APPLICATION GUIDE
FOR USE WITH

HEATING ONLY - 75, 100, 125, 165
&
COMBI - 115, 150, 205

This manual has been prepared for use with the appropriate Installation, Operation and Maintenance Manual.
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1. 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.

2. General
Boiler installation shall be completed by qualified agency. See Installation, Operation & Maintenance Manual for additional information.

**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.

**WARNING**
Fire, Explosion, Asphyxiation, Electrical shock hazard! Flooding will result in damages such as electrical problems, corrosion, inoperative parts, mold and other unforeseen issues which can occur over time. Any equipment determined by a professional as damaged by a flood, defined as excess of water or other liquid, shall be replaced. Failure to follow these directions will result in a Hazardous Situation.

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

- United States
  - National Electrical Code, NFPA 70.
- Canada
  - Natural Gas and Propane Installation Code, CAN/CSA B149.1.
  - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1

Additional manual reset low water cutoff and/or high limit may be required.

5. 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.
75, 100 & 125 HEATING ONLY
WITH OPTIONAL INDIRECT DHW CONNECTION

75, 100 & 125 HEATING ONLY
WITHOUT OPTIONAL INDIRECT DHW CONNECTION

165 HEATING ONLY

**Legend**

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<td>E</td>
<td>Gas Shutoff Connection</td>
<td>3/4&quot; [22.2 mm]</td>
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<td>Condensate Drain Connection</td>
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<td>J</td>
<td>Optional Indirect DHW Connection</td>
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**Manifold 75/100/115/125/150**

**Manifold 165**

1-1/4” Header

1-1/2” Header
LABOR SAVING PIPING MANIFOLDS / NEAR BOILER PIPING CONNECTIONS

**115 & 150 COMBI**

**205 COMBI**

### LEGEND

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<td>Heating Return Connection</td>
<td>3/4&quot; [22.2 mm] 1&quot; [25.4 mm]</td>
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<td>Domestic Cold Water Inlet</td>
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<td>3/4&quot; [22.2 mm]</td>
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<td>Boiler Fast Fill</td>
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<td>G</td>
<td>Domestic Hot Water Outlet</td>
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<td>H</td>
<td>Condensate Drain Connection</td>
<td>13/16&quot; [21 mm] ID Hose 3/4 NPT</td>
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<td>I</td>
<td>Heating Supply Connection</td>
<td>3/4&quot; [22.2 mm] 1&quot; [25.4 mm]</td>
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<td>J</td>
<td>Manifold</td>
<td>1-1/4&quot; sweat [31.8 mm] 1-1/2&quot; sweat [38.1 mm]</td>
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<td>K</td>
<td>5 gpm DHW Flow Restrictor (Factory installed) (205 only)</td>
<td>NA 3/4&quot; NPT</td>
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GENERAL INFORMATION - HYDRONIC PIPING

WARNING
Burn and scald hazard! Manufacturer requires installation of field supplied anti-scald valve. Failure to follow these instructions could result in death or serious injury.

General Information:
Piping installation, materials, and joining methods shall conform to requirements of authority having jurisdiction or in absence of such requirements:
- **USA** - National Fuel Gas Code, ANSI Z223.1/NFPA 54
- **Canada** - Natural Gas and Propane Installation Code, CAN/CSA B149.1

Manufacturer Requirements/Recommendations:
- **Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve.** Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.
- Use a water filter on potable incoming water supply line.
- Manufacturer recommends use of a magnetic dirt separator in the hydronic system where there are cast iron or steel components, or where the previous boiler was a cast iron heat exchanger. The abrasive, extremely fine sediment is difficult to remove and can deposit onto heat exchanger surfaces and accumulate in pump cavities causing reduced efficiency and premature wear.
- If the piping manifold is not used the ASME temperature and pressure relief valve and temperature and pressure gauge shall be installed to conform to requirements of the authority having jurisdiction. Refer to appropriate manufacturer instructions for installation requirements.
- If the piping manifold is not used, a primary / secondary piping arrangement is manufacturer required, unless using Buffer Tank. A maximum of 12 in of separation between the supply and return pipe (closely spaced tees) of the boiler shall be maintained. Limit combined supply and return pipe lengths to maximum linear lengths of 20 ft (6.1 m) between boiler and closely spaced tees, when minimum ¾ in NPT pipe size is used. Linear length may be increased if supply and return pipe size is increased to limit pressure drop.
- Manufacturer recommends installing a shutoff and purge valve to use during commissioning to ensure the boiler does not shut down due to over temperature. Do not install shutoff between boiler and LWCO or pressure relief valve.

