VIESMANN

Application Guide

Vitocrossal 300, CU3A
Residential Boiler

Application Guide

The application examples contained in this document serve as a guideline only. These are not engineered drawings and are not intended to replace project designs provided by a professional engineer. It is the responsibility of the installing contractor to ensure all aspects of the system comply with the local authorities having jurisdiction.

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Pre-Face / Overview

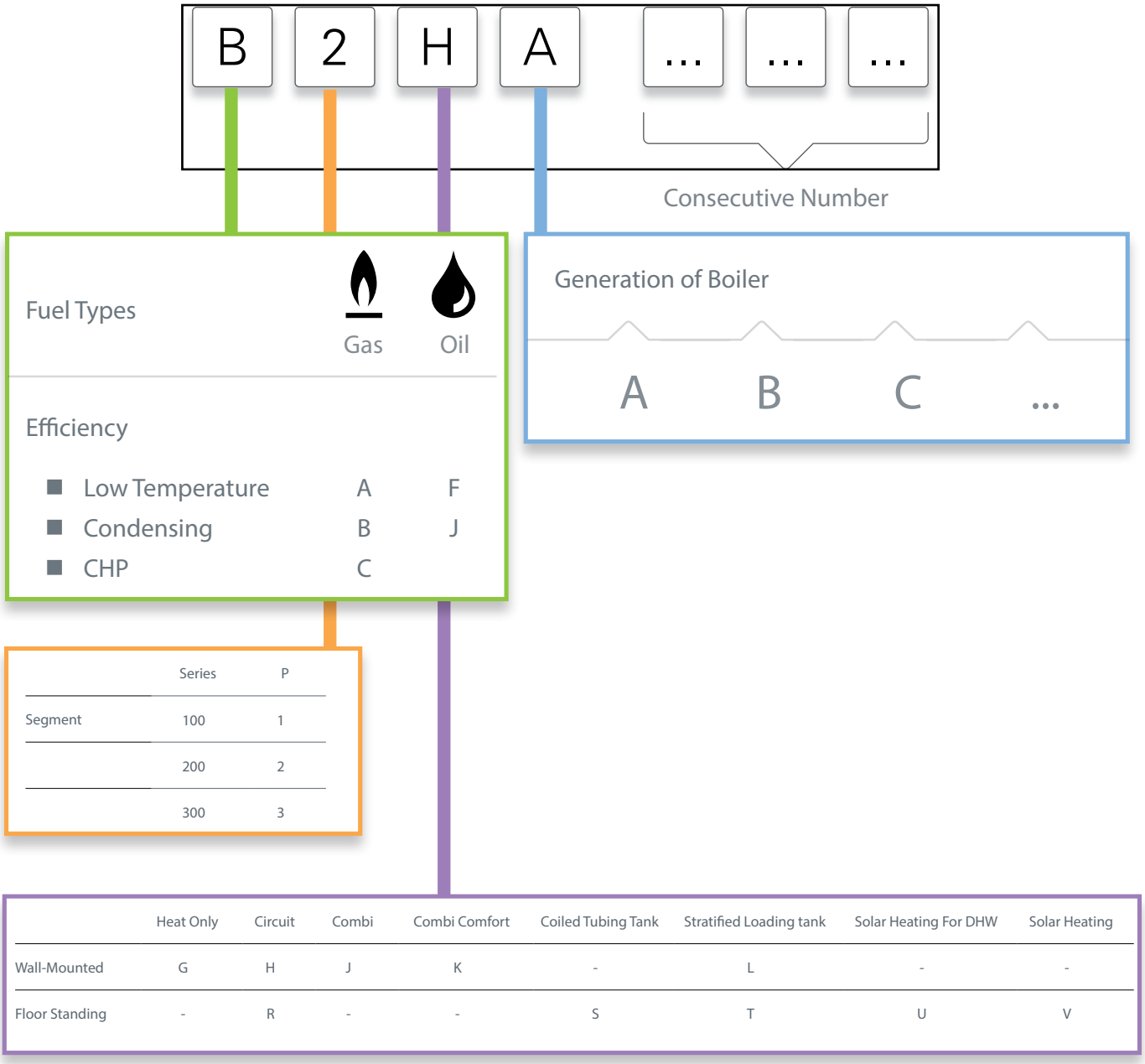
Each day Viessmann heating systems face a wide variety of requirements and challenges here in North America, and around the world. Whether in historically protected homes, modern commercial buildings, or in large facilities, Viessmann products meet every demand and offer solutions for all your needs: wood, oil, or gas fired boilers for both residential and commercial use, from 12KBTU to 17.9MMBH (4 to 5263kW), domestic hot water storage tanks, solar collectors, Biogas technologies, and much more.

Viessmann also sets the standard for operational reliability, operating comfort, environmental friendliness and a long service life. All Viessmann products have one thing in common: they are based on a modular technology strategy with one common platform. This way, different product versions can be created to fulfill each customer's specific requirements. In short, Viessmann takes care of all your needs, from start to finish.

Part of that is a comprehensive support program: A knowledgeable Viessmann sales representative network, technical training academy, and technical support personnel assist you right from the planning stage through to the installation and start-up phase of a project.

With Viessmann you are witnessing intelligent, high-tech boiler technology at work. We have selected some of the most interesting Viessmann applications from across North America for your reference.

Identifying Boiler Nomenclature



	Series	P
Segment	100	1
	200	2
	300	3

	Heat Only	Circuit	Combi	Combi Comfort	Coiled Tubing Tank	Stratified Loading tank	Solar Heating For DHW	Solar Heating
Wall-Mounted	G	H	J	K	-	L	-	-
Floor Standing	-	R	-	-	S	T	U	V

Identifying Application Codes

Recommended Product Applications

Application	Typical Supply Temperature	Vitodens 100	Vitodens 200/222-F	Vitocrossal 300 CU3A	Vitorond 100
Baseboard / Fan Coil 	High 160 -190 °F	◆[1]	◆[1]	★	★
Cast Iron Radiator 	Medium 140 -160 °F	★	★	★	◆[2]
Panel Radiator 	Medium 120 -160 °F	★	★	★	◆[2]
Radiant Floor Heating 	Low 80 -120 °F	★	★	★	●
Indirect DHW 	High 160 -190 °F	◆[1]	◆[1]	★	★
Air Handlers 	Medium 120 -180 °F	★	★	★	★

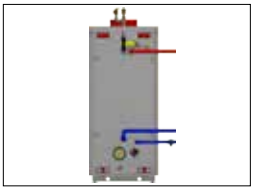
★ **Best Choice**
◆ Possible with limitations
● Not recommended

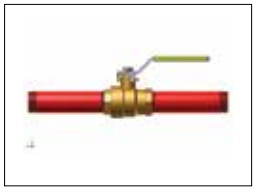
1- Limited maximum boiler supply water temperature.
2- Ensure boiler protection to prevent against low return water temperature

Refer to Technical Data Manual of each product for applicable certifications. Technical information subject to change without notice.

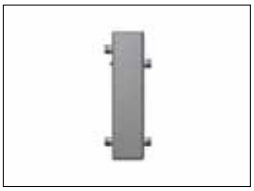
Component Index

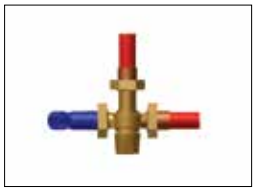
Hydronic Components

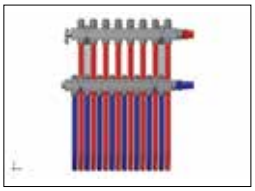

Vitrocrossal CU3A

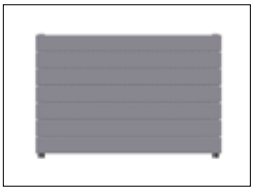

Ball valve

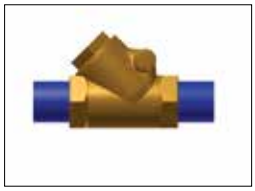

Circulator with isolation flanges

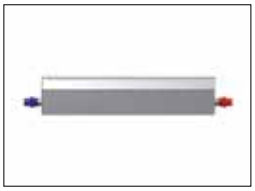

Low loss header


Thermostatic mixing valve


Radiant infloor manifold


Panel radiator


Flow check valve


Hot water baseboard radiator


Boiler water feed with double back check valve


Air eliminator


Expansion tank


Purge assembly:
(sediment faucet and ball valve)


Zone valve


Hydronic air handler


Towel radiator

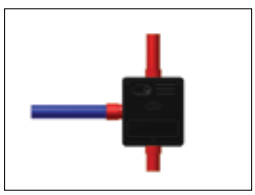
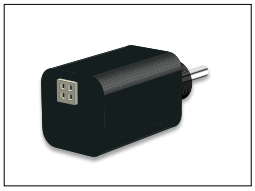

Viessmann 3-way mixing valve with actuator motor


Plate and frame heat exchanger

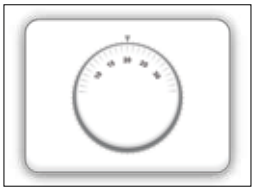
Electrical Components


Aquastat


Secondary low water cut-off


Motorized mixing valve


Outdoor temperature sensor


Thermostat


Temperature sensor


Viessmann Vitotrol


Multi-zone control


24V Zone valve


Circulator

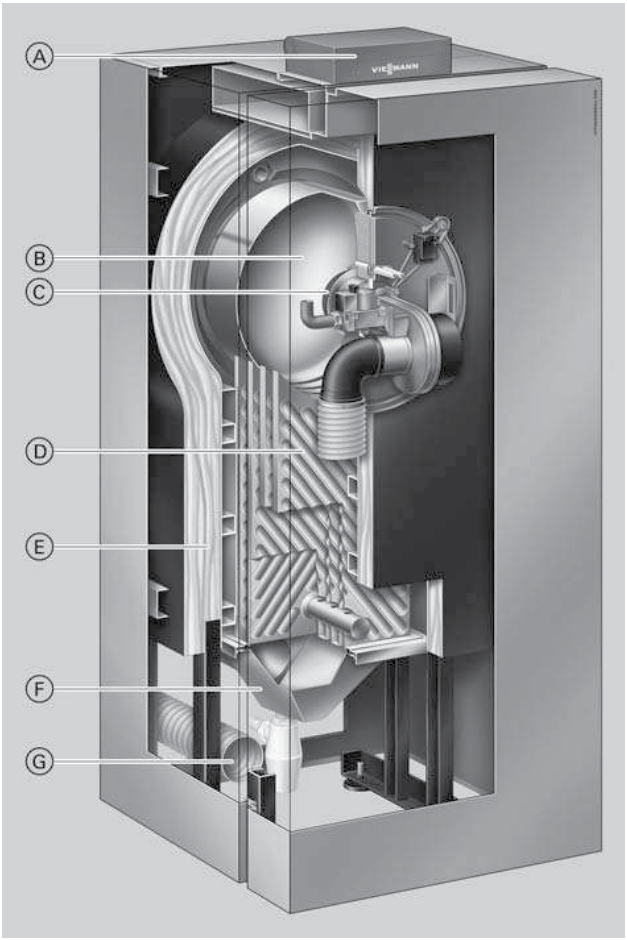

120 volt power


VIESMANN
VITOCELL 100
VIESMANN

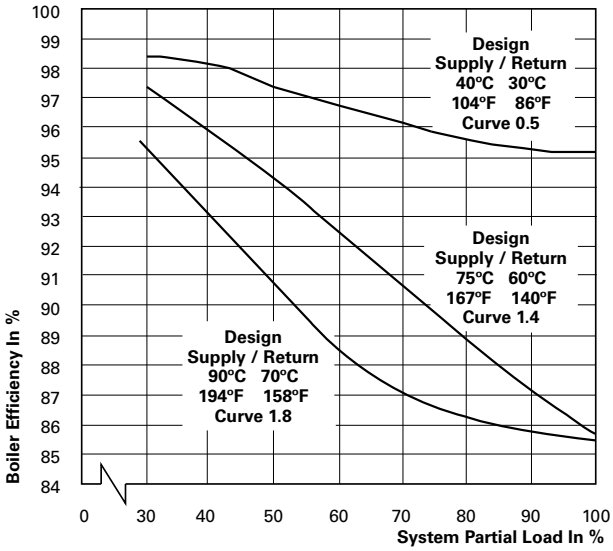
Vitocrossal CU3A

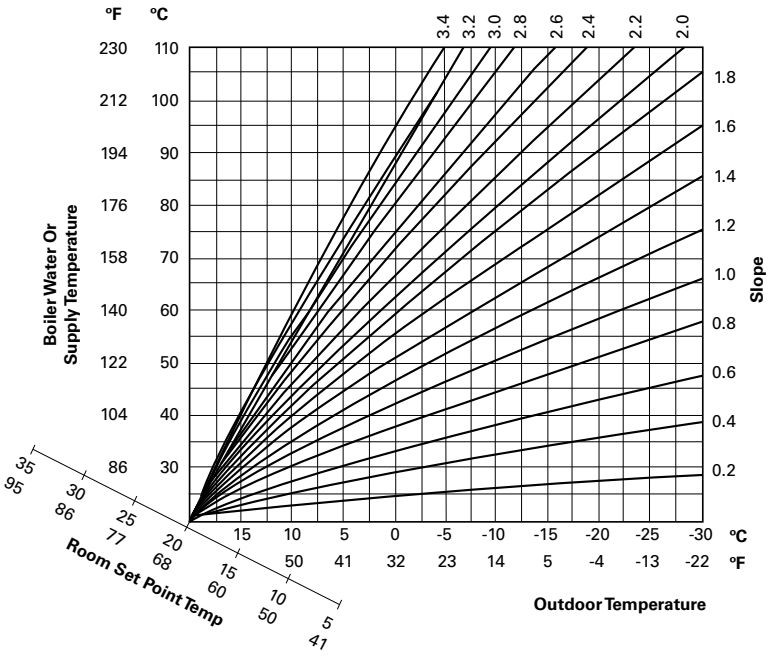
Product Information

Vitocrossal 300 CU3A 94 to 199



Product may not be exactly as shown





Legend

Ⓐ Digital Vitotronic boiler control unit
Ⓑ Water-cooled stainless steel combustion chamber
Ⓒ Modulating MatriX gas burner – for extremely clean combustion
Ⓓ Stainless steel Inox-Crossal heat exchanger
Ⓔ Highly effective thermal insulation
Ⓕ Flue gas collector with condensate drain pipe
Ⓖ Combustion air intake for direct vent (two-pipe) systems

Product Information

Technical Data

Vitocrossal 300 CU3A 94 to 199 Technical Data

Technical Data

Boiler Model No. CU3A		94	125	160	199
Natural Gas / Liquid Propane Gas					
CSA input	MBH (kW)	19-94 (5.6-27.5)	25-125 (7.3-36.6)	43-160 (12.6-47)	43-199 (12.6-58)
CSA output / DOE heating capacity* *1*	MBH (kW)	17.7-87 (5.2-25.5)	23.3-116 (6.8-34)	40-149 (11.7-43.7)	40-185 (11.7-54.2)
Net AHRI Rating	MBH (kW)	76 (22)	101 (30)	129 (38)	161 (47)
Heat exchanger surface area	$ft.^2$ (m^2)	16.7 (1.5)	20.7 (1.9)	34.1 (3.2)	34.1 (3.2)
Min. gas supply pressure					
Natural gas	"w.c.	4	4	4	4
Liquid propane gas	"w.c.	10	10	10	10
Max. gas supply pressure **3*					
Natural gas	"w.c.	14	14	14	14
Liquid propane gas	"w.c.	14	14	14	14
A.F.U.E.	%	95	95	95	95
Weight	lbs (kg)	269 (122)	275 (125)	352 (160)	352 (160)
Boiler water content	USG (L)	13.5 (51)	13.0 (49)	18.8 (71)	18.8 (71)
Max. operating pressure at 210°F (99°C)	psig (bar)	30 (2)	30 (2)	30 (2)	30 (2)
Boiler water temperature					
- Adjustable high limit (AHL) range space heating (steady state)	°F (°C)	68-194 (20-90)	68-194 (20-90)	68-194 (20-90)	68-194 (20-90)
DHW production	°F (°C)	194 (90)	194 (90)	194 (90)	194 (90)
- Fixed high limit (FHL)	°F (°C)	210 (99)	210 (99)	210 (99)	210 (99)
Boiler connections					
Boiler heating supply and return	NPTM	1¼"	1¼"	1¼"	1¼"
Pressure relief valve	NPTF	¾"	¾"	¾"	¾"
Boiler drain	NPTM	1"	1"	1"	1"
	NPTF	¾"	¾"	¾"	¾"
Gas valve connection					

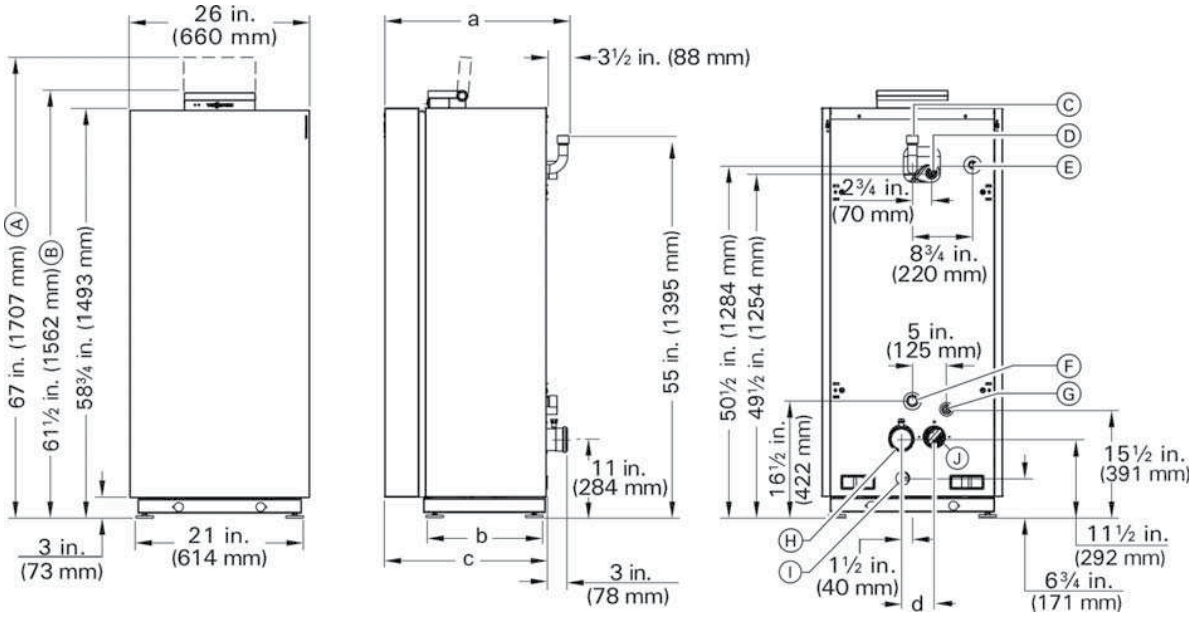
*1 Output based on 140°F (60°C), 120°F (49°C) system supply/return temperature.

*2 Net AHRI rating based on piping and pick-up allowance of 1.15.

*3 If the gas supply pressure exceeds the maximum gas supply pressure value, a separate gas pressure regulator must be installed upstream of the heating system.

Note: For high altitude installation at 10,000 ft. the input for model Vitocrossal 300 CU3A will have an altitude de-ration of 18%.

