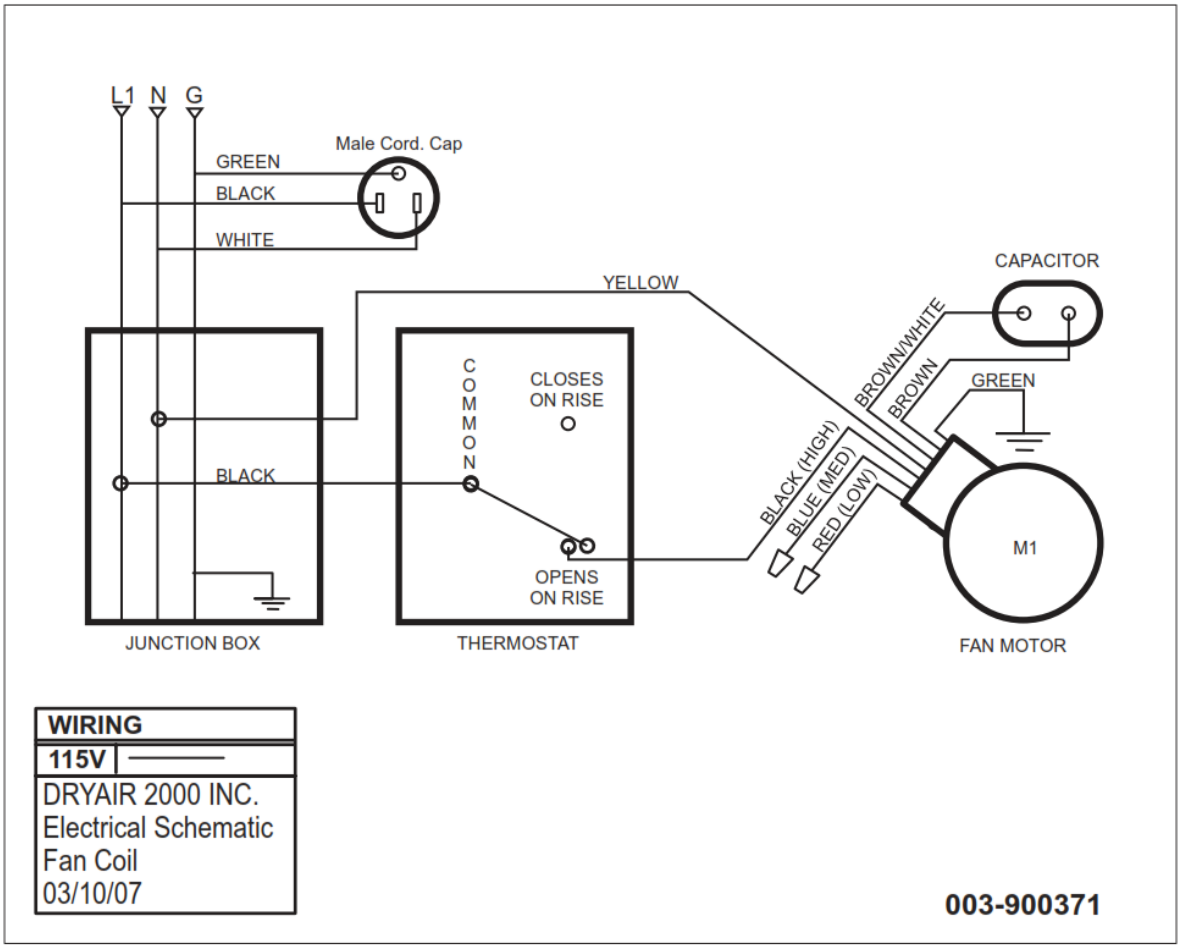


Figure 8-3 Model HE200 Fan Coil

Model HE80 Fan Coil (slimline)