FOR YOUR SAFETY READ BEFORE OPERATING

DANGER
Hot Water Can Scald!
Water heated to temperature for clothes washing, dish washing and other sanitizing needs can scald and cause permanent injury. Children, elderly, and infirmed or physically handicapped persons are more likely to be permanently injured by hot water. Never leave them unattended in bathtub or shower. Never allow small children to use a hot water tap or draw their own bath.
If anyone using hot water in the building fits the above description, or if state laws or local codes require certain water temperatures at hot water taps, you must take special precautions:
- Use lowest possible temperature setting.
- Install some type of tempering device, such as an automatic mixing valve, at hot water tap or water heater. Automatic mixing valve must be selected and installed according to manufacturer's recommendations and instructions.
- Water passing out of drain valves may be extremely hot. To avoid injury:
  ◦ Make sure all connections are tight.
  ◦ Direct water flow away from any person.
GENERAL INFORMATION - HYDRONIC PIPING

<table>
<thead>
<tr>
<th>Water Temperature Setting</th>
<th>1st Degree Burn Exposure Time For An Adult</th>
<th>2nd and 3rd Degree Burn Exposure Time For An Adult</th>
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<tr>
<td>120° F</td>
<td>1 minute</td>
<td>5 minutes</td>
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<tr>
<td>130° F</td>
<td>5 seconds</td>
<td>30 seconds</td>
</tr>
<tr>
<td>140° F</td>
<td>2 seconds</td>
<td>5 seconds</td>
</tr>
<tr>
<td>150° F</td>
<td>1 second</td>
<td>1.5 seconds</td>
</tr>
<tr>
<td>160° F</td>
<td>Instantaneous</td>
<td>0.5 seconds</td>
</tr>
</tbody>
</table>

**Note**: Provided Wiring and Piping illustrations are meant to show system concepts only. Installer is responsible for all equipment required by authority having jurisdiction.

**Note**: Arrange piping to prevent water dripping onto boiler.

All piping diagrams are shown with optional DHW Indirect Tank where applicable.

The Labor Saver Piping Manifold, which is supplied with each boiler, is shown with most of the following piping diagrams.

### Use of Indirect Water Heater (DHW) Heating Only Boiler:

**Note**: Sensors supplied with this boiler are proprietary to the manufacturer. Use of alternate sensors WILL diminish boiler performance.

- Use DHW sensor kit 550003189 to interface with boiler. Wire to M2 terminals #3 and #4. Exception: not applicable for the 165 model, use aquastat for indirect tank control.
- For heating only boilers with DHW outlet connection, see page 4, indirect water heater shall be piped utilizing the internal boiler pump. See pages 10 and 13.
- Locate tank as close to boiler as possible.
- See Indirect Tank Performance chart, page 40 of this manual.
- Change P03 on boiler for application as specified on the applicable wire diagram in this manual or Boiler Control Section 9 of Installation, Operation & Maintenance Manual supplied with the boiler.

### Use of Buffer Tank:

- If using internal boiler pump, manifold shall be cut for use as shown on page 24. Increase pipe size to match Buffer tank connections as shown.
- Locate tank as close to boiler as possible.
Electrical Wiring Information:

All field wiring shall conform to the authority having jurisdiction or, in the absence of such requirements to:

- **USA**: National Electrical Code, ANSI/NFPA 70,

Wiring diagrams shown in this manual utilize ARGO™ Controls, the optional use of an Indirect Domestic Hot Water Tank, and optional use of a H2O Buffer Tank.

Reference the zone control manufacturer instruction manual for control operation and priority setting of DHW zones.

**Note**

* DO NOT use 120 V thermostat terminals (M1- #1 and #2).

**Note**

Provided Wiring and Piping illustrations are meant to show system concepts only. Installer is responsible for all equipment required by authority having jurisdiction.

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**BOILER CONTROL**

![Diagram of Boiler Control]

10k Ω DHW Indirect Tank Sensor (125 Unit Only) or DHW Indirect Tank Aquastat (Heating Only Boilers)

1k Ω Outdoor Reset Sensor

0-10 V Connection

Zone Control End-Switch

Open Therm

**SUPPLY Cord** 120V/60HZ

* Ground Sensors using terminal 4
Locate shut off valve after any field installed LWCO.
If adding an indirect tank with sensor to a Heating Only Boiler, change P03 from 08 to 05.
See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.

Reference zone control manufacturer instructions for details on setting priority if necessary.
If adding an indirect tank with *Thermostat* to a *Heating Only Boiler*, change P03 from 08 to 04.

See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.