Boiler Dimensions - Models 300 CU3A 94 to 199



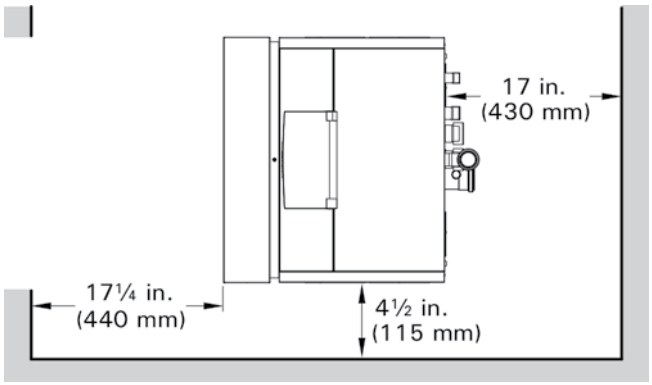
Legend

Ⓐ Overall boiler height (boiler control open)
Ⓑ Overall boiler height (boiler control closed)
Ⓒ Safety header connection
Ⓓ Boiler supply
Ⓔ Gas connection
Ⓕ Boiler return
Ⓖ Boiler drain
Ⓗ Vent connection
Ⓘ Condensate drain connection
Ⓙ Combustion air connection

Model 94, 125			Model 160, 199		
a	in. (mm)	27 (684)	a	in. (mm)	31½ (801)
b	in. (mm)	17 (430)	b	in. (mm)	21½ (545)
c	in. (mm)	23½ (595)	c	in. (mm)	28 (712)
d	in. (mm)	4¾ (120)	d	in. (mm)	5½ (140)

Note: All height dimensions of the boiler have a tolerance of +.6 in. (+15 mm) due to the factory installed adjustable feet.

Service Clearances



Recommended minimum service clearances
For typical Vitocrossal CU3A series boiler installations, Viessmann recommends installing the boiler with the service clearances shown in the illustration.

Note: The Vitocrossal 300 CU3A series boiler conforms to the zero inches vent clearance to combustibles testing requirements dictated by the boiler Harmonized Standard ANSI Z21.13. CSA/4.9 (latest edition) and therefore is listed for zero clearance to combustibles when vented with a single-wall UL/ULC certified special venting system The zero inches vent clearance to combustibles for the Vitocrossal 300 CU3A boiler supercedes the clearance to combustibles listing that appears on the special venting system label.
The back or side clearance shall be increased if piping installation is required.

See the Vitocrossal 300 CU3A Venting System Installation Instructions for details.

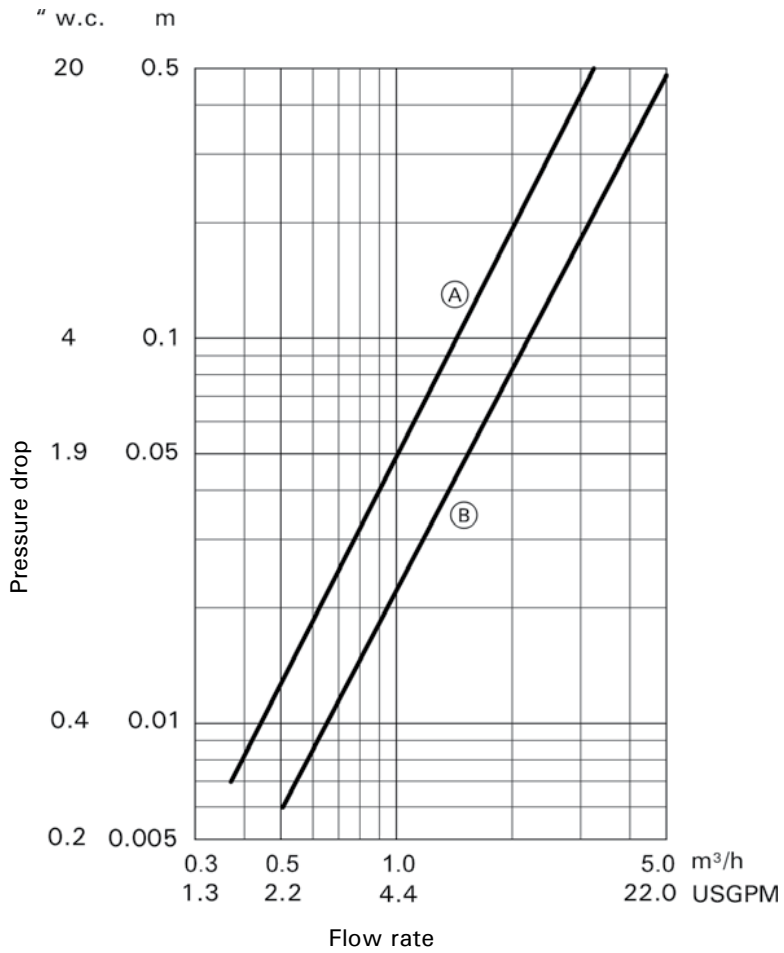
Minimum clearances to combustibles

Boiler model CU3A	94	125	160	199
Top	0	0	0	0
Sides (left and right)	0	0	0	0
Vent pipe	0	0	0	0
Front (alcove or closet)	0	0	0	0
Rear	0	0	0	0
Floor	combustible	combustible	combustible	combustible

The Vitocrossal CU3A series boilers are approved for closet and alcove installation with the clearances to combustibles listed.

Waterside Flow

Pressure Drop (heating water side)



Legend
Ⓐ Boiler models CU3A 94, 125
Ⓑ Boiler models CU3A 160, 199

The Vitocrossal 300 is only suitable for fully pumped hot water heating systems.

Boiler models CU3A	ΔT = 20°F (10 K)	ΔT = 30°F (15 K)	ΔT = 40°F (20 K)
	Flow rate USGPM (m³/h)	Flow rate USGPM (m³/h)	Flow rate USGPM (m³/h)
94	9.9 (2.2)	6.6 (1.5)	4.9 (1.1)
125	13.3 (3.0)	8.9 (2.0)	6.6 (1.5)
160	17.0 (3.9)	11.4 (2.6)	8.5 (2.0)
199	22.7 (5.2)	15.0 (3.4)	11.4 (2.6)

Note: This boiler does not require a flow switch.

System Design Considerations

IN THE COMMONWEALTH OF MASSACHUSETTS...
- this product shall be installed by a licensed plumber or gas fitter.
- the flexible connector (if used) cannot exceed 36".
- any level type shutoff used must be of tee handle type.

Boiler location

As a direct vent appliance, the Vitocrossal 300 CU3A can be installed for room air independent operation (sealed combustion) regardless of size and ventilation method of the room in which it is located.
The Vitocrossal 300 CU3A can be installed, for example, in the main living area of a house, in non-ventilated utility rooms, cupboards, closets and alcoves with no clearance required from combustible materials, as well as in attics with a direct outlet for the flue gas/fresh air system.
Follow all local and national codes.

Flue gas system

Viessmann PP(s) (Polypropylene) concentric flue gas/fresh air systems for room air independent operation (sealed combustion) and side wall venting are tested to ANSI Z21.13 - CSA 4.9 (latest edition) and are certified together with the Vitocrossal 300 CU3A boiler as a constructional unit.
The Vitocrossal 300 CU3A boiler may also be vented, using an AL29-4C® special stainless steel, single-wall, room air dependent or independent venting system (UL listed for category IV), polypropolene PP(s) or CPVC single wall room air dependent or independent venting system (listed to ULCS636 or UL1738) for CAT IV appliances.
For a more detailed description of the direct vent and single-wall vent system, please refer to the Vitocrossal 300 CU3A Venting System Installation Instructions.

Flue gas temperature protection

Flue pipes used for the Vitocrossal 300 CU3A are suitable for max. flue gas temperatures of up to 230°F (110°C).
No flue gas temperature protection is required as the maximum permissible flue gas temperature is not exceeded in any operating condition or in the event of malfunctioning.

Low water cut-off

A low water cut-off may be required by local codes.
If the boiler is installed above the radiation level, a low water cut-off device of approved type must be installed in all instances. An approved type low water cut-off device must be provided by the heating contractor.
Do not install an isolation valve between the boiler and the low water cut-off.

Water connections

Vitocrossal 300 CU3A boilers can be used in any fully pumped hot water heating system.
Minimum system pressure is 14 psig.
Chemical corrosion protection products
Corrosion does not typically occur in sealed heating systems which have been correctly installed and are correctly operated.
Many manufacturers of plastic pipes recommend the use of chemical additives. In this case, only those commercially available corrosion protection products approved for boilers with domestic hot water heating via single-wall heat exchangers (instantaneous plate heat exchangers or DHW tanks) must be used.

Water quality

Treatment for boiler feed water should be considered in areas of known problems, such as where a high mineral content and hardness exist. In areas where freezing might occur, an antifreeze may be added to the system water to protect the system. Please adhere to the specifications given by the antifreeze manufacturer. Do not use automotive silicate based antifreeze.
Please observe that an antifreeze/water mixture may require a backflow preventer within the automatic water feed and influence components such as diaphragm expansion tanks, radiation, etc. Maximum antifreeze content is 50% for the Vitocrossal 300 CU3A boiler.
Do not use antifreeze other than specifically made for hot water heating systems. System also may contain components which might be negatively affected by antifreeze.
Check total system frequently when filled with antifreeze.
Advise system operator/ultimate owner that system is filled with a glycol mix. The heating contractor must provide a MSDS (Material Safety Data Sheet) for the antifreeze used to the system operator/ultimate owner.

Total permissible hardness of the fill and top-up water

Total heating output	**Specific heating volume**					
MBH	**< 5 USG per 3412 BTU**		**≥ 5 USG per 3412 BTU to < 13 USG per 3412 BTU**		**≥ 13 USG per 3412 BTU**	
≤ 170	300 ppm	17.5 gpg	200 ppm	11.7 gpg	2 ppm	0.11 gpg
> 170 to ≤ 682	200 ppm	11.7 gpg	150 ppm	8.8 gpg	2 ppm	0.11 gpg
> 682 to ≤ 170	150 ppm	8.8 gpg	2 ppm	0.11 gpg	2 ppm	0.11 gpg
> 2050	2 ppm	0.11 gpg	2 ppm	0.11 gpg	2 ppm	0.11 gpg

ppm - parts per million
gpg - grains per gallon

Considerations

System layout

- The max. boiler water temperature for space heating and DHW production is 194°F (90°C). To minimize distribution losses, Viessmann recommends that the heating and domestic hot water systems be based on a maximum boiler supply temperature of 194°F (90°C).

- Due to the low return temperatures required for gas condensing, no mixing valves should be used in the heating circuit whenever possible. If mixing valves are required, e.g. for multi-circuit systems or underfloor heating systems, only 3-way mixing valves must be used.
  Do not use 4-way mixing valves with condensing boilers.

Underfloor heating systems

For underfloor heating systems Viessmann recommends the use of plastic tubing with an oxygen diffusion barrier in order to prevent the diffusion of oxygen through tubing. If plastic tubing without an oxygen diffusion barrier is used in underfloor heating systems, Viessmann recommends that such systems be separated from the boiler with a heat exchanger.
Underfloor heating systems and heating circuits containing a very large volume of water must be connected to the boiler via a 3-way mixing valve; please refer to the applicable installation example in this manual.

Oxygen diffusion barrier underfloor tubing

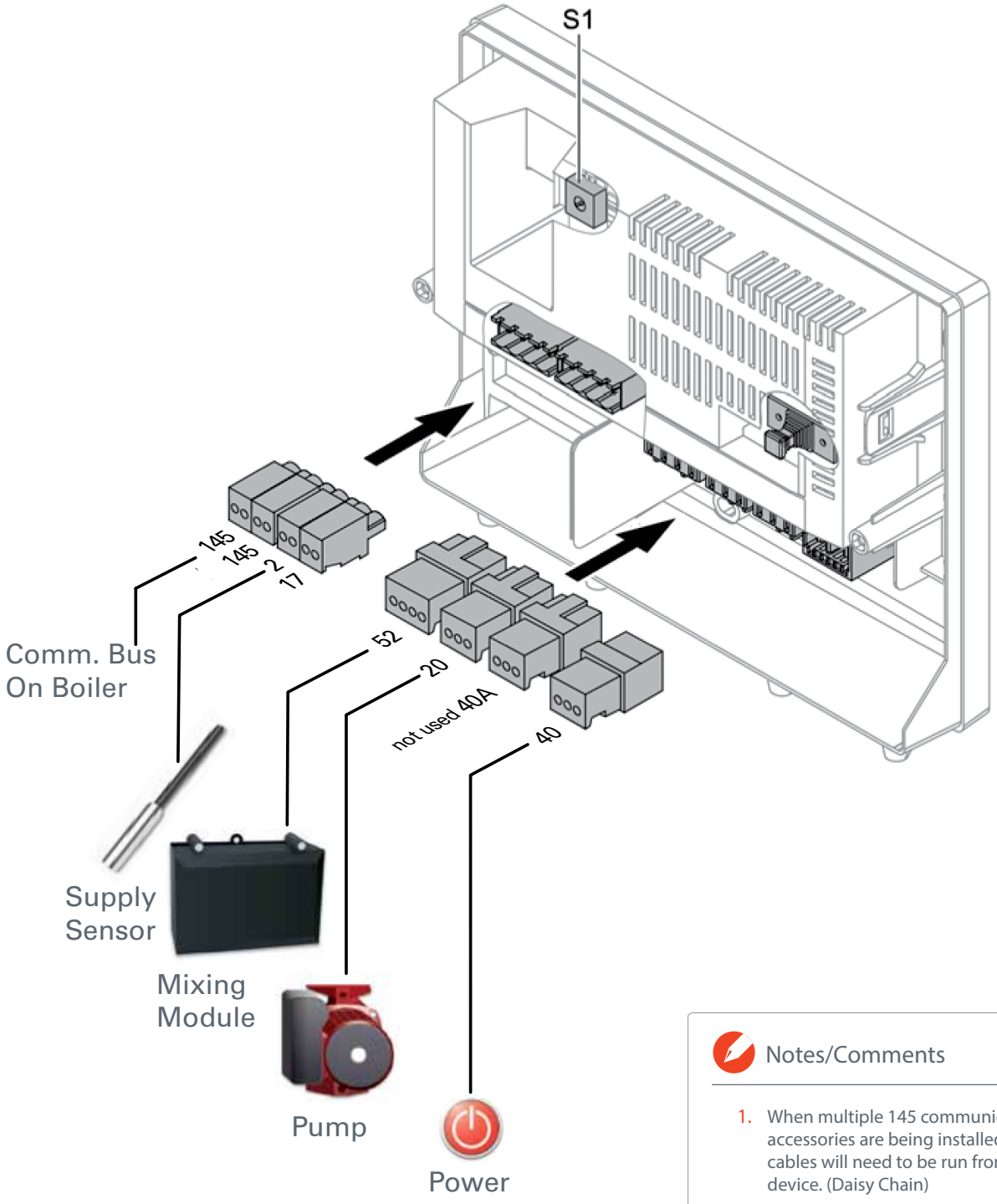
The boiler warranty does not cover leaks resulting from corrosion caused by the use of underfloor plastic tubing without an oxygen diffusion barrier. Such systems must have the non-oxygen diffusion barrier tubing separated from the boiler with a heat exchanger. Viessmann recommends the use of underfloor plastic tubing with an oxygen diffusion barrier.

Warranty

Our warranty does not cover damages resulting from the following:

- installation or service by unqualified and unlicensed personnel.
- attempting to perform any repair work on the boiler other than that mentioned in the boiler literature.
- tampering with or attempting, without Viessmann permission, to readjust the factory settings of the;
  -combination gas valve
  -combustion air opening of the burner blower
- leaks resulting from corrosion caused by the use of underfloor plastic tubing without an oxygen diffusion barrier. For detailed warranty information, please read warranty sheet supplied with product.

Product Information



Notes/Comments

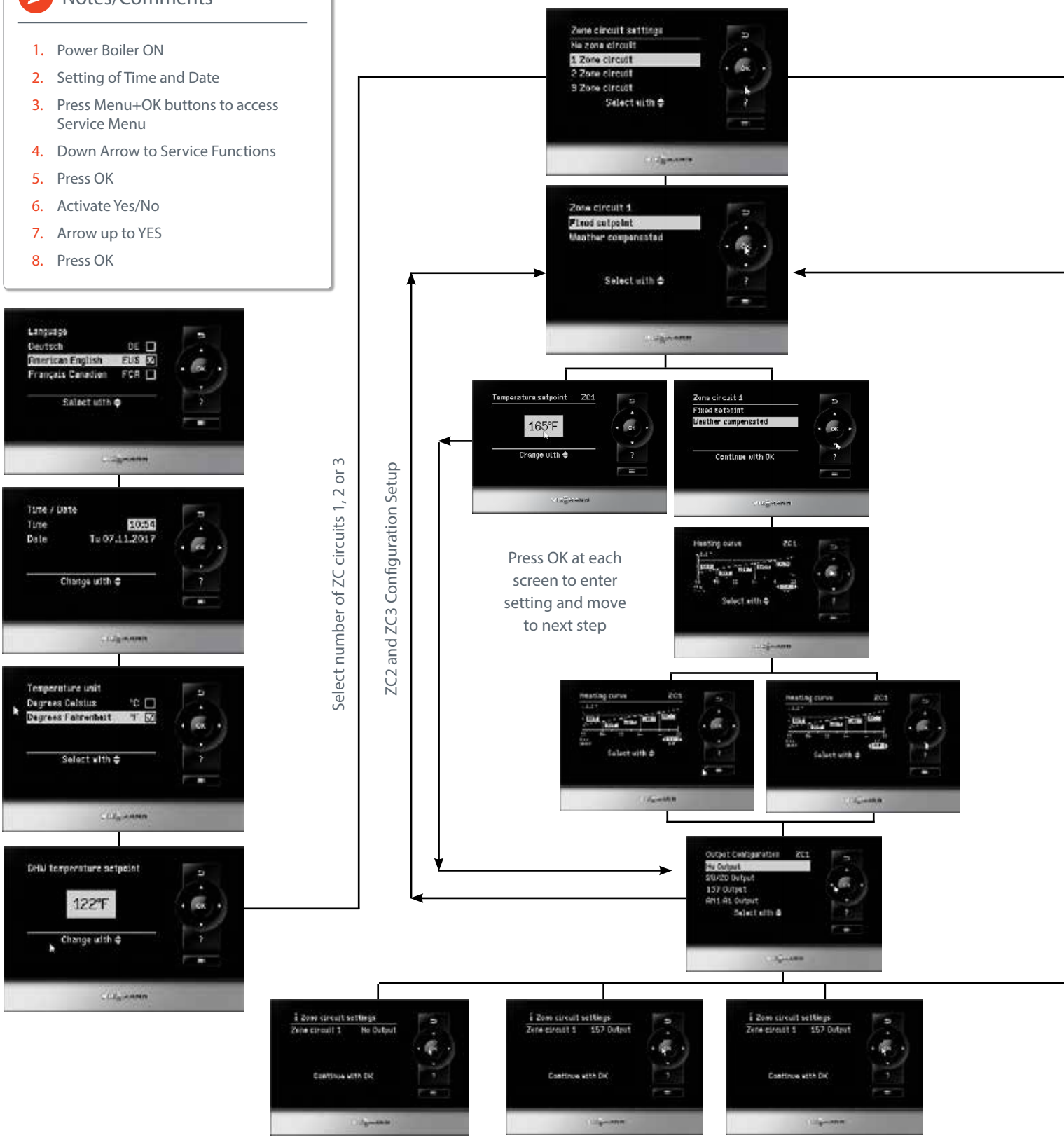
1. When multiple 145 communication accessories are being installed, 145 cables will need to be run from device to device. (Daisy Chain)
2. Ensure to set the S1 switch to assign the mixing valve heating circuit.

