

AQUAS POOL PACKAGE INSTALLATION INSTRUCTIONS

FOR MODELS: XPN 400 – 801

parts4heating
 800-536-1582 Fax: 866-448-9304
 info@parts4heating.com

AQUAS Pool Package

The AQUAS pool package system is a high efficiency commercial condensing boiler, pre-piped package system from the factory to an indirect heat exchanger. This pool heater is a low temperature operating system designed to take advantage of the stainless steel heat exchanger and condensing operating temperatures to ensure the highest efficiency possible. The AQUAS is designed around a predetermined flow set by the manufacturer between the boiler and the indirect heat exchanger. The AQUAS operates off the pool system pump itself which will continually supply water to the indirect heat exchanger. This means there is no need to purchase a dedicated circulator to deliver water to this package system.

Installation Instructions

To achieve the optimum operating efficiency of your AQUAS it is recommended that you keep the pool water flow of each appliance within plus or minus five gallons per minute of the recommended flow as stated in Table A. Low flow through the indirect heat exchanger will result in elevated temperatures supplied to the pool.

TABLE A		
MODEL	RECOMMENDED SYSTEM WATER FLOW	CONNECTION SIZE
400	93 GPM	2.5"
501	117 GPM	2.5"
601	142 GPM	2.5"
701	166 GPM	3"
801	202 GPM	3"

RECOMMENDED CLEARANCES:
BOILER - SEE KNIGHT XL I & O MANUAL
INDIRECT HEX - ALLOW 18" FOR SERVICE ON ALL SIDES

Piping

Pool / spa connections to the indirect heat exchanger are SCH 80 CPVC glue fittings. The connections from the field loop to the heat exchanger are to be done in CPVC pipe as follows:

- Use cement on the connections so they are rated for CPVC pipe and have enough body to hold the connection.
- To make the connection, apply glue to both the CPVC flange and the section of pipe.
- Insert the pipe into the flange until it reaches the bottom of the flange.
- Turn the pipe a half turn in the socket to ensure that a proper seal is made.

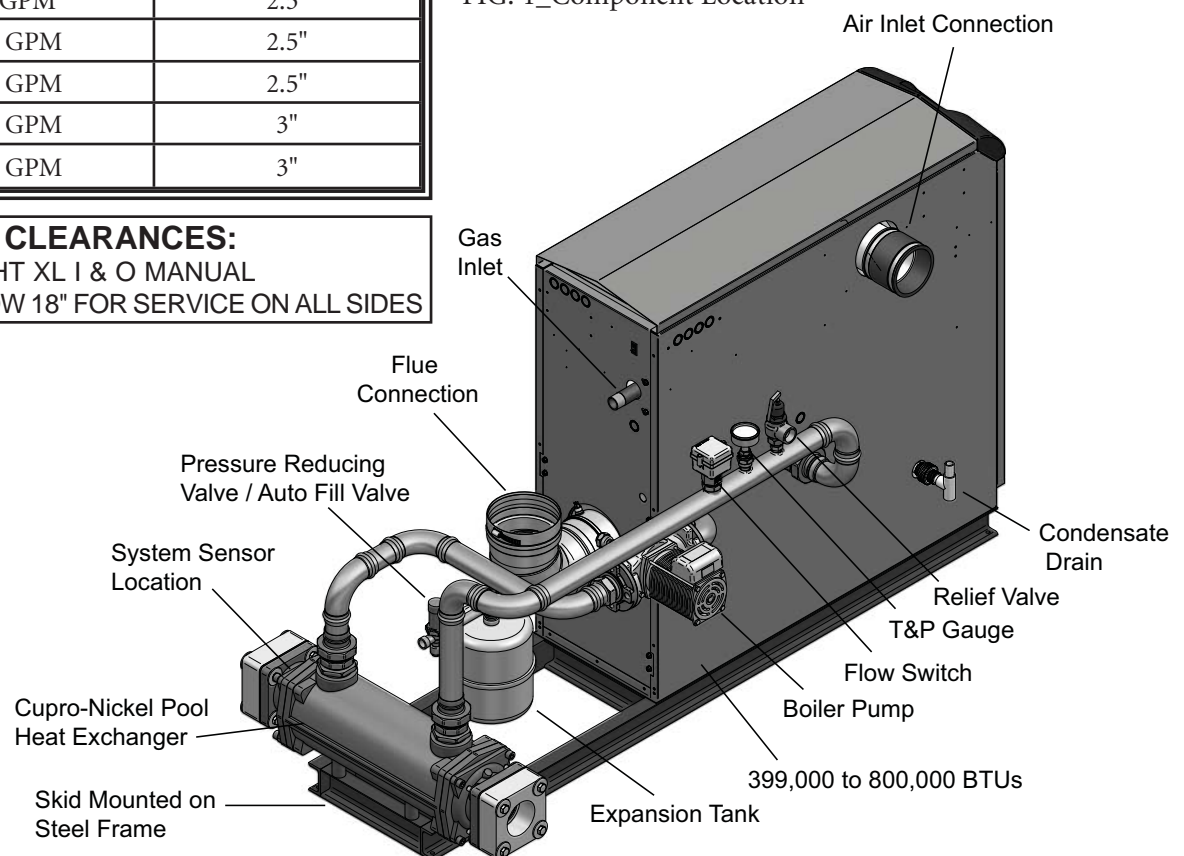
Pool water is designed to flow from right to left standing in front of the boiler (factory installed sensor is on the inlet side of the indirect heat exchanger, see FIG. 8).

