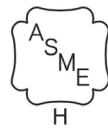
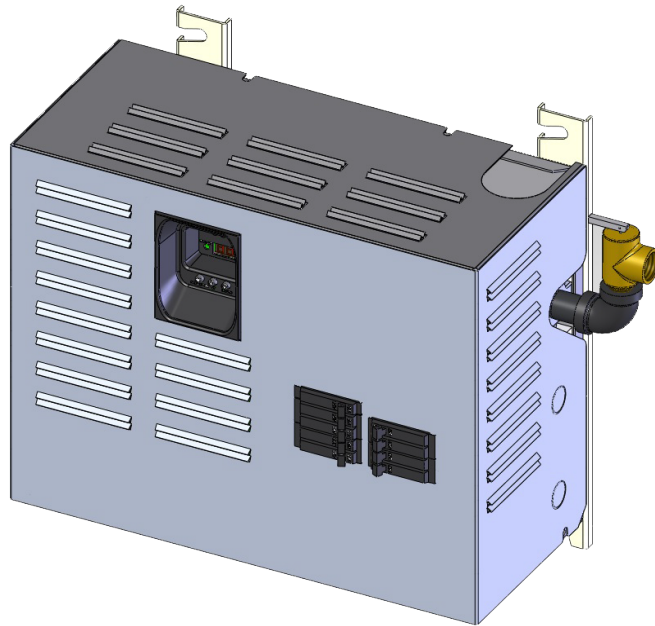




"AT" SERIES ELECTRIC HOT WATER BOILERS FOR FORCED HOT WATER

INSTALLATION, OPERATION & MAINTENANCE MANUAL



Information and specifications outlined in this manual in effect at the time of printing of this manual. ECR International, Inc. reserves the right to discontinue, change specifications or system design at any time without notice and without incurring any obligation, whatsoever.



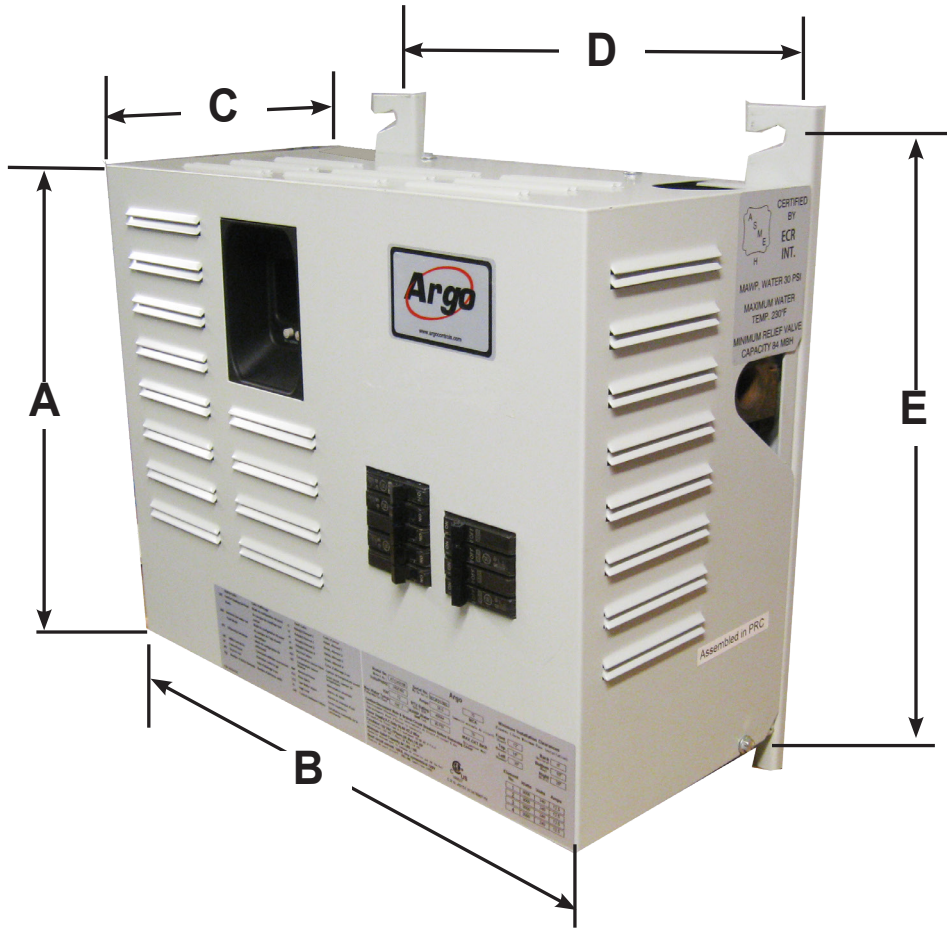
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"AT" SERIES BOILER DIMENSIONS



Dimensions					Inlet & Outlet Pipe Size	Approximate Shipping Wt.
A	B	C	D	E		
14 ⁵ / ₈ "	18 ⁵ / ₈ "	9 ¹ / ₃₂ "	14 ³ / ₈ "	16 ¹⁵ / ₃₂ "	1 ¹ / ₄ NPT	70 lbs.

IMPORTANT SAFETY INFORMATION

General

Boiler installation shall be completed by qualified agency.

WARNING

Fire, explosion, asphyxiation and electrical shock hazard. Improper installation could result in death or serious injury. Read this manual and understand all requirements before beginning installation.

Keep this manual near boiler
Retain for future reference

Become familiar with symbols identifying potential hazards.



This is the safety alert symbol. Symbol alerts you to potential personal injury hazards. Obey all safety messages following this symbol to avoid possible injury or death.

DANGER

Indicates a hazardous situation which, if not avoided, WILL result in death or serious injury

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Used to address practices not related to personal injury.

Installation shall conform to requirements of authority having jurisdiction or in absence of such requirements:

- United States
 - National Electrical Code, NFPA 70.
- Canada
 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1

Where required by authority having jurisdiction, installation shall conform to Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

Additional manual reset low water cutoff may be required.

Requirements for Commonwealth of Massachusetts:

Boiler installation must conform to Commonwealth of Massachusetts code 248 CMR which includes but is not limited to: Installation by licensed plumber or gas fitter.

WARNING

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Do not obstruct air openings to boiler room. Failure to follow these instructions could result in death or serious injury.

WARNING

Modification, substitution or elimination of factory equipped or supplied or specified components could result in death or serious injury.

Introduction

- Boiler sizing is crucial. Calculate the maximum hourly heat loss for each heated space in accordance with procedures describes in The Hydronics Institute manual H-22 (Heat Loss Calculation Guide), or method suitable for local conditions, provided results are in agreement.
- Select appropriate boiler based on accurate heat loss calculation.
- Do not oversize boiler, sizing is critical for in-floor radiant heat applications.
- This manual is intended to familiarize installer and user of Electric Hydronic Block with its installation, operation and maintenance to assure its normal trouble free operation.
- Argo electric boilers are designed and manufactured with quality components for maximum life, durability and minimum service. Follow installation instructions carefully before operating heating system for optimum efficiency and satisfaction.

Unpacking

- Remove packaging and inspect unit for damage or missing parts.
- Report any concealed damage or claims to carrier immediately.

Standard Features

Control

- Three character LED display
- Three button User Interface
- Error code display
- Element Staging and Rotation
- Dual set points for comfort heating and domestic hot water
- Setting for Fahrenheit or Centigrade temperature scales
- Water temperature heating range 90°-180°F (32-82°C)
- Dry fire protection
- Connections for flow sensor and low water cutoff
- Load management control connection with auxiliary heat source connection
- Freeze protection
- Circulator pump terminals
- 40VA transformer
- Three wire thermostat connection
- Audible alarm
- Pump exercising
- Relay contact monitoring
- Non-Volatile memory

Product Description

Electric Hydronic Block is heating device converts electrical energy to heat energy through medium of water. Simplified theory of this conversion is as follows:

$$\begin{aligned} \text{Electrical Energy} \times \text{Conversion Factor} &= \text{Energy} \\ &\text{– Or –} \\ \text{Kilowatts Of Electricity Used Per Hour} \times 3412 &= \\ \text{British Thermal Units (Btuh) Available Per Hour For} & \\ \text{Heating.} & \end{aligned}$$

- Information is basis used to establish Electric Hydronic Block ratings (See Table 1 on page 4). Since conversion process requires no combustion, boiler operates with highest possible efficiency.
- Electric Hydronic Block is constructed with cast iron boiler that conforms to American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code. Interior design allows just enough water to be present for proper heating element operation - no excess water is stored which would cause undesirable thermal losses and longer recovery times.
- Maximum Allowable Working Pressure Water (MAWP) 30 PSI.
- Control system is assembled in modular package keeping overall size and weight of Electric Hydronic Block to minimum. Construction of entire Electric Hydronic Block conforms to Canadian Standards Association (CSA) Standards for Safety for Electric Boilers. Following important product information is located on cabinet cover:
 - Model Number
 - Manufacturer's Serial Number
 - BTU Rating
 - Heating Element Ratings
 - Water Pressure & Temperature Limits
 - CSA Listing
 - ASME Stamp
 - Total Amps
 - Clearance
- Argo Electric Boilers are controlled by electronic control board maintaining water temperature. Control cycles heating elements based on heating demand, and preset boiler outlet water temperature. Control also operates 120Vac circulating pump rated up to 5A. When thermostat calls for heat, control will operate boiler to regulate water temperature at pre-selected set point. System pump is on whenever thermostat calls for heat.
- This product is not designed for aluminum wiring.

VOLTAGE RATING TABLES

Table 1 -AT Boiler Electrical Specifications

INSTALLATION MANUAL AND OPERATING INSTRUCTIONS

Operating at 240 Vac												*Recommended Wire		
"AT" Series - 2 Element Boiler														
Model	Boiler Size Nominal kW	Voltage (AC)	Output Power (Watts)	Output Power BTU/Hr.	Amperage	Element Size (Watts) at 240Vac	Number Elements	Accessory Load (A)	Total Amps	MCA	MOP	60°C (140°F) AWG	75°C (167°F) AWG	90°C (194°F) AWG
AT0623	6	240	6,000	20,500	25.0	3,000	2	6	31.0	38.8	40.0	8	8	10
AT0824	8	240	8,000	27,300	33.3	4,000	2	6	39.3	49.2	50.0	6	8	8
AT1025	10	240	10,000	34,100	41.7	5,000	2	6	47.7	59.6	60.0	4	6	6
AT1226	12	240	12,000	41,000	50.0	6,000	2	6	56.0	70.0	70.0	4	4	6
"AT" Series - 4 Element Boiler														
AT1243	12	240	12,000	41,000	50.0	3,000	4	6	56.0	70.0	70.0	4	4	6
AT1644	16	240	16,000	54,600	66.7	4,000	4	6	72.7	90.8	100.0	2	3	4
AT2045	20	240	20,000	68,200	83.3	5,000	4	6	89.3	111.7	125.0	1/0	2	2
AT2446	24	240	24,000	82,000	100.0	6,000	4	6	106.0	132.5	150.0	2/0	1/0	1

Operating at 208 Vac

"AT" Series - 2 Element Boiler												*Recommended Wire		
AT0623	6	208	4,507	15,400	21.7	3,000	2	6	27.7	34.6	35.0	8	10	10
AT0824	8	208	6,009	20,500	28.9	4,000	2	6	34.9	43.6	45.0	6	8	8
AT1025	10	208	7,511	25,600	36.1	5,000	2	6	42.1	52.6	60.0	6	6	8
AT1226	12	208	9,013	30,800	43.3	6,000	2	6	49.3	61.7	70.0	4	6	6
"AT" Series - 4 Element Boiler														
AT1243	12	208	9,013	30,800	43.3	3,000	4	6	49.3	61.7	70.0	4	6	6
AT1644	16	208	12,018	41,000	57.8	4,000	4	6	63.8	79.7	80.0	3	4	4
AT2045	20	208	15,200	51,200	72.2	5,000	4	6	78.2	97.8	100.0	1	3	3
AT2446	24	208	18,027	61,600	86.7	6,000	4	6	92.7	115.8	125.0	1/0	1	2

MCA = Minimum Circuit Ampacity
MOP = Maximum Over-current protection

*Recommended Field Wire Size per NEC Table 310.16

Not more than three (3) current carrying conductors in raceway

Based on ambient temperature of 30°C (86°F). Other ambient temperatures see NEC or CEC for correction factors.