Zone Control Wizard Setup

Notes/Comments

1. Power Boiler ON
2. Setting of Time and Date
3. Press Menu+OK buttons to access Service Menu
4. Down Arrow to Service Functions
5. Press OK
6. Activate Yes/No
7. Arrow up to YES
8. Press OK

System with 1 Zone Circuit



Select number of ZC circuits 1, 2 or 3

ZC2 and ZC3 Configuration Setup

Press OK at each screen to enter setting and move to next step

System with 2 Zone Circuits

OR

System with 3 Zone Circuits

OR

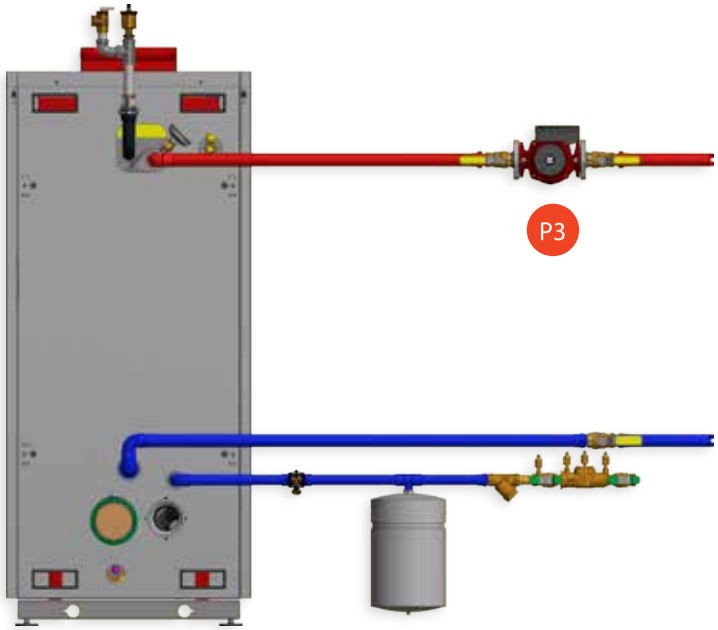
Operational Screen Information

ZC Fixed Setpoint Configured

ZC Weather Compensated Configured

User Interface Details:

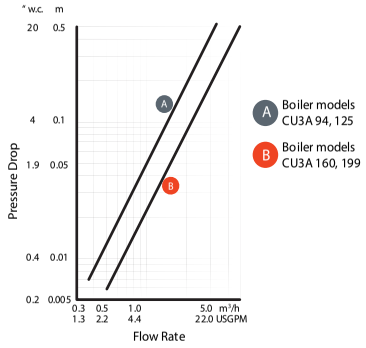
1. Indication of ZC circuit boiler is configured for ZC1/ZC2/ZC3 use arrows left or right to select.
2. Display will show when a ZC call is present and a symbol if ZC1/ZC2/ZC3 are configured with an associated pump output.
3. Display of actual boiler water temperature.
4. Flame indication when burner ON and will show % of modulation.
5. Target temperature of zone. The Fixed Setpoint will show the set temperature during configuration and Weather Compensated will show target based on slope and shift.
6. Outdoor temperature is shown when Weather Compensated ZC is configured.



Notes/Comments

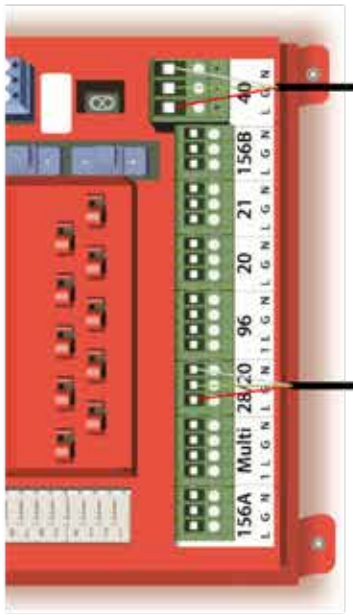
1. Refer to component index on Page 5.
2. Since the CU3A is a high mass boiler, primary/secondary piping is not required.

Pressure Drop / Pump Sizing



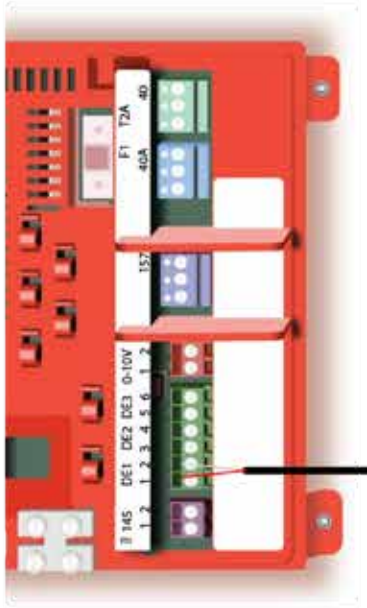
Application Code

CU3X 1ZC1ZP.01



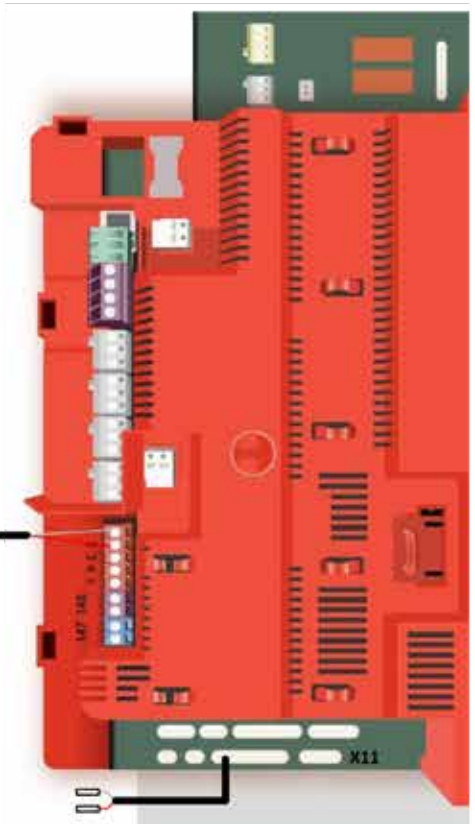
Power

ZC1
(P3)



ZC1
*Thermostat

Outdoor
Sensor



Application Code

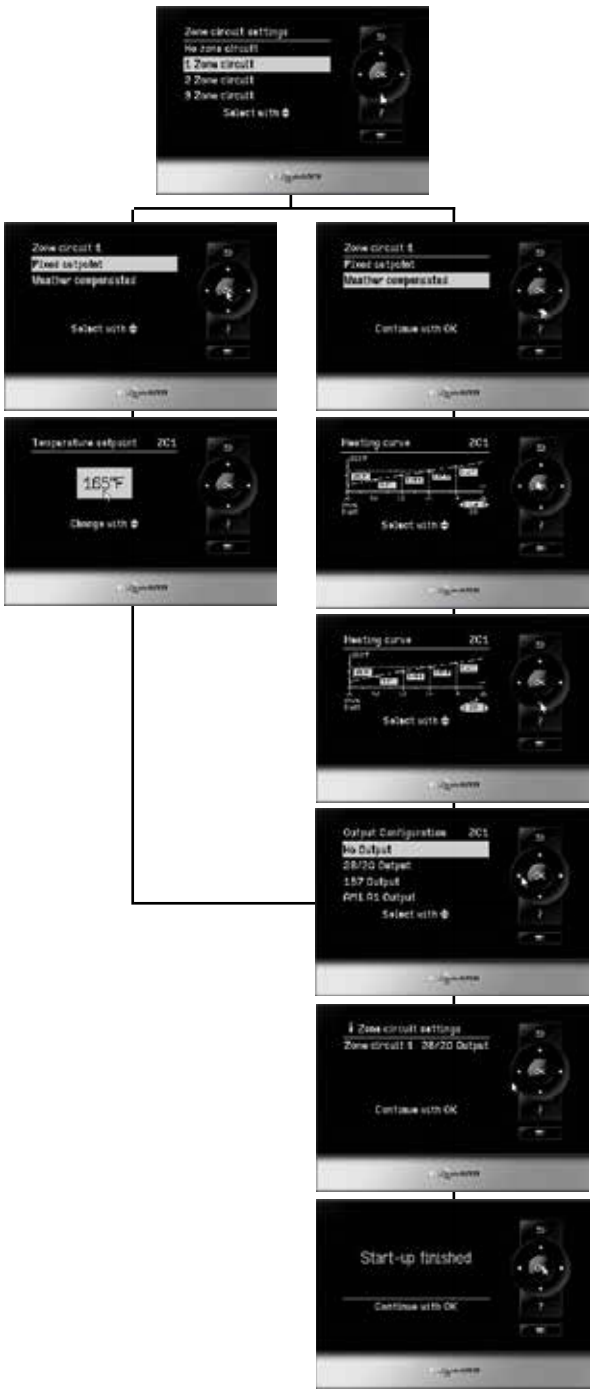
CU3X 1ZC1ZP.01

Notes/Comments

1. *Dry contact thermostat only.

Zone Control Wizard Setup 1 Zone Circuit: Fixed Set Point OR Weather Compensated

This particular application represents a high mass boiler with a single system loop. When the ZC1 thermostat calls for heat, the boiler will turn on the configured 28/20 P3 pump providing the necessary flow. Depending on the ZC1 configuration, it is possible to provide either a fixed setpoint or a weather compensated control option.



Select the correct number of Zone Circuit connections with respect to the number of thermostats connected to the DE connections.
Press OK

Depending on how the zone temperature set point is determined, select either Fixed Setpoint or Weather Compensated.

Fixed Setpoint: Enter the value that is to be used by the boiler as a target water temperature when there is a call for heat.

Weather Compensated: The Slope and Shift settings can be adjusted to allow a heating curve to be set. When there is a zone heat demand, the calculated set point will be used as long as the demand is present.

Select the desired pump output that will be enabled during a ZC call. When there is a call, the output will be energized for the duration of the call. For this application the P3 pump was wired to the 28/20 output.

The zone circuit setting output summary shows the selected pumps depending on the number of zones selected in the very beginning. Press the back button if the summary is incorrect.

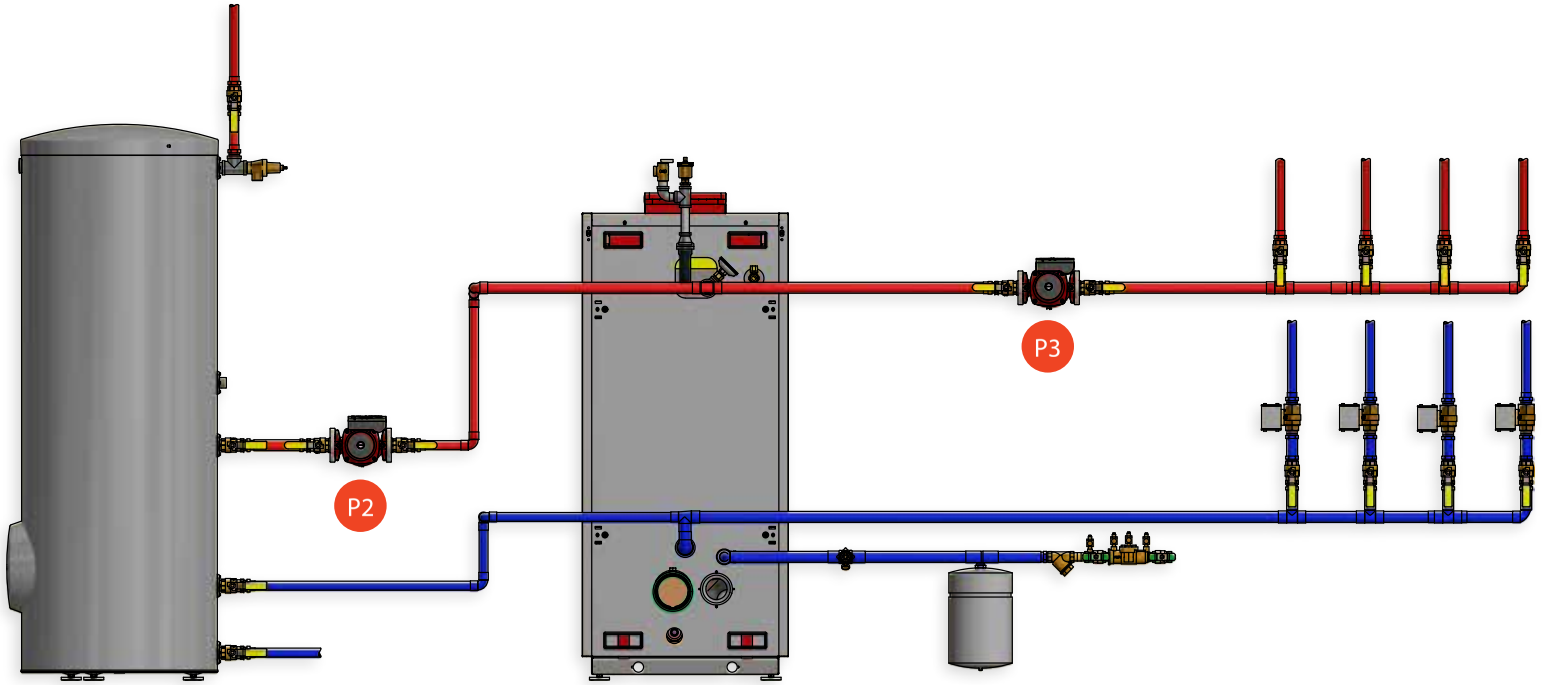
The Start-up is finished and boiler is ready for operation.

Application 1 - Operational Setup ... continued

Further Considerations

Notes/Comments

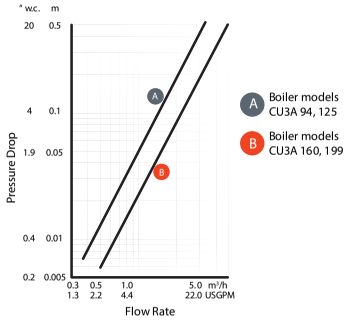
Application 2



Notes / Comments

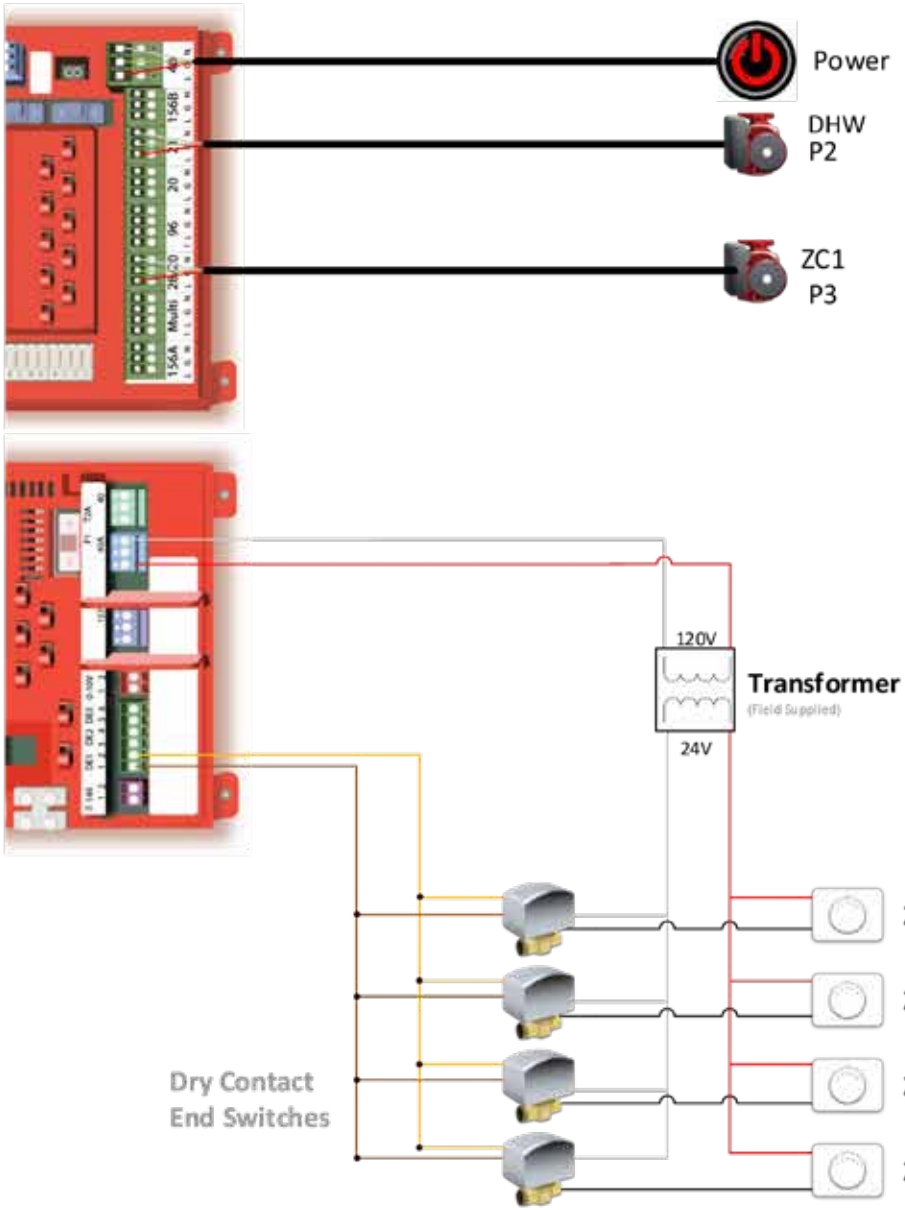
1. Since the CU3A is a high mass boiler, primary/secondary piping is not required.
2. If a single speed circulator is being utilized, a pressure differential bypass is recommended to prevent increased circulation when a single zone valve opens.
3. A variable speed circulator will automatically adjust to opening and closing zones. This ensures proper flow regardless of how many zones are open.

Pressure Drop / Pump Sizing



Application Code

CU3I 1ZC4ZV.01

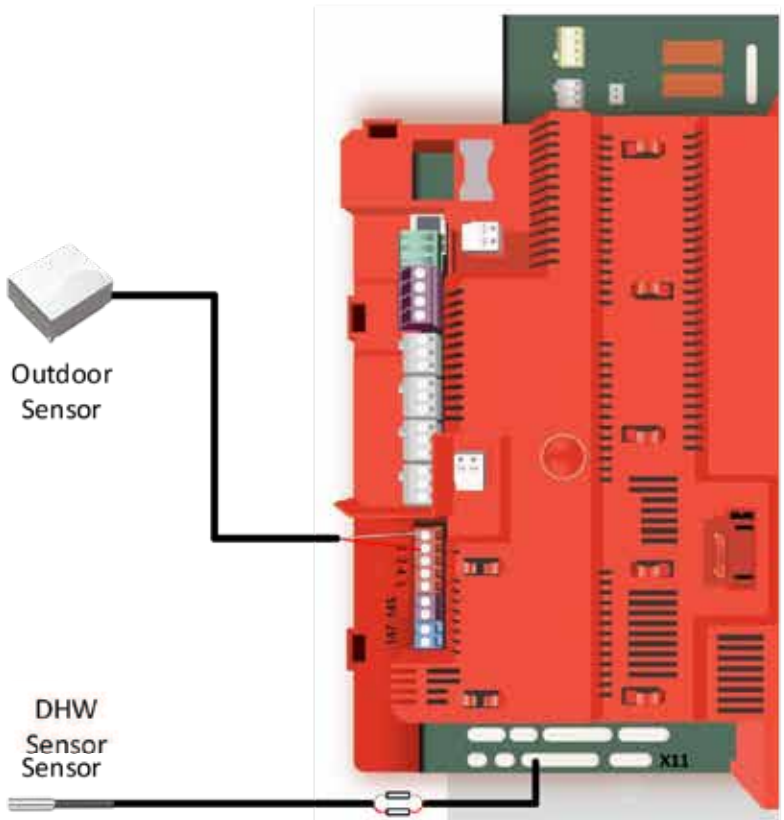


Application Code

CU3I 1ZC4ZV.01

Notes / Comments

1. Dry contact signal to DE1 only.
2. If field wiring of transformer not preferred, a multi zone valve control can be used in place.