The supply and return water piping to the indirect heat exchanger shall be no smaller than 2.5" for models 400 - 601 and 3" for models 701 - 801.

Throttling Valve

A ΔT of 8° - 10°F across the indirect heat exchanger is recommended. Throttling valves are used to set the flow through the indirect heat exchanger (standard gate valves are acceptable).

FIG. 1_Component Location



The system can be installed in either a Full Flow or Diverted Flow orientation:

Full Flow (reference FIG. 6)

If the total system flow of the swimming pool or spa system is within five gallons per minute of the recommended system water flow as shown in Table A on page 1, this type of system is recommended.

Diverted Flow (reference FIG.'s 7 & 8)

Criteria for installing a diverted flow system is as follows:

- If the total system flow is greater than the amount required by the indirect heat exchanger.
- Installations with temperatures in excess of 95°F. This is necessary so the pool high limit will not trip. No water should enter the pool / spa in excess of 110°F. If the heat exchanger pool outlet is in excess of 110°F the water must be tempered down.
- Multiple unit installation.

Example: Total system flow is 500 gallons per minute (GPM). If two AQUAS Pool Packages (800,000 Btu/hr) were installed, each of the pool packages would require 202 GPM for a total of 404 GPM of the pool water being diverted through the indirect heat exchangers while the other 96 GPM would be diverted back to the pool.

Auxiliary Mixed Water Limit Control

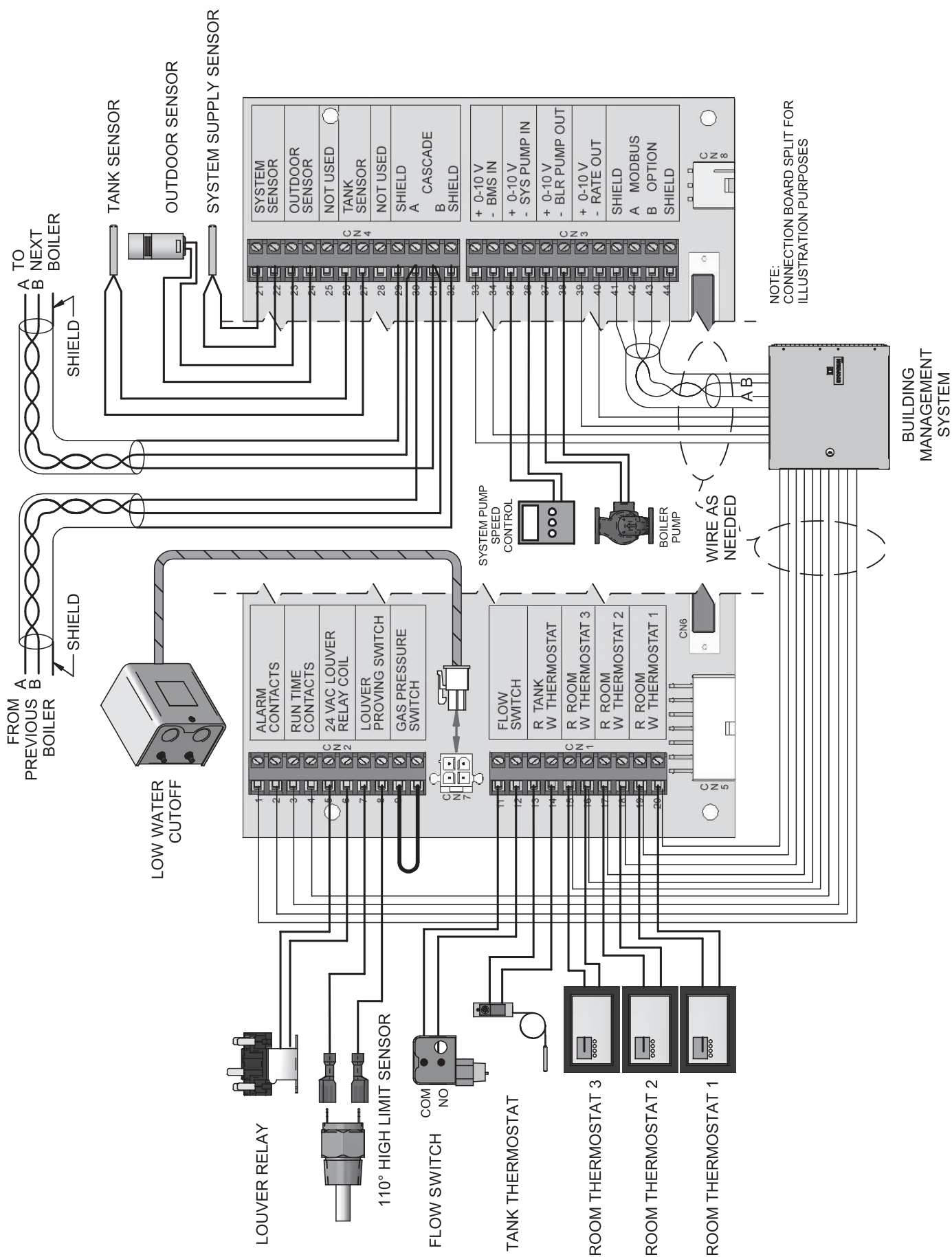
Ensure that the auxiliary 110°F mixed water limit control is installed in the filter system piping. Install the auxiliary limit a minimum of three feet downstream from the point where the heated water from the indirect heat exchanger is added to the filtration system (see FIG.'s 6-8). If the water leaving the heat exchanger is in excess of 110°F a bypass must be installed to temper the water below 110°F before re-entering the pool/spa.