Reference zone control manufacturer instructions for details on setting priority if necessary.
Shut off & Purge Valve

Locate shut off valve after any field installed LWCO.
If adding an indirect tank with sensor to a Heating Only Boiler, change P03 from 08 to 05.
See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.
If adding an indirect tank with **Thermostat** to a **Heating Only Boiler**, change P03 from 08 to 04. See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.

Reference zone control manufacturer instructions for details on setting priority if necessary.
Locate shut off valve after any field installed LWCO.
If adding an indirect tank with *Thermostat* to a *Heating Only Boiler*, change P03 from 08 to 04.

See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.

Reference zone control manufacturer instructions for details on setting priority if necessary.
165 WITH ZONE VALVES

Locate shut off valve after any field installed LWCO.
If adding an indirect tank with **Thermostat** to a **Heating Only Boiler**, change P03 from 08 to 04.

See Section 9, Parameter Settings in Boiler Installation, Operation & Maintenance Manual for details.

Reference zone control manufacturer instructions for details on setting priority if necessary.
115, 150 & 205 WITH ZONE CIRCULATORS, ARGO UZ3 ZONE CONTROL

ZONE THERMOSTATS

THERMOSTATS

ZONE VALVES

DIGITAL LCD USER DISPLAY

UZ3

TO EXPANSION
ZONE MODULE

Transformer

115 Vac

PRI PUMP

ZONE CIRCULATOR

LINE

115 Vac FIELD SUPPLIED
POWER PER NEC
AND LOCAL CODES

M2 terminal strip
on boiler

115 Vac FIELD SUPPLIED
POWER PER NEC
AND LOCAL CODES
Locate shut off valve after any field installed LWCO.
115, 150 & 205 WITH ZONE VALVES - Wiring Diagram

115 Vac Field Supplied Power Per NEC and Local Codes

115 Vac

Transformer

321

X

N

C

115 Vac

24V

L

115 Vac

NEC Class 2 Low Voltage

Thermostats

Zone Valves

Vannes de Zone

Zone Circulator

Digital LCD User Display

Zone Module

To Expansion Module

12A 250V

PTC

Fuse

115 Vac

ZONE 1

ZONE 2

ZONE 3

NEC Class 2 Low Voltage (24Vac)

WRT T C WRT T C

Primary Pump

M2 Terminal Strip on boiler

M2
Buffer Tank Piping

When installing low mass systems, additional water mass may be required to avoid short cycling by the boiler. In these applications it is recommended that a buffer tank be installed.

Buffer Tank on Central Heat Circuit Using Internal Boiler Circulator

Note:
- DHW piping not shown for clarity. Reference applicable sections of this manual for DHW piping details.
- Internal Boiler circulator used on Primary circuit.
Buffer Tank On Central Heat Circuit With Primary Pump and Supplied Manifold

**NOTE**: Acceptable primary pump locations: Either 1 or 2. For pump wiring see diagrams on pages 26-29.
Buffer Tank Pump Wiring

Controlling A Primary Pump On A Combi Boiler With Zone Valves, No Indirect Tank
Buffer Tank Pump Wiring

Controlling A Primary Pump On A Combi Boiler With Zone Pumps, Argo ARM 4P Zone Control and A822-II
Buffer Tank Pump Wiring

Controlling A Primary Pump On A Combi Boiler With Zone Valves and Indirect Tank With Priority, Argo UZ3 and AR822-II Zone Controls
Optional Equipment

**IMPORTANT:** Sensors supplied with this boiler are proprietary to the manufacturer. Use of alternate market sensors WILL diminish boiler performance.

1. **1k Ω** Outdoor Air Sensor, if used.
   A. Boiler automatically recognizes sensor when used.
   B. See Chart 1 for sensor data. Sensor part number BD710487302V
   C. Locate outdoor sensor to protect against wind and direct sunlight. Mounting instructions provided with sensor.
   D. Maximum wire length is 100 ft (30m) for 22 ga. wire, or 150 ft (45m) for 18 ga. wire.
   E. Connect wires to M2 OUTDOOR SENSOR terminals 4 & 5. Wires are interchangeable. See Accessories.

2. **10k Ω** Sensor for Indirect DHW Tank (Heating Only Boiler, Exception: not applicable to the 165 model, use aquastat for indirect tank control).
   A. See Chart 2 for sensor data.
   B. Connect wires to M2 terminals 3 & 4.