Zone Control Wizard Setup 1 Zone Circuit: Fixed Set Point with 157 Pump Output

In this system you have a Vitocrossal CU3A with an indirect water heater and a four-zone single temperature system. Upon a call for heat from one of the four zone thermostats, the respective zone valve will open. The end switch will provide a demand and the 28/20 output connected P3 pump will turn on providing a target boiler water temperature. In the event there is a call for DHW, the P2 circulator will be engaged. This will provide a domestic priority function for the purpose of quickly satisfying a DHW demand.

Since this particular application is a single temperature circuit, select 1 Zone Circuit from the menu options.

This application is based on a Fixed Setpoint temperature during a zone call for heat. Press OK to confirm selection.

Enter the value that is to be used by the boiler as a target water temperature where there is a call for heat. You can adjust the values by arrowing down or up to the correct set point value and press OK.

The pump based on this application is controlled by the 28/20 output. Arrow down until 28/20 Output is highlighted and press OK.

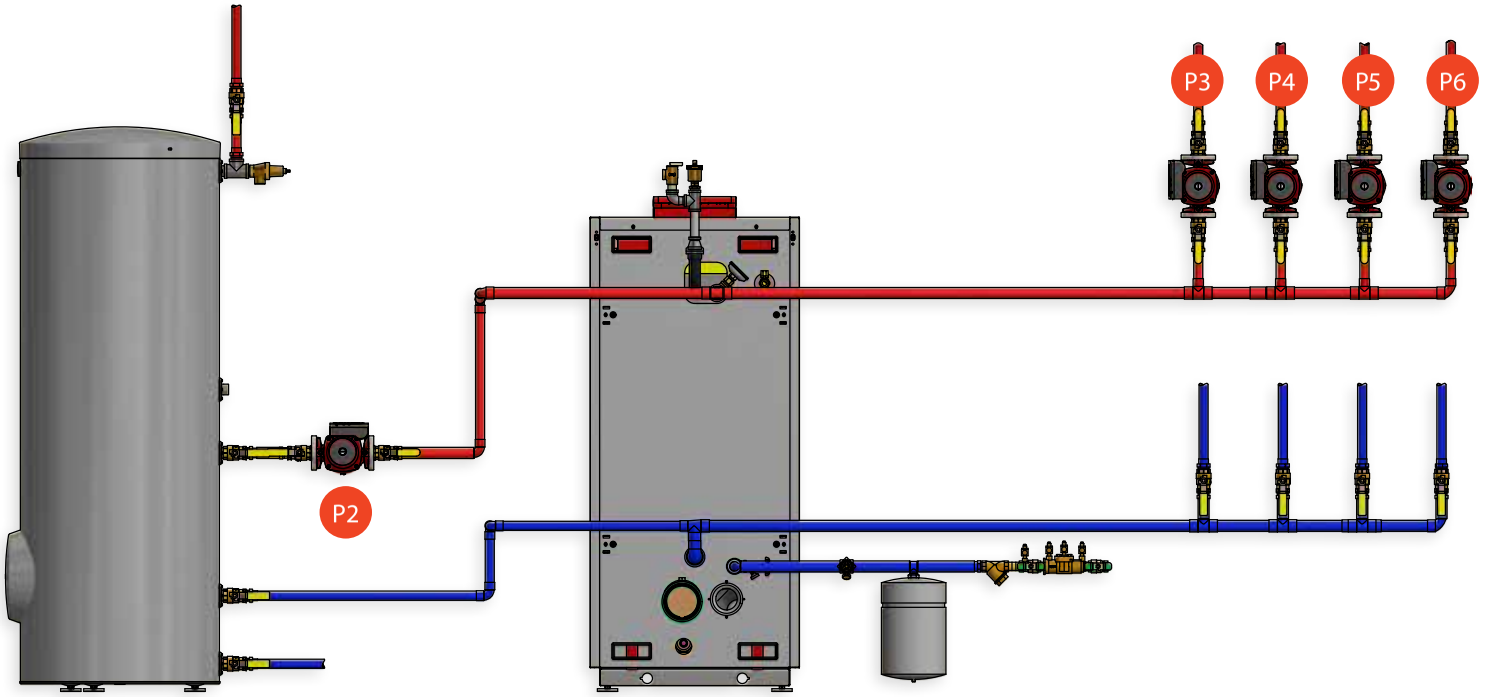
The zone circuit setting output summary shows the selected pumps depending on the number of zones selected in the very beginning.
Press OK to continue.

The Start-up is finished and boiler is ready for operation. Press OK to continue

Application 2 - Operational Setup ... continued

Notes/Comments

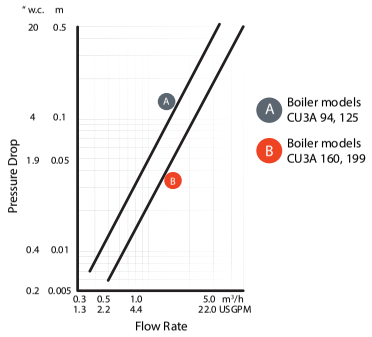
Vitocrossal CU3A — Application 3



Notes/Comments

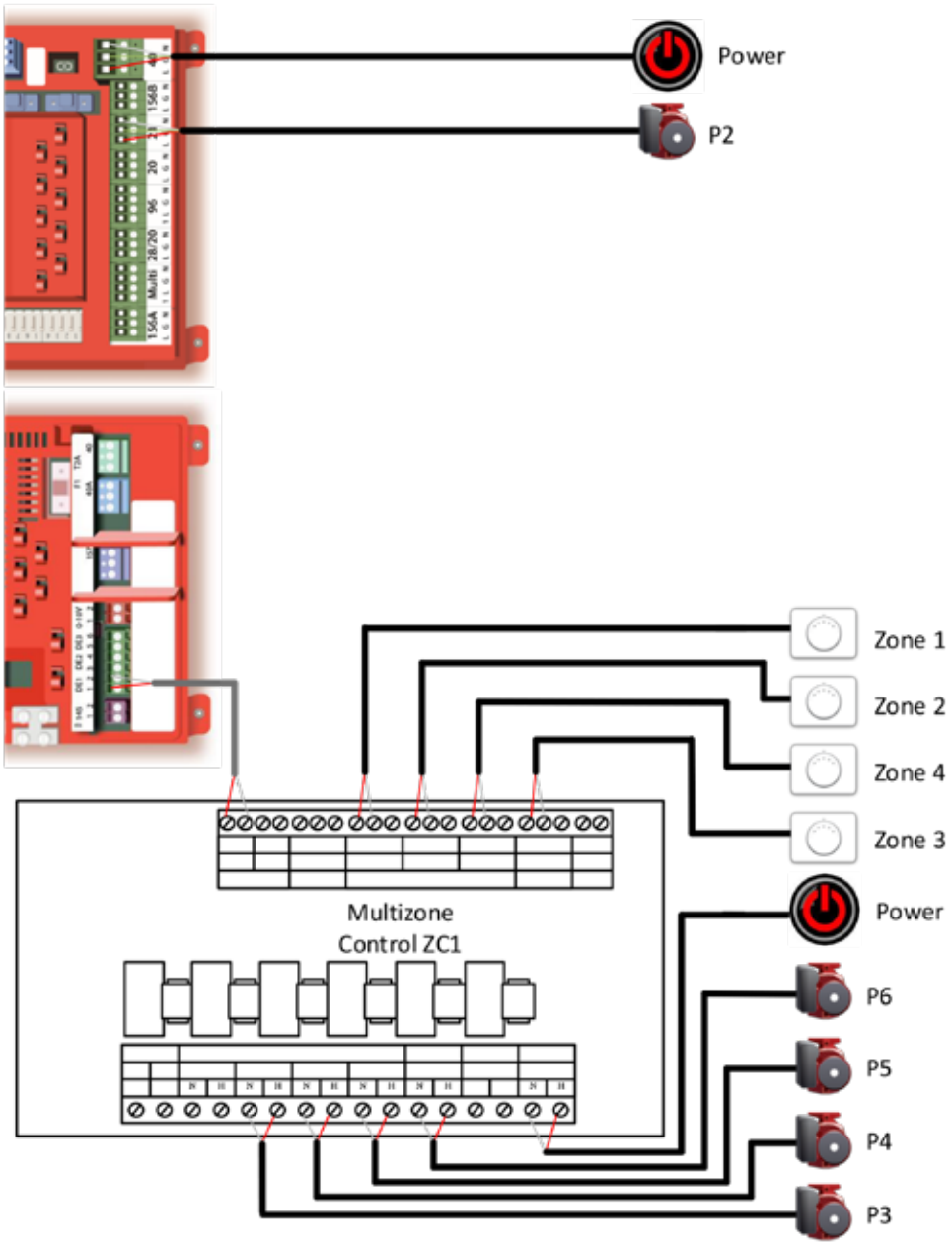
1. Reference component index on page 5.
2. Always consider the electrical consumption associated with zoning a system with circulators. Often there are more efficient alternatives which could be considered when designing a system.
3. Since the CU3A is a high mass boiler, primary/secondary piping is not required.

Pressure Drop / Pump Sizing



Application Code

CU3I 1ZC4ZP.01



Application Code

CU3I 1ZC4ZP.01

Notes / Comments

1. There are no configured pumps with respect to the Zone Circuit configuration. Pumps are controlled by the Multizone Control.

Zone Control Wizard Setup 1 Zone Circuit: Fixed Set Point w/no configured pump output

If you are zoning with pumps, consider this application for your next install. This system shows a Vitocrossal CU3A with an indirect water heater and a four zone single temperature system. Upon a call for heat from a thermostat, the associated zone pump is energized by the multi-zone control. The connection of the heat demand output of the Multizone Control will provide a demand to the DE1 of the EA1 boiler generating a ZC1 set point demand. This is a very simple control solution for single temperature applications.

Since this particular application is a single temperature circuit, select 1 Zone Circuit from the menu options.

This application is based on a Fixed Setpoint temperature during a zone call for heat. Press OK to confirm selection.

Enter the value that is to be used by the boiler as a target water temperature where there is a call for heat. You can adjust the values by arrowing down or up to the correct set point value and press OK.

There is no assigned pump for this application. Pressing the OK button will not assign any specific pump output

The zone circuit summary indicates no pumps selected.

The Start-up is finished and boiler is ready for operation. Press OK to continue

Application 3 - Operational Setup ... continued

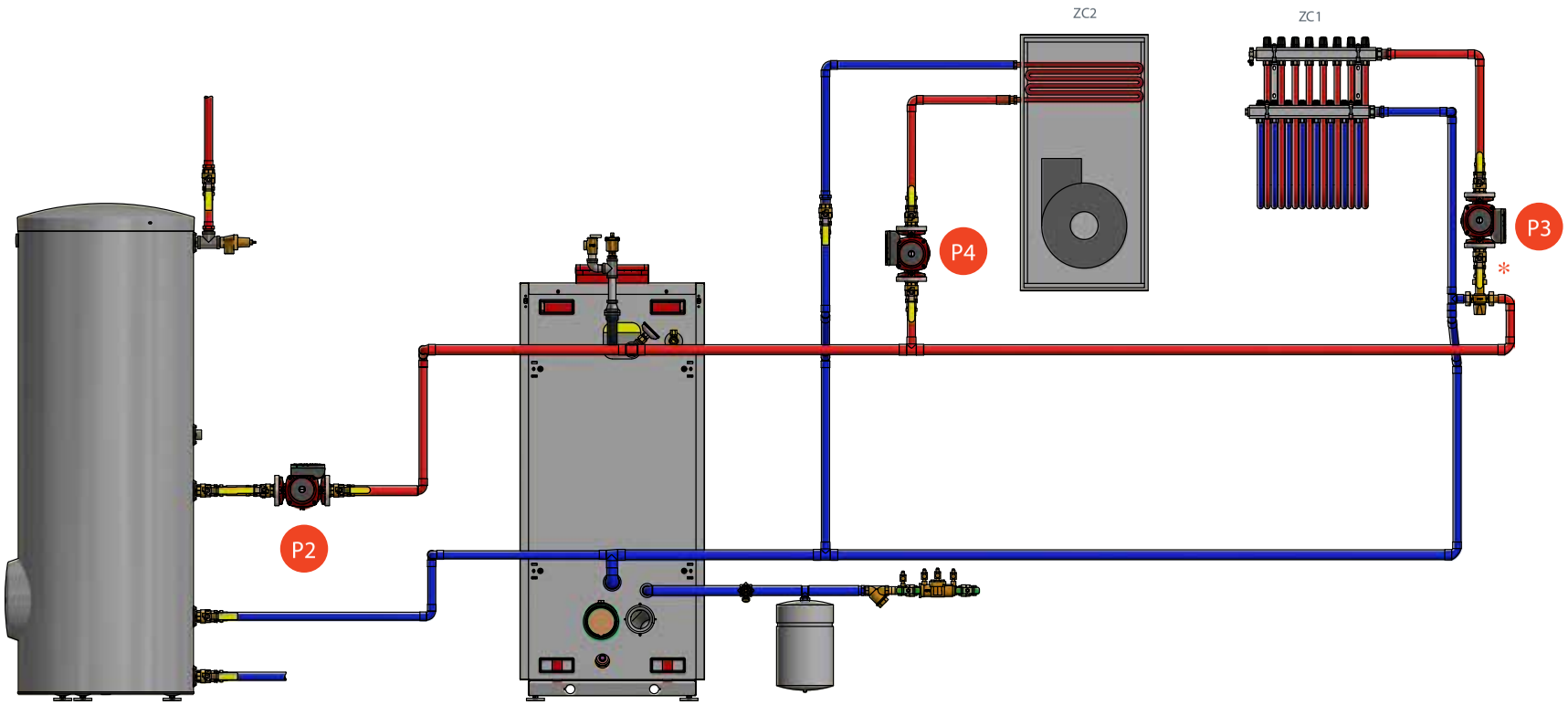
Further Considerations

DHW Production
Set timer schedule as desired. If DHW production possible at any time, program timer settings to 0:00 to 24:00

The HC1 settings are still available should an outdoor reset based zone be connected. Should mixing valve extension kits be used, adjust the outdoor reset settings as required.

Notes/Comments

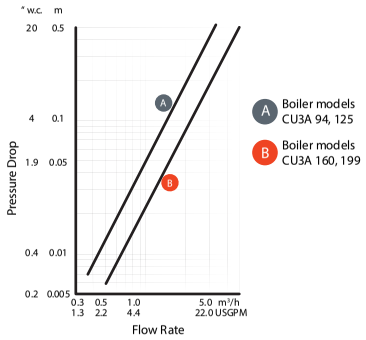
Application 4



Notes / Comments

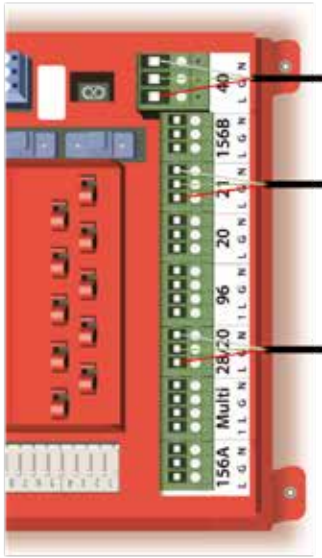
1. A thermostatic mixing valve should be installed to protect the radiant floor heating from receiving excessive hot water. (*shown above)
2. Component index on page 5.
3. Since the CU3A is a high mass boiler, primary/secondary piping is not required.

Pressure Drop / Pump Sizing



Application Code

CU3I 2ZC2ZP.01



Power

P2

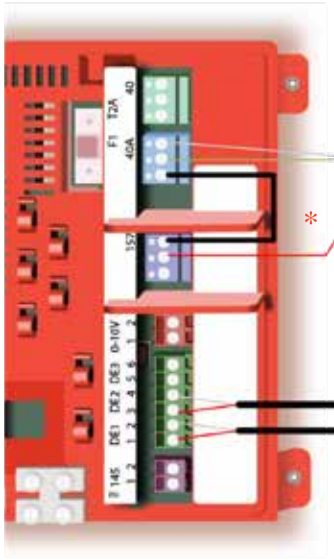
ZC1
P3

Application Code

CU3I 2ZC2ZP.01

Notes / Comments

1. Heat demand contact from air handler must be a dry contact / potential free.
2. The dry contact for the radiant heat circuit could come from a device such as a thermostat, zone valve, or multi zone controller.
3. Don't forget about the jumper between the 40A plug and the 157 Plug. (*)
4. If P4 is controlled by the air handler, no pump wiring is necessary.



Notes / Comments

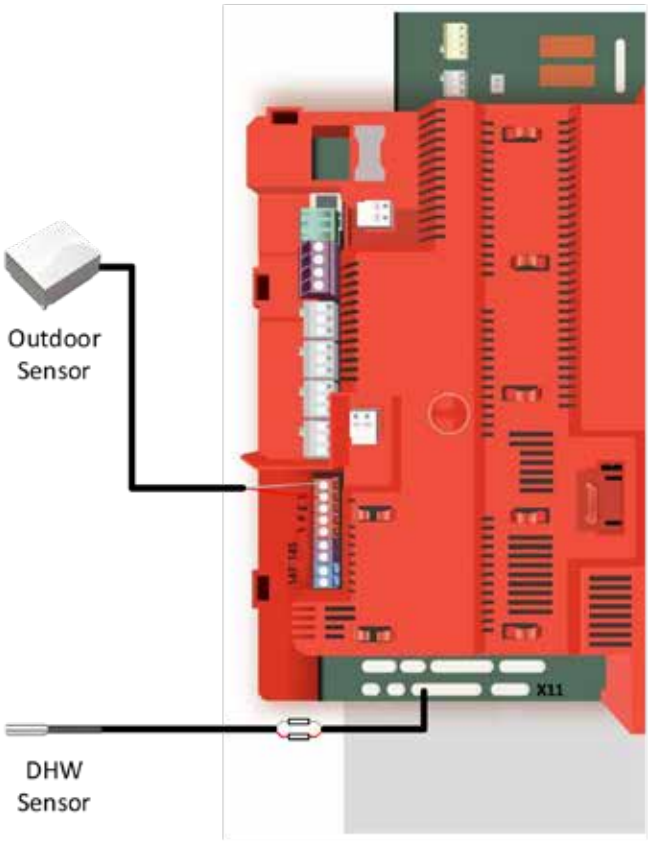
For air handlers without internal pumps.

ZC2
P4

*

Heat Demand Contact from Air Handler ZC2

Contact from infloor heat control ZC1



Outdoor Sensor

DHW Sensor

Zone Control Wizard—2 ZC—ZC1 Setpoint Demand with ZC2 Weather Compensated

This application features two heat circuits which operate at different temperatures. This particular drawing portrays ZC1 as a low temperature circuit and the air handler as a mid/high temperature circuit, ZC2. Although there are many different configurations, the setup below will operate ZC1 as an on/off function where an outdoor reset curve will be enabled during a thermostat call. The ZC2 air handler will operate on a constant temperature setpoint also referred to as a Fixed Setpoint. It is important to provide a method of protecting the ZC1 from high water temperatures when the air handler is operating, so don't forget to include the thermostatic mixing valve. The ZC1 shown here is configured with pump output 28/20 and the ZC2 call will bring on the 157 plug connected pump should there be a call for heat.