The limit will be mounted in a 3/8" NPT tapped fitting installed in the filtration system piping or it may be installed directly into a tapped opening in the PVC filter system piping. Turn off the filter system pump when installing the auxiliary limit in the filtration system piping. Tapped openings can be added to the PVC pipe by first drilling 9/16" pilot holes in the PVC pipe at least three feet downstream of the point where the heated water from the indirect heat exchanger is added to the filter piping. The drilled pilot holes can now be carefully threaded with a 3/8" NPT tap. After the pipe threads have been cut into the PVC pipe wall the limit and bulbwell can be inserted into the tapped openings.

Apply a small amount of a high quality RTV silicone sealant to the threads to prevent leaks and install the limit and bulbwell into the threaded opening in the pipe. Install the limit control and bulbwell and tighten to seal. Do not over tighten either part into the threaded opening in the PVC pipe. Over tightening can damage the parts and/or strip the threads cut into the plastic pipe. Wire the 110°F limit into the pool heater control circuit as shown in FIG. 2 on page 3. If additional wire length is needed, use 18 gauge wire for distances up to 30 feet. For longer distances, size the wire per Table B.

TABLE B Remote Wire Connection	
WIRE GAUGE	MAXIMUM ALLOWABLE LENGTH
12 GA	100 ft.
14 GA	75 ft.
16 GA	50 ft.
18 GA	30 ft.

FIG. 2_Low Voltage Connections

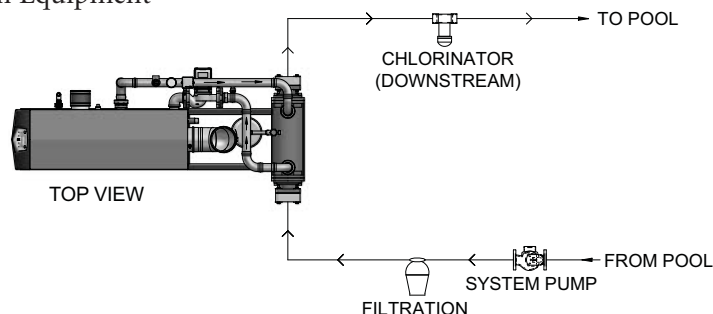


Indirect Heat Exchanger

Installation Instructions

Heat exchangers should be installed downstream of the pumping and filtration equipment (reference FIG. 3).