Use Copper conductors only.

Recommended use only Class B or C type wire (see Table 2).

Check with latest version of NEC and local codes.

UL-834, Section 14.2

Assuming 60°C (140°F) wire will be used for connections to boiler rated at 80 amperes or less, and 75°C (167°F) wire will be used with boiler rated at more than 80 amperes.

LOCATING THE BOILER

⚠ WARNING

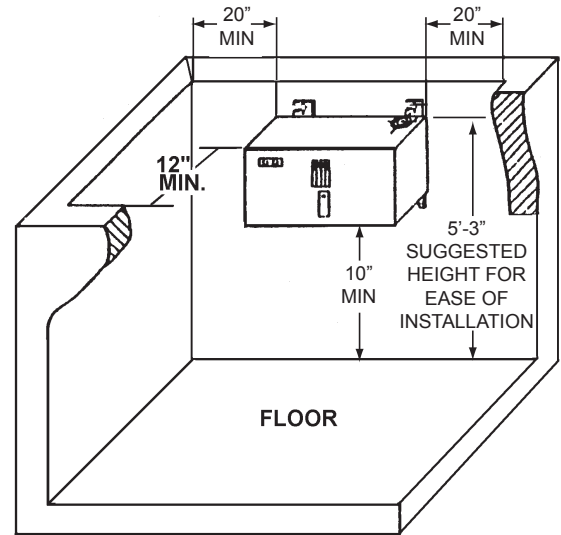
Electrical shock hazard. Do not install boiler under water source. Failure to do so could result in death or serious injury.

1. Boiler is intended for indoor installation only and not subject to water spray or leakage.
2. Electric Hydronic Block units are intended to be wall mounted and provided with mounting brackets for wall mounting. Use of lag screws or anchor bolts through holes provided, or on 3/4" plywood panel. On uneven walls, suggest mounting surface be provided such as two 2 x 4's.
3. Mount surface of Electric Hydronic Block, no closer than 20 inches to wall surface on left and 20 inches minimum to wall surface on right or more, depending on plumbing. Minimum top clearance 16 inches, bottom 10 inches. Allow sufficient room from front of unit to door or wall to remove cover - at least 12 inches minimum.
4. Install unit with minimum clearance from top of unit to ceiling of 16 inches. If minimum requirements of space are used, suggested enclosure be exposed to means of ventilation. Electric Hydronic Block unit must be mounted level, using top of back plate as leveling point.
5. When installed in utility room, door should be wide enough to allow largest boiler part to enter, or to permit replacement of another appliance such as water heater.
6. Boiler room should be well vented and temperature maintained between 45-80°F (7-26.5°C).

Minimum clearances to combustible constructions are:

TOP	16 IN.
FRONT	12 IN.
LEFT SIDE.....	20 IN.
RIGHT SIDE	20 IN.
REAR.....	0 IN.
BOTTOM.....	10 IN.

BOILER LOCATION & CLEARANCE DIMENSIONS



NOTE: Greater clearances for access should supercede fire protection clearance.

⚠ WARNING

Fire, explosion, asphyxiation, burn, scald and electrical shock hazard. System design must incorporate primary/secondary piping to allow boiler pump to prepurge and post purge the unit before and after energizing the heating element. Shortened element life and/or opening of safety relief valve could occur. Failure to follow these instructions could result in death or serious injury.

Circulating System

- Design system as primary/secondary piping. Operate system with maximum output temperature of 180°F (82°C) or lower and temperature rise across the unit of 20°F (11°C) or lower. Refer to tables below and Figures 2 & 3.
- Return water temperature must be higher than room temperature in which boiler is installed to prevent condensation.

"AT" Series - 2 Element Boiler	
KW Capacity	Minimum Flow Rate (GPM)*
6	2.0
8	2.7
10	3.4
12	4.1

"AT" Series - 4 Element Boiler	
KW Capacity	Minimum Flow Rate (GPM)*
12	4.1
16	5.5
20	6.8
24	8.2

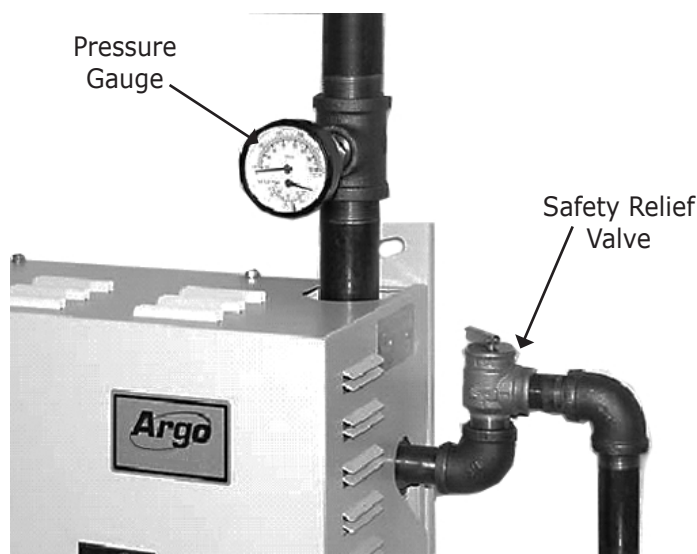
** Flow rate based on 20°ΔT*

Connecting Supply And Return Piping

1. Hot water boilers installed above radiation level must be provided with low water cutoff device either as part of boiler or at time of boiler installation.
2. When boiler is connected to heating system utilizing multiple zone circulators, each circulator must be supplied with flow control valve to prevent gravity circulation.
3. Reduced pressure back flow preventer must be present under provisions required by Environmental Protection Agency, (EPA).
4. Manufacturer requires plumbing arrangements as illustrated in Figures 2 & 3. Inlet or return pipe is located at bottom of unit. Reverse flow will result in noisy operation and cause very early element failure. Drain cock is to be located at lowest point of piping.

5. Outlet or supply pipe line to radiation is located at top of unit. Combination temperature pressure (altitude) gauge is provided with each unit and should be installed close to boiler outlet. It is important the gauge sensor be completely immersed in flowing water to assure correct temperature readings.
6. Install gate valves at locations shown in Figures 2 & 3, so any boiler servicing requiring removal of water can be done quickly and easily. Not illustrated but recommended is installation of air vents at high points of hydronic system to reduce initial start up time and help avoid element burnout during entire life of heating system.
7. Safety relief valve is supplied with each Electric Hydronic Block and must be installed vertically. Install at location and discharge direction shown using pipe nipple and elbow supplied. See Figure 1. Add piping so any water discharged will not damage boiler or other system components.
8. For further piping information refer to Hydronics Institute (AHRI) manual (Installation Guide for Residential Hydronics).
9. Pipe the discharge outlet of the safety relief valve within 6" of the floor.

Figure 1 - Safety Relief Valve



HYDRONIC PIPING

Figure 2 - Primary/Secondary Piping for Multiple Zoning with Circulators

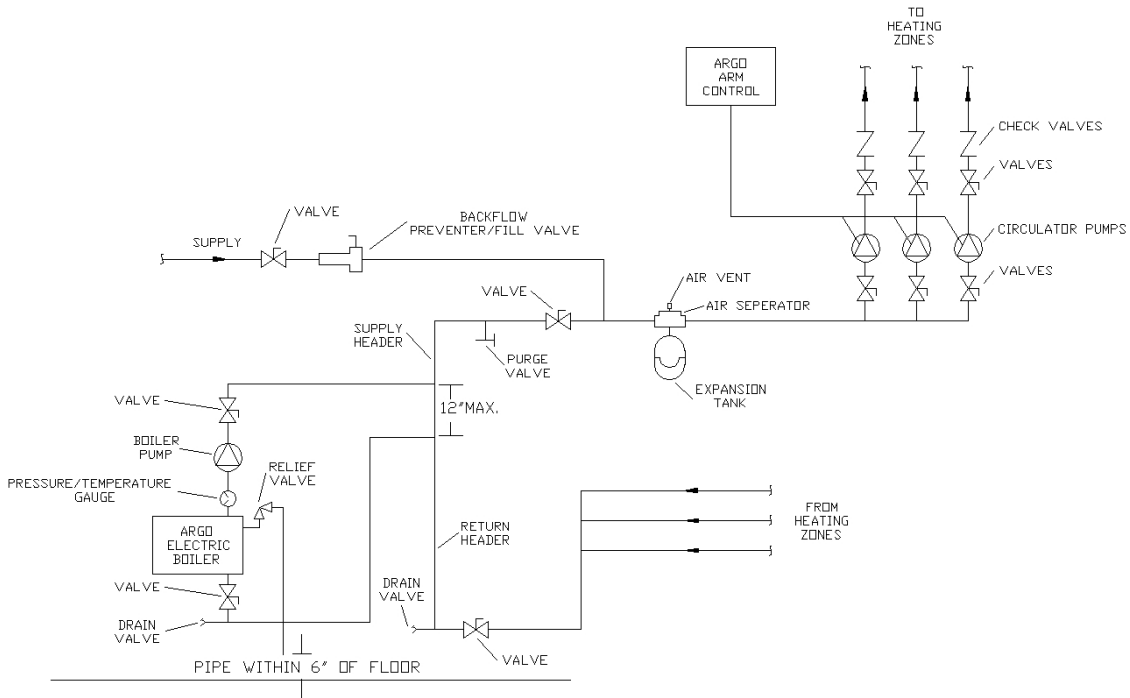
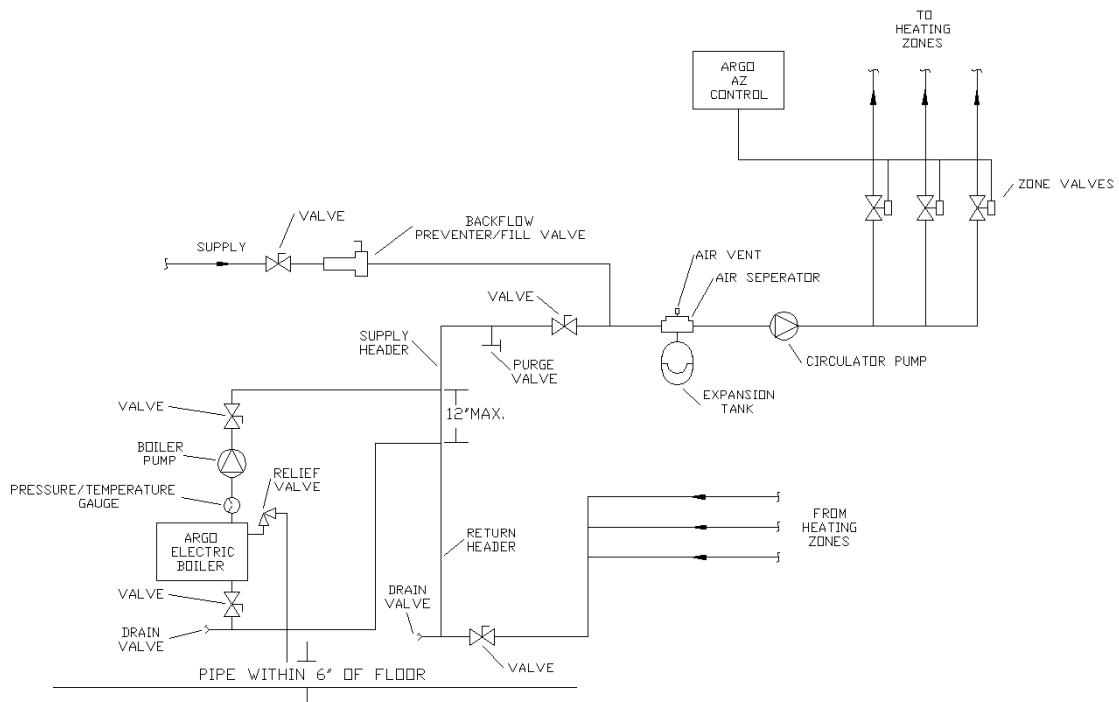