### CHART 1 - 1K Ω OUTDOOR AIR SENSOR DATA

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<td>51.8</td>
<td>1,763</td>
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### CHART 2 - 10K Ω INDIRECT TANK SENSOR DATA

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tr>
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<td>91.4</td>
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<td>25,308</td>
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<td>98.6</td>
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<td>5,551</td>
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<td>19,854</td>
<td>104.0</td>
<td>5,332</td>
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<td>18,930</td>
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<td>18,054</td>
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<td>4,923</td>
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<td>109.4</td>
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<td>111.2</td>
<td>4,549</td>
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<td>14,980</td>
<td>114.8</td>
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<td>14,306</td>
<td>116.6</td>
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<td>3,748</td>
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<td>125.6</td>
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<td>127.4</td>
<td>3,222</td>
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<td>75.2</td>
<td>10,447</td>
<td>129.2</td>
<td>3,104</td>
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<td>9,999</td>
<td>131.0</td>
<td>2,991</td>
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<td>78.8</td>
<td>9,572</td>
<td>132.8</td>
<td>2,882</td>
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<td>80.6</td>
<td>9,166</td>
<td>134.6</td>
<td>2,778</td>
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<td>82.4</td>
<td>8,779</td>
<td>136.4</td>
<td>2,679</td>
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<tr>
<td>84.2</td>
<td>8,411</td>
<td>138.2</td>
<td>2,583</td>
</tr>
</tbody>
</table>
1. 1K Ohm (1k Ω) Outdoor Temperature Sensor Kit - BD710487302V

- Use the Outdoor Sensor (OAS) Kit with Heating Only or Combi Boilers.
- Wire Control to boiler M2 terminal strip, terminals 4 and 5 as shown.
- Install/locate Control follow supplied instructions with sensor kit and Installation, Operation and Maintenance Manual (IOM).

**Setting “Kt” Climate Curve:**

1. Boiler automatically recognizes OAS sensor when wired to M2 terminal block. Display changes to show current default “Kt” value (80). Note display value.
2. When operating in CH mode, boiler setpoint is determined by the Kt value selected and actual outside air temperature. Refer to applicable °F (or °C) chart, (pg. 30) for setpoint information.
   - Select Kt range which will satisfy the desired boiler delivery temperature based on outdoor temperature range expected for your location. For example: if you need 176°F water when the outside temperature is 20°F and colder, select 35 for your Kt setting.
   - To change “default” Kt value on boiler control use or CH Heating buttons.
   - Restrict the upper limit of the Kt curve by using Parameter P16 to set the maximum boiler water temperature. P16 Default is 176°F.
3. When OAS is installed, pressing or buttons will no longer display boiler CH setpoint temperature. It now displays the Kt value which can range from 10 to 90.
4. When scrolling has stopped, boiler will automatically “SAVE” value as new Kt default value and automatically return to CH mode when no Kt adjustment activity is sensed. Kt values can be changed in +/- 1 point increments.
5. To return, to verify or change current Kt “default value” depress one of the CH setpoint adjustment buttons (once), or CH Heating buttons, while in any heating or standby mode. Adjust Kt value to obtain desired comfort level.

**Note**

For temperatures below -40°F (-40°C), maximum heating flow temperature set point no longer increases and curves on the graph become horizontal. Boiler set point will override sensor setpoint.
2. 10k Ω Indirect Storage Tank Sensor Kit

Heating Only boiler can be electrically connected to Indirect Storage Tank.

Diagram of electrical connection of external indirect storage tank is shown below.

Connect DHW priority sensor to terminals 3 and 4 on terminal block M2. The element of the sensor must be inserted in the sensor well located on the indirect storage tank.

Verify the exchange capacity of the indirect tank coil is appropriate for power of the heating only boiler. Adjust DHW temperature (+95°F...+140°F / +35°C...+60°C) by pressing \( - \) buttons on boiler control panel.

Parameter PO3 for Heating Only boiler, with no indirect tank remains Factory Set at 08. No change is required.

If adding an Indirect Tank with a sensor to Heating Only Boiler - change PO3 parameter from 08 to 05.

If adding an Indirect Tank with a thermostat to Heating Only Boiler - change PO3 parameter from 08 to 04.

See Section 9, Parameter Settings, in boiler’s Installation, Operation, and Maintenance Manual.

Parameter PO3 for COMBI boiler factory set at OO requires no change.

Management of 0-10V Input

To activate the 0-10v function parameter 82 must be set to 3.

There must be at or above 3 V DC present for the control to recognize a call for heat.

When P78 = 1 the 0-10v input manages CH heating setpoint directly per chart below.

When P78 = 2 the 0-10v input manages CH heating input directly per chart below.