FIG. 3_Pumping and Filtration Equipment

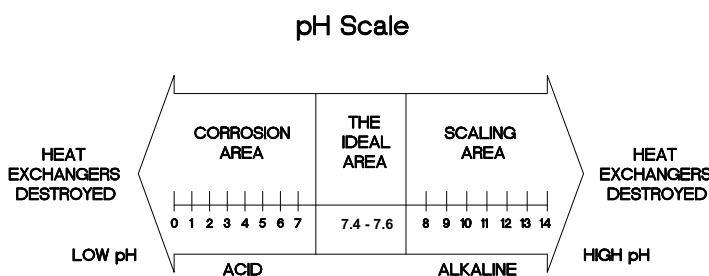


Pool Water Chemistry

It is essential that the instructions in this section along with the Ryznar Stability Index and/or Calcium Stability Index are followed to prevent corrosion / erosion of the indirect heat exchanger:

- Always keep pH to within correct levels. The ideal pool pH should be kept to within 7.4 to 7.6.
- Under no circumstances should the pH fall below 7.2 or rise above 7.8 (see FIG. 4). Check on a day-to-day basis. Alter pool condition as necessary.
- Ensure that chlorine levels are within the range recommended by the chemical manufacturer and are in accordance with the type of pool, for example; private, hotel, school or municipal.
- If a bypass is fitted to the indirect heat exchanger circuit, it is essential that any or all of the valves are correctly positioned to allow the recommended pool water flow to pass through the heat exchanger.
- The system filter unit should be checked regularly, especially sand filters (to detect sand and diatomaceous earth). Sand filters, if working incorrectly, can allow sand to pass around the pool circuit causing erosion of the pipework and heat exchanger. Keep the pool free from debris such as leaves, grass cuttings, etc. This foreign matter can cause decay and increase pH.
- It is essential that the correct amount of chlorine dosage is added to the pool. To allow proper dispersion of the dose in the pool water, distribute the chemicals to various areas of the pool. Do not dose in one area only, as this will create high acidic areas which can cause corrosion / erosion of the pool equipment.
- Chlorinator should be installed downstream of the AQUAS.

FIG. 4_pH Scale



Filling the System

The boiler is filled through the pressure reducing auto-fill valve. The operating pressure of this system is 15 psi between the heater and the indirect heat exchanger. There are no adjustments necessary to the fill valve cartridge (factory set). The expansion tank is set at 20 psi. It is necessary to check the pressure of the expansion tank when annual maintenance is performed. The boiler system operates off a city or potable water system which feeds a closed loop system. A hard line is piped from the potable water supply to the pressure reducing valve. This water is to remain on at all times when the system is in operation.

Pressure Reducing Valve

The valve is equipped with a fast-fill feature that can be used to override normal operation when filling and purging the system. To activate fast-fill, push and hold down the fast-fill knob on top of the cartridge as shown in FIG. 5.

Relieve air from the system through operation of the pressure relief valve by pulling the lever on top of the valve, causing it to open.

FIG. 5_Pressure Reducing Auto-Fill Valve

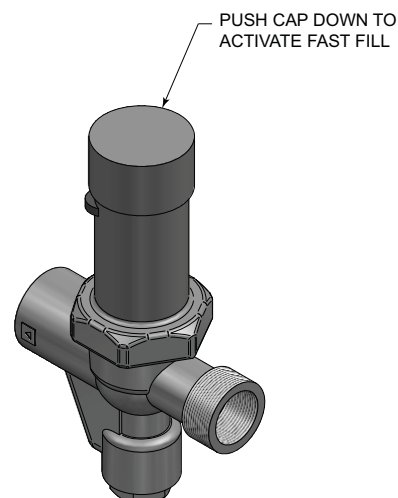
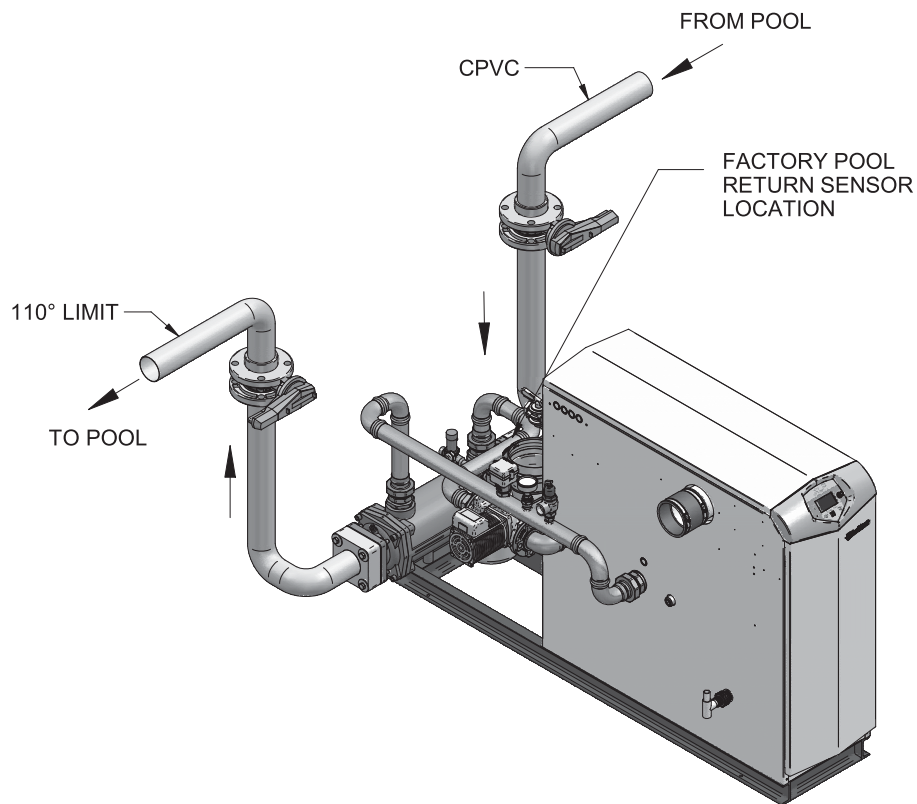