Figure 3 - Primary/Secondary Piping For Multiple Zoning With Zone Valves



Boiler Wiring

NOTICE

Boiler is not designed for use of aluminum wiring. Boiler failure can occur if aluminum wiring is used.

1. Argo Electric Hydronic Boilers are pre-wired for use with 240-volt, 3 wire, single-phase, 50/60-hertz power. For reduction in boiler capacity when line voltage is less than 240 volts see Table 1 page 6.
2. Opening provided in jacket bottom panel for field wiring, refer to rating chart for recommended wire sizes. See Figure 4 for stepped Electrical Knock-out.
3. Electrical wiring shall be in accordance with requirements of authority having jurisdiction. Refer to:
 - Canada - Canadian Electrical Code, CSA C22.1 Part 1, Safety Standards for Electrical Installations.
 - USA - National Electrical code, ANSI/NFPA 70.
4. Verify nameplate rating and check related codes to properly size conductors, switches and over current protection.
5. Stepped knockout is provided on bottom of cabinet for different voltage connections. Wire connections refer Figures 8 and 9 or wiring diagram on inside of boiler front cover.
6. All circuit breakers or disconnects ahead of boiler must be OFF. Turn boiler integral breakers off at this time as well. Remove boiler front cover by removing 4 screws from top and sides.
7. Boilers used in multiple zone system, zone valves must be powered from independent source and have electrically isolated end switches or isolating relays wired in parallel to boiler thermostat terminals. **Do not attempt to power zone valves from transformer in boiler control system.**

Field Wiring

- All Field wiring shall be in accordance with NEC or CEC standards.
- Minimum Circuit Ampacity (MCA) and recommended Maximum Over-current Protection (MOP) are listed on nameplate of unit, see Table 1.
- **Use Copper conductors only.**
- Use only Class B or C Stranded wire. See Table 2.
- Wire Strip Length: 11/16" (Minimum). See field wiring diagram. See Figures 9 and 10.
- Wire must be fully inserted into terminal block.
- Field terminal wire lugs shall be securely tightened.
- Do not use wire grease on wire termination connections. This will change torque properties.

Figure 4 - Stepped Electrical Knock-outs - Jacket Bottom

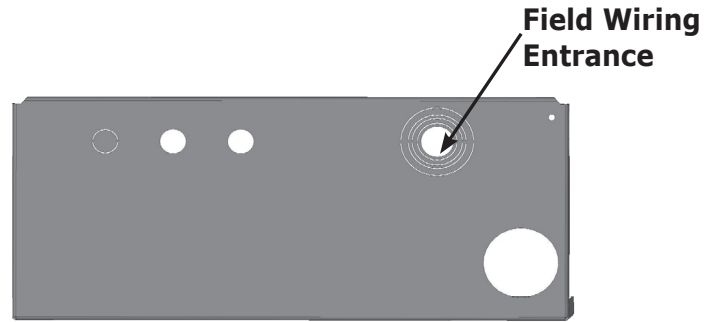
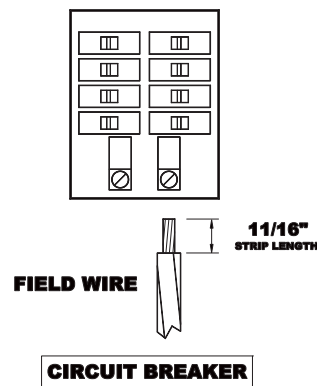


Figure 5 - Field Wiring Diagram



Wire Classes - Table 2		
Wire Size AWG	Number of Concentric Strands	
	Class B	Class C
10	7	19
8	7	19
6	7	19
4	7	19
3	7	19
2	7	19
1	19	37
1/0	19	37
2/0	19	37

Class B - Power cables
Class C - Power cables where more flexibility is desired

Field Wiring - Continued

Limit Control Operation

1. MAIN POWER SUPPLY: Depending on model designation, the electric Hydronic Block may be energized by alternating current service entrances: 240 volt single phase 50 or 60 cycle 3 wire plus ground. Wire size see Table 1. Sizes listed for various capacity units include total amperes necessary to operate elements, circulator and zone valves where used. Wire sizes specified conform to Canadian Electrical Code (Canada) or National Electric Code (USA) and include derating for ampacity and temperature. **Use copper wire only.** Check state and local requirements.

- A. Read data name plate before connecting unit. Electrical connections are provided and located for proper installation.
- B. Use only copper wire of proper size and make sure all terminations are tight. Do not use aluminum wire.

2. CIRCULATOR POWER SUPPLY: Terminals identified as C1(L) and C2(N) at bottom of control panel (Figure 6) shall be used to supply one circulator pump power. Circulator motor shall not be larger than 1/6 horsepower with maximum 5.0 amp rating. Wiring from control panel to the pump should have insulation rated 75°C. Circuit protection is provided by 15 amp breaker on boiler.

NOTE: If circulator pump is larger than maximum size listed above, separate circulator pump relay must be provided with separate overload protection. Where more than one circulator is used for zoning, it must be installed and protected according to approved electrical codes.

Note: Argo AT Boiler will work with standard and programmable setback thermostats.

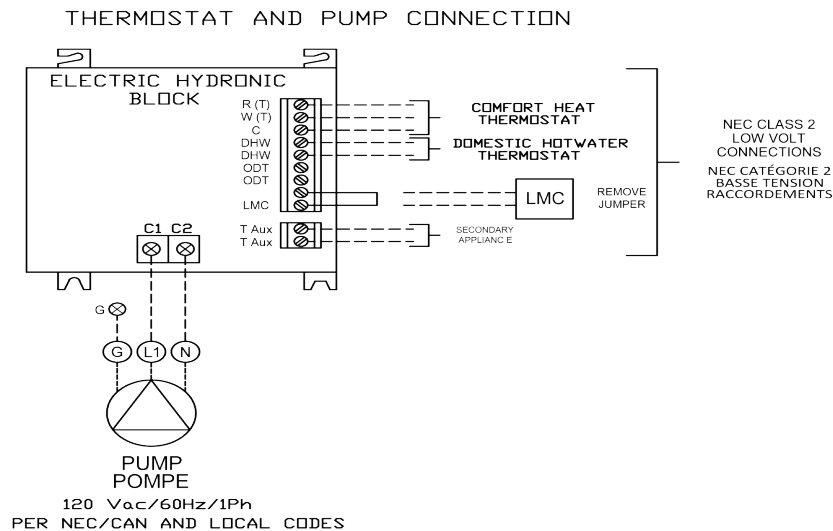
Thermostat Installation

1. Install thermostat on inside wall five feet above floor.
2. NEVER install thermostat on outside wall.
3. Do not install thermostat where it will be affected by sunlight, drafts, televisions, lighting fixtures, hot or cold pipes, fireplaces, or chimneys.
4. Instructions for final adjustment of thermostat (adjusting heating anticipator, calibration, etc.) are packaged with thermostat.
5. **Recommended setting for heating anticipator is 0.1 amps.**

Wiring On Control

- **PUMP:** Connect only 120 Vac 1/6 hp (maximum) pump to terminals C1(L) and C2(N) on controller. Ground screw is located on control panel. Strip wire ends before inserting into terminal block. Tighten terminal screws. **Do not use pump rated greater than 5 amps!!**
- **THERMOSTAT:** Two or three wire thermostat capable. Terminals R(T), W(T) and C are provided. Two wire thermostat use R(T) and W(T). Three wire thermostat also use terminal C. See Figure 6. **Do not apply external power source to terminals!!** Strip wire ends before inserting into terminal block. Tighten terminal screw clamps.

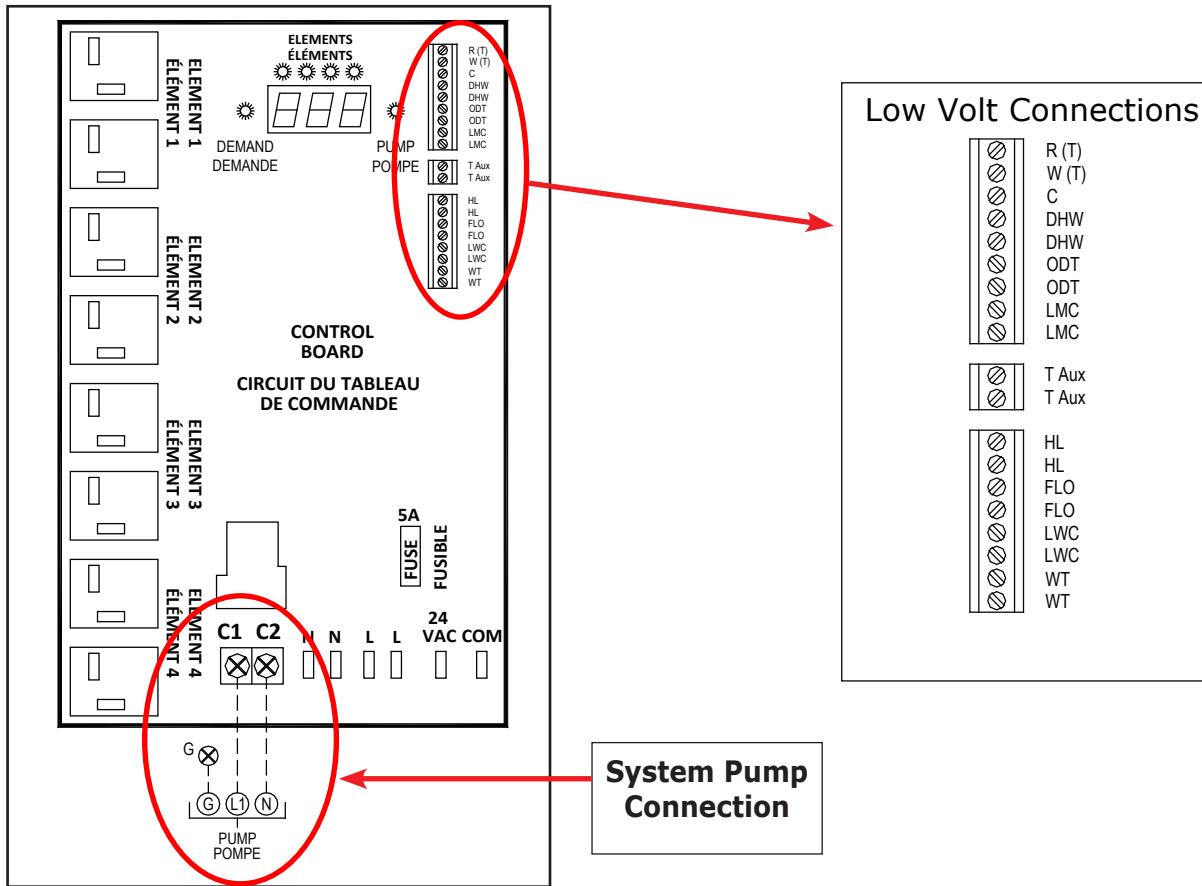
Figure 6 - Thermostat and Pump Connection