When P78 = 0 Disabled

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Temp Setting</th>
<th>P78=1 0-10V Input</th>
<th>P78 = 2 0-10V Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>°F</td>
<td>kW, MBH</td>
<td>kW, MBH</td>
</tr>
<tr>
<td>0-3</td>
<td>3</td>
<td>25, 77</td>
<td>4.9, 16.6</td>
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<tr>
<td></td>
<td>4</td>
<td>32, 90</td>
<td>7.3, 24.9</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>40, 104</td>
<td>9.7, 33.3</td>
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<td></td>
<td>6</td>
<td>49, 120</td>
<td>12.2, 41.6</td>
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<tr>
<td></td>
<td>7</td>
<td>57, 135</td>
<td>14.7, 50.0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>65, 149</td>
<td>17.1, 58.3</td>
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<tr>
<td></td>
<td>9</td>
<td>73, 163</td>
<td>19.5, 66.6</td>
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<td></td>
<td>10</td>
<td>80, 176</td>
<td>21.2, 75.0</td>
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</tbody>
</table>
CIRCULATOR CONNECTIONS - WIRING DIAGRAM

SINGLE ZONE CIRCULATOR WIRING USING ARGO AR822-II
75 & 100 - HEAT ONLY WIRING DIAGRAM

MODEL 75 & 100 - HEAT ONLY
MODEL 165 - HEAT ONLY

165 - HEAT ONLY WIRING DIAGRAM
ALTITUDE EFFECTS ON BOILER PERFORMANCE

MODEL 75
CALCULATED EFFECTS OF HI-ALTITUDE ON BOILER PERFORMANCE

MODELS 100/115
CALCULATED EFFECTS OF HI-ALTITUDE ON BOILER PERFORMANCE

ALTITUDE (FEET)

BOILER INPUT (BTUH)

HEAT MODE
Net Rating Heat Mode

DHW MODE
Net Rating Heat Mode

ALTITUDE (FEET)

BOILER INPUT (BTUH)
MODELS 125/150
CALCULATED EFFECTS OF HI-ALTITUDE ON BOILER PERFORMANCE

MODELS 165/205
CALCULATED EFFECTS OF HI-ALTITUDE ON BOILER PERFORMANCE
# APPLICATION TABLE - INDIRECT HOT WATER TANK PERFORMANCE CHART

## HEATING ONLY BOILERS 75, 100, 125, 165

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. First Hour Rating</th>
<th>Continuous Rating</th>
<th>Boiler Output Needed For Maximum Performance</th>
<th>Boiler Water Flow Through Coil</th>
<th>Pressure Drop Through Coil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gal/Hr @ 140 F</td>
<td>Gal/Hr @ 115 F</td>
<td>(BTU/Hr)</td>
<td>Gal/Min</td>
<td>(Ft. Water)</td>
</tr>
<tr>
<td>H2O130</td>
<td>176</td>
<td>233</td>
<td>149</td>
<td>206</td>
<td>112,000</td>
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<tr>
<td>H2O140</td>
<td>193</td>
<td>254</td>
<td>157</td>
<td>218</td>
<td>118,000</td>
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<tr>
<td>H2O140L</td>
<td>186</td>
<td>251</td>
<td>150</td>
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<td>116,000</td>
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<td>H2O150</td>
<td>196</td>
<td>254</td>
<td>151</td>
<td>231</td>
<td>125,000</td>
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<td>H2O160</td>
<td>231</td>
<td>298</td>
<td>177</td>
<td>244</td>
<td>132,000</td>
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<td>H2O160L</td>
<td>211</td>
<td>272</td>
<td>157</td>
<td>218</td>
<td>118,000</td>
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<tr>
<td>H2O180</td>
<td>241</td>
<td>306</td>
<td>169</td>
<td>234</td>
<td>127,000</td>
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<tr>
<td>H2O1115</td>
<td>291</td>
<td>363</td>
<td>188</td>
<td>260</td>
<td>141,000</td>
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<tr>
<td><strong>High Output Units 60HO, 80HO, and 115HO</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2O160HO</td>
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<td>468</td>
<td>299</td>
<td>414</td>
<td>221,000</td>
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<tr>
<td>H2O180HO</td>
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<td>479</td>
<td>294</td>
<td>407</td>
<td>220,000</td>
</tr>
<tr>
<td>H2O180HOC</td>
<td>386</td>
<td>507</td>
<td>314</td>
<td>435</td>
<td>236,000</td>
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<tr>
<td>H2O1115HO</td>
<td>413</td>
<td>532</td>
<td>310</td>
<td>429</td>
<td>232,000</td>
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<tr>
<td>H2O1115HOC</td>
<td>423</td>
<td>545</td>
<td>320</td>
<td>442</td>
<td>240,000</td>
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<td><strong>Extra High Output Units 85XHO and 115XHO</strong></td>
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<tr>
<td>H2O1115XHOC</td>
<td>674</td>
<td>893</td>
<td>571</td>
<td>790</td>
<td>428,000</td>
</tr>
</tbody>
</table>

**Notes:**
- 176 °F Boiler Supply Water Temperature, AHRI Conditions -50 °F Inlet Water @ 240 GPH Flow Rate.
Low Water Cut Off - Heating Only and Combi Boilers

These guidelines are supplied when necessary to install an additional Low Water Cut Off (LWCO), for sensing a low water level condition in a boiler, as required by the Authority Having Jurisdiction.