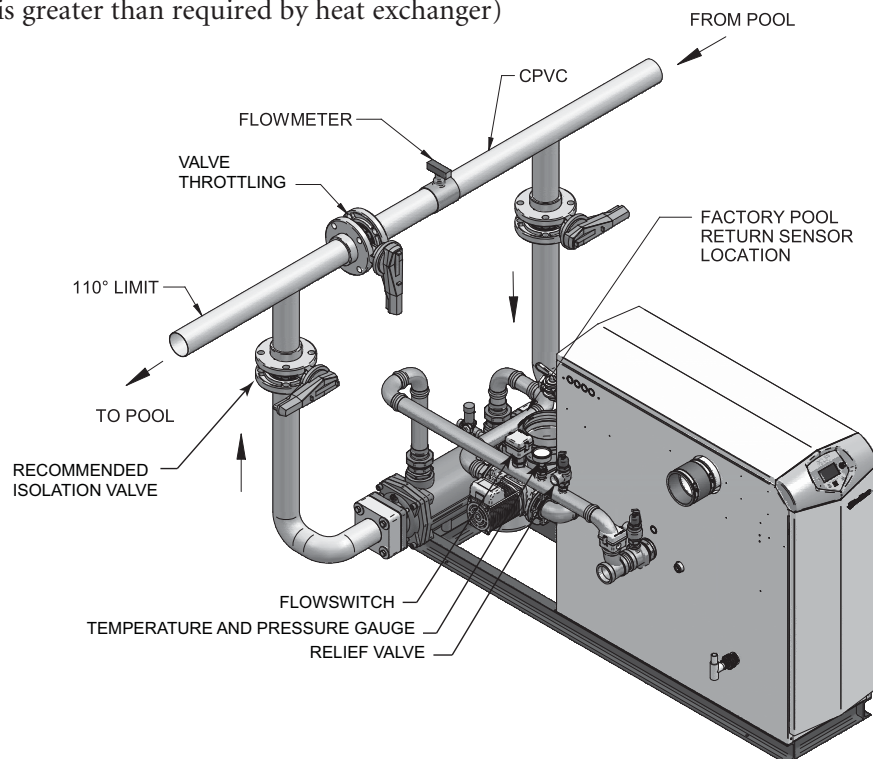
FIG. 6_Full Flow



NOTICE

Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

FIG. 7_Bypass (if flow is greater than required by heat exchanger)



NOTICE

Adjust valves to provide suggested flow per Table A on page 1.