ELECTRICAL CONNECTIONS

Figure 7 - Wiring on Control Board

Figure 8 - Low Voltage Wiring on Control Board



Control Inputs (NEC Class-2 Low Voltage)

R (T)	Comfort Heating – Thermostat Input (R W C) or zone valve end switch (R W), Dry Contact Close R-W Activation, 24Vac R-C
W (T)	
C	
DHW	Domestic Hot Water – Thermostat Input. Dry Contact Close Activation DHW – DHW
ODT	Not Used
*LMC	Load Management Control Input. Dry Contact Normally Close LMC – LMC
HL	High Limit Input (Factory Installed)
*FLO	Flow Switch Input – Installer Supplied. Dry Contact Normally Close FLO – FLO
*LWC	Low Water Cutoff Input – Installer Supplied. Dry Contact Normally Closed LWC –LWC
WT	Water Temperature Sensor Input (Factory Installed)

Control Output (NEC Class-2 Low Voltage)

T Aux	Auxiliary Heating Appliance Thermostat Connection
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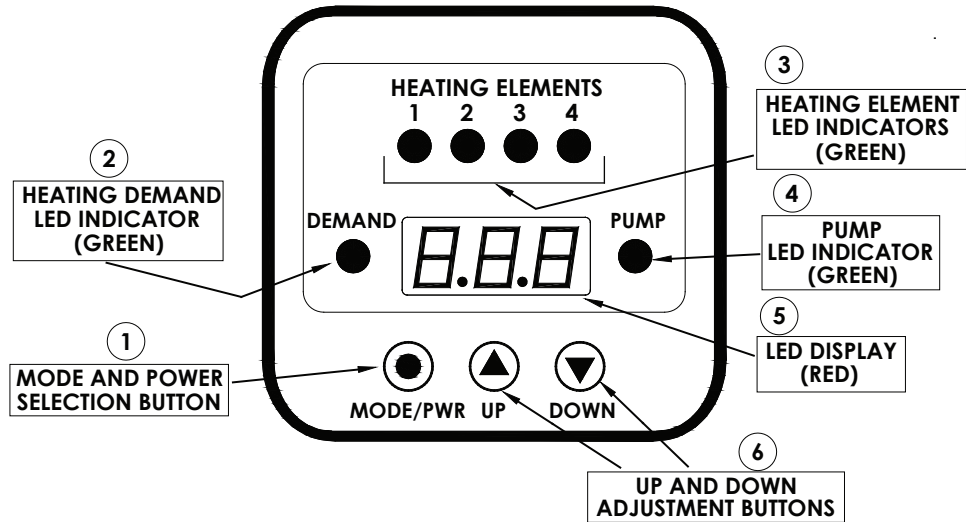
*Factory Jumper Installed

System Pump Connection (120Vac 60Hz, 1ph, 5A 1/6 hp Max)

C1	Pump Hot (L1)
C2	Pump Neutral (N)
G	Pump Ground (G)

SEQUENCE OF OPERATION

Figure 8A - AT Boiler Controller



1	Mode and Power Selection Button - Turns the boiler on and off, selects mode and configuration settings
2	Heating Demand LED Indicator - Energized when there is call for comfort heating or domestic hot water
3	Heating element LED Indicators - Energized with corresponding heating element
4	Pump LED Indicator - Energized with boiler pump relay
5	LED Display - Indicates water temperature, set point, mode, and error codes
6	Up and Down Adjustment Buttons - Used to select temperature set point for comfort heating, domestic hot water and configuration selections

SEQUENCE OF OPERATION

Setting the AT Boiler Controller

User Settings	Display	Possible Value	Factory Setting	Overview
On/Off Mode	ON	ON	OFF	Press and hold the MODE/PWR button for 2 seconds to turn the unit On or Off.
	OFF	OFF		
<p>Note: When electrical power has been removed and re-applied, when the unit is turned on it will automatically enter a dry fire test mode (If dFt is on, see Configuration). The display will flash dFt. To bypass the test, Press and hold Up ▲ and Down ▼ arrow buttons for 2 seconds.</p>				
<p>To access the following: Unit must be in the "ON" Mode. Press the MODE/PWR button to select setting.</p>				
<p>Press the up ▲ or down ▼ arrow buttons to change setting.</p>				
<p>Press the MODE/PWR button to save setting. Display will flash three times to confirm setting is saved</p>				
<p>Automatically exits and saves after 5 seconds.</p>				
Comfort Heat Setting	CHS	90-180°F	150°F	Press the MODE/PWR button to select setting. Press the up ▲ or down ▼ arrow buttons to change setting. Hold the button to scroll rapidly.
Domestic Hot Water Setting	dHS	32-82°C	170°F	
Differential Setting	dFS	4-20°F	10°F	
		2-11°C		
<p>Configuration Settings</p>				
<p>To Access: Unit must be in the "OFF" Mode. Press and hold Up ▲ and Down ▼ arrow buttons for 10 seconds Press the up or down arrow button to choose selection. Press the MODE/PWR button to enter the selection. Press the Up ▲ or Down ▼ arrow button to change the setting. Press MODE/PWR button so save selection. To Exit: Press and hold Up ▲ and Down ▼ arrow buttons for 2 seconds. Automatically saves setting and exits after 60 seconds.</p>				
Temperature Scale	dEG	C	F	Press the Up ▲ or Down ▼ arrow buttons to change setting.
		F		
Number of Heater Elements	Stg	2	2 or 4	Press the Up ▲ or Down ▼ arrow buttons to change setting.
		4		
Active Elements	EL	1-2	1-2	Available only if STG is 2. Press the Press the Up ▲ or Down ▼ arrow buttons to change setting.
		3-4		
Dry Fire Test Active/Inactive	dFt	On	On	Press the Up ▲ or Down ▼ arrow buttons to change setting
		OFF		

SEQUENCE OF OPERATION

Boiler Display Codes

Display	Description	Range	Note
ON	Boiler in On mode		
OFF	Boiler in Off mode		
CHS	Comfort Heating Setting	90-180°F (32-82°C)	Control prevents setting from being higher than Domestic Hot Water Setting
dHS	Domestic Hot Water Setting	90-180°F (32-82°C)	Control prevents setting from being lower than Comfort Heating Setting
dFS	Differential Setting	4-20°F (2-11°C)	Applies to CHS & dHS
dEg	Degrees Temperature scale	F or C	
Stg	Heating Element Stages	2 or 4	
EL	Active Elements	1-2 or 3-4	Only available if Stg is 2
dFt	Dry Fire Test		Displayed when power initially applied
LdC	Load Management	Displayed when LMC terminals open	De-activates heating elements. Diverts TT to TTAux for secondary appliance.
F	Degrees Fahrenheit		
C	Degrees Centigrade		
1-2	Elements 1 & 2 Active	Two element boiler only	
3-4	Elements 3 & 4 Active	Two element boiler only	

Fault Codes

Display	Failure	Alarm	Boiler state	Action Required
r1	Element-1 relay failure	Audible Alarm	ON	Check all circuit breakers. Reset power by cycling pump circuit breaker (15A) or pressing and holding MODE/PWR button for 2 seconds. Call for service if problem persists.
r2	Element-2 relay failure	Audible Alarm	ON	
r3	Element-3 relay failure	Audible Alarm	ON	
r4	Element-4 relay failure	Audible Alarm	ON	
dFF	Dry Fire Failure	Audible Alarm after 3 attempts	ON	Correct fault, reset power
tSO	Temperature sensor open	Audible Alarm	ON	Replace temperature sensor
tSS	Temperature sensor shorted	Audible Alarm	ON	
AbP	Abnormal Power	Audible Alarm	Control voltage outside the range of 18-30Vac	Verify all circuit breakers are on. Call for service if problem persists
FLO	Flow Switch Open	Audible Alarm	Flow switch open (Installer item)	Check water flow
LCO	Low Water Cutoff Open	Audible Alarm	Low Water Cutoff open (Installer item)	Check water level
HL	High limit(s)	Audible Alarm	High Limit(s) Open	Reset power, Call for service
CHF	Control Hardware	Audible Alarm	Control Hardware Failure	Call For Service
FP	Freeze Protection	No Audible Alarm	Water temperature below 45°F (27°C)	Control energizes pump and heating mode until WT reaches 55°F.

Initial Start Up

When electrical power is applied to AT boiler the control displays firmware revision code. It will then revert to mode it was in prior to power loss (factory setting is OFF mode). Pressing MODE/PWR button for 2 seconds, unit will enter ON mode. Pressing MODE/PWR button again for 2 seconds will return unit to OFF mode. Once in ON mode the control automatically begins a Dry Fire Test (if DfT is set to Y in the configuration) where pump is energized and first element is pulsed. (see Dry Fire Test Mode). Dry Fire Test is only initiated after power loss. To by-pass Dry Fire Test Mode and enter heating mode, press ▲up and ▼down arrow buttons for 2 seconds.

Two Temperature Operation

AT boiler is designed to control two loads with independent temperature control such as a comfort heating zone (CHS) and indirect domestic hot water tank (DHS). Other applications include in-floor radiant system with fin tube baseboard system.

Setting Water Temperature

To set boiler water temperature, place boiler in on mode and then select temperature setting mode by pressing MODE/PWR button. Use ▲up or ▼down arrow buttons to set temperatures for comfort heating "CHS", domestic hot water setting "dHS" and differential setting "dFS".

NOTICE

Setting for CHS cannot exceed setting for DHW. Setting for DHW cannot be set below setting for CHS.

Heating Operation Sequence

To begin heating sequence control board must be "On" for boiler operation. All safety inputs must be closed (HL, LWC, FLO) as well as Load Management Control (LMC) terminals. Setpoint temperature for either CHS or dHS must be above current water temperature.