Select the correct number of Zone Circuit connections with respect to the number of thermostats connected to the DE connections. Press OK

This application is based on a Weather Compensated, arrow down and press OK to confirm setting.

The Slope and Shift settings can be adjusted to allow a heating curve to be set. When there is a zone heat demand, the calculated set point will be used as long as the demand is present. Arrow up or down to move to the shift setting from slope. Making an adjustment of either setting will graphically indicate how the heating curve moves.

Once the settings have been made, press OK to continue. These settings can be easily adjusted later on should they need to be changed.

The ZC1 pump for this particular application is the 28/20 pump. Pressing OK continues to the ZC2 circuit,

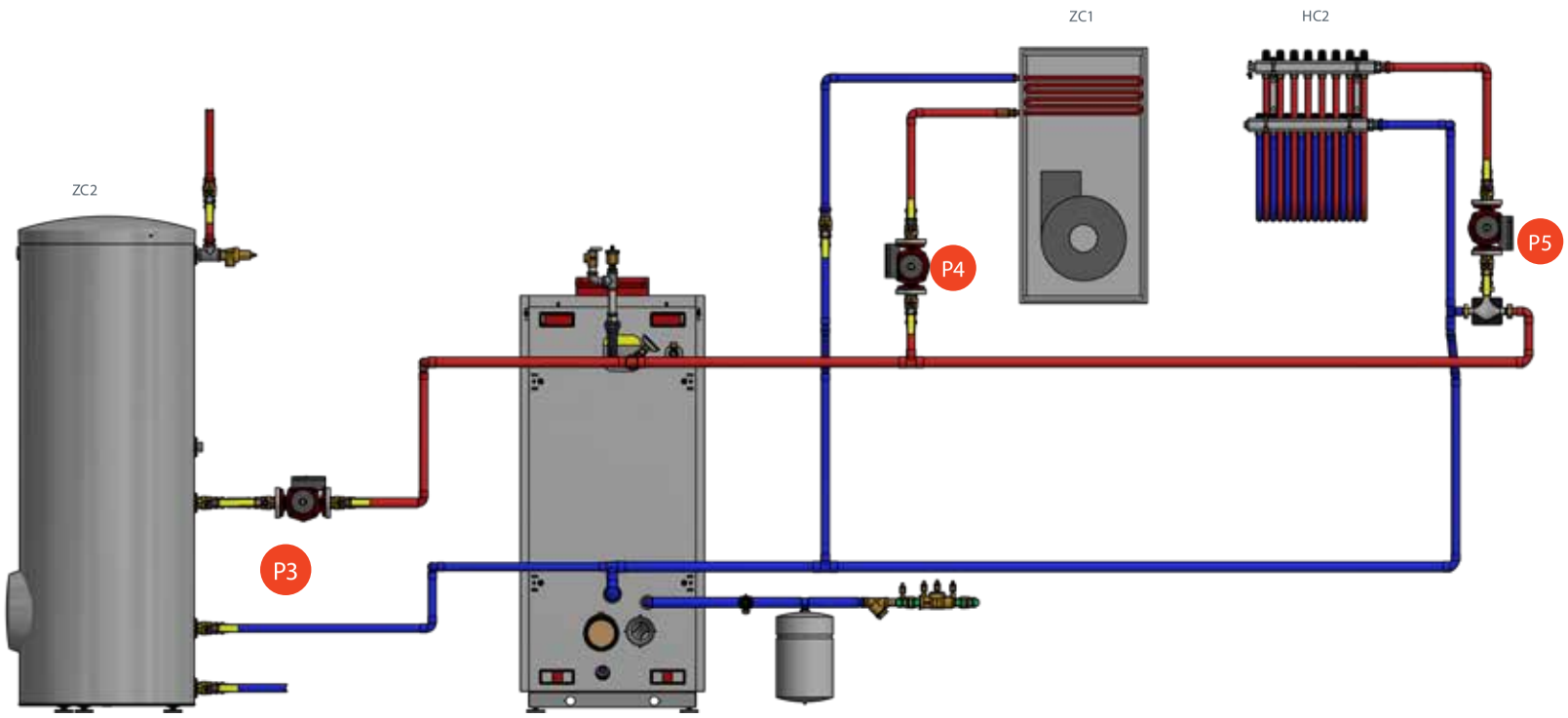
The Zone Circuit 2 is to be set for Fixed Setpoint temperature demand. Press OK to select and continue.The next screen allows for a set point adjustment of the zone target temperature

The final step in this application configuration is to select the associated pump for ZC2. Select the 157 Output and press OK. If the pump is controlled by the air handler, select "No Output".

Following will be the output summary and the start up configuration is finished

Application 4 - Operational Setup ... continued

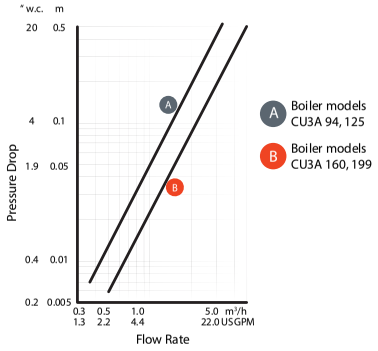
Notes/Comments



Notes / Comments

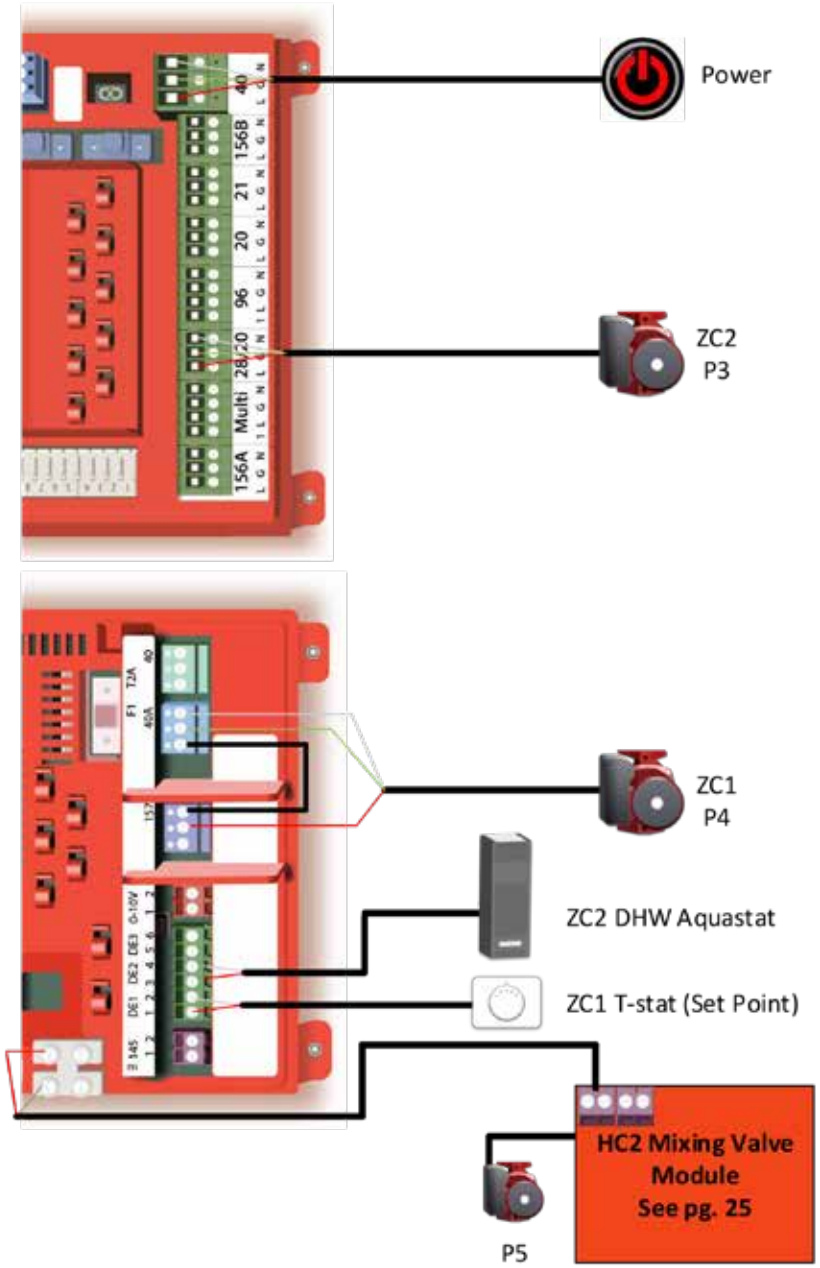
1. A thermostatic mixing valve may be required on the radiant loop to prevent excessive hot water supply to the circuit when the DHW is calling for heat.
2. Component Index on pages 5.
3. When the indirect DHW tank is part of the system load, consideration must be given to the size of the boiler in order to allow for simultaneous operation of space heating and DHW.

Pressure Drop / Pump Sizing



Application Code

CU3I 3HC/Z3ZP.01



Application Code

CU3I 3HC/Z3ZP.01

Notes / Comments

1. For more information regarding the wiring of the Mixing Valve Module, see page 25
2. Don't forget about the jumper between the 40A plug and the 157 Plug. (*)
3. 3. If P4 is controlled by the air handler, no pump wiring is necessary.

Zone Control Wizard Setup 1 Zone Circuit: Fixed Set Point with 157 Pump Output

This application shows a low temperature heat circuit with 3-way mixing valve, a high temperature heating circuit ZC1 and an indirect DHW tank that is controlled by an aquastat. This application allows for simultaneous operation of both space heating and DHW, just remember to size your boiler accordingly. (ZC1 or ZC2 depending on application) The control will be configured without pump P4 for air handlers with internal pumps. If the air handler does not have an internal pump, then a ZC call for heat will turn on the P4 pump configured on the 157 plug providing water flow for air handler heating coil. The HC2 mixing valve will operate from heating curve settings, set within the boiler control. The ZC2 demand from the DHW aquastat will be sensed by the DE2 input and turn on the associated 28/20 pump output during control configuration.

Select the correct number of Zone Circuit connections with respect to the number of thermostats connected to the DE connections. Press OK

This application is based on a Fixed Setpoint temperature during a zone call for heat. Press OK to confirm selection.

Enter the value that is to be used by the boiler as a target water temperature where there is a call for heat. You can adjust the values by arrowing down or up to the correct set point value and press OK.

If the air handler has an internal pump, select "No Output" and press OK.
If the Air handler does not have an internal pump, the pump operation is controlled by the 157 Output. Arrow down until 157 Output is highlighted and press OK.

The zone circuit setting output summary shows the selected pumps depending on the number of zones selected in the very beginning. Press OK to continue.

The Start-up is finished and boiler is ready for operation. Press OK to continue

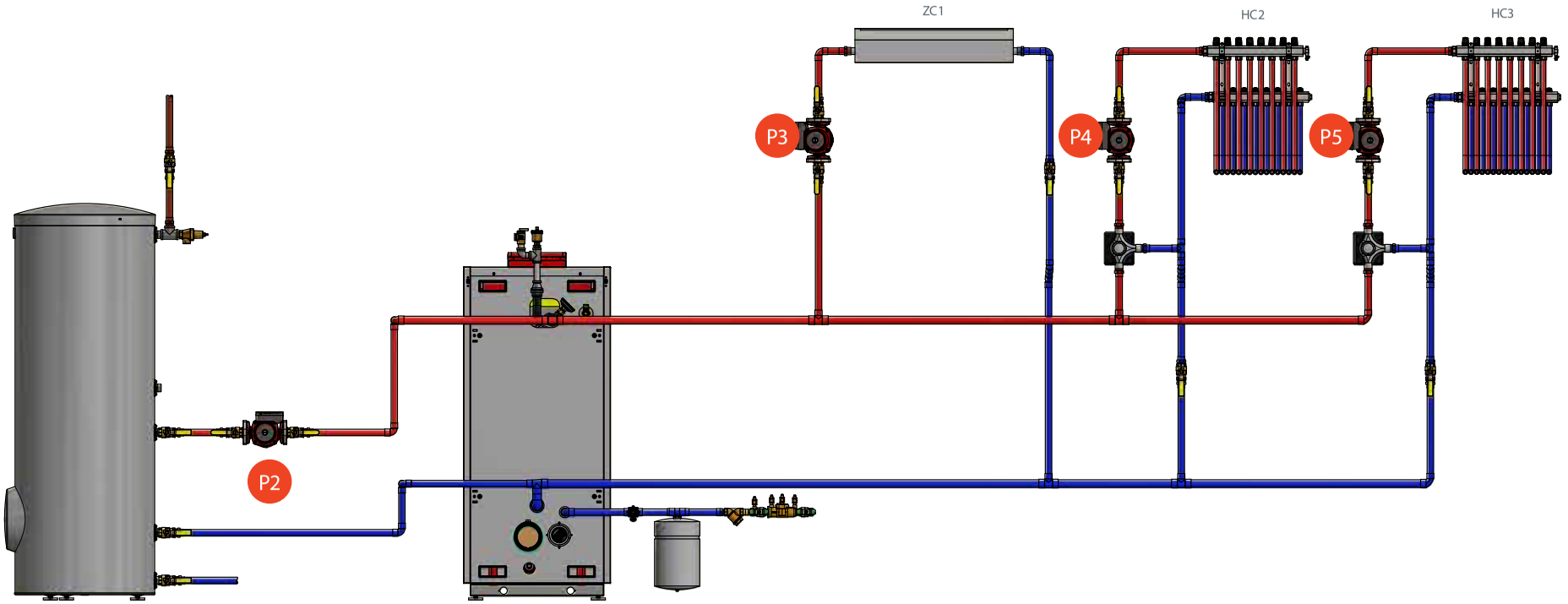
Application 5 - Operational Setup ... continued

Further Considerations

The HC1 settings are still available should an outdoor reset based zone be connected. Should mixing valve extension kits be used, adjust the outdoor reset settings as required.

Notes/Comments

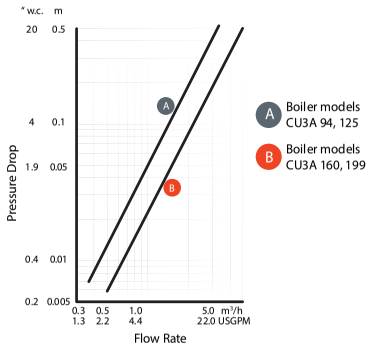
Vitocrossal CU3A — Application 6



Notes / Comments

1. Component Index on pages 5.
2. External flow check valves are not necessary if built into the circulators.
3. Since the CU3A is a high mass boiler, primary/secondary piping is not required.

Pressure Drop / Pump Sizing

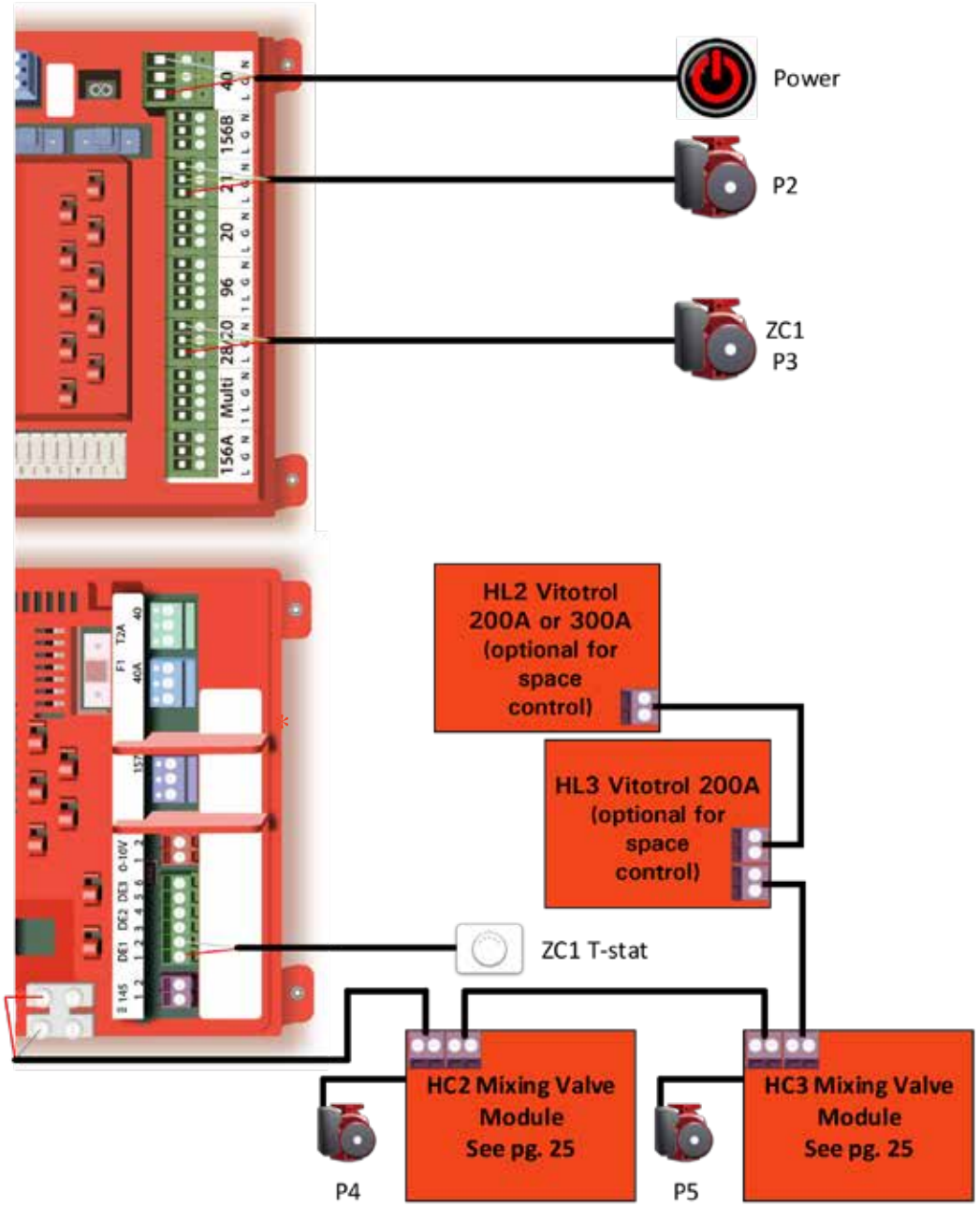


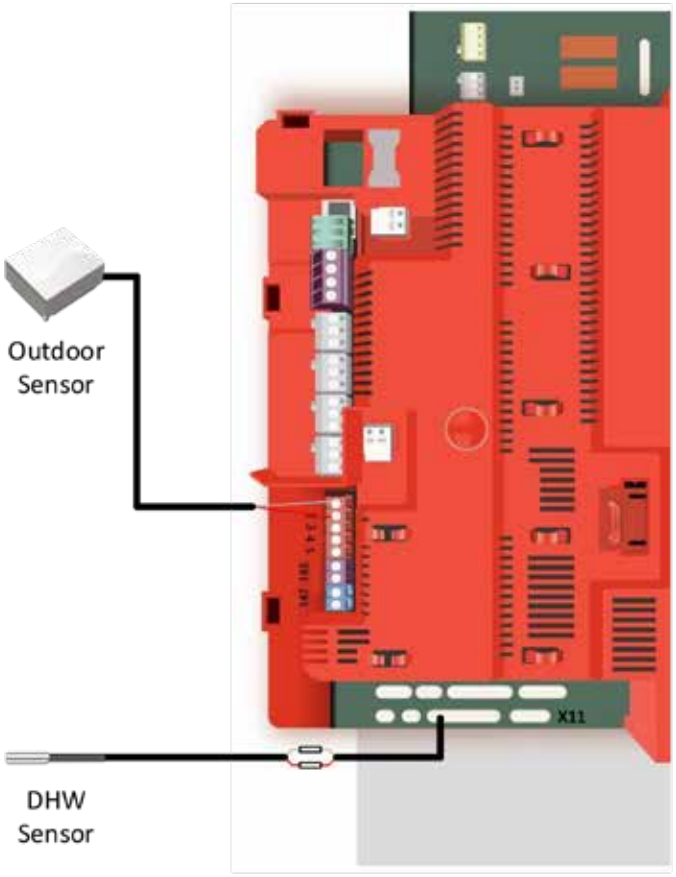
Application Code

CU3I 3HC/ZC3ZP.02

Application Code

CU3I 3HC/ZC3ZP.02





Zone Control Wizard Setup 1 Zone Circuit: Fixed Set Point with 28/20 Pump Output

This application shows 2 heat circuits with mixing valves, a high temperature zone circuit, and an indirect DHW tank. This system approach maximizes system efficiency, control and comfort through precise water monitoring. The ZC1 thermostat call for heat will enable 28/20 output to power the P3 pump providing flow in the unmixed temperature heating circuit. The ZC1 circuit can be configured to operate based on a Fixed Setpoint demand temperature or a Weather Compensated demand. The HC2 and HC3 mixing valve controls will operate based on heat curve settings from within the boiler.

