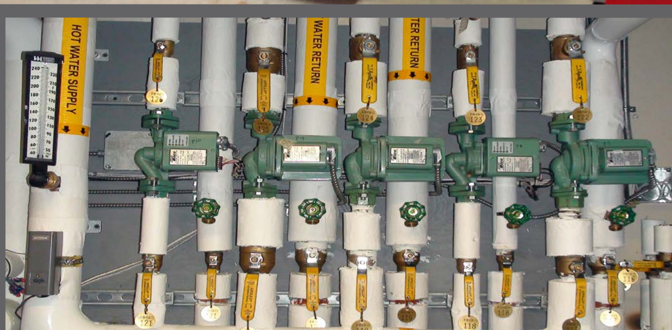
HEATING WITH WOOD

Wood Boiler Planning Guide

- Boiler Planning
- Plumbing Layouts
- Thermal Storage
- Clearances
- Wiring



fröling better heating

effecta

LK

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Wood Boiler Planning Guide

Tarm Biomass®-Improving the way you live!

Dear Valued Tarm Biomass® Customer

We at Tarm Biomass® want to make your installation go as smooth as possible. This document includes important design criteria including clearances, chimney requirements, thermal storage sizing, system concept diagrams, and wiring.

The system concepts shown in this guide are only examples and they should not substitute for complete system planning.

We reserve the right to make technical changes without prior notice.

For final specifications, please see product owner's manuals which supercede all guidance in this document.

If more information is needed, please contact your local Tarm Biomass® dealer or call us directly at 1-800-782-9927.

Thank You,

Tarm Biomass®

About Tarm Biomass®

Tarm Biomass®, is a third-generation, family-owned business that has pioneered the sales and service of high efficiency biomass boilers in North America for over 30 years.

Tarm Biomass'® primary objective is to offer innovative heating solutions, paired with a significant commitment to consumer education and environmental awareness. Exclusive partnerships with ISO 9001 certified manufacturers allows Tarm Biomass® to offer products with reliability and very high over-all efficiency, all while promoting the utilization of carbon-cycle biomass that is critical to the lowering of net greenhouse gas emissions.

Boiler Sizing

Sizing a boiler properly is critical for ensuring a problem-free installation. A boiler must not only be large enough to meet the heating needs of the building, but also meet the demands of those who tend it. A boiler that is too small may not keep up with a heating load or even if it can keep up, may still demand too much tending and too many fillings. A boiler that supplies more heat than the heating load demands will require a larger thermal storage tank to perform properly. While proper sizing of a boiler requires the heat loss analysis of a skilled installer, there are rules of thumb and other information that can help guide a sizing decision such as historical fuel usage, building size, type of heating system, any new or future building improvements, and/or the number of linear feet of radiant tubing or baseboard radiators. Installation of thermal storage significantly improves the liklihood that an over-sized wood boiler will meet heating loads while not operating inefficiently or in a way that will damage the boiler. The installer bears responsibility for proper boiler sizing.

Thermal Storage Tank Sizing

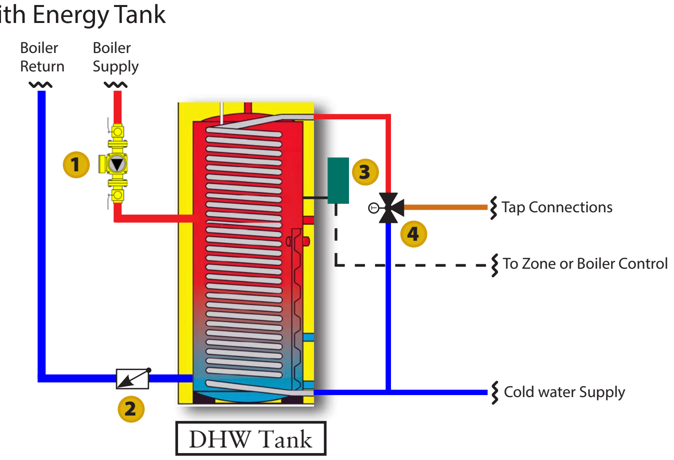
All wood boilers benefit from thermal storage. The most advanced and efficient wood boilers available are designed for use with thermal storage and will not perform to their design capability without thermal storage. Fot that reason all Tarm Biomass® wood boilers require thermal storage and it is important to size the storage tanks properly. A volume of 75-85 gallons of thermal storage per 10,000 Btu's of boiler output is ideal, though sometimes smaller volumes provide perfectly satisfactory operation. More thermal storage volume is almost always better. Added storage volume increases the number of hours or days between re-firing a boiler while allowing for less discretion about how much wood to load in the firebox each firing. Other factors to consider are boiler combustion chamber size, house characteristics, summer/shoulder season use, and lifestyle. At Tarm Biomass® we prefer pressurized thermal storage, but offer pressurized and unpressurized thermal storage options. For your convenience, there is a chart below that can be used to determine proper thermal storage sizing.

Tank Sizing (Minimum-Ideal)	
Boiler Model	Volume (gals)
Frõling S3 Turbo 30	400-800
Frõling S3 Turbo 50	600-1200
Effecta Smart 40	400-900
Effecta Smart 55	800-1200

Domestic Hot Water Production

Domestic hot water can be produced at the same time that building heat is provided by using an indirect hot water heater. A smaller tank than those used for thermal storage, an indirect hot water heater, is connected to your heating system like a heating zone. The wood boiler system or your back-up boiler heats potable water through a heat exchanger within the tank. This is a very energy efficient and effective way of producing hot water using renewable energy. At Tarm Biomass® we offer indirect hot water heating options with very large heat exchangers. These heaters provide instantaneous potable hot water at lower boiler water or thermal storage tank temperatures.