To start boiler heating sequence the thermostat or pump end switch will close the connection between terminals [Comfort heat - R & W (T & T)] or [Domestic hot water - DHW_T&T] on the control. Pump relay energizes for 30 seconds prior to electric elements while a check of safety circuit and water temperature is conducted. (Note Flow and LWCO circuits check is conducted after the pump starts, since water flow and water level are dependent on pump being energized). If heating load is satisfied by residual heat in the boiler during 30 second pre-purge period the elements will not energize. Heating element(s) will begin to energize after 30s pre-purge is complete.

LED's for heating elements, pump status and heat call will illuminate as each is energized. If safety circuit is open elements will not energize and error code is displayed.

During heating operation the safety circuit is monitored. If no faults exist the first element will energize and rate of water temperature rise is calculated.

Control will energize elements in sequence based on temperature rise of water and target time of 5 minutes to reach setpoint. Minimum on an off times apply to each element.

When water temperature approaches setpoint temperature heating elements will de-energize to prevent water temperature from exceeding setpoint temperature. When water temperature reaches set point all remaining heating elements will de-energize. Control will then cycle elements on and off to maintain set point temperature. At start of each subsequent heating cycle the lead element to energize will rotate to allow for even duty cycle time over all elements.

Pump will remain energized while there is call for heat (TT or DHW-TT closed). When call for heat is satisfied unit enters post purge period. Pump shall remain energized for 3 minutes starting at point in which last element de-energized.

Rate which elements energize and de-energize to maintain water temperature can be adjusted. Differential setting is used to determine point which heating elements are energized or de-energized. Increasing differential setting will de-energize heating elements sooner and reduce potential for temperature overshoot. A larger differential will also reduce cycles per hour of the boiler.

Decreasing differential setting will keep heating elements on longer and allows for tighter set point control increasing potential for temperature overshoot. A small differential also increases boiler cycles per hour.

Starting point for differential setting is 10°F (5.5°C). Depending on application, boiler size, number of heating zones and whether or not there is domestic hot water application, differential setting can be adjusted to accommodate the installation.

Dry Fire Test

Dry Fire is not a substitute for a low water cutoff sensor control.

Dry Fire Test detects presence or lack of water in the boiler and prevent elements from energizing if dry condition exists. Dry Fire Test Mode is initiated following power outage and can take from 5 to 10 minutes to complete. Boiler must be ON and configuration setting for dFt must be set to Y. During Dry Fire Test pump is energized and first heating element is pulsed while temperature sensor is monitored to determine if water is present in the boiler. If failure occurs, "DFF" is displayed and a re-try takes place. After three consecutive failures an audible alarm will sound and pump will stop. Power must be removed and dry condition corrected to clear fault code.

Once initiated, Dry Fire Test can be canceled by pressing ▲up and ▼down arrow buttons simultaneously for 2 seconds. *This by-pass feature is intended for installer and should only be used when it is clear that dry condition does not exist.* Dry Fire Test is selectable in configuration mode and can be set to Y or N. To prevent Dry Fire testing from automatically occurring, change setting for dFt to N in configuration mode. Do not change setting unless special circumstances exist with application where conducting of Dry Fire Test does not accurately detect presence of water in the boiler.

Load Management Control (LMC)

Load management (LMC) feature can be used to temporarily de-activate the boiler and place it in stand-by mode. Some utility companies use this feature during peak demand periods to load trim the utility's power grid.

Control is equipped with auxiliary set of contacts (T Aux) which can be used to connect a secondary heating appliance. While the load management terminals (LMC) are open the heating elements are prevented from energizing and "LdC" is displayed. The call for heat on TT or DHW terminals is then diverted to the T Aux terminals to energize a secondary heating appliance.

When LMC is open and TT or DHW_TT is closed, the pump shall remain off except for post purge mode.

LMC terminals on boiler are intended to be connected to low volt, normally closed dry contacts of the utility LMC unit. Do not connect power to LMC terminal.

To connect utility LMC system, first remove jumper from LMC terminals on AT boiler control, then connect LMC unit to terminals.

The T aux terminals can be used to energize a secondary appliance. T Aux terminals are low voltage, normally open and will close when LMC terminals open and there is heating call on either R(T)-W(T) or DHW terminals .

Flow Sensor Input (FLO)

Flow sensor feature can be used to connect an installer provided water flow sensor to de-activate the boiler if water is not flowing through the boiler (abnormal condition).

The control is equipped with an auxiliary set of contacts (FLO) which can be used to connect a water flow sensors. While the flow sensor terminals (FLO) are open the heating elements are prevented from energizing and "FLO" is displayed. The sensor input is only active while the control is attempting to energize heating element(s). The flow sensor input IS NOT active during the pre and post purge modes.

The FLO terminals on the boiler are intended to be connected to low volt, normally closed dry contacts of the water flow sensor.

To connect a flow sensor first remove the factory installed jumper from the FLO terminals of the AT boiler control. Then connect the alarm output, dry contact, normally closed terminals of the flow sensor to the FLO terminals of the AT boiler control. Do not connect power to the FLO terminal.

Low Water Cutoff Sensor Input (LWCO)

Low Water Cutoff Sensor feature can be used to connect an installer provided low water cutoff sensor to de-activate the boiler if water is not present at the sensor (abnormal condition).

The control is equipped with an auxiliary set of contacts (LCO) which can be used to connect a low water cutoff sensor. While the low water cutoff terminals (LCO) are open the heating elements are prevented from energizing and "LCO" is displayed. The sensor input is only active while the control is attempting to energize heating element(s). The low water cutoff sensor input IS NOT active during the pre and post purge modes.

The LCO terminals on the boiler are intended to be connected to low volt, normally closed dry contacts of the water flow sensor.

To connect a low water cutoff sensor first remove the factory installed jumper from the LCO terminals of the AT boiler control. Then connect the alarm output, dry contact, normally closed terminals of the low water cutoff sensor to the LCO terminals of the AT boiler control. Do not connect power to the LCO terminal.

Anti-Short Cycle Timer, heating call satisfied

After the completion of a comfort heating or domestic hot water cycle, the heating elements shall remain off for a minimum of three (3) minutes. The ASCT time begins when the last heating element de-energizes. The pump shall be allowed to run during the ASCT period.

Anti-Short Cycle Timer, water temperature satisfied

While a heating call exists (TT or DHW-TT closed) and an element cycles off to maintain setpoint temperature, it will not re-energize for 90 seconds.

Pump Exercising

After 24 hours of pump inactivity, the pump will turn on for 60 seconds. Boiler must be in ON mode for pump exercising to occur.

Non-Volatile Memory

If power is lost, after it is restored the unit will return to the mode it was in prior to power loss. All user settings shall be retained and restored.

Boiler Fault Codes

● **Freeze Protection**

If the water temperature falls below 45°F (7°C) the control will automatically initiate a heat call sequence RW (TT) until the water temperature reaches 55°F (13°C). Boiler must be in ON mode for freeze protection to occur.

● **Relay Failure Alarm**

If a heating element relay fails the control shall switch off all heating elements and energize the pump. The audible alarm shall sound and the relay designator, "r1", "r2", "r3", "r4" shall be displayed until for a minimum of 30 seconds and until the error clears.

● **Temperature Sensor Failure**

The water temperature sensor shall be monitored at all times, (on and off modes). If the sensor is open "tSO" shall be displayed. If the sensor is shorted "tSS" shall be displayed. In both cases the control shall switch off all heating elements. The audible alarm shall sound for a minimum of 30s and until the error clears.

● **Abnormal Power Alarm**

The incoming power shall be monitored at all times, (on and off modes). If the power to the control falls outside the range of 18Vac - 30Vac the control shall switch off all appliances. The audible alarm shall sound and "AbP" shall be displayed for a minimum of 30 seconds and until the error clears.

● **Flow Alarm**

The flow alarm shall only be monitored during the heating cycle while elements are energized or attempting to be energized. An open flow switch shall have no effect while heating elements are off. If flow switch opens while elements are energized or attempting to be energized, control shall switch off all elements and enter 60 second purge mode. The audible alarm shall sound and "FLO" shall be displayed for minimum of 30 seconds and until error clears or demand for heat ceases. Pump shall remain on for minimum of 30 seconds after fault clears.

● **Low Water Cutoff Alarm**

The Low Water Cutoff alarm shall only be monitored during the heating cycle while elements are energized or attempting to be energized. An open Low Water Cutoff shall have no effect while heating elements are off. If Low Water Cutoff opens while elements are energized or attempting to be energized, control shall switch off all elements and enter 60 second purge mode. The audible alarms sound and "LCO" is displayed for minimum of 30 seconds and until the error clears or demand for heat ceases. The pump shall remain on for minimum of 30 seconds after fault clears.

● **High Limit Alarm**

The high limit alarm shall be monitored at all times except while the LMC terminals are open. If the High Limit switch opens the control shall switch off all elements and enter a 60 second purge mode. The audible alarm shall sound and "HL" shall be displayed for a minimum of 30 seconds and until the error clears. The pump shall remain on for a minimum of 30 seconds after the fault clears.

● **Control Hardware Failure**

Control hardware monitoring system is active while control is on. If control hardware failure is detected the control shall switch off all appliances. The audible alarm shall sound and "CHF" is displayed for minimum of 30 seconds and until error clears.

● **Test Mode**

Test mode is intended for installer verification of AT Boiler control. It is used to reduce time required to conduct comprehensive function test of the unit. *Initiation of test mode can be accessed through the user interface and is not intended for unauthorized personal.*

To enter test mode unit must be energized and in OFF mode. Press and hold ▲up arrow button for 4 seconds. The firmware version is displayed for 3 seconds then element configuration ("2" or "4") is displayed.

Pressing either ▲up or ▼down arrow buttons change the element configuration (2 or 4). Select configuration that coincides with boiler.

Press MODE/PWR button, display will illuminate all segments 8.8.8 along with demand LED (TT).