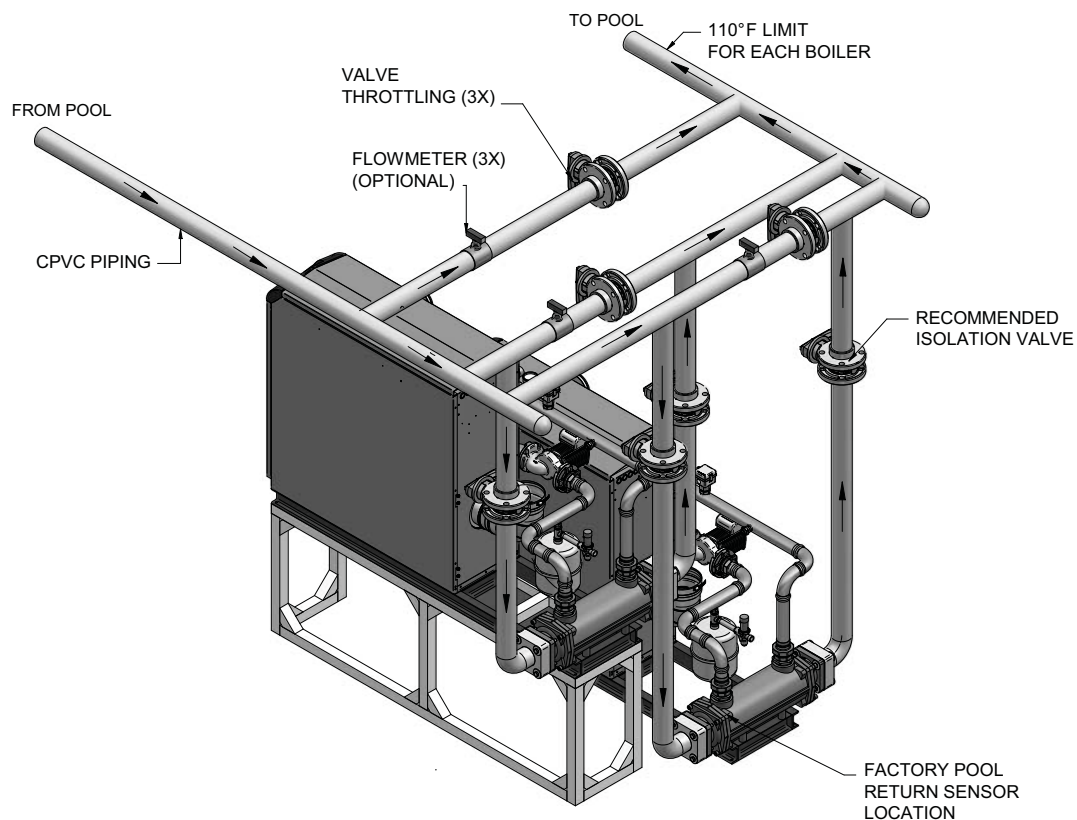
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Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

NOTICE

System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

FIG. 8_Bypass Multiple Units (if flow is greater than required by heat exchanger)



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NOTICE

System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

Cascade

When multiple boilers are installed, they can be wired together in a cascade sequence. A maximum of eight boilers can be controlled from a single control. In this application one boiler would be designated as the Leader control and all others would be designated as Member controls.

If the water temperature at the inlet side of the indirect heat exchanger sensor is less than the set point + the turn-off offset - the off-on differential, then the control will initiate a call for heat on the Cascade (see the Knight XL Service Manual for an explanation of the offset and differential). The Leader will energize the lead boiler on the Cascade. For a new startup this will be the Leader boiler.

The boiler will fire at its ignition speed and will then modulate its firing rate to maintain the set point. If the first boiler reaches 100% of its firing rate, the Leader will calculate at what point the second boiler could fire at 20% of its firing rate. At this point, the Leader will fire the second boiler on the Cascade. For a new startup, this would be the first Member boiler. The boiler will fire at its ignition speed and will then modulate its firing rate to maintain the set point.

If the set point still cannot be met, the Leader will continue firing more Members until either the heat demand is met or all boilers on the Cascade are firing. As the heat demand decreases, the last boiler on will modulate down to 20% of its firing rate. Once the demand for that boiler is zero, it will shut down. As the heat demand decreases further, the second to last boiler will modulate down and shut off. This will continue until the demand is satisfied and all boilers are shut off.

Wiring of the Cascade

When wiring the boilers for Cascade operation, select one boiler as the Leader boiler. The remaining boilers will be designated as Members. See “Configuration of the Cascade” for a detailed explanation of this procedure.

Communication between the Leader boiler and the Member boilers is accomplished by using shielded, 2-wire twisted pair communication cable. Connect one of the twisted pair wires to terminal A on each of the Low Voltage Connection boards (FIG. 2), and the other wire of the twisted pair to terminal B on each of the Low Voltage Connection Boards. Connect the shield wires to one of the shield ground terminals on the Low Voltage Connection Boards. If more than two boilers are on the Cascade, daisy chain the wiring from the Sequencing terminals on the second boiler to the Sequencing terminals on the third boiler, then from the third to the forth, and so on. The connections between boilers can be made in any order, regardless of the addresses of the boilers. Try to keep each cable as short as possible.

Configuration of the Cascade

NOTICE

Please note that the brackets ([]) denote screen status.

When installed in a Cascade system, the individual controls must be programmed for cascade operation. This is accomplished by accessing the control parameters.