Select the 1 Zone Circuit with respect to the ZC thermostat connected to the DE connections. Press OK

This application is based on a Fixed Setpoint temperature during a zone call for heat. Press OK to confirm selection.

Enter the value that is to be used by the boiler as a target water temperature where there is a call for heat. You can adjust the values by arrowing down or up to the correct set point value and press OK.

The pump based on this application is controlled by the 28/20 output. Arrow down until 28/20 Output is highlighted and press OK.

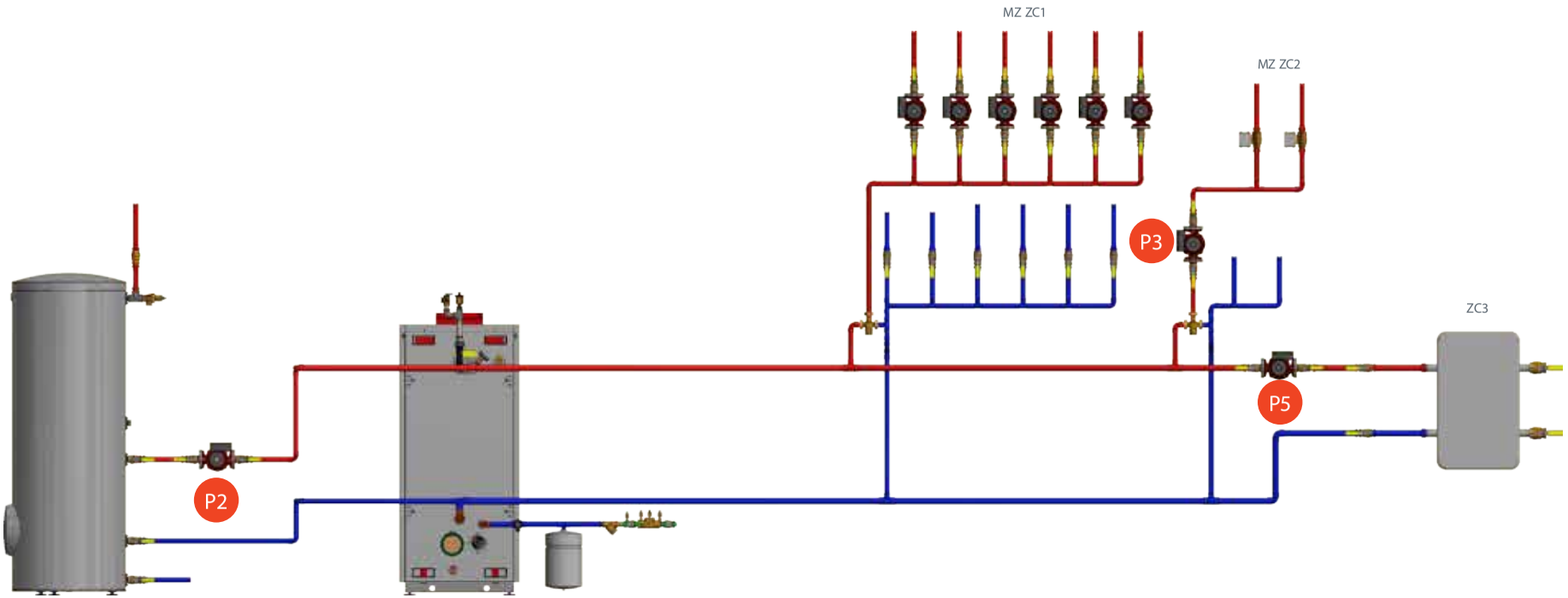
The zone circuit setting output summary shows the selected pumps depending on the number of zones selected in the very beginning. Press OK to continue.

The Start-up is finished and boiler is ready for operation. Press OK to continue

Application 6 - Operational Setup ... continued

Notes/Comments

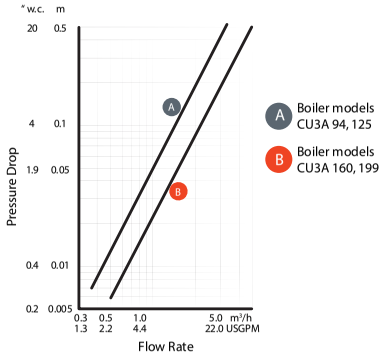
Vitocrossal CU3A — Application 7



Notes / Comments

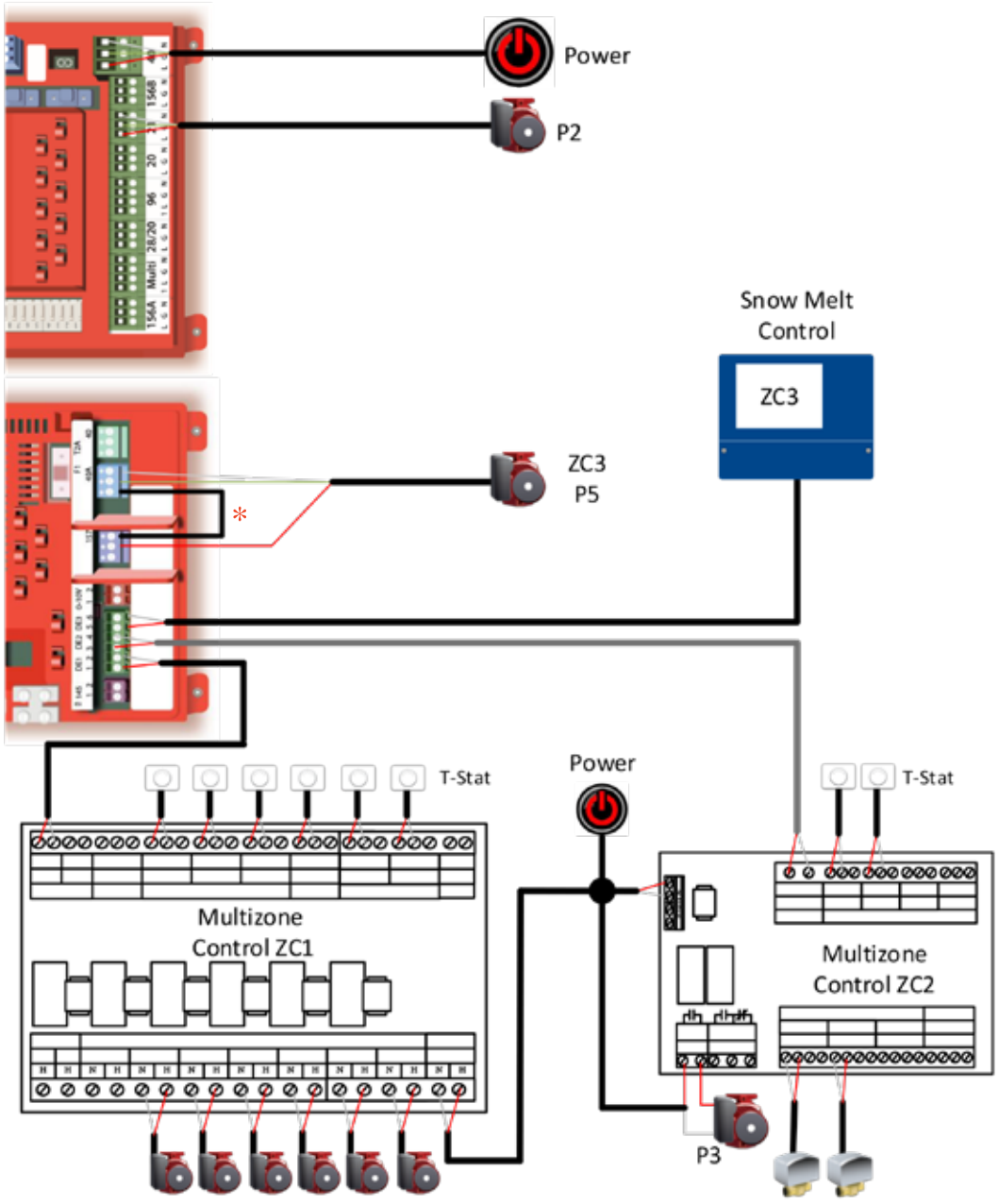
1. Component Index on pages 5.
2. External flow check valves are not necessary if built into the circulators.
3. Since the CU3A is a high mass boiler, primary/secondary piping is not required.

Pressure Drop / Pump Sizing



Application Code

CU3I 3ZC9C.01

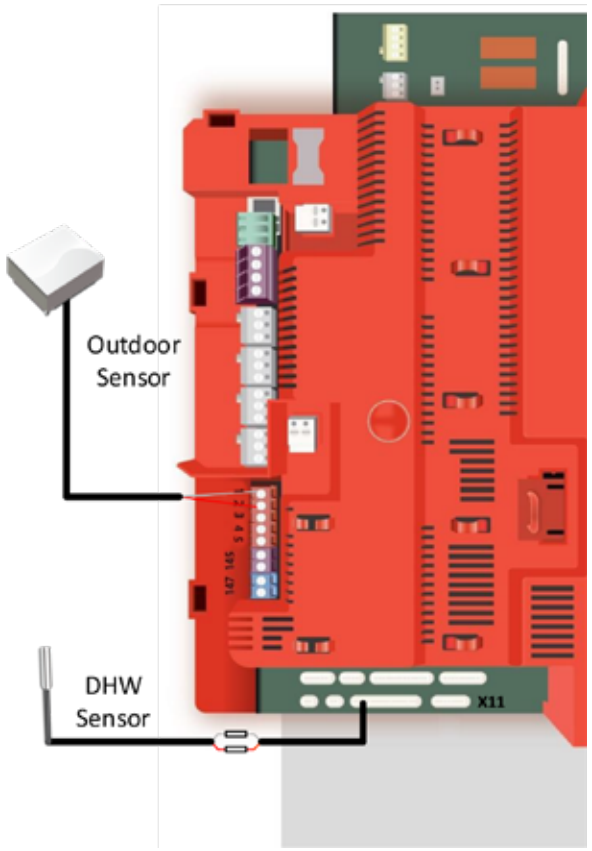


Application Code

CU3I 3ZC9C.01

Notes / Comments

1. Jumper must be installed between the 40A plug and the 157 Plug. (*)
2. When there are demand for multiple temperatures, the boiler will target the highest of the the requested temperatures.



Zone Control Wizard—3 ZC—ZC1 Setpoint Demand with ZC2 Weather Compensated

This application shows 3 heating circuits, where a combination of pumps, zone valves and two types of call for heat are utilized. The ZC1 demand input comes from a Multizone Control which is responsible for accepting thermostat calls where a respective pump is enabled. The ZC1 is also configured for a Weather Compensated function which allows a zone set point to be calculated based on the slope and shift settings. The ZC2 input from the second Mutlizone Control is configured for a Fixed Setpoint when there is a call. This Mutlizone Control is responsible for controlling 2 zone valves based on the 2 thermostats. Lastly, ZC3 input comes from a snow melt control. The ZC3 is also configured to provide pump control on the 157 plug output.

Select the correct number of Zone Circuit connections with respect to the number of controls connected to the DE connections. Press OK

This application is based on a Weather Compensated for ZC1. Arrow down and press OK to confirm setting.

The Slope and Shift settings can be adjusted to allow a heating curve to be set. When there is a zone heat demand, the calculated set point will be used as long as the demand is present. Arrow up or down to move to the shift setting from slope. Making an adjustment of either setting will graphically indicate how the heating curve moves.

Once the settings have been made, press OK to continue. These settings can be easily adjusted later on should they need to be changed.

There is no pump associated with ZC1 for this particular application. OK continues to the ZC2 circuit.

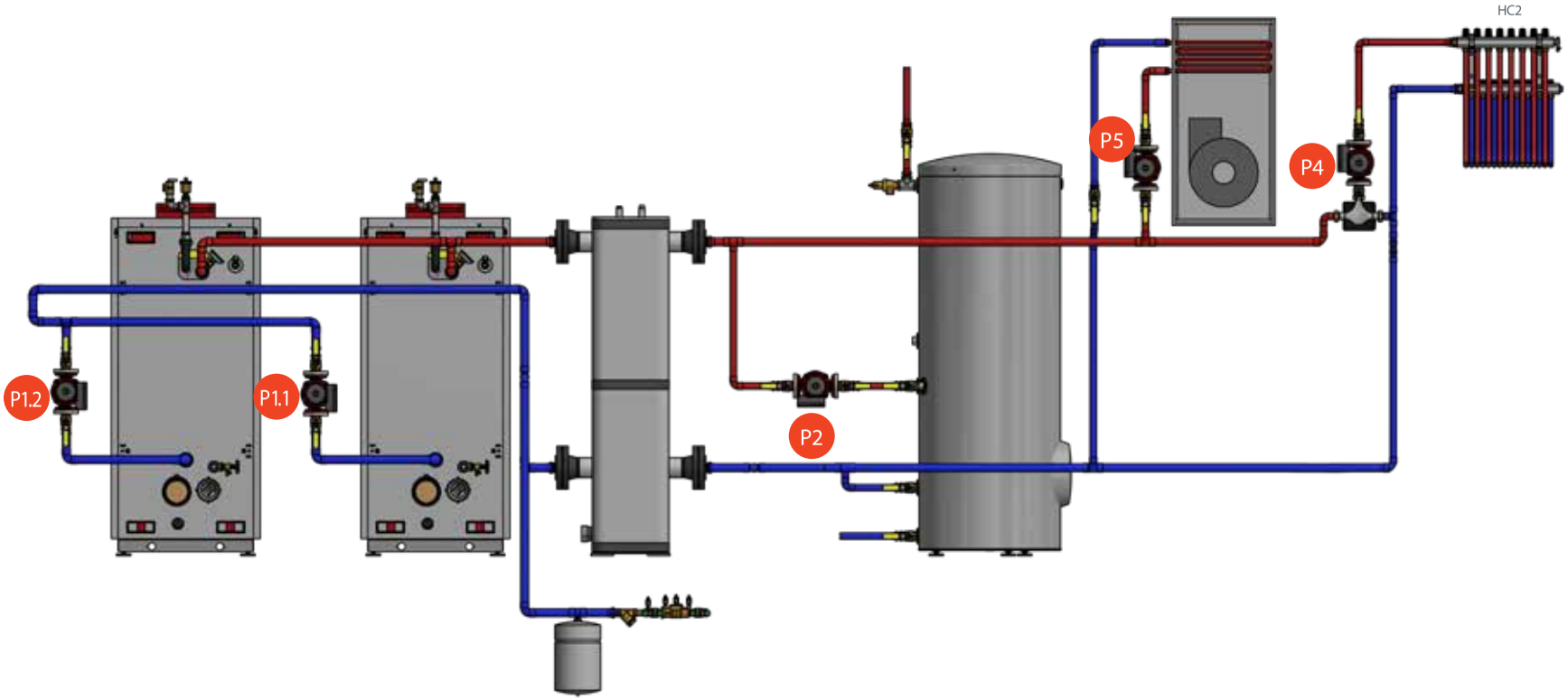
The Zone Circuit 2 is to be set for Fixed Setpoint temperature demand. Press OK to select and continue.

The next screen allows for a set point adjustment of the zone target temperature

The Zone Circuit 3 as shown below is to be set for Fixed Setpoint temperature demand. Press OK to select and continue. The next screen allows for a set point adjustment of the zone target temperature and lastly the selection of the 157 pump output.

Application 7 - Operational Setup Instructions... continued

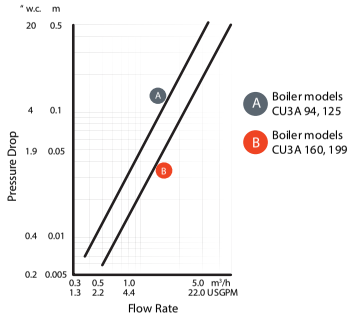
Notes/Comments



Notes / Comments

1. Component Index on pages 5.
2. Since the circulator in the air handler is not controlled by the boiler, higher than design water temperatures may reach the air handler when the DHW is calling for heat.
3. Since the CU3A is a high mass boiler, primary/ secondary piping is not required.
4. The low loss header can be replaced with closely spaced tees as shown in application #9.