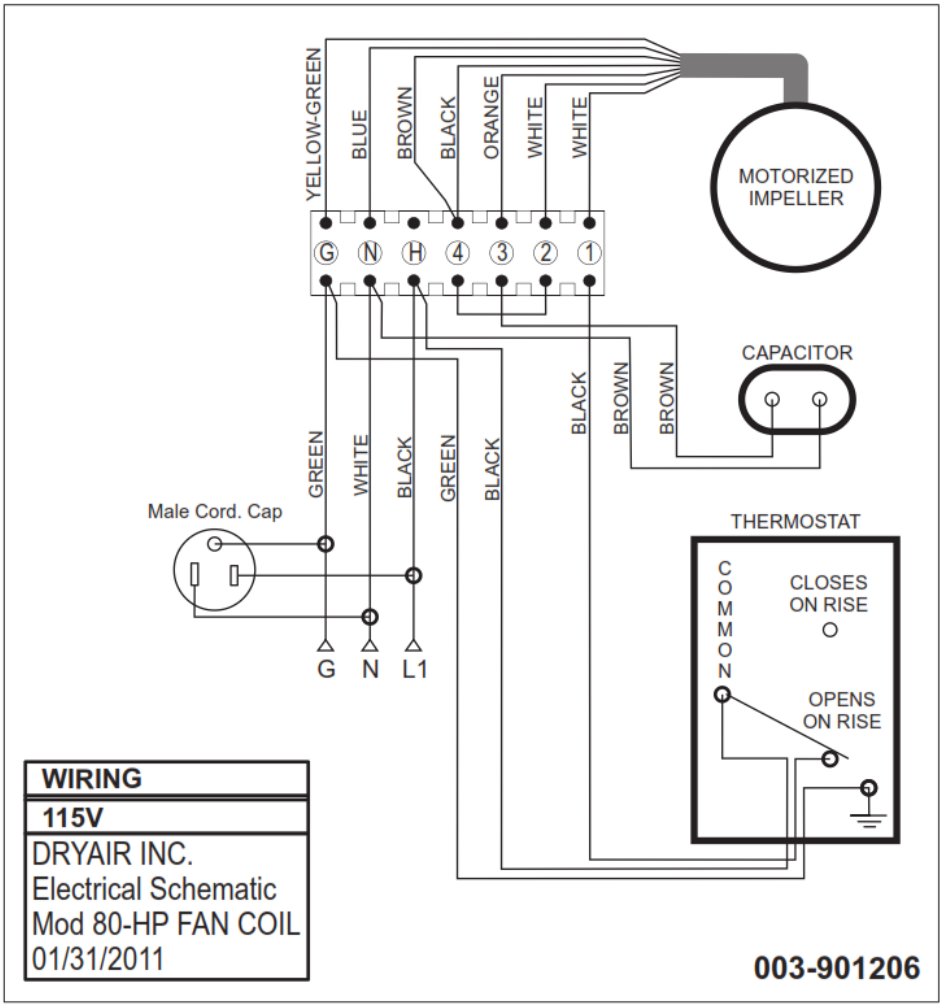


Figure 8-4 Model HE80 Fan Coil

Model HE600 Fan Coil

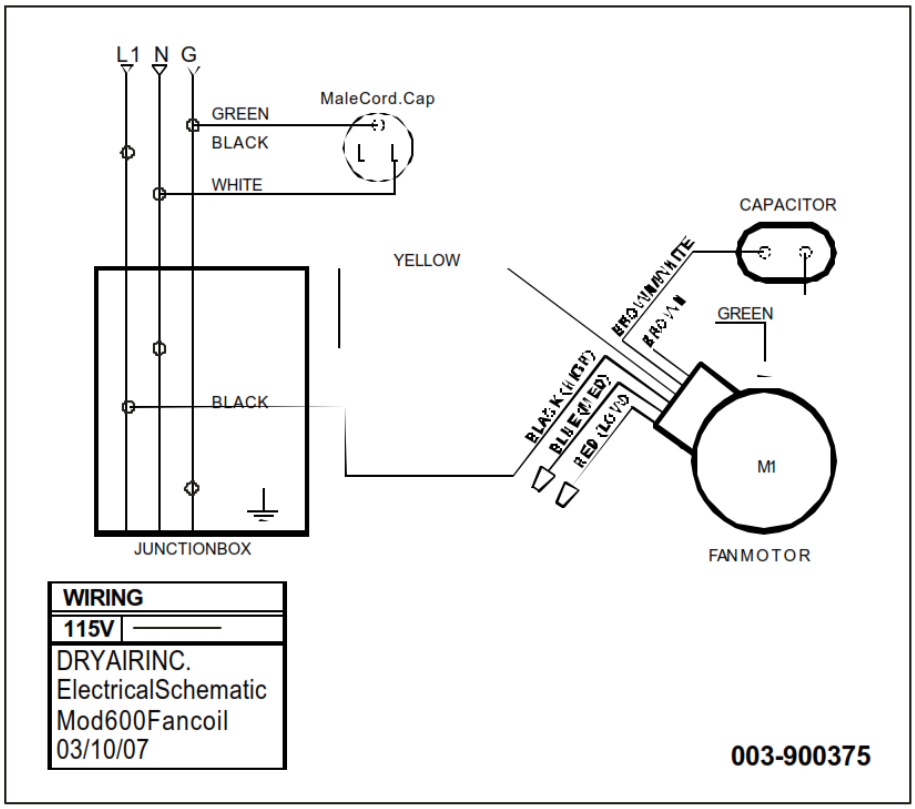