Press the [MENU] key for at least five (5) seconds. Input the Installer code as described in the Knight XL Service Manual. Once the control parameters have been accessed, use the NAVIGATION DIAL to select the Control Mode parameters. Press the NAVIGATION DIAL to access these parameters.

Rotate the NAVIGATION dial to select the parameter “Cascade Address”. Press the NAVIGATION dial to access this parameter. Each appliance in the Cascade system must be programmed with its own address. The boiler designated as the Leader will have an address of 0. The remaining boilers in the Cascade will be Members and have addresses from 1 - 7. Rotate the NAVIGATION dial to select the appropriate address. Press the RIGHT SELECT [SAVE] key. If installing the boilers in an existing system, the new boilers should be programmed as the Leader and/or the higher number addresses.

Press the RIGHT SELECT [HOME] key to upload the address into the control. Repeat this procedure for all boilers in the Cascade, designating the Leader control and the Member controls.

AQUAS Pool Setup

To access the Installer setting press and hold the Menu/Exit key until it requires the installer’s code. Proceed and enter #5309 (reference Table C on page 10).

NOTE: NA = No adjustment necessary.

Standalone Operation

Temperature Settings

1. SH1 Set Point (Pool Temperature)
2. Minimum SH Set Point (Pool Temperature Minimum)
3. Maximum SH Set Point (Factory Set 104°F)
4. SH1 Offset (2°F Minimum) number of degrees above the set point the boiler will turn off.
5. SH1 differential (4°F Minimum) number of degrees below the turn off temperature the boiler must see before the boiler will turn on.

Example: Set Point 78°F

Offset = 2 Boiler OFF at 80°F

Differential = 4 Boiler ON at 76°F

Cascade Multiple Units Together

Temperature Settings

1. SH1 Set Point (Pool Temperature)
2. Minimum SH Set Point (Pool Temperature Minimum)
3. Maximum SH Set Point (Factory Set 104°F)