Pressure Drop / Pump Sizing



Application Code

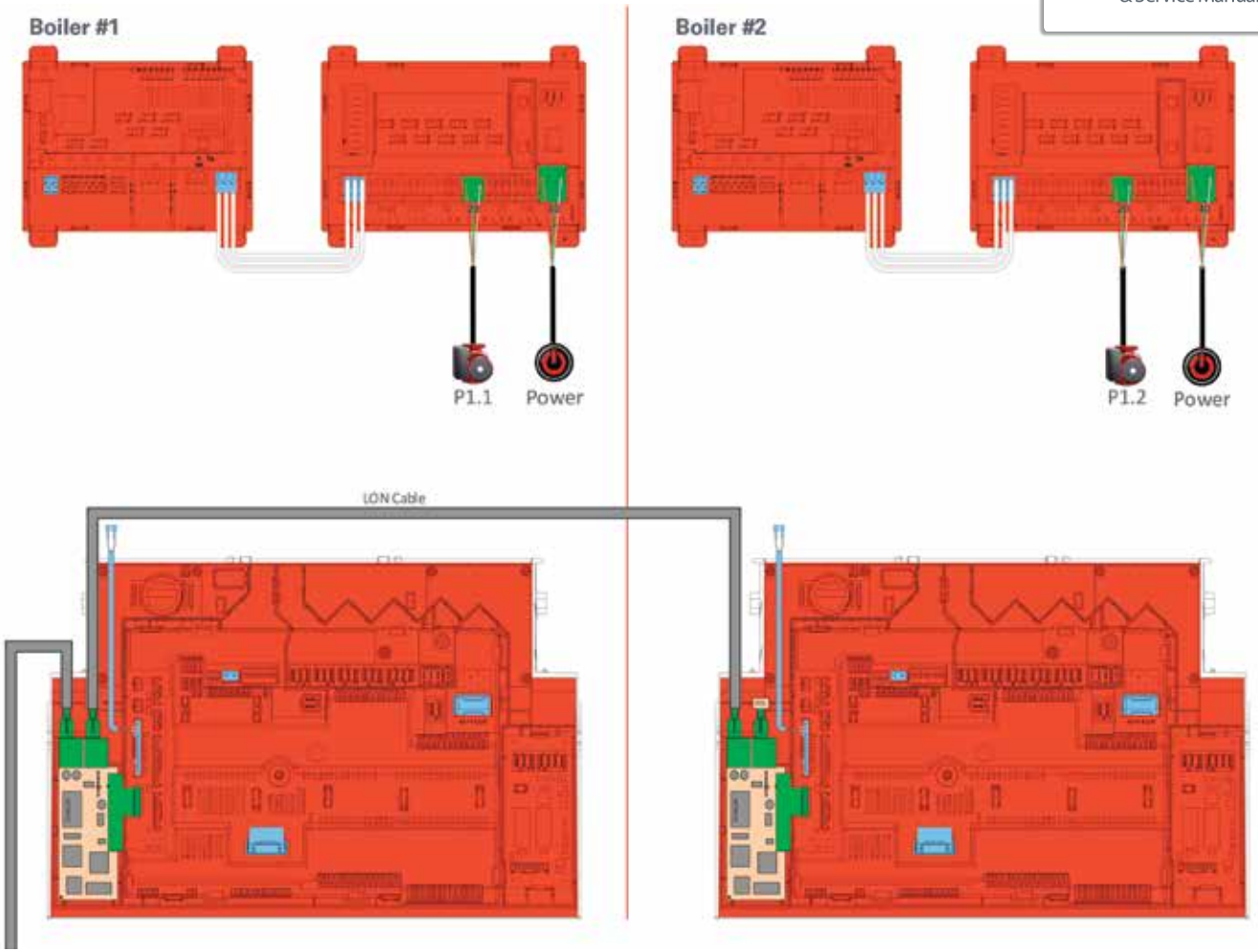
2CU3I 3HC/ZC3ZP.01

Application Code

2CU3I 3HC/ZC3ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, if using multiple circulators and mixing valve motors, isolation relays may be required.
2. P5 is internally controlled by the air handler.
3. Stroke direction of the mixing valve motor should be verified by an actuator test. (Refer to the Installation & Service Manual of the Cascade Control)



Vitocrossal CU3A — Application 8

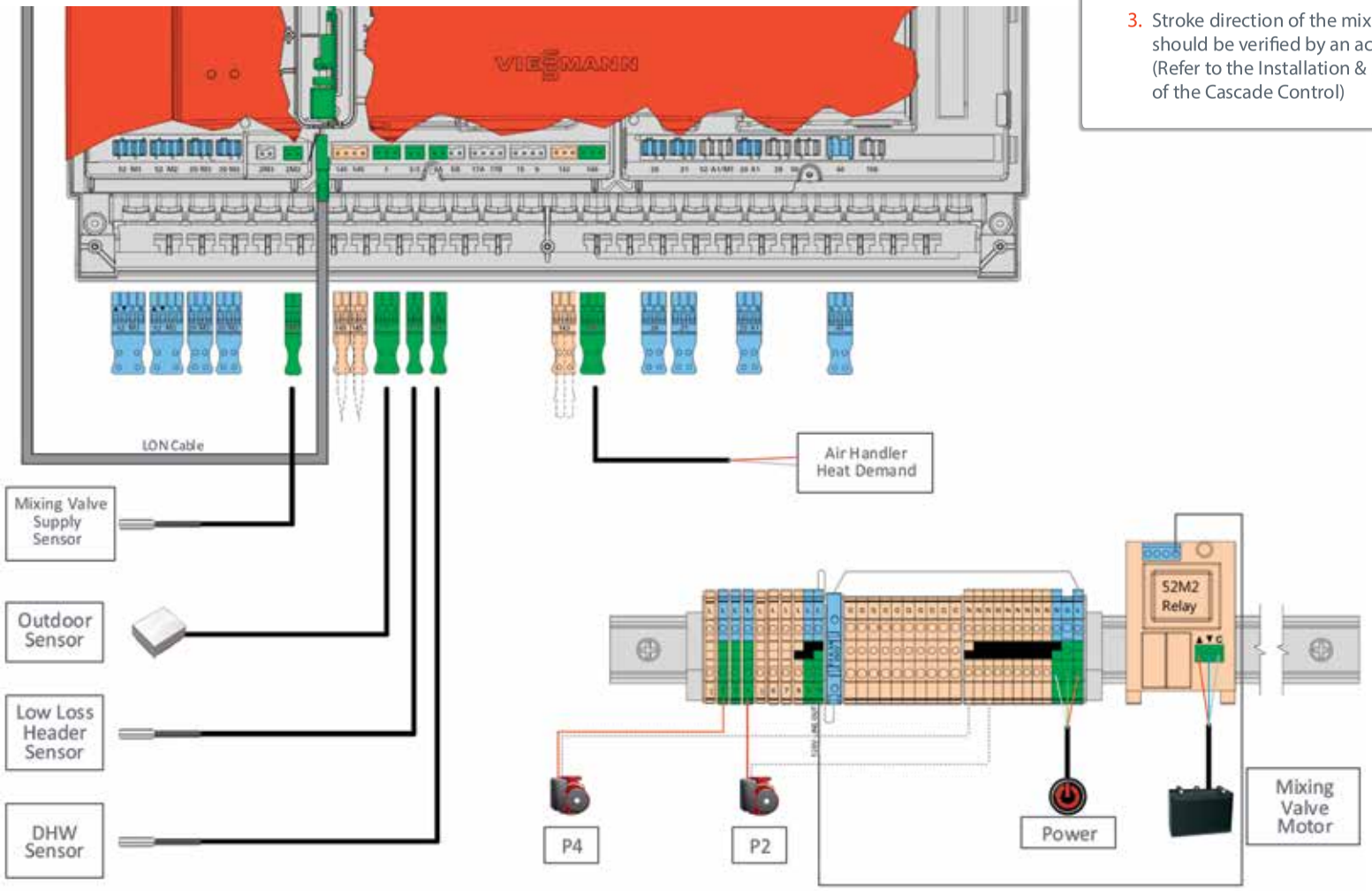
Application Code

2CU3I 3HC/ZC3ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, if using multiple circulators and mixing valve motors, isolation relays may be required.
2. P5 is internally controlled by the air handler.
3. Stroke direction of the mixing valve motor should be verified by an actuator test. (Refer to the Installation & Service Manual of the Cascade Control)

MW2C Cascade Control



Application 8 Operational Setup Instructions

This application consists of a low temperature heat circuit with motorized mixing valve, a hot water forced air fan coil, indirect DHW and a 2-boiler cascade separated by a low loss header. This multi-boiler configuration offers greater flexibility in system design as it allows for increased system turndown, boiler redundancy, increased BTU inputs, and simultaneous operation of the heating and DHW. As the cascade control targets the maximum temperature for the system, the mixing valve offers the added benefit of automatically adjusting the supply water temperature regardless of the water temperatures being supplied to the other heat circuits. Since this is all controlled by the cascade control, this makes for a simple, long lasting and efficient system. To set up this system, follow the steps below:

Type/Option	Step#	Description	Parameter	Set to:	Setup Location
Setup on each boiler	1	Set to multi-boiler mode	Service Function -> Select Multiboiler Application		Service Menu
	2	Set boiler number	07:	Set Boiler #	Set in Level 2 Coding
	3	Set LON participant number	77:	Set Boiler #	
	4	Set boiler pump	37, 8a will need to be set to 176	0	
Setup On Cascade Control	5	Complete participant check (For further instruction, refer to Installation & Service Manual)			Service Menu
	6	Select system type	00	:04	Set in Level 2 Coding
	7	Set supply temperature of external demand	9B	Set Temp.	
	8	Set up HC2 outdoor reset curve			Set In Heating Sub Menu
	9	Set DHW temperature			
Optional Adjustments					
Set a Heating Schedule Set a DHW Schedule Set a DHW Recirculation Schedule for P2.1					Set In Heating Sub Menu

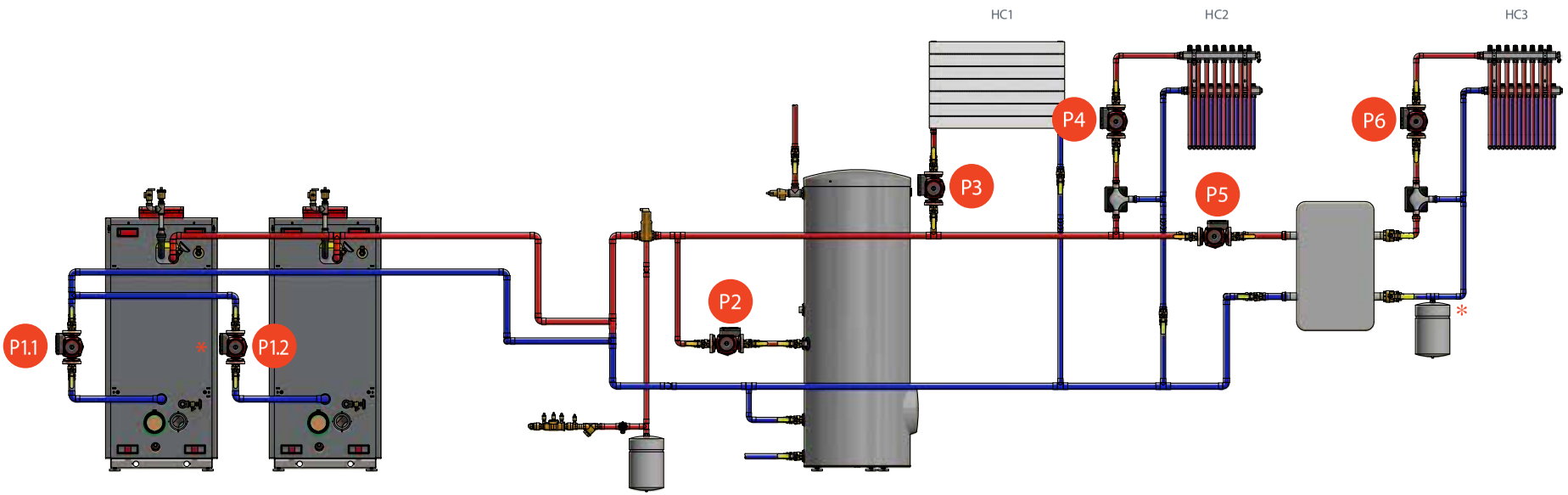
Notes/Comments

1. To enter service menu on the boiler you must hold the "OK" and ☰ buttons for 5 seconds.
2. Setup wizard for the boilers and cascade controls must be completed before proceeding with any additional configurations.
3. To enter the service level of the cascade control, press on the menu icon, select Service, and input the following password: viservice.

   To proceed to level 2 coding, select system

   configuration icon, select coding 2 and input the following password: viexpert

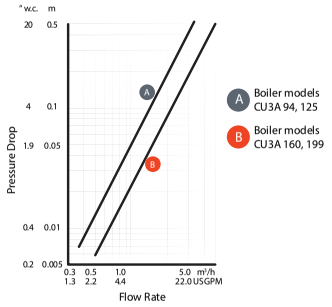
Vitocrossal CU3A — Application 9



Notes / Comments

1. Component Index on pages 5.
2. External flow check valves are not necessary if built into the circulators.
3. Since HC3 is separated from the system via a heat exchanger, an automatic fluid feeder may be desired.(*)
4. Based on recommended piping practices, a pressure relief valve should be installed on the secondary side of the heat exchanger.*

Pressure Drop / Pump Sizing



Application Code

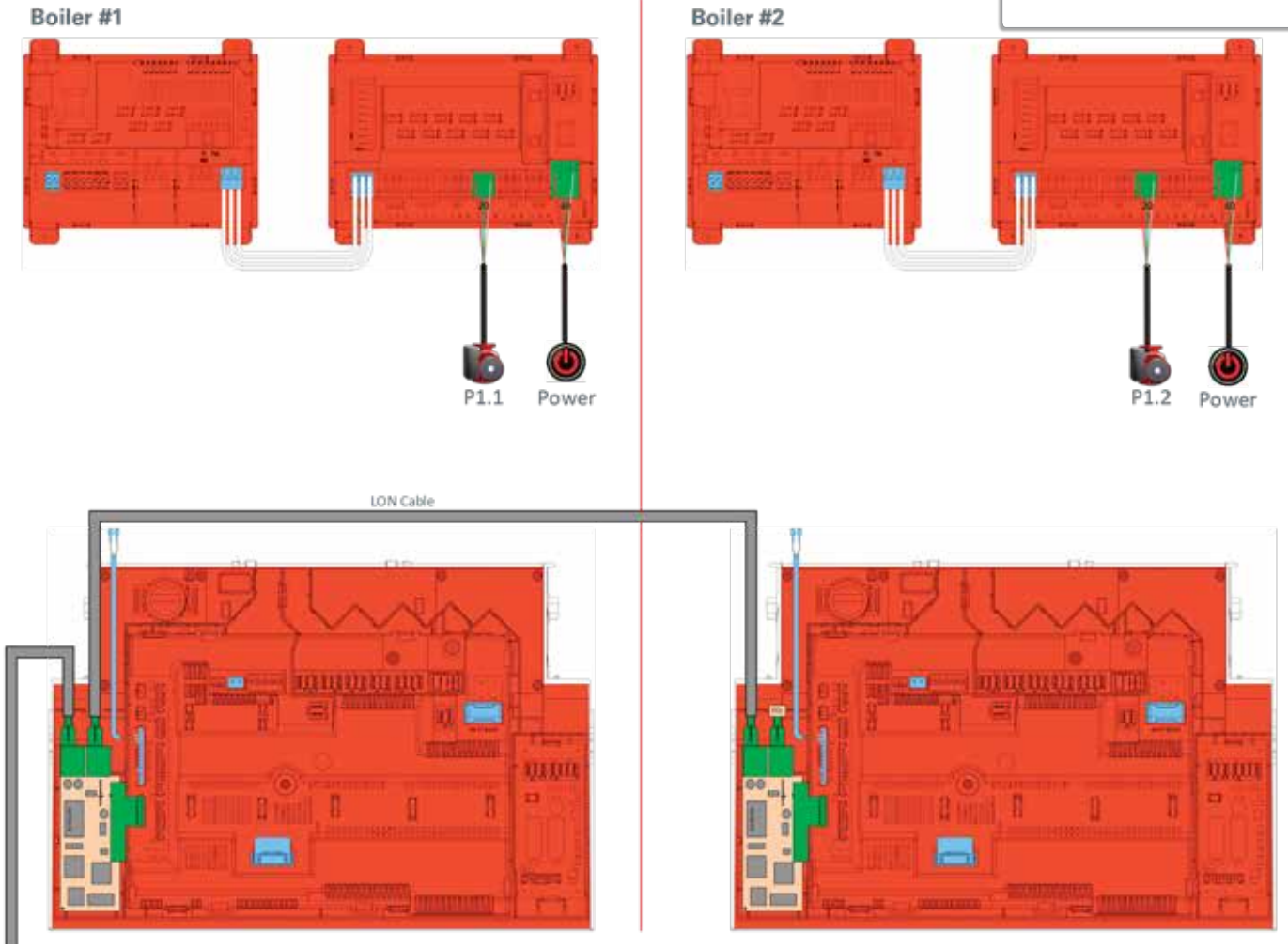
2CU3I 4HC4ZP.01

Application Code

2CU3I 4HC4ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, if using multiple circulators and mixing valve motors, isolation relays may be required.
2. Stroke direction of the mixing valve motors should be verified by an actuator test. Refer to the Installation and Service Manual of the Cascade Control.



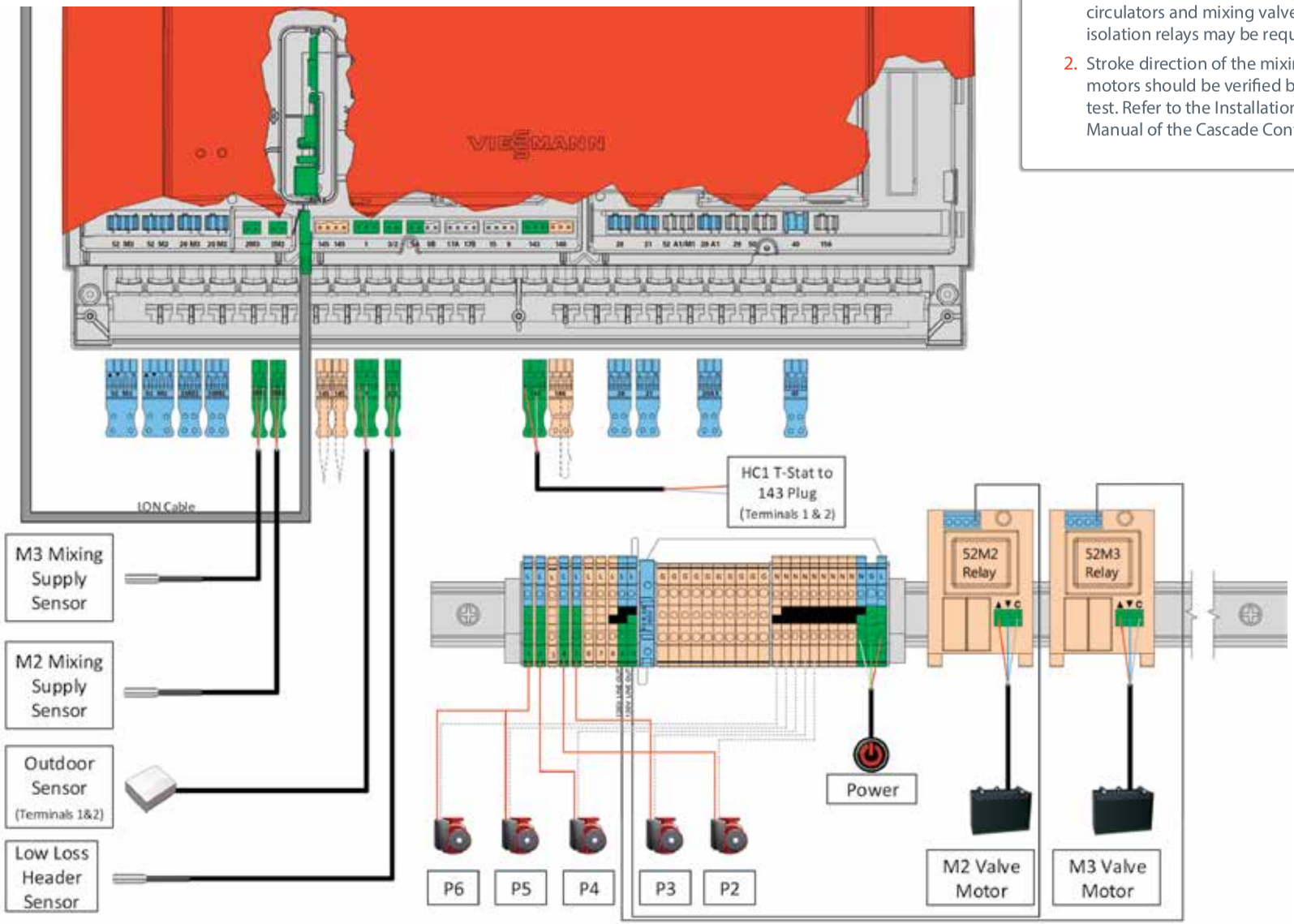
Application Code

2CU3I 4HC4ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, if using multiple circulators and mixing valve motors, isolation relays may be required.
2. Stroke direction of the mixing valve motors should be verified by an actuator test. Refer to the Installation and Service Manual of the Cascade Control.