Follow LWCO manufacturer installation instructions for type of LWCO selected in addition to these instructions.

LWCO shall be 120V/60HZ control and dry contacts sized for load being connected. Wire control to boiler. See Figure below.

Connect LWCO device to the system ground. Ground Boiler in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code (NEC) or Canadian Electrical Code CEC.

LWCO Wiring Diagram

- Locate LWCO sensing device in the supply piping, above the minimum height of boiler. See Figure page 42, Piping Diagram.
- Position control in piping above boiler to assure proper boiler protection.
- For proper operation, sensing element of the LWCO control shall be positioned in the tee to sense the main water stream. Maintain minimum 1/4” spacing from pipe walls. Element shall NOT contact the rear, or side walls of the tee. See Figure page 43.
- Install an air vent using a tee to avoid nuisance shutdowns.
- Apply small amount of pipe sealant to threaded connections.
- Arrange piping to prevent water dripping onto boiler.
- DO NOT install water shutoff valve between boiler and LWCO sensing device.
**LOW WATER CUTOFF**

**PIPING DIAGRAM - LWCO LOCATION**

- Arrange piping to prevent water dripping onto boiler.
- Illustrations are meant to show system piping concept only. Installer is responsible for all equipment and detailing required by authority having jurisdiction.

* Note: Arrange piping to prevent water dripping onto boiler.
* Note: Illustrations are meant to show system piping concept only. Installer is responsible for all equipment and detailing required by authority having jurisdiction.

---

**Note:** DO NOT PLACE ISOLATION VALVE BEFORE TEE OR LWCO.

* Check Local Codes for Maximum Distance to Floor.

---

* To Drain

---

Supply

Purge Valve

Position LWCO Above Top of Boiler

Gas Boiler

5 gpm Limiter Factory Installed 205 Only

Magnetic Dirt Separator

---

* To Drain

---

DO NOT PLACE ISOLATION VALVE BEFORE TEE OR LWCO.
LOW WATER CUTOFF - DETAIL

NO

NO

YES
**ERROR CODE TABLE**

**Table of Error Codes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E09</td>
<td>Gas Valve Connection Cable</td>
</tr>
<tr>
<td>E10</td>
<td>External Probe Fault</td>
</tr>
<tr>
<td>E12</td>
<td>Water Flow Switch Open</td>
</tr>
<tr>
<td>E13</td>
<td>Water Flow Switch Close</td>
</tr>
<tr>
<td>E15</td>
<td>Gas Valve Fault</td>
</tr>
<tr>
<td>E18</td>
<td>Water Refill Enabled</td>
</tr>
<tr>
<td>E19</td>
<td>Max Time Of Water Refill</td>
</tr>
<tr>
<td>E20</td>
<td>Central Heating Flow NTC Fault</td>
</tr>
<tr>
<td>E28</td>
<td>Flue NTC Fault</td>
</tr>
<tr>
<td>E40</td>
<td>Central Heating Return NTC Fault</td>
</tr>
<tr>
<td>E50</td>
<td>Hot Water NTC Fault (tank version)</td>
</tr>
<tr>
<td>E53</td>
<td>Obstruction on flue pipe-combustion off</td>
</tr>
<tr>
<td>E55</td>
<td>PCB to be set by the “Calibration Function”</td>
</tr>
<tr>
<td>E71</td>
<td>Fan parameter Out of range in auto calibration</td>
</tr>
<tr>
<td>E72</td>
<td>Combustion test out of range in auto calibration</td>
</tr>
<tr>
<td>E77</td>
<td>Current Out of range</td>
</tr>
<tr>
<td>E78</td>
<td>Minimum gas valve current</td>
</tr>
<tr>
<td>E79</td>
<td>Maximum gas valve current</td>
</tr>
<tr>
<td>E83-87</td>
<td>Communication error</td>
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<tr>
<td>E92</td>
<td>Combustion test alarm during auto-setting</td>
</tr>
<tr>
<td>E109</td>
<td>Pre-Circulation Fault</td>
</tr>
<tr>
<td>E110</td>
<td>Safety Thermostat Operated</td>
</tr>
<tr>
<td>E117</td>
<td>System Water Pressure To High</td>
</tr>
<tr>
<td>E118</td>
<td>System Water Pressure To Low</td>
</tr>
<tr>
<td>E125</td>
<td>Circulation Fault (Primary Circuit)</td>
</tr>
<tr>
<td>E128</td>
<td>Flame Failure</td>
</tr>
<tr>
<td>E129</td>
<td>Frequent loss of flame during ignition</td>
</tr>
<tr>
<td>E130</td>
<td>Flue NTC Operated</td>
</tr>
<tr>
<td>E133</td>
<td>Interruption of Gas Supply or Flame Failure</td>
</tr>
<tr>
<td>E134</td>
<td>Elapsed time Gas valve open without gas</td>
</tr>
<tr>
<td>E135</td>
<td>Interruption of gas supply (internal error)</td>
</tr>
<tr>
<td>E160</td>
<td>Fan or Fan Wiring Fault</td>
</tr>
<tr>
<td>E321</td>
<td>Domestic Hot Water NTC sensor fault</td>
</tr>
<tr>
<td>E384</td>
<td>False flame</td>
</tr>
<tr>
<td>E385</td>
<td>Under voltage</td>
</tr>
</tbody>
</table>