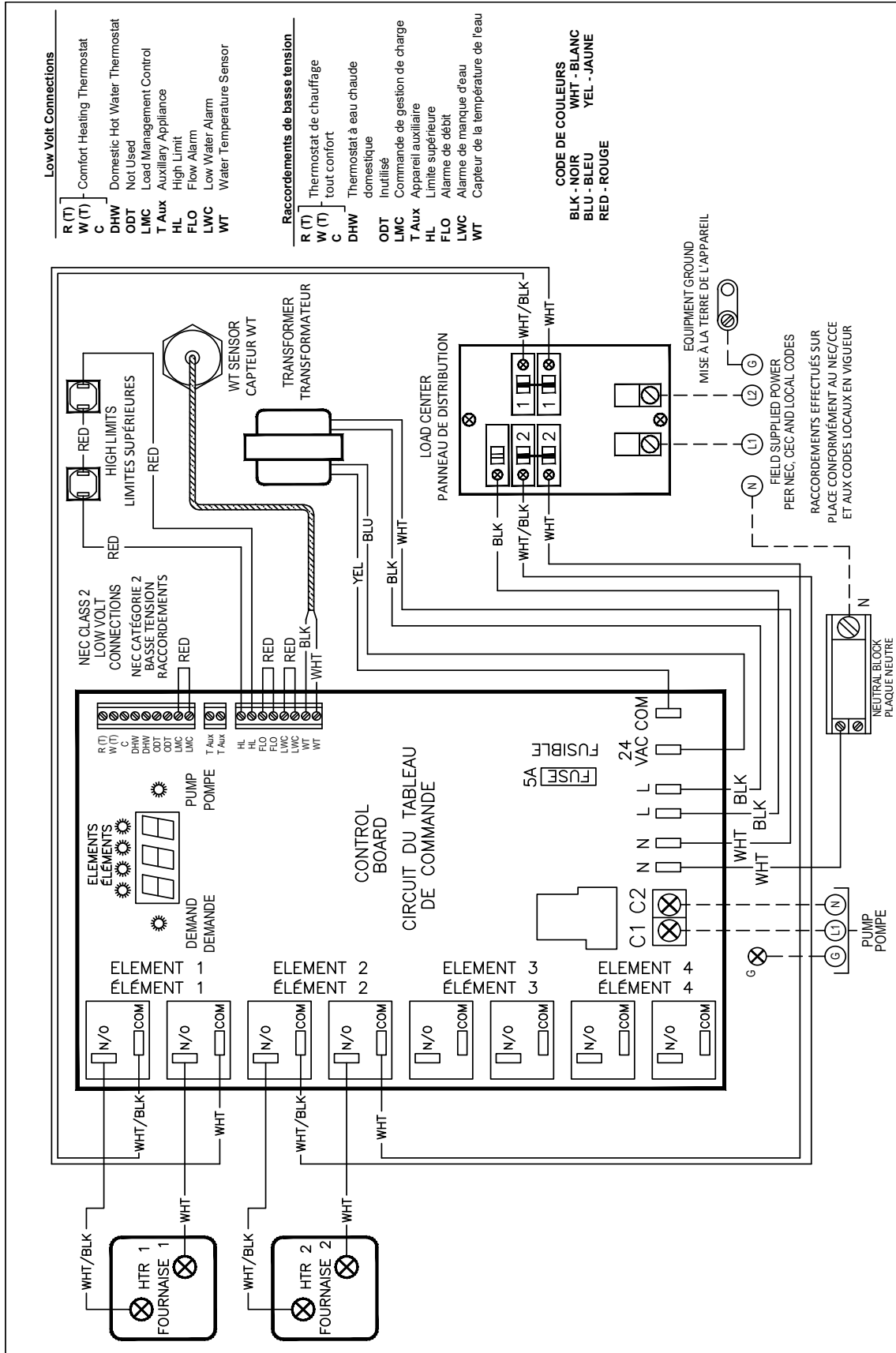
Pressing MODE/PWR button again, "tSt" is displayed. Check is made of Flow Sensor circuit, Low water cutoff sensor circuit, High limit circuit, Load management circuit and water temperature sensor. If any circuit is open or temperature sensor is shorted the display will indicate an error code (FLO, LCO, HL, LdC, tSO, tSS) and audible alarm will sound.

Pressing MODE/PWR button again enters element check sequence. Each element heating circuit is checked for power. If the element does not have power error is displayed ("r1", "r2", "r3", "r4") and audible alarm will sound.

When test is completed "dOn" is displayed. Pressing MODE/PWR button will repeat the test. Pressing ▲up arrow button exits test mode and returns to off mode. Control automatically exits test after 4m. Removing power exits test mode.

WIRING DIAGRAMS

Figure 9 - Wiring Diagram 2 Element w/ Breakers



STARTUP AND SEASONAL MAINTENANCE

Use qualified service agency for annual inspection of boiler and heating system.

NOTICE

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after service.

Placing Hydronic block into service.

1. Verify hydronic block circuit breaker or switch at service entrance and hydronic block circuit breakers within unit are in "Off" position.

NOTICE

Only propylene glycol can be used in heating system to prevent freezing. Recommendation is maximum 40% or less propylene glycol mixture to ensure proper operation of electric boiler.

2. Fill heating system with water until pressure is 10-15 PSIG. Check for leaks, repair if necessary, purge all air from system.

NOTICE

Failure to vent and keep air out of heating system will result in damage to heating elements in hydronic block. Damage due to element dry fire is not covered by manufacturer's warranty.

3. Set boiler operating temperature to desired heating water temperature. See Sequence of Operation.
Boiler is equipped with a secondary high-limit temperature device set at 200° F as safety limit control. High limit temperature device has automatic reset function and will reset at 170° F.
4. Turn on hydronic block circuit breaker at service entrance and/or disconnect switch and all circuit breakers on hydronic block.
5. Set room, thermostat above room temperature. Circulator pump will now operate.
6. Check system again for leaks. Allow circulator pump to run until all air has been vented from system. Gurgling or rushing sound indicates presence of air. Do not allow electric elements to fire until all air is purged from system. Reset room thermostat if needed. Re-purge boiler if necessary.
7. Hydronic block will start to produce heat. Listen for air passing through system as water temperature increases. Water pressure will rise somewhat as temperature increases - this is normal as long as the pressure remains less than 25 PSIG.

8. When thermostat calls for heat, circulator will be energized and green pump LED will light. Heating elements are energized with green heating element LEDs. Once boiler water temperature reaches set point temperature controller will regulate water temperature by staging its elements. Number of elements which stay on is based on heating demand and set point of boiler water temperature. After all room thermostats are satisfied, controller de-energizes elements one after another, and switches pump off after 3 minutes.

Hydronic block requires minimum periodic maintenance.
Annual maintenance allow for trouble free operation.

WARNING

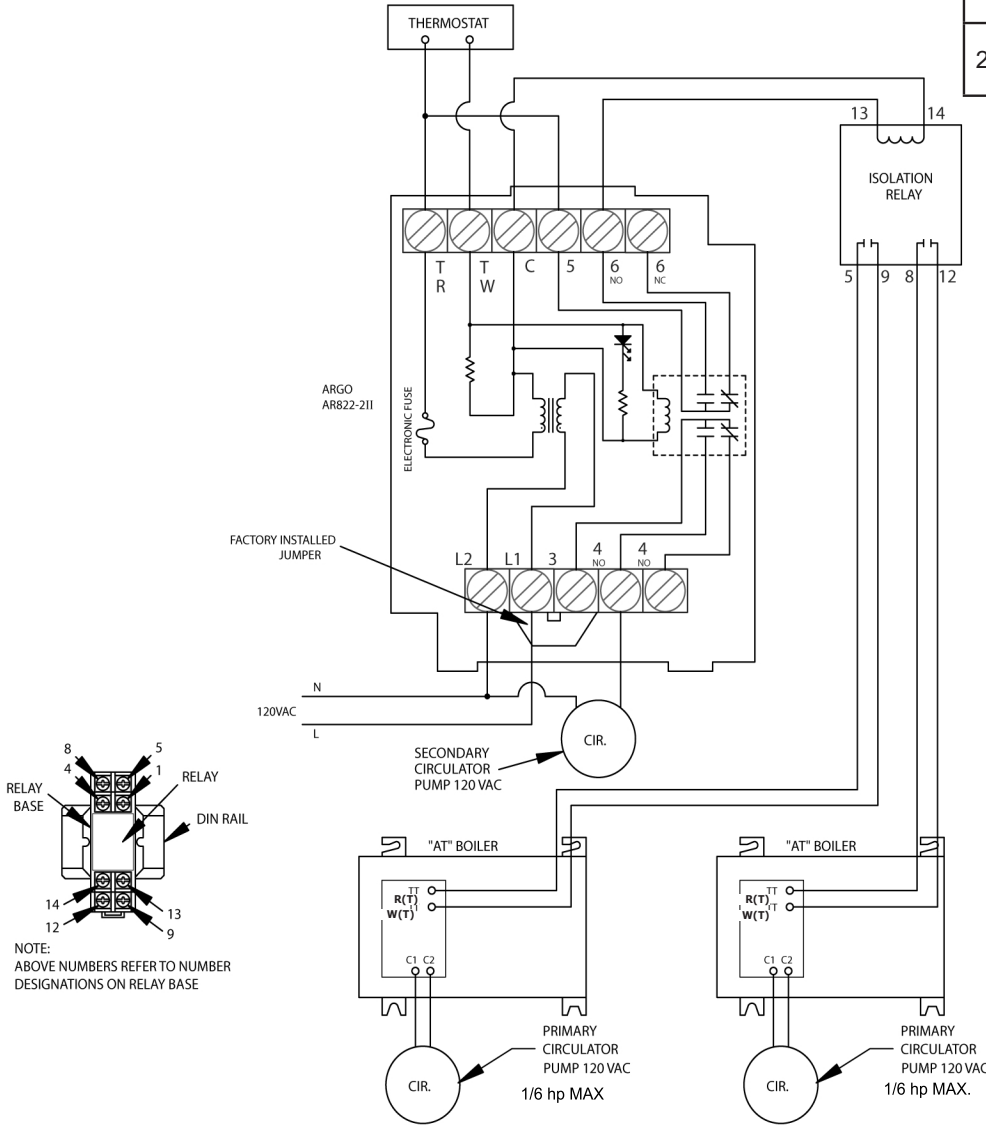
Electrical shock hazard. Turn OFF electrical power supply at main power switch before servicing unit. Service shall be preformed by a qualified service agent. Failure to do so could result in death or serious injury.

1. Boiler is designed to provide years of trouble free performance under normal operating conditions. Conduct general external examination at beginning of each heating season and at mid-heating season to assure good working performance continues. A qualified service technician should examine at least once every year.
2. Do not store anything against boiler or allow dirt or debris to accumulate in area immediately surrounding boiler.
3. Elements will burn out if boiler is not adequately filled with water when electrical power is turned on. Do not connect thermostat wire until system has been filled with water. Drain water out of system only when absolutely necessary to make repairs or prevent freeze-up during extended cold weather shutdown.
4. Check temperature and pressure gauge frequently. During normal operating conditions, pressure should be stable throughout heating season. If pressure under normal operating conditions consistently rises and falls over period of time, this can indicate fill valve leak, system leak, or compression tank malfunction. Leaks anywhere must be repaired immediately. If leaks or significant pressure fluctuations are observed, call for service immediately.
5. Test safety relief valve for proper operation. Refer to valve manufacturer's instructions packaged with relief valve.
6. Check field entrance wire connections to unit for any signs of looseness or over heating. Verify wire lugs are securely tightened.
7. Check all heating element wiring for signs of dark or damaged connections. Replace if any sign of failure exists.