Figure 8-5 Model HE600 Fan Coil

Model MAXCOIL

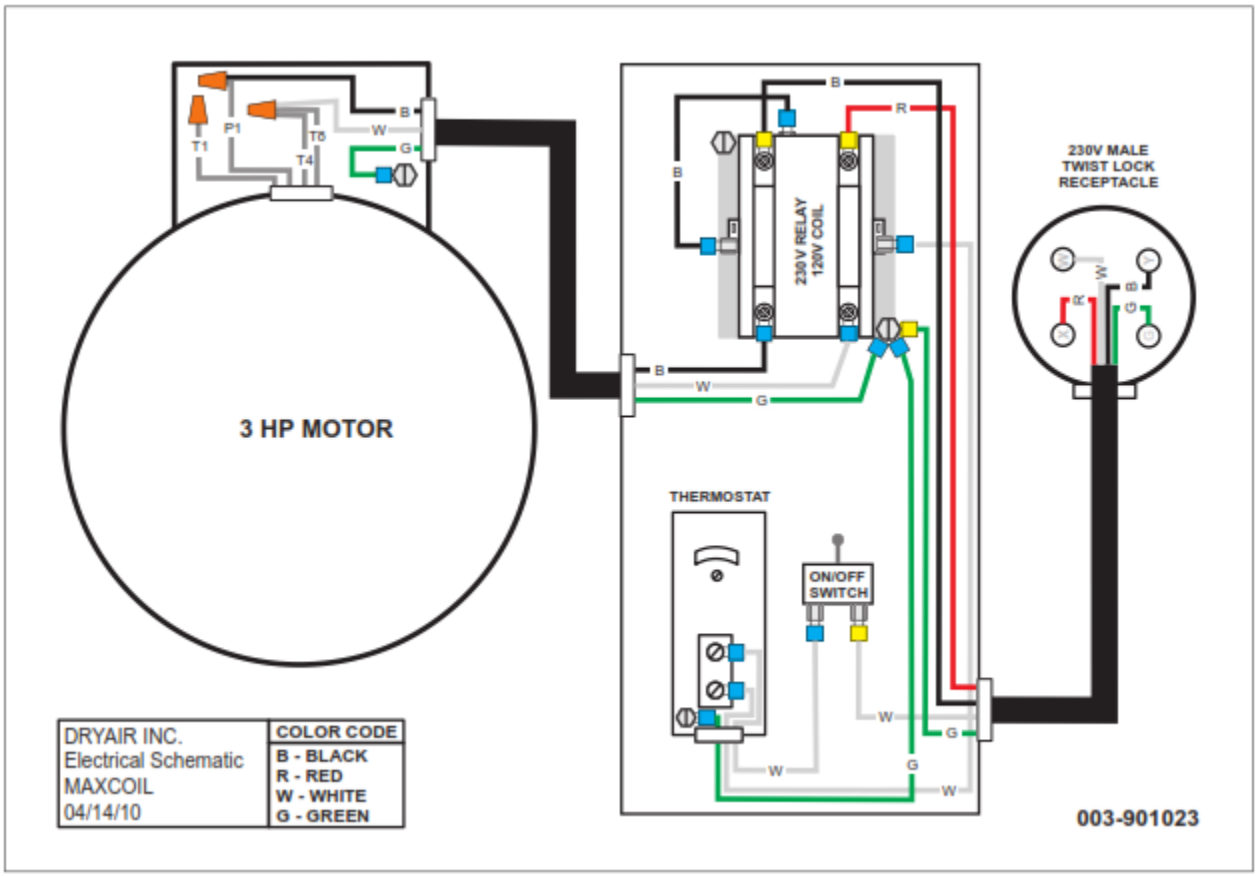
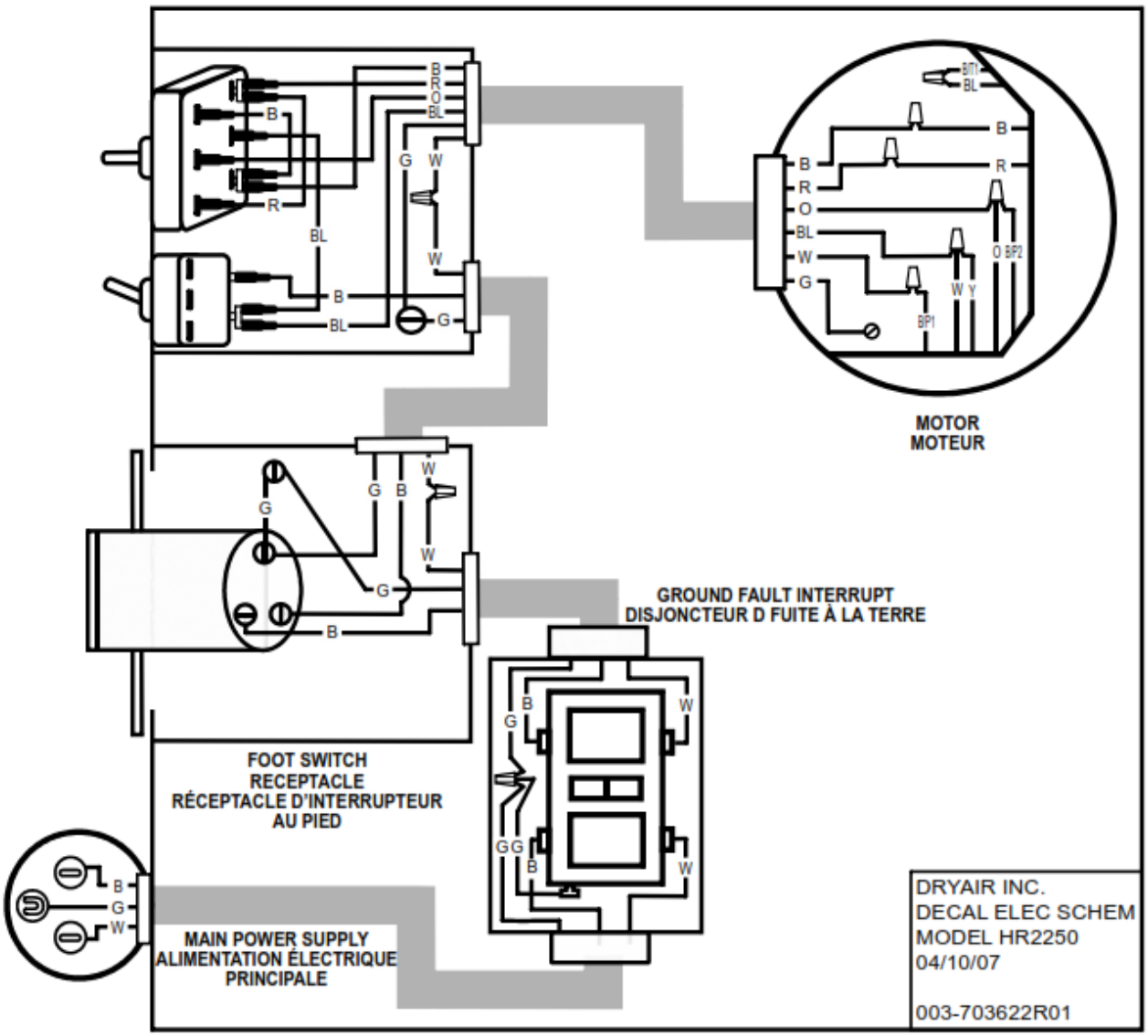