**Note:** When instructed press and hold "RESET" for between 1-3 seconds to reset the boiler.

**Initial Fault Finding Checks**

1. Check gas, water and electrical supplies are available at the boiler.
2. Electrical supply = 120V ~60 HZ
3. The preferred minimum gas pressure is 3.5” wc for Natural gas and 10” for LPG
   Perform electrical system checks, i.e. Ground Continuity,
4. Resistance to Ground, Short Circuit and Polarity with a suitable meter.

**NOTE: These checks must be repeated after any servicing or fault finding.**

- Ensure all external controls are calling for heat and check all external and internal fuses. Before any servicing or replacement of parts, ensure the gas and electrical supplies are isolated.

1. If a fault occurs on the boiler an error code may show on the fascia display:
   - E53 - Indicates possible obstruction in the flue duct.
   - E55 - Indicates the PCB is not setting/calibrated.
   - E71, E72, E78 and E92 - Indicates possible wrong calibration, a new calibration is needed.
   - E92 - Indicates possible flue recirculation in the flue duct.
   - E83-87 - Shows possible error of communication with thermostat. (Go to section P, page 47)

2. Pressing the 'RESET' button for 1-3 seconds when: E110, E125, E133, E134, E135, E09, E15, E128 and E384 - are displayed it is possible to relight the boiler.

3. If this does not have an effect, or error codes are displayed regularly further investigation is required.
Central Heating

1. **Turn on mains power.**
   - The display illuminates
   - Go to section 'A'

2. **Error 110 or 133 or 134 or 135 or 125 or 384 or 09 or 15 flashing**
   - Yes
   - Press the 'Reset' button for between 1-3 seconds
   - No
   - If the E110 is still flashing. Go to section 'H'

3. **Error 20, 28, 40, 50, 321 or 431 flashing**
   - Go to section 'D', if E55 is displayed go to section N

4. **Error 117 or 118 flashing**
   - No
   - Ensure controls are set to demand and verify the contacts are closed
   - Go to section 'B'

5. **Error 160 flashing**
   - Yes
   - If E53 is displayed go to section O

6. **Fan runs after 1 minute from the request**
   - No
   - Go to section 'C'

7. **Fan runs at correct speed**
   - No
   - Error 160 flashing
   - Go to section 'C'

8. **Spark at ignition electrodes for up to 5 seconds and for 5 attempts.**
   - No
   - Error 133 flashing
   - Go to section 'E'
   - Yes
   - Burner does not stay alight after 5 seconds
   - Error E125 flashing after 1 minute
   - Go to section 'J'

9. **Error E109 flashing**
   - Yes
   - Go to section 'H'

10. **Burner output modulates to maintain the temperature set**
    - No
    - Check the Central Heating NTC sensor
    - Go to section 'D'

11. **Error E130 flashing**
    - Yes
    - Go to section ‘M’
    - No
    - Fan stops after 30 seconds
    - Operation sequence successful

*If 09, 15 and 384 is flashing or re-occurs regularly check all PCB connections, if this has no effect replace the PCB.*
Fault Finding Solutions Sections

A

Power supply 120V

1. Main terminals L and N
   - Check electrical supply
   - Connection OK at connector x10

2. Integrity of the fuse
   - Replace fuse

3. PCB – X10 connector Mains terminals L & N
   - Check wiring
   - Display illuminated
   - PCB fault

B

120V at PCB – connector x13 pump terminals Blue to Brown (See Wiring Diagram)

120V between PCB – connector x13 pump terminal Blue and PCB – connector x11 pump terminal Black. (See Wiring Diagram)

C

Fan connections correct at fan and PCB Connectors X11 & X23 See Wiring Diagram

Is there 120V AC at fan terminals connector X11 blue to brown. See Wiring Diagram

Fan jammed of faulty winding

Replace PCB

Replace Pump

Replace PCB

Make connections

Replace fan
**FAULT SOLUTION SECTIONS**

**D**

Temperature sensor faulty, Check correct location and wiring

- **YES**
  - Temperature sensors faulty, Cold resistance approximately
  - $10k\Omega @ 77^\circ F$ (CH sensor)
  - $20k\Omega @ 77^\circ F$ (Flue sensor)
  - (resistance reduces with increase in temp.)