Figure 11 - Single Zone with Circulator - 2 Boilers

ISOLATION RELAY	
ITEM NUMBER	DESCRIPTION
R35C	Relay 10A 24VAC
240004745	Relay Base, DIN Rail Mount
240004746	DIN Rail Approx. 2" Long

SINGLE ZONE WITH CIRCULATOR
2 BOILERS



ADDITIONAL WIRING DIAGRAMS

Figure 12 - Two Zones with Circulator - 2 Boilers

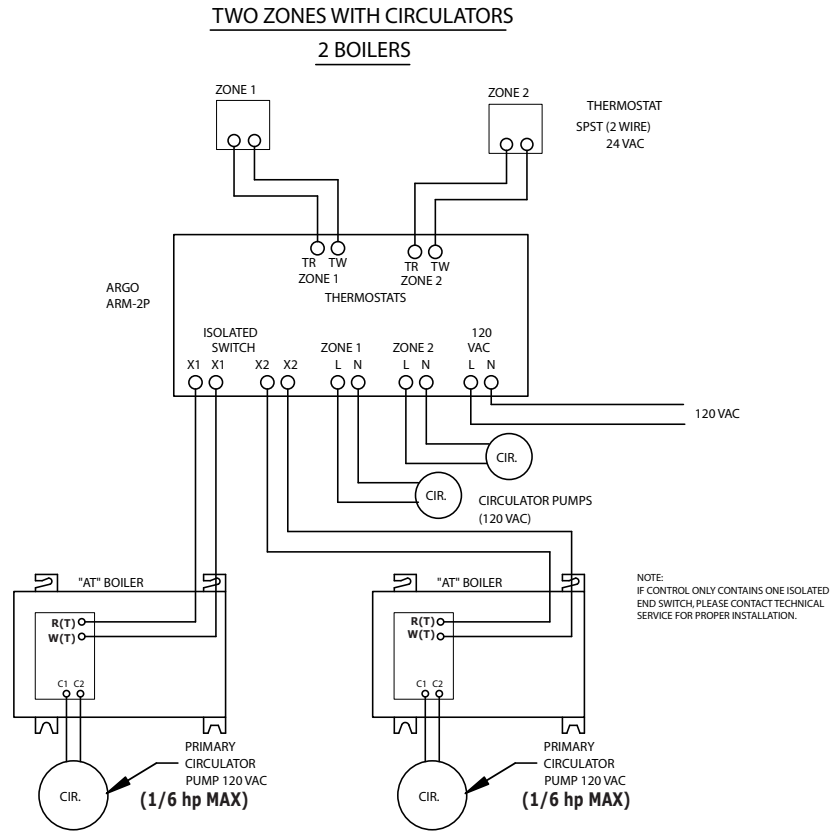


Figure 13 - Three Zones with Zone Control Valves - 2 Boilers

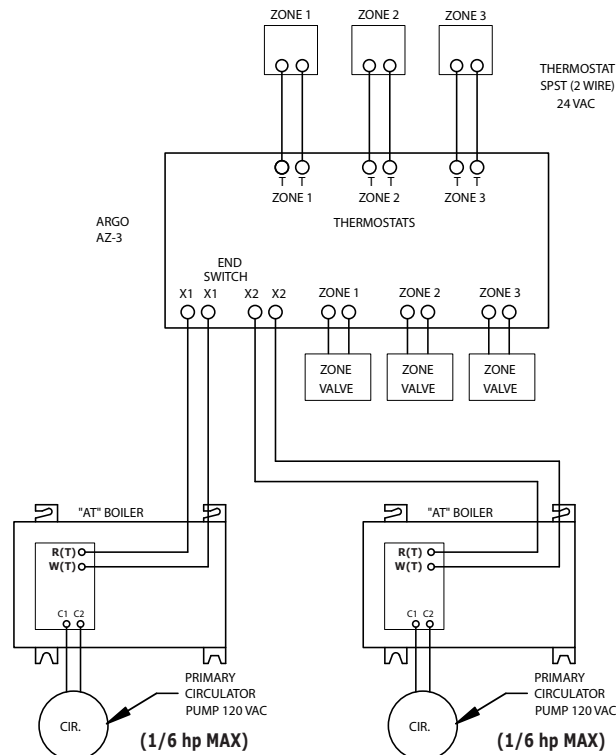


Figure 14 - Three Zones Control Valves

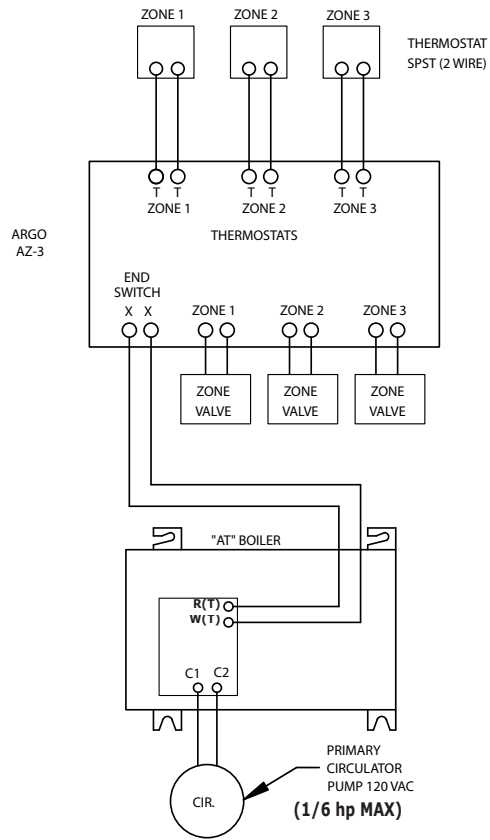
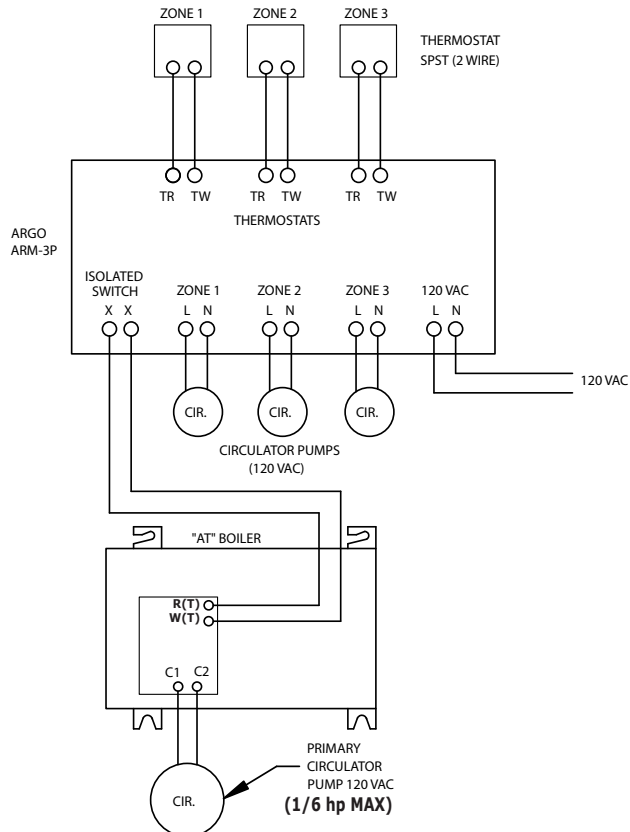
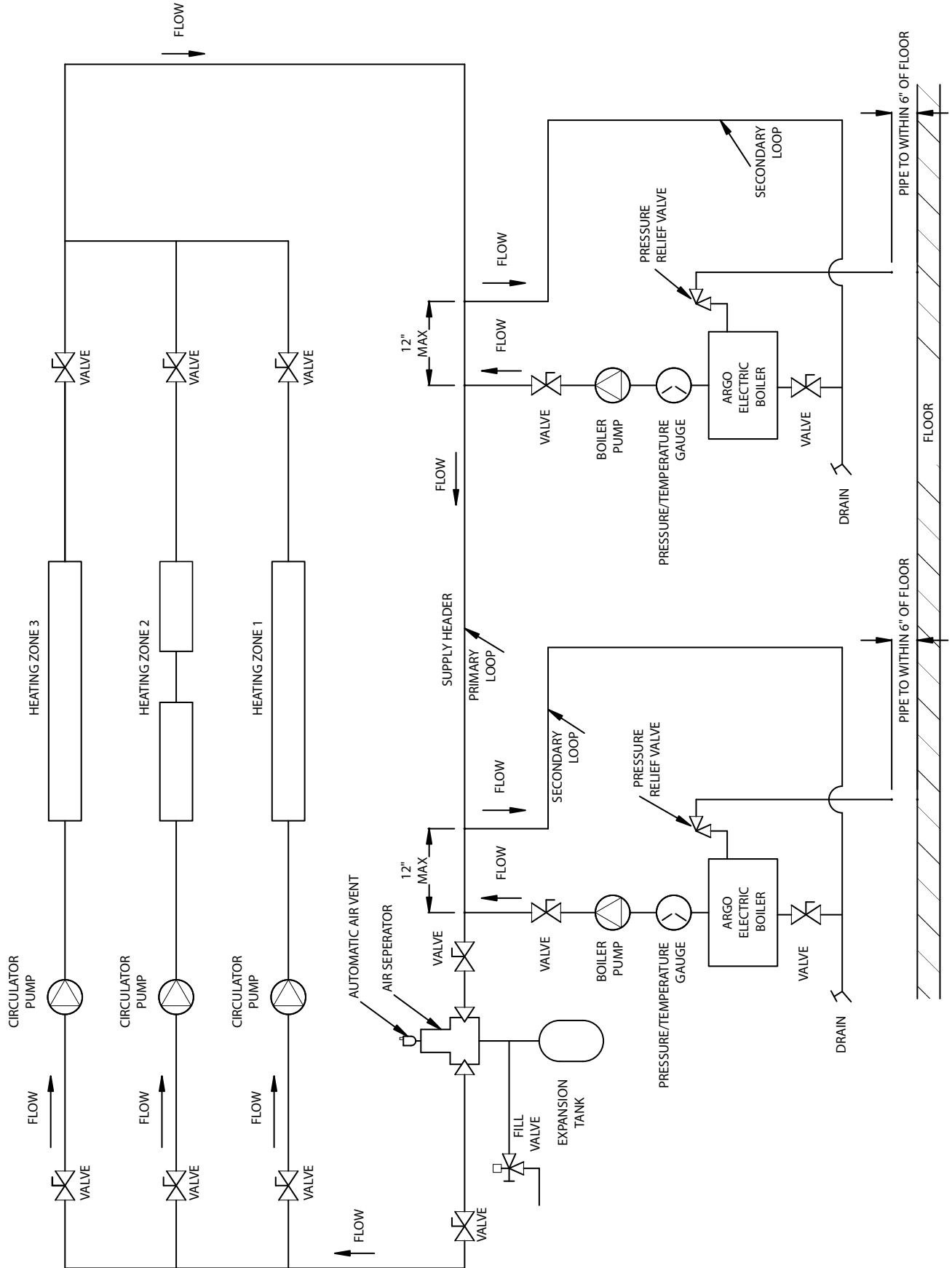


Figure 15 - Three Zones with Circulators



MODULAR BOILER PIPING



TROUBLESHOOTING

This section is to assist service technician when trouble shooting electric boiler. It is important to isolate before proceeding. Control error codes can be helpful identifying cause of problem. If you suspect wiring fault, check all external wiring and wiring connections following wiring diagram label on inside of boiler's cover. Additional wiring diagram is included with this manual.



WARNING

Electrical shock hazard. Turn OFF electrical power supply at service panel before making electrical connections. Failure to do so could result in death or serious injury.

7. After element has been removed, carefully clean any remaining gasket material from casting surface. Take care not to scratch or score surface.
8. Install new gasket and heating element while assuring element is correctly positioned.
9. Close relief valve. Open feed line valve and check for leaks. Open gate valves. Install heating element wires and cabinet cover.
10. Refer to "Startup and Seasonal Maintenance" for purging of air prior to energizing heating elements.

Noisy Boiler

- Check water pressure of boiler. Should be 15-25 PSIG.
- Check for air within system. Install proper air vents and purge unit as necessary.