MW2C Cascade Control



Application 9 Operational Setup Instructions

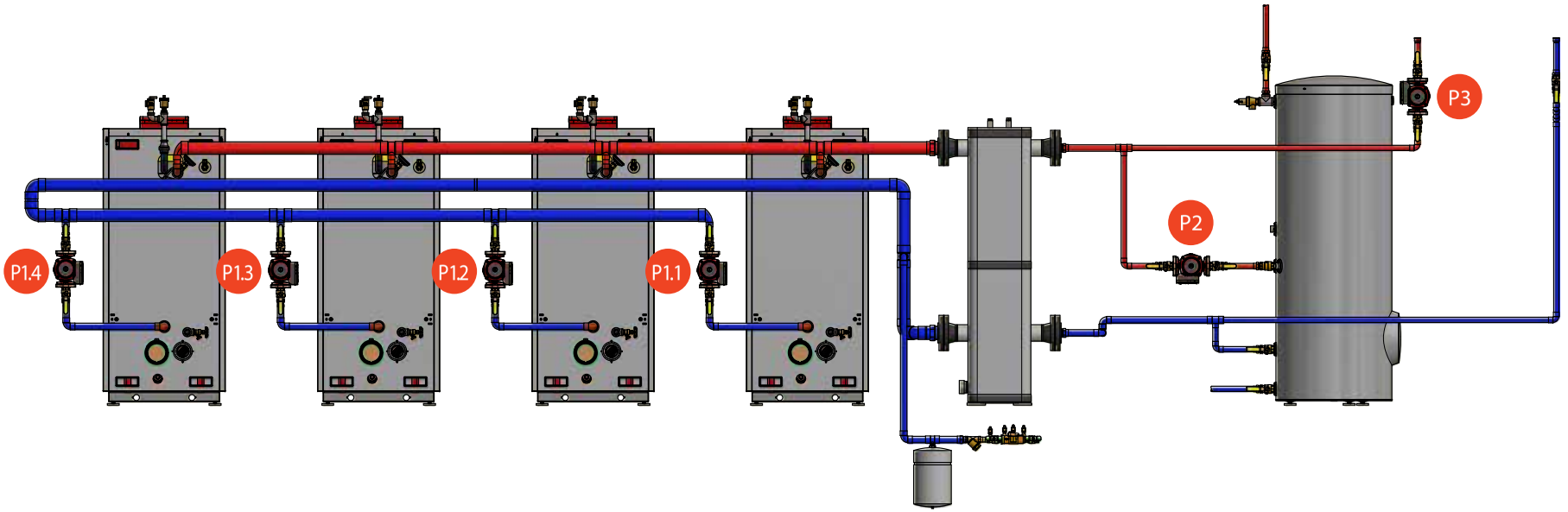
This application consists of a mid-temperature heat circuit, a low temperature heat circuit with motorized mixing valve, and a low temperature heat circuit with heat exchanger and mixing valve. This application is conducive to systems in which glycol must be incorporated for safety purposes. This multi-boiler configuration offers greater flexibility in system design as it allows for increased system turndown, boiler redundancy, increased BTU inputs, and simultaneous operation of the heating and DHW. As the cascade control targets the maximum temperature for the system, the mixing valves offer the added benefit of automatically adjusting the supply water temperature regardless of the water temperatures being supplied to the other heat circuits. Since this is all controlled by the cascade control, this makes for a simple, long lasting and efficient system. To set up this system, follow the steps below:

Type/Option	Step#	Description	Parameter	Set to:	Setup Location
Setup on each boiler	1	Set to multi-boiler mode	Service Function -> Select Multiboiler Application		Service Menu
	2	Set boiler number	07:	Set Boiler #	Set in Level 2 Coding
	3	Set LON participant number	77:	Set Boiler #	
	4	Set boiler pump function	37, address 8a needs to be set to 176	0	
Setup On Cascade Control	5	Complete participant check (For further instruction, refer to Installation & Service Manual)			Service Menu
	6	Assign thermostat to HC1	91	:01	Set in Level 2 Coding
	7	Remove pump post purge	F2	:00	
	8	Setup HC1 outdoor reset curve			Set In Heating Sub Menu
	9	Setup HC2 outdoor reset curve			
	10	Setup HC3 outdoor reset curve			
	11	Adjust HC1 heating schedule	--:--		
Optional Adjustments					
Set a Heating Schedule Set a DHW Schedule					Set In Heating Sub Menu

Notes/Comments

1. To enter service menu on the boiler you must hold the "OK" and ☰ buttons for 5 seconds.
2. Setup wizard for the boilers and cascade controls must be completed before proceeding with any additional configurations.
3. To enter the service level of the cascade control, press on the menu icon, select Service, and input the following password: viservice

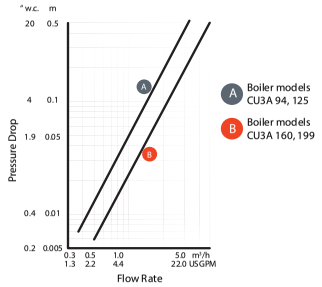
   To proceed to level 2 coding, select system configuration icon, select coding 2 and input the following password: viexpert



Notes / Comments

1. Component Index on pages 5.
2. External flow check valves are not necessary if integrated into the circulators.

Pressure Drop / Pump Sizing



Application Code

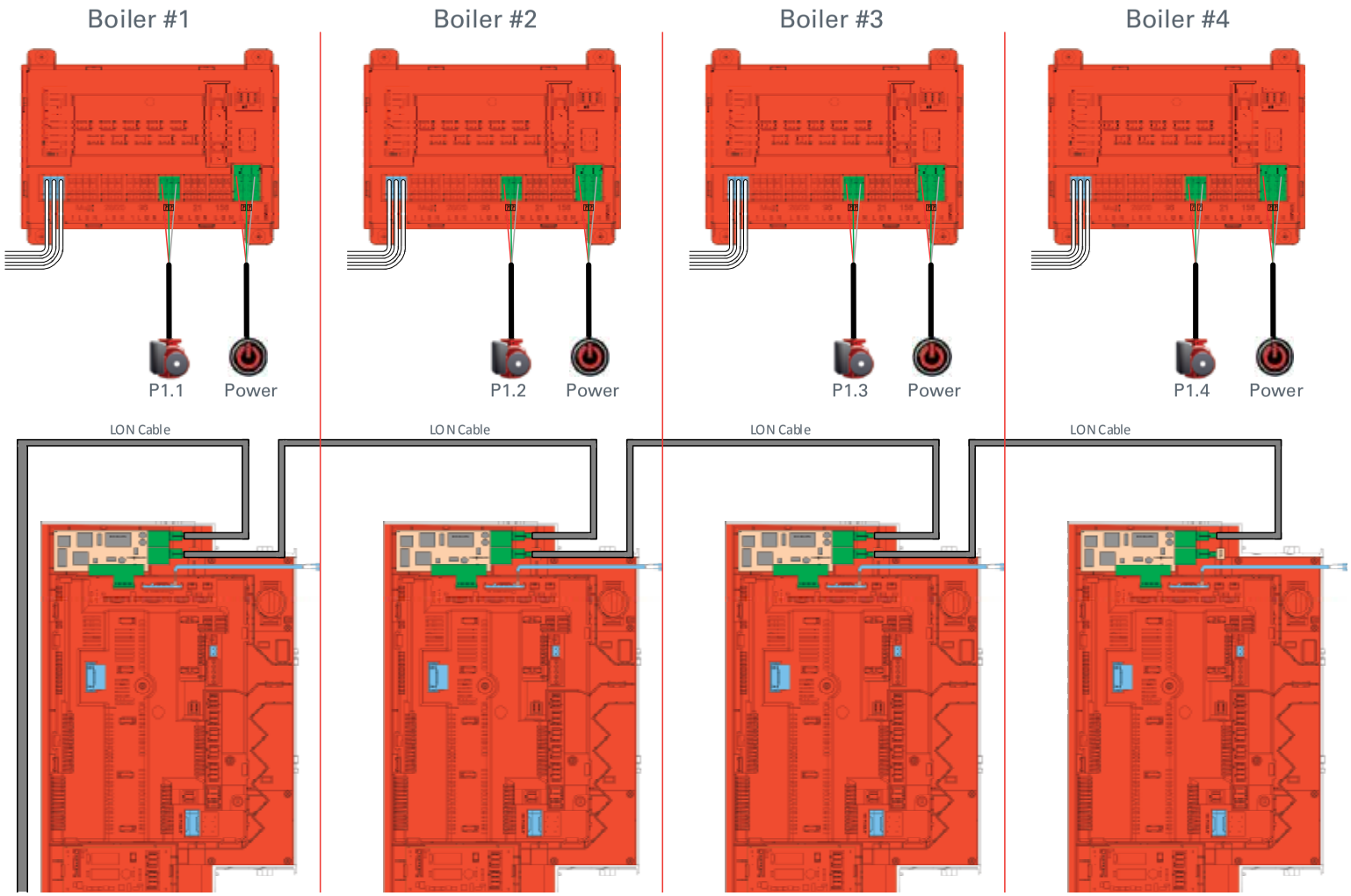
4CU3I 2HC2ZP.01

Application Code

4CU3I 2HC2ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, isolation relays may be required when current draw of field supplied components is exceeded.



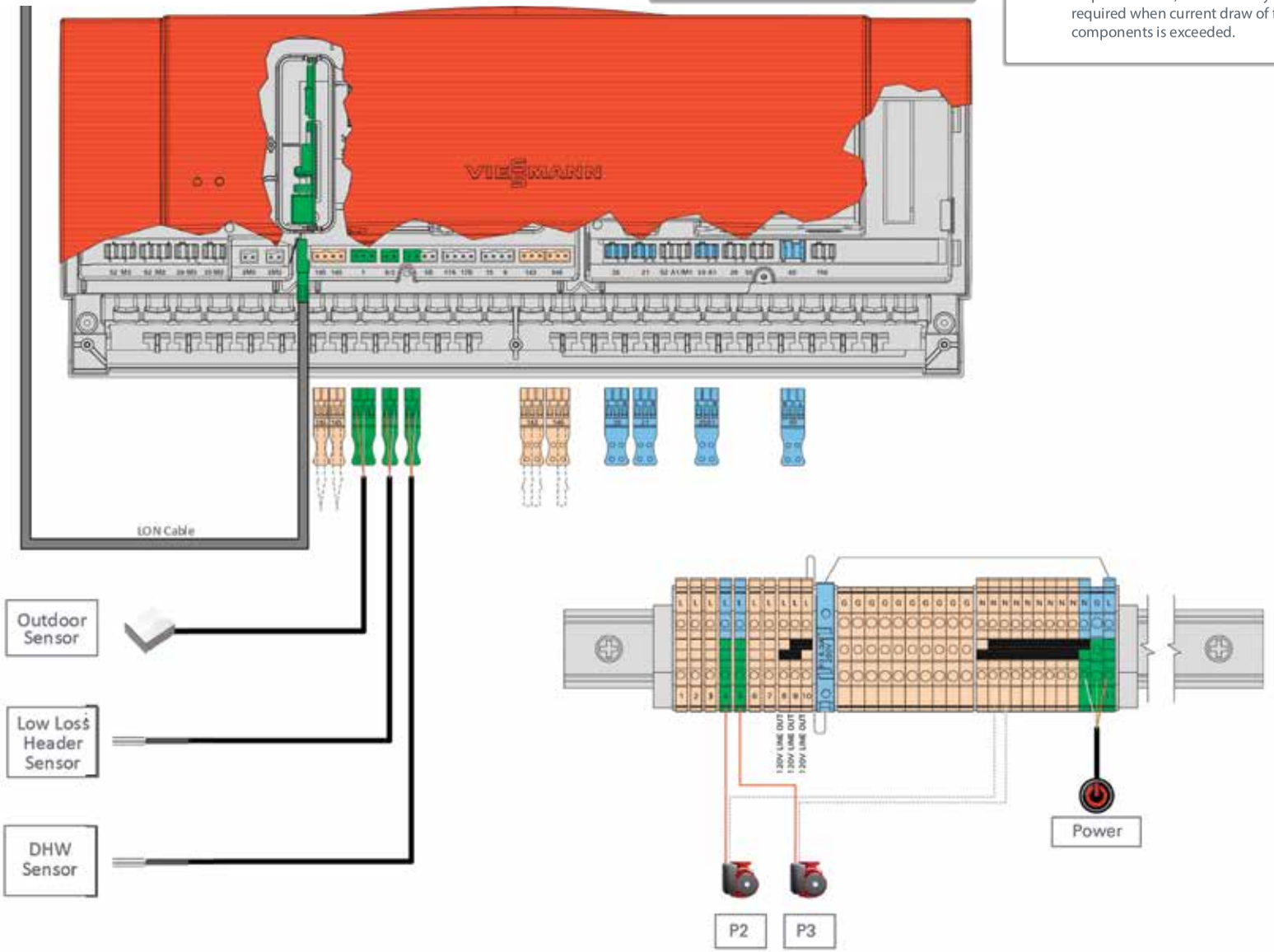
Application Code

4CU3I 2HC2ZP.01

Notes / Comments

1. Max amp load of the cascade control is 6 amps. Therefore, isolation relays may be required when current draw of field supplied components is exceeded.

MW2C Cascade Control



Application 10 Operational Setup Instructions

This application consists of a 4-boiler cascade, a single building loop and an indirect DHW. Designing a system in this way allows constant circulation of heated fluid throughout larger commercial buildings. This provides the ability to have unit specific heat emitters and controls to maximize the comfort within the building. The P3 circulator operates continuously until the outdoor temperature exceeds the warm weather shut down, at which time the boiler and circulators will all enter into a standby mode until the outdoor temperature drops or there is a demand for DHW. To set up this system, follow the steps below:

Type/Option	Step#	Description	Parameter	Set to:	Setup Location
Setup on each boiler	1	Set to multi-boiler mode	Service Function -> Select Multiboiler Application		Service Menu
	2	Set boiler number	07:	Set Boiler #	Set in Level 2 Coding
	3	Set LON participant number	77:	Set Boiler #	
	4	Set boiler pump function	37, set 8a to 176 first	0	
Setup On Cascade Control	5	Complete participant check (For further instruction, refer to Installation & Service Manual)			Service Menu
	8	Setup HC1 outdoor reset curve			Set In Heating Sub Menu
	9	Set DHW temperature			
	11	Adjust HC1 heating schedule	--:--		
Optional Adjustments					
Set a Heating Schedule Set a DHW Schedule					Set In Heating Sub Menu

Notes/Comments

1. To enter service menu on the boiler you must hold the "OK" and ☰ buttons for 5 seconds.
2. Setup wizard for the boilers and cascade controls must be completed before proceeding with any additional configurations.
3. To enter the service level of the cascade control, press on the menu icon, select Service, and input the following password: viservice

   To proceed to level 2 coding, select system configuration icon, select coding 2 and input the following password: viexpert

Application Rules & Formulas

Universal Hydronics Formula:

$$GPM = \frac{BTUH}{500 \times \Delta T} \qquad BTUH = GPM \times 500 \times \Delta T$$

Piping & Tubing Properties

Steel/Wrought Iron Pipe

Size	Content/ft (gal)	Max Flow Rate[1] (GPM)	Max Heat Carrying Capability (BTUH)[2]
1/2"	.016	4	40,000
3/4"	.028	7	70,000
1"	.045	12	120,000
1-1/4"	.078	20	200,000
1-1/2"	.106	28	280,000
2"	.174	44	440,000

*Based on a velocity of 4fpm
*Based on 20°F ΔT

Pex Tubing

Size	Content/ft (gal)	Max Flow Rate[1] (GPM)	Max Heat Carrying Capability (BTUH)[2]
1/2"	.009	2.3	23,000
5/8"	.013	3.3	33,000
3/4"	.018	4.6	46,000
1"	.030	7.5	75,000
1-1/4"	.046	11.2	112,000
1-1/2"	.105	15.6	156,000

*Based on a velocity of 4fpm
*Based on 20°F ΔT

Copper Tubing (Type L)

Size	Content/ft (gal)	Max Flow Rate[1] (GPM)	Max Heat Carrying Capability (BTUH)[2]
3/8"	.007	2	20,000
1/2"	.012	3.2	32,000
3/4"	.025	6.5	65,000
1"	.043	10.9	109,000
1-1/4"	.065	16.3	163,000
1-1/2"	.092	22.9	229,000
2"	.161	39.6	396,000

*Based on a velocity of 4fpm
*Based on 20°F ΔT

Quick Pipe Resistance Calculation:

1. Measure longest run of pipe
2. Add 50% for fittings
3. Multiply by .04

= A rough calculation on the feet of head the pump needs to overcome for that circuit.

Radiant Sizing:

Estimating Radiant Tubing

6" OC Qty = FT^2 of space x 2

12" OC Qty = FT^2 of space x 1.2

Estimating BTUH for Radiant

Floor Warming = 15-20 btuh/ft

Floor Heating = 35-50 btuh/ft

Expansion Tank Quick Sizer

Boiler Output	Finned Baseboard	Air Handler/ Unit Heater	Cast Radiator	Cast Iron Baseboard
25,000	15	15	15	15
50,000	15	15	30	30
75,000	30	30	30	60
100,000	30	30	60	60
125,000	30	60	60	90
150,000	30	60	90	90
175,000	60	60	30V	30V
200,000	60	90	30V	30V
250,000	60	90	30V	40V
300,000	90	30V	30V	40V

Buffer Tank Sizing

Minimum Tank Volume

$$\frac{\text{Boiler Run Time x (Min Boiler Firing Rate - Smallest Zone)}}{500 \times \Delta T}$$

Pool Sizing

Pool Capacity (gallons):

Circular Pool = Avg. Depth x Diameter^2 x 5.9

Rectangular Pool = Avg. Depth x Length x Width x 7.5

BTUH Requirement:

$$\text{BTUH} = \frac{\text{Pool Capacity x 8.34 x Temp Rise}}{\text{Hours to Heat Pool}}$$

Temp. Difference between pool temp and ambient air temp (°F)	10°	15°	20°	25°	30°
BTUH/Ft^2	105	158	210	263	368

This is Viessmann

The Viessmann Group is one of the world's leading manufacturers of heating and renewable energy systems. Family-owned since 1917, Prof. Dr. Martin Viessmann leads the company in its third generation. The group today employs over 11,400 employees worldwide and has a turnover of approx. 2.1 billion Euro. 27 manufacturing facilities in 11 countries, sales & distribution facilities in Germany and 74 other countries, and 120 sales offices worldwide provide customer proximity and a strong global presence. For three generations, Viessmann has been providing comfortable, efficient and environmentally-responsible heating solutions, tailored to the needs of the market. With ongoing research and development and a focus on product innovation, Viessmann has pioneered technologies that have continuously set standards and made the company into a technological innovator and pacesetter of the entire industry.

With the current comprehensive product range, Viessmann is offering a multi-level program of high-tech, state-of-the-art heating products. Wall-mounted gas-fired condensing boilers, floor-standing oil – or gas-fired hot water heating boilers, solar thermal systems, control technology and DHW storage tanks – all designed to achieve superior performance, reliability and energy savings.

Accountability for the environment and society, fairness when dealing with business partners as well as the pursuit of perfection and maximum efficiency in all business transactions are key values for Viessmann – as a company, and as individuals. This, together with the products and services we offer, allows us to offer our customers the benefit and added value of a strong brand.

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