- **NO** Replace sensor

**E**

Gas at burner

- **NO** Ensure gas is on and purged

- **YES** Check wiring & PCB – X36 and X2 connector. See Wiring Diagram.

- **NO** Check the resistance of the coils:
  - Pin 1 and 3 = 20 - 30 Ohm
  - Pin 2 and 4 = 60 - 70 Ohm

- **YES** Replace gas valve

- **NO** Replace PCB

**F**

Check and correct if necessary

1. Inlet gas pressure
2. Ignition electrode and lead
3. Electrode connection
4. Spark gap and position
5. Continuity between burner and earth
6. Condensate trap blocked

- **YES** Check wiring, See Wiring Diagram

- **NO** Replace PCB

2. Check and correct if necessary
   1. Proper operation of the condensate sensor
   2. Ground wires attached to condensate switch
   3. Flame sensing wires attached to condensate switch

   Replace condensate sensor or wires

**G**

Check the gas supply pressure:

1. For Natural Gas greater than 3.5" wc
2. For LPG greater than 8" wc

2. Check and correct if necessary
   1. Flame sensing electrode position
   2. Flame sensing electrode and lead connections
   3. Recirculation of flue
   4. Calibration
   (CO2 values - see instruction)

   Replace flame sensing electrode or gas valve

3. Check and correct if necessary
   1. Proper operation of the condensate sensor
   2. Ground wires attached to condensate switch
   3. Flame sensing wires attached to condensate switch

   Replace condensate sensor or wires
**FAULT SOLUTION SECTIONS**

**H**

Overheat thermostat operated or faulty.

- Check for and correct any system faults (water circulation).

  - Allow to cool. Continuity across thermostat terminals more than 1.5 ohm
    - Replace safety thermostat

  - Check Flow, Return, sensors. See section 'D'
    - Is E110 is still flashing
      - Replace PCB

**I**

CH system pressure less than 7.25 psi or more than 43 psi.

- Restore System Pressure

  - Check wiring and pcb connection at connector x22 is there approx. 5 V DC between the green and black terminals
    - Replace pressure sensor
    - Replace PCB

**J**

Ensure correct circulation of the pump

- Check flow temperature sensor connections and position. Sensors swapped. Cold resistance approximately. 10kΩ @ 77° F (CH sensors) (resistance reduces with increase in temp.)

  - Replace sensor

  - Go to section 'B'

**K**

Is there 120V at:

1. PCB connector x13 3 way valve terminals
   - Blue to Black central heating mode
   - Blue to Brown domestic hot water mode
   - See Wiring Diagram

   - Replace PCB

   - Check 3 way valve cable.

2. Motor, 3 way valve

   - Replace motor 3 way valve
Is main water filter and assembly clean and rotor free to move?

YES

PCB connector x22 Hall effect sensor terminals. Check the voltage is approximately 5 VDC between the Red and Blue wires. See Wiring Diagrams.

YES

With water running through DHW circuit, measure red and white wire for 2.8 VDC for flow triggering.

YES

Check DHW NTC sensor for proper OHM value

YES

Replace PCB

NO

Replace PCB

NO

Replace Hall Effect Sensor

NO

Replace DHW NTC sensor

L

1. Temperature sensors faulty.
   Cold resistance approximately
   10kΩ @ 77°F (CH sensor)
   20kΩ @ 77°F (Flue sensor)
   (resistance reduces with increase in temp.)

   NO

   Replace sensor

2. If pump is running the heat exchanger could be obstructed

   YES

   Replace heat exchanger

M

Performs the autocalibration function (see the Service manual)

N

Display blank

YES

Verify the position of the Service key

O

1. Check obstruction in the flue duct

   YES

   Remove the obstruction on the flue pipe

   NO

   Performs the calibration function (see the Service manual)

2. Check and correct if necessary
   1. Proper operation of the condensate sensor
   2. Ground wires attached to condensate switch
   3. Flame sensing wires attached to condensate switch

   Replace condensate sensor or wires

P

Check the electrical connection between Ru and pcb
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