Heating Element Change

Heating element change, use following procedure:

1. Turn off hydronic unit circuit breaker at service entrance and/or disconnect switch.
2. Close gate valves near inlet and outlet of hydronic block.
3. Close feed line valve if using automatic fill.
4. Open drain valve and allow water to drain from boiler. Manual operation of relief valve will assist drainage by allowing air to enter.
5. Remove cabinet cover and disconnect two wires attached to effected heating element.
6. Remove four bolts securing heating element to casting pry element loose. Take note of markings on element flange to assure proper reinstallation.

TROUBLESHOOTING

⚠ WARNING

Electrical shock hazard. Turn OFF electrical power supply at main power switch before servicing unit. Service shall be performed by a qualified service agent. Failure to do so could result in death or serious injury.

AT Boiler Trouble Shooting

Fault	Possible Cause	Corrective action
HL - High Limit Trip	Is circulator pump functional?	If pump is not working replace.
	Check temperature rise across boiler.	If > 20°F - Increase flow rate by using larger pump or pipe size.
	Check for temperature overshoot after completion of heating cycle.	If greater than 10°F then increase differential setting.
	Check that HL screw terminals on control board are tight.	
	Are high limit switches open while water temperatures less than 200°F (<200°F)?	Check high limit switches with Ohm meter. Replace high limit(s) open.
	Is heat load too small?	Check heat load calculations.
AbP - Abnormal Power Alarm	Power too high or too low?	Check Incoming power is between 197Vac and 240Vac (197< IP <240Vac). If power outside range, contact electrician to have power corrected.
	Power is OK while unit is off but drops when unit is on.	Check for adequate wiring and breaker size.
Water temperature overshoots set point temperature.	A small overshoot is normal, however if overshoot is greater than 10°F (OS > 10°F) then check the following.	Check temperature rise across boiler is less than 20°F. If too high then increase flow rate through boiler, use larger boiler pump if necessary.
	Boiler is oversized for heating zone?	Check heat load calculations.
	Differential is too low?	Increase differential temperature setting.
DFF - Dry Failure Alarm	Air in boiler?	Purge boiler until all air is removed.
		Check that adequate air vents located in critical system high points. Add vents as necessary.
tSO, tSS - Temperature sensor failure.	Check resistance value of sensor using R/T chart.	Good - Check for loose WT terminals on control board.
		Bad - Replace Sensor.
CHF Control Hardware Failure	Check for all wiring for damage or loose connections.	Bad - Tighten any loose terminals. Replace Damaged Wiring.
		Good - Replace Control.
Circuit Breakers Trip	Inspect wiring for damage or short circuits.	Bad-Tighten any loose terminals. Replace damaged wiring.
	Inspect heating elements, Check element resistance value is between 9-20Ω (Ohms).	Bad - Replace heating element(s).
	Is current draw between 12 and 25A (Amps) per element?	Bad - Replace heating element(s).
r1, r2, r3, r4 Relay failure code	Is heating element wiring loose or damaged?	Bad-Tighten any loose terminals. Replace Damaged Wiring.
	Is heat relay stuck closed?	With power removed check relay contacts with an Ohm meter. Replace control if relay is stuck closed.

TROUBLESHOOTING

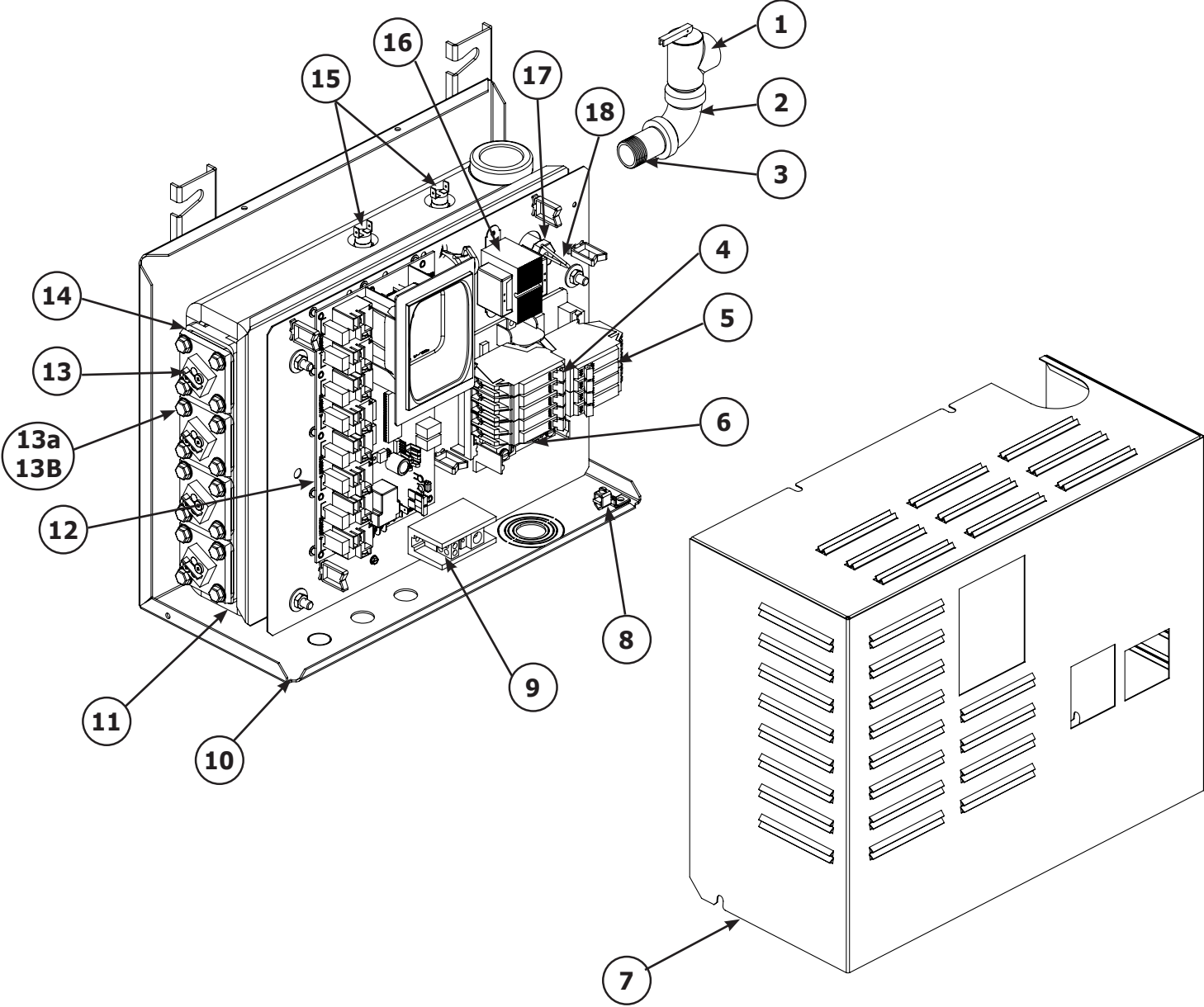
FLO Flow Switch Alarm	Is flow switch installed?	N - Check control board jumper is in place and secure. Tighten FLO screws if needed.
		Y - System air locked - Purge system and add venting as needed.
		Y - Check that flow switch is functioning properly. Conduct self test on flow switch (Consult manufactures instructions).
LWC Low Water Cutoff Alarm	Is LWCO Installed?	N - Check control board jumper is in place and secure. Tighten LWC screws if needed.
		Y - System air locked - Purge system, add venting as needed.
		Y - System low on water - Check water feed to boiler, check for leaks. Repair as needed.
		Y - check that LWCO is functioning properly. Conduct self test on LWCO switch (Consult manufactures instructions).
Control Display Dark/ Un-responsive	Is electrical power applied to unit?	Check Incoming power is between 197Vac and 240Vac (197 < IP < 240Vac). If power outside range, contact electrician to have power corrected.
	Field Service circuit breakers tripped?	Check for loose or damaged wiring. Replace wiring if damaged.
		Check heating element resistance within 9-20Ω (Ohms). Replace element if outside range.
	AT boiler 15A breaker tripped?	Inspect control and all wiring for damage. Replace any damaged components or wiring.
		Inspect field installed thermostat and wiring for damage. Repair and replace as necessary.
	Is control transformer functioning?	Check for 24Vac on R and C terminals of control board. If less than 18Vac on R & C with primary side between 104 and 130Vac then replace transformer.
		With power removed check control transformer primary and secondary windings for open or short. If windings are open or short, replace transformer.
		With power removed check 5A fuse on control board. If bad replace fuse.
	Is wiring loose or damaged?	Inspect all thermostat wiring for damage loose connections or damage. Replace wiring if necessary.
	Control functions correctly however does not heat water.	Heating element(s) failed?
AT boiler 40A breakers tripped?		Check for loose or damaged wiring. Replace wiring if damaged.
		Check heating element resistance within 9-20Ω (Ohms). Replace element if outside range.
		Check control board for damaged heat relay(s).
		Check boiler pump is operational. Replace if necessary.

RESISTANCE VS. TEMPERATURE TABLE

Resistance Vs. Temperature Table		
Temp (°C)	Temp (°F)	Ohms (Ω)
0	32.0	
5	41.0	
10	50.0	
15	59.0	
20	68.0	
25	77.0	
30	86.0	
35	95.0	
40	104.0	
45	113.0	
50	122.0	
55	131.0	
60	140.0	
65	149.0	
70	158.0	
75	167.0	
80	176.0	
85	185.0	
90	194.0	
95	203.0	
100	212.0	

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PARTS LIST - 2 & 4 ELEMENT BOILER



PARTS LIST - 2 & 4 ELEMENT BOILER

2 & 4 Element Electric Boiler		
Item	Part Number	Description
1	VR-001.01	Relief Valve - 30 PSI
2	E1	Elbow 3/4" x 90°
3	N1	Nipple 3/4" x 2"
4	B28	Circuit Breaker 15 A - 1 Pole - G.E. THQP 115
5	B27	Circuit Breaker 40 A - 2 Pole - G.E. THQP 240
6	I25	Load Center Assembly - G. E. TLM812U2
7	109008918	Cover
8	L9	Ground Lug
9	B194	Neutral Terminal Block
10	P23	Chassis, Back/Bottom
11	550003227	Pressure Vessel - Cast Iron, 2 Element
	550003228	Pressure Vessel - Cast Iron, 4 Element
12	240010295	Control Board - 2 Element, kit, includes wires
	240010296	Control Board - 4 Element, kit, includes wires
13	E13	Heating Element - 3KW/240 Volt
	E14	Heating Element - 4KW/240 Volt
	E15	Heating Element - 5KW/240 Volt
	E16	Heating Element - 6KW/240 Volt
13a	S66	Bolt, 5/16 - 18 x 3/4
13b	W29	Washer, Flat 5/16"
14	G12	Gasket, Heating Element
15	S47	Safety Limit Control (High Limit, Fixed Temperature)
16	240011565	Transformer 115/24V, 40VA
17	240010289	Water Temperature Sensor Kit
18	240004756	Brass Well
+	240010268	5 Amp Fuse
+ = Not Shown		

HOMEOWNER'S REFERENCE TABLE

Model Number: _____

Serial Number: _____

Date Installed: _____

Contractor: _____

Contact: _____

Address: _____

Telephone Number: _____

After Hours Number: _____

If different from Installation Contractor:

Service Tech: _____

Telephone Number: _____

After Hours Number: _____



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