Figure 8-6 Model MAXCOIL

Model Hose Reel HR2250



WIRING - CÂBLAGE

COLOR CODE	CODE COULEUR
B - BLACK	N - NOIR
Y - YELLOW	J - JAUNE
R - RED	R - ROUGE
W - WHITE	B - BLANC
BL - BLUE	BL - BLEU
O - ORANGE	O - ORANGE
G - GREEN	V - VERT
B/P2 - BLACK P2	N/P2 - NOIR P2
B/T1 - BLACK T1	N/T1 - NOIR T1
B/P1 - BLACK P1	N/L1 - NOIR L1

Figure 8-7 Model Hose Reel HR2250

Model Hose Reel HR6000

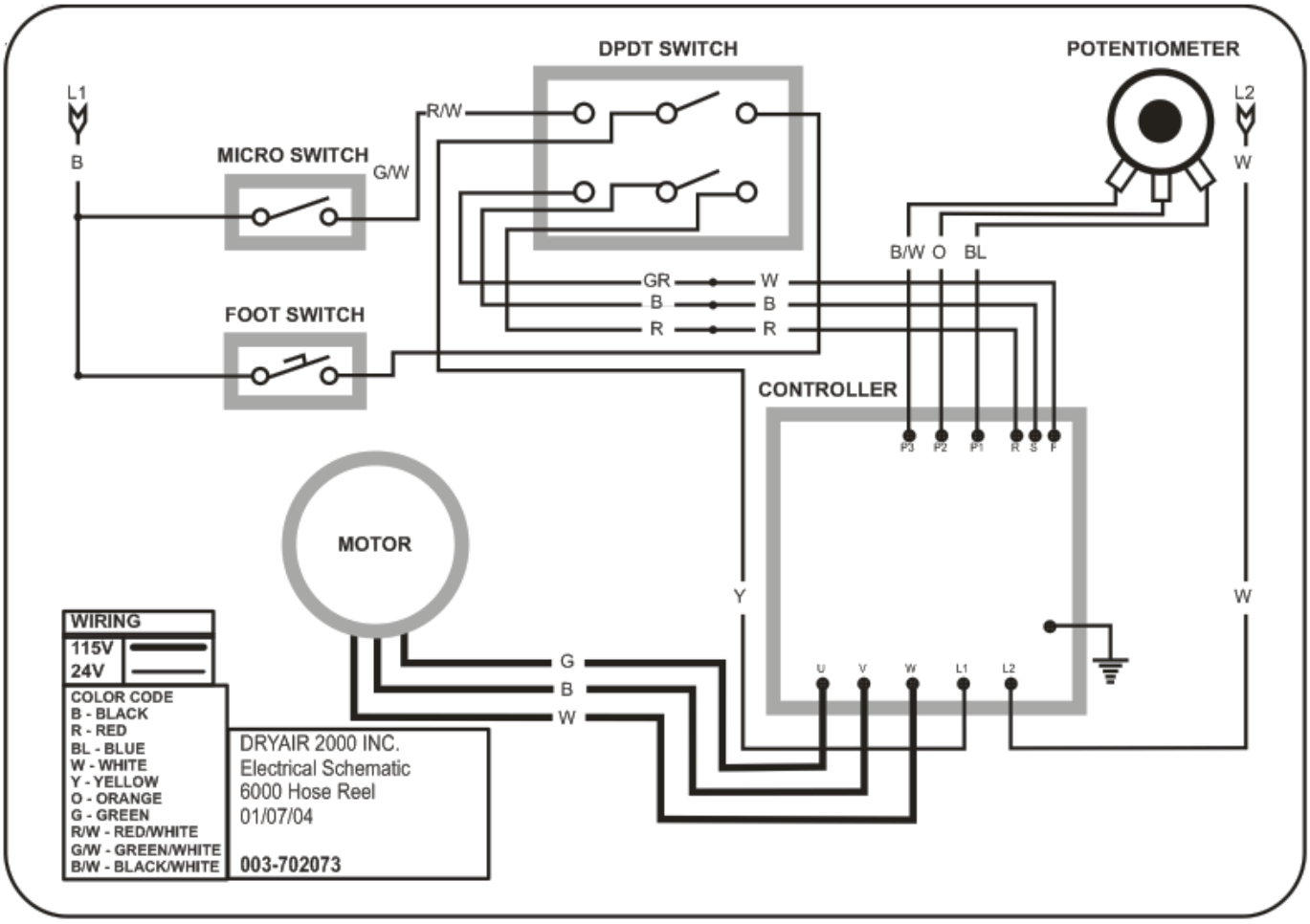


Figure 8-8 Model Hose Reel HR6000

Model Hose Reel HRA series (belt drive reels)