Control Modes

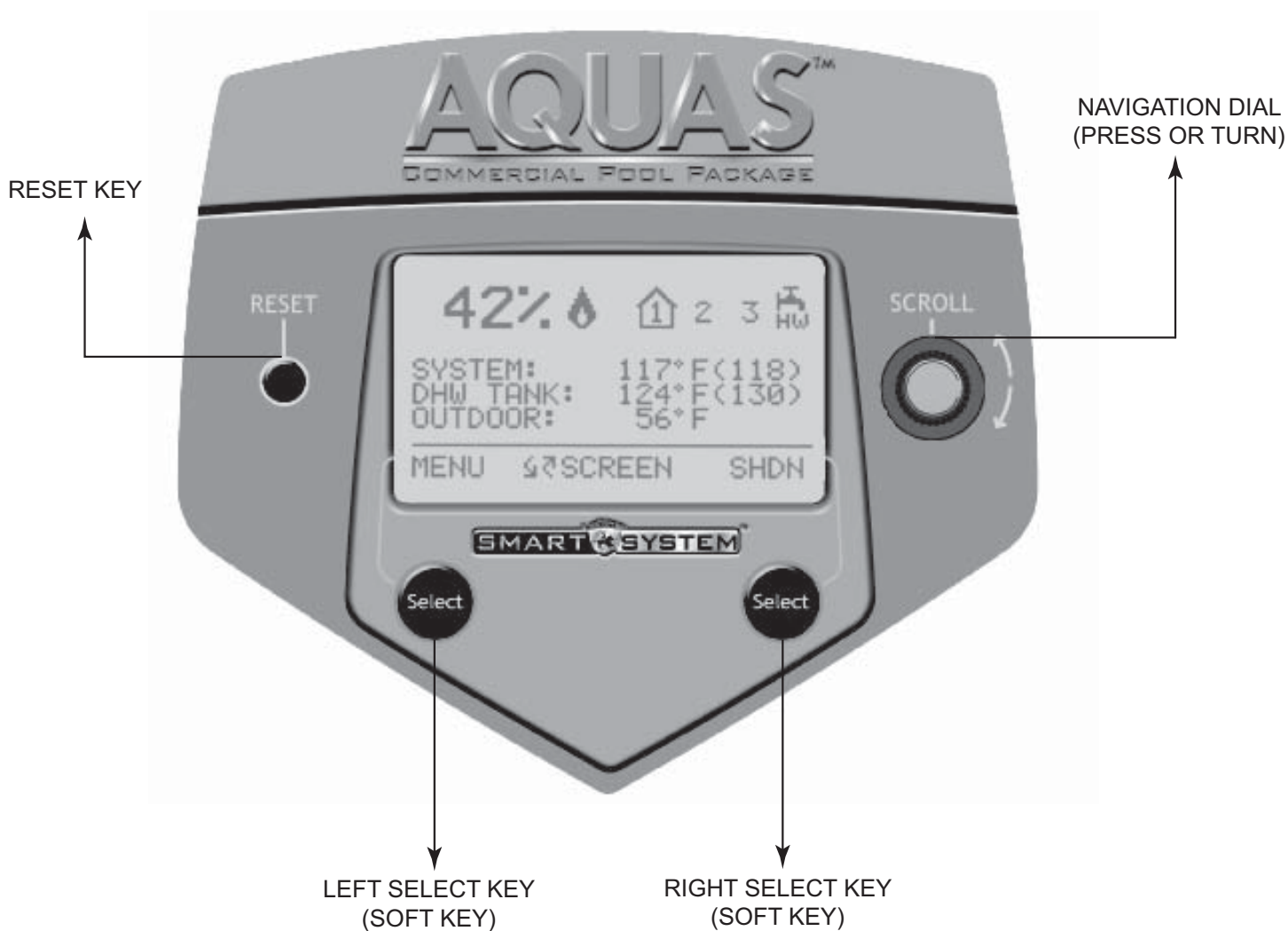
Cascade

1. Controlling Sensor (Not Applicable)
2. BMS Tstat Input (Active / InActive) (Not Applicable)
3. (Not Applicable)
4. BMS (Active / InActive) (Not Applicable)
5. ModBus (Active / InActive) (Not Applicable)
6. Cascade Address (Leader 0) (Member 1, 2, 3, etc.,)
7. Cascade Type (L/L/EFF) See the Knight XL I & O Manual for description and settings.
8. Max Cascade Outlet Set Point
9. Cascade Offset (2°F minimum, this is the warmest the pool will ever be above temperature)
10. Cascade Off / On Differential (This parameter determines how much the temperature must be below the turn off temperature (set point + offset) before the Lead boiler turns on. Four degrees is the tightest this setting can be.
11. Min On / Off Time (Not Applicable)
12. Min Next On Time (Not Applicable)
13. Boiler Size (Not Applicable)

Example: Set Point 78°F
Offset = 2 *Boiler OFF at 80°F*
Differential = 4 *Boiler ON at 78°F*

Use the control panel (FIG. 9) to set temperatures, operating conditions, and monitor boiler operation.

FIG. 9_Control Panel



The information on the bottom of the display shows the functions of the two SELECT keys (on either corner), and the NAVIGATION dial (in the center):









MENU = Left SELECT Key

SET POINTS = NAVIGATION Dial - Pressing Down

SHDN = Right SELECT Key

Display panel menu access

Table C Use this procedure to access menus from the display panel

BUTTON	SCREEN STATUS	OPERATION	DISPLAY
	[SHDN]	Press the RIGHT SELECT soft key [SHDN].	STANDBY OUTLET 117°F INLET 128°F <hr/> MENU ↓SETPOINTS SHDN
	[YES]	Press the LEFT SELECT soft key [YES].	STANDBY SHUTDOWN <hr/> YES NO
	[MENU]	Press and hold the LEFT SELECT soft key [MENU] for five (5) seconds.	STANDBY OUTLET 117°F INLET 128°F <hr/> MENU ↓SETPOINTS SHDN
		Rotate the NAVIGATION dial clockwise until 5 is displayed (first digit on the left).	SHUTDOWN PASSWORD 0000 <hr/> EXIT ↓ NEXT SAVE
		Press the NAVIGATION dial to select the next digit. Rotate the NAVIGATION dial clockwise until 3 is shown in the display.	SHUTDOWN PASSWORD 5000 <hr/> EXIT ↓ NEXT SAVE
		Press the NAVIGATION dial 2 times to move to the last digit. Rotate the NAVIGATION dial counterclockwise until 9 is displayed.	SHUTDOWN PASSWORD 5300 <hr/> EXIT ↓ NEXT SAVE
	[SAVE]	Press the RIGHT SELECT soft key [SAVE].	SHUTDOWN PASSWORD 5309 <hr/> EXIT ↓ NEXT SAVE
		Rotate the NAVIGATION dial counterclockwise to select a category.	SHUTDOWN >GENERAL TEMPERATURE SETTINGS DATA LOGGING FUNCTIONS <hr/> HOME ↵ SCROLL

Notes



Revision Notes: Revision A (ECO C05705) initial release.

Revision B (ECO C07676) reflects the expansion of “Piping” information on page 1.

Revision C (ECO C10184) reflects the update of the SMART SYSTEM logo on page 9, the change in family name to AQUAS and the update of FIG.’s 8 and 9.