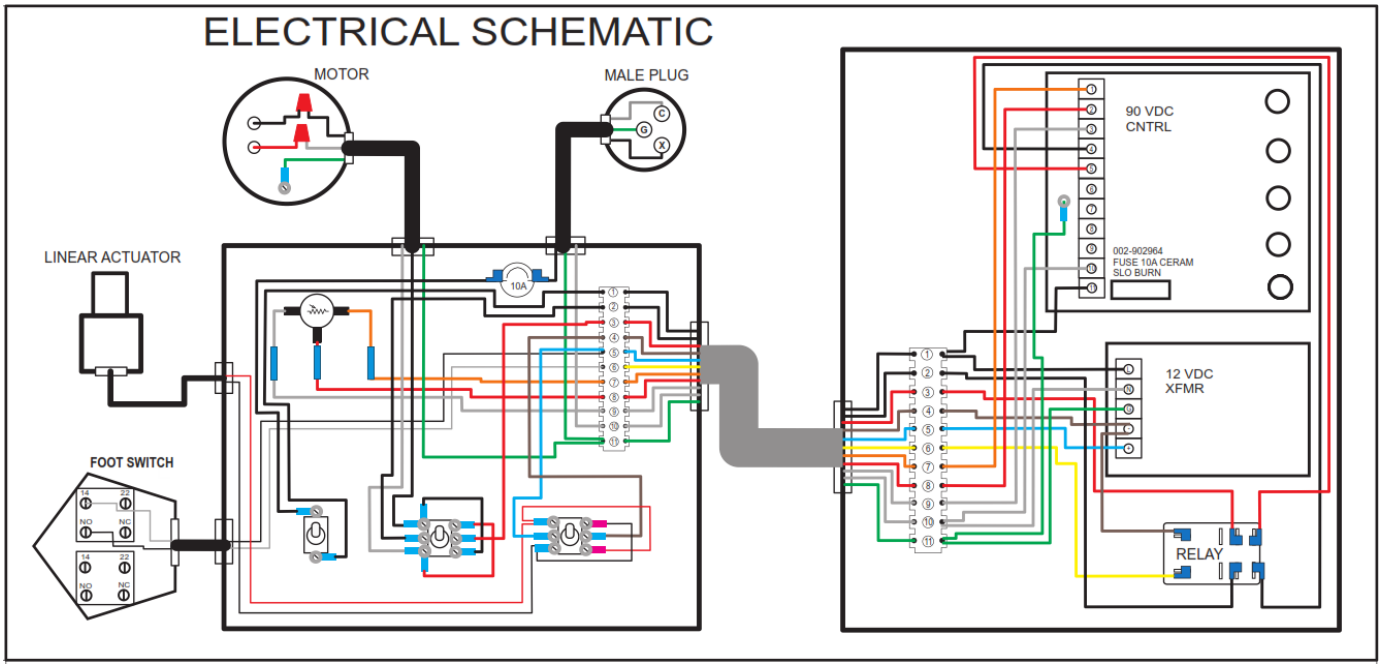


Figure 8-9 Model Hose Reel HRA series

Model Mixing Booster

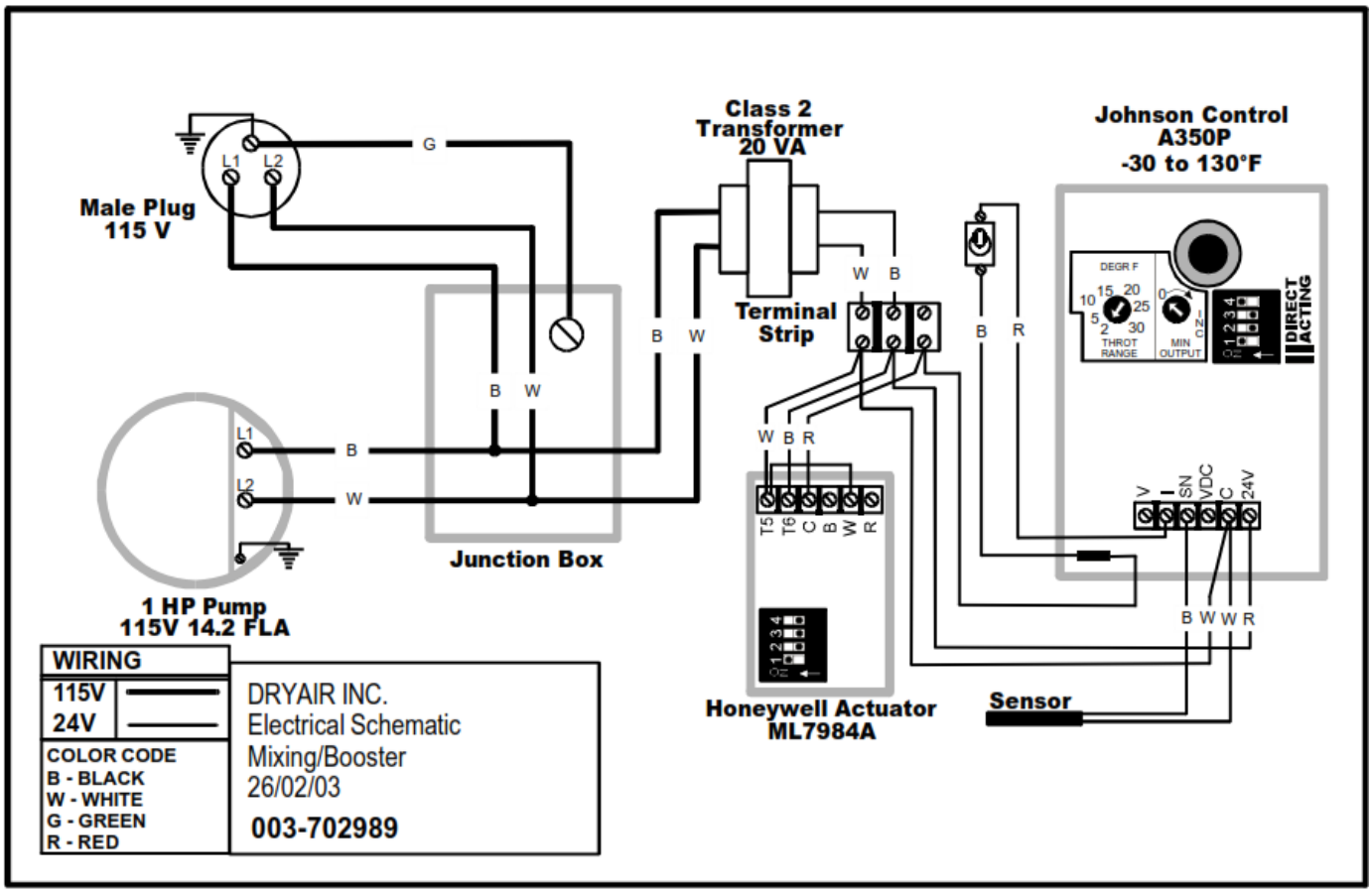


Figure 8-10 Model Mixing Booster

Model Pump Booster Mixing Valve

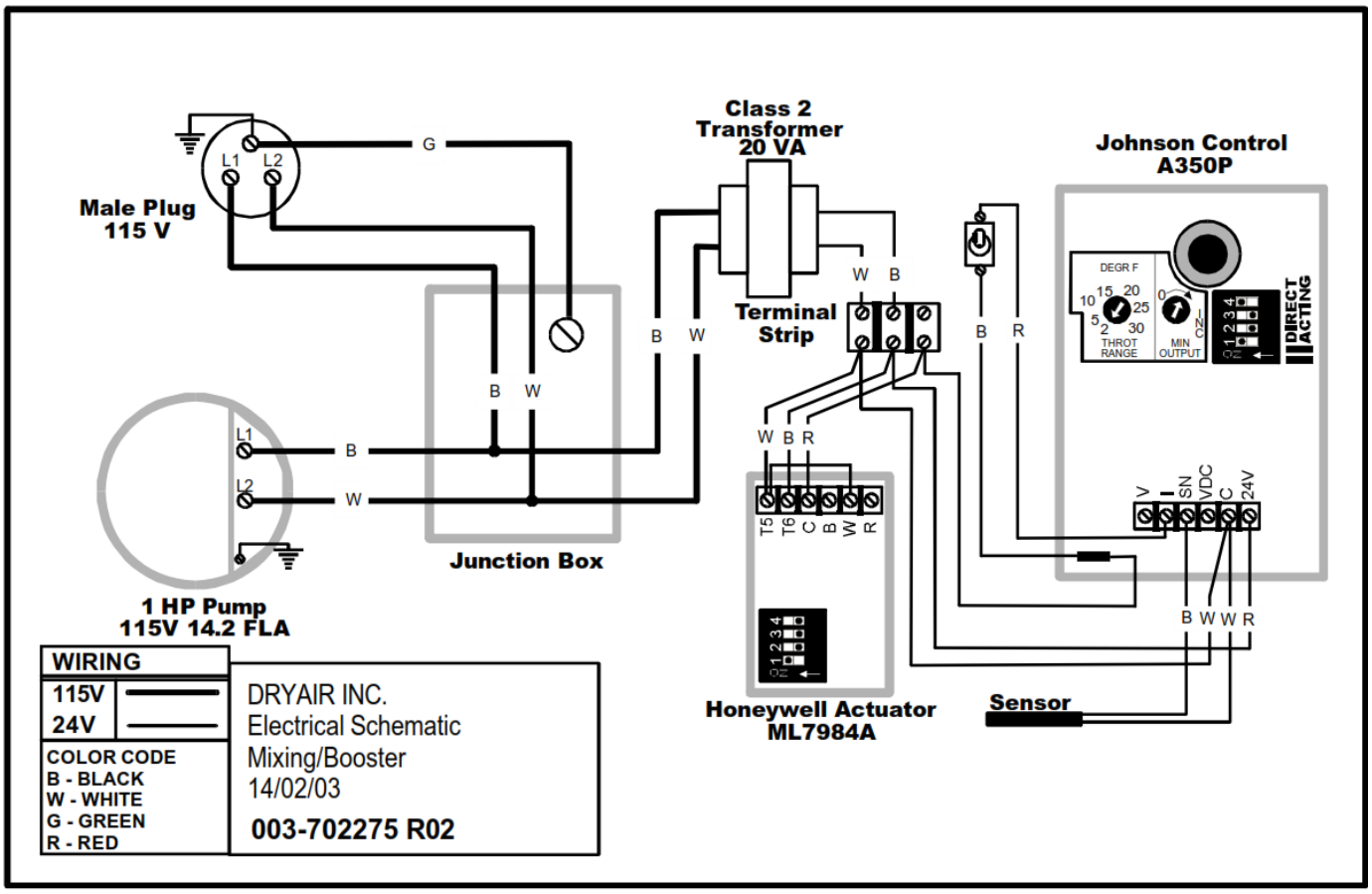


Figure 8-11 Model Pump Booster Mixing Valve

Model Plate Heat Exchanger Glycol to Glycol

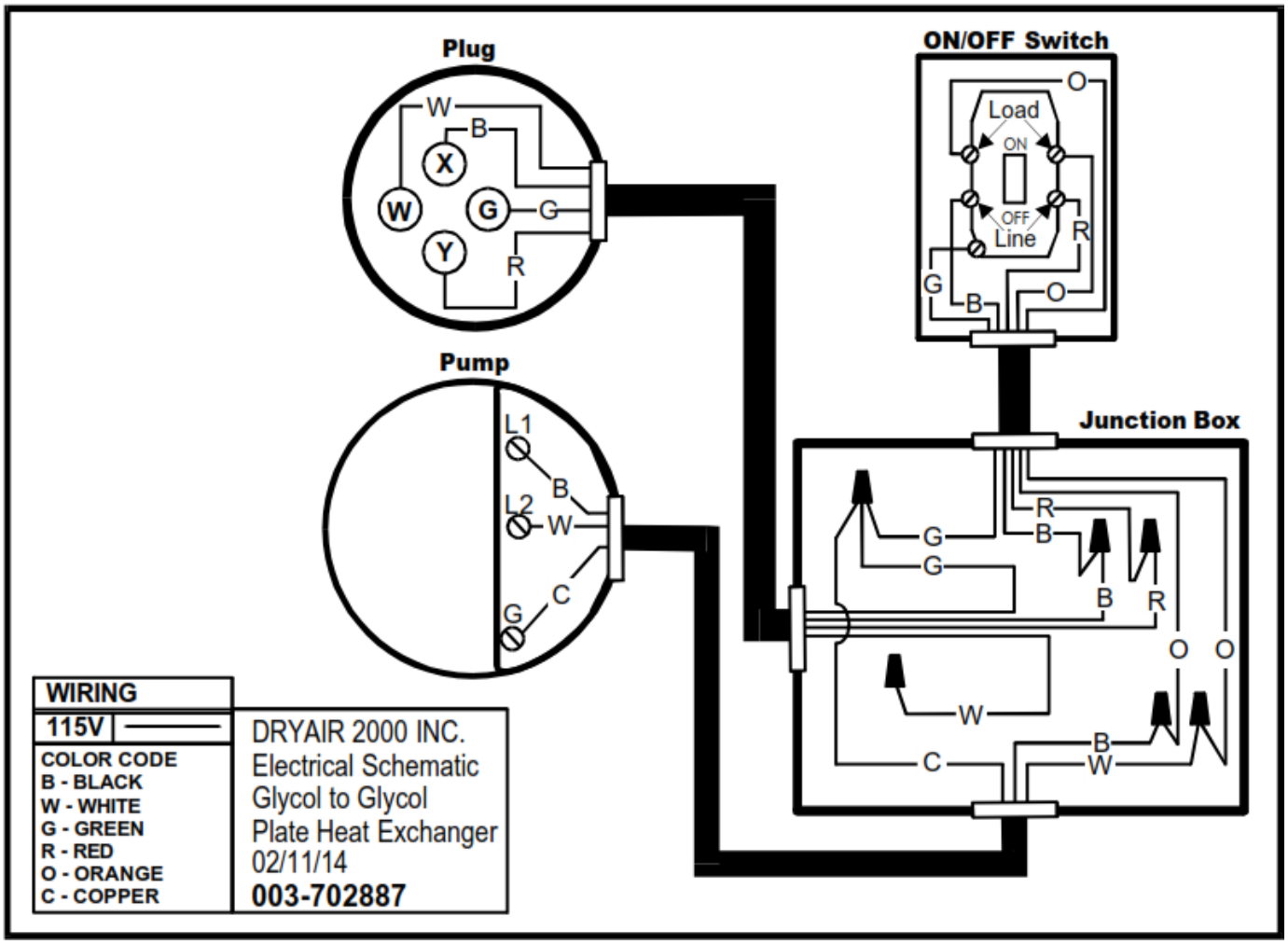


Figure 8-12 Model Plate Heat Exchanger Glycol to Glycol

Model Humidistat Fan Coil Control

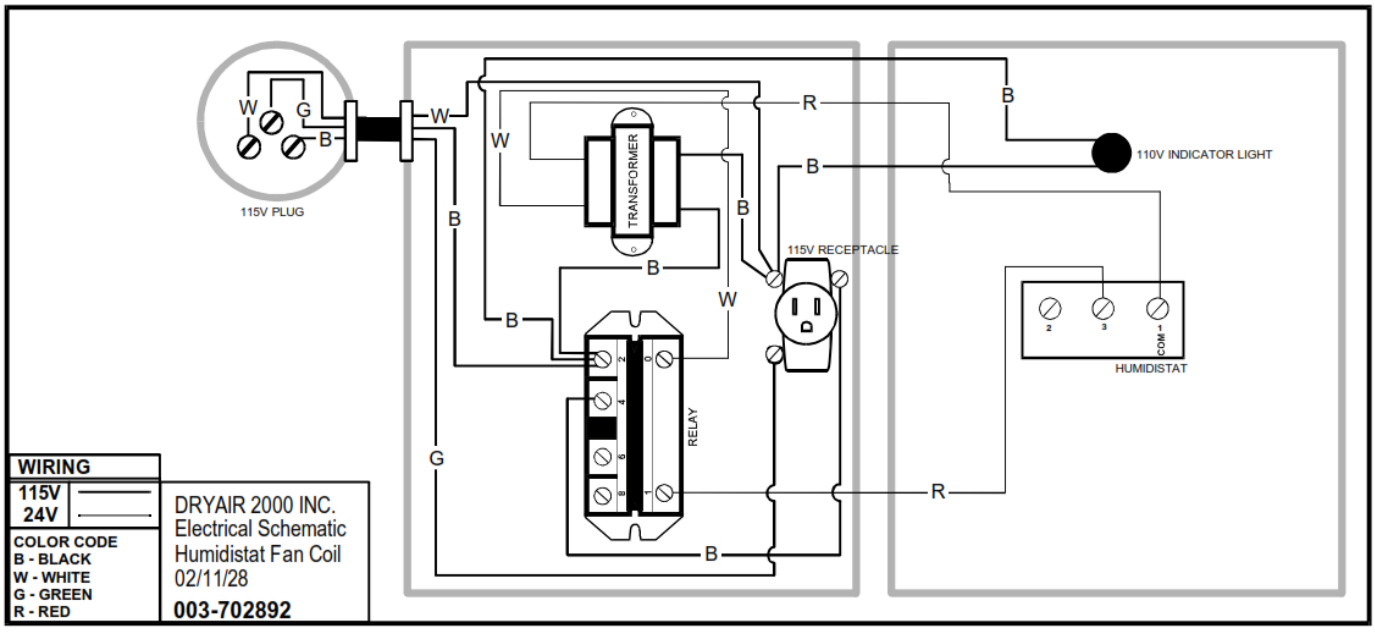


Figure 8-13 Model Humidistat Fan Coil Control

9.Weights and Dimensions

Table 9-1 Weights and Dimensions

Model	Condition	Pounds (lbs)	Kilograms (kgs)	Width (FT)	Length (FT)	Height (FT)
300 GTS	Dry	5,236	2,380	8.5	15.5	8
	Full Fuel	6,044	2,747			
	Dry c/w Generator	5,852	2,660			
	Full Fuel c/w Generator	6,660	3,027			
600 GTS	Dry	6,996	3,180	8	16.5	8
	Full Fuel	8,538	3,881			
	Dry c/w Generator	7,579	3,445			
	Full Fuel c/w Generator	9,121	4,146			
900-GTS	Dry	7,348	3,340	8	16.5	8
	Full Fuel	8,890	4,041			
	Dry c/w Generator	7,964	3,620			
	Full Fuel c/w Generator	9,506	4,321			
900 Flex	Dry	11,418	5,180	8	22.5	8
	Full Fuel	13,014	5,903			
	Dry c/w Generator	12,034	5,460			
	Full Fuel c/w Generator	13,630	6,182			
900 CHU	Dry	2800	1270	5	6	8
	Full Fuel	4065	1844			
2000-1200	Dry	1825	828	4	8	10

10. MATERIAL SAFETY DATA SHEET

11. Operator Notes