Domestic Hot Water Example with Energy Tank



Key:	
1	Circulator
2	Check Valve
3	DHW Aquastat
4	Thermostatic Mixing Valve

The Chimney

The chimney is one of the most critical factors in the successful operation of any wood boiler. A good chimney will provide a continuous and dependable draft to pull the exhaust gasses out of the appliance.

Flue gas exhaust temperature can be low enough to cause condensation in chimneys. Condensation will over time, damage a masonry chimney. Accordingly, installation of a stainless steel chimney liner (made with 304, 316, or 321 alloys) inside the chimney flue is worth considering. Chimneys located outside the warm envelope of a building are especially susceptible to down-drafting and condensation. "Outside" chimneys often benefit greatly from insulated stainless steel chimney liners.

The chimney draft must be stable. The top of the chimney must be 3 feet above the roof and 2 feet above any structure within 10 feet measured horizontally. Please refer to NFPA 211.

Boiler Data for Planning the Flue Gas System

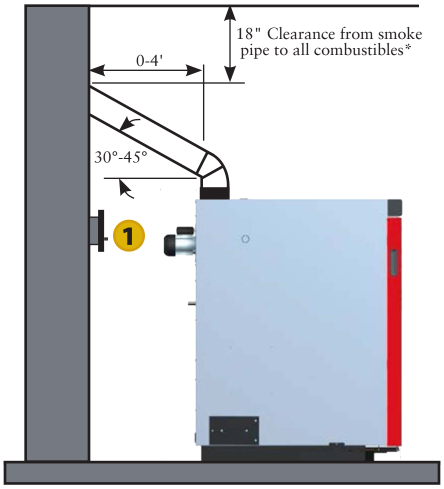
Chimney Data		Boiler Model			
Description	Unit	S3 Turbo 30	S3 Turbo 50	Smart 40	Smart 50
Minimum Draft	inches WC	.03	.03	.06	.06
Maximum Draft	inches WC	.10	.10	N/A	N/A
Flue Pipe Diameter	inches	6*	6*	6*	8*
Distance to center of flue	inches	63⅜-67½**	67⅜-71½**	56¾-57⅝**	59¾-60⅝**

*flue collar adaptor required. **measurement is based on type of flue connection used (refer to page 6).

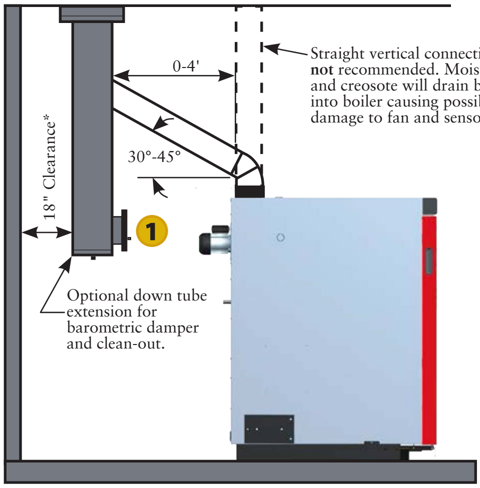
Chimney Connection

The smoke pipe connecting the boiler to the chimney flue must be black or stainless steel, have a minimum thickness of 24 gauge, and rise a minimum of ¼" per foot of run toward the chimney. Smoke pipe sections must be attached to one another with a minimum of three sheet metal screws and sealed with a high-temperature sealant such as high temperature silicone. The smoke pipe should not contain more than two 90° elbows (45° elbows are preferred over 90° elbows).

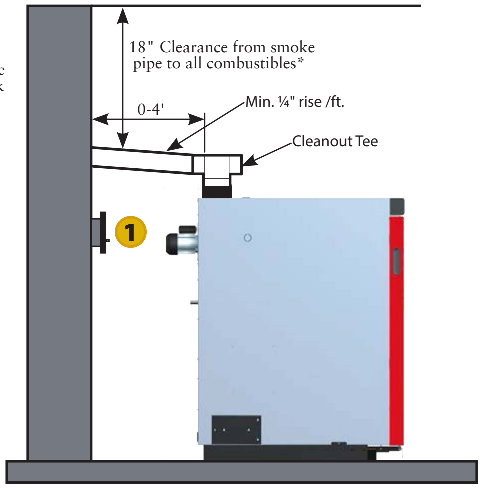
A barometric draft regulator is installed only when there is the presence of excessive or irregular draft. A strong natural draft can cause the boiler to continue burning when the draft fan is off. This is highly unlikely with boilers connected to a thermal storage system because the draft fan should rarely be off. If however, an irregular draft is present a barometric draft regulator can be installed. Boilers with an induced draft fan must have a sealed chimney connection to prevent ash and dust from penetrating into the room. A barometric draft regulator should be installed in postion **1** as shown in the images below. With the barometric draft regulator installed below the flue connection it is not in the air flow path of the boiler and is on the negative pressure side of the connection.



Boiler connected to chimney with connecting flue at 30-45° to help prevent ash build-up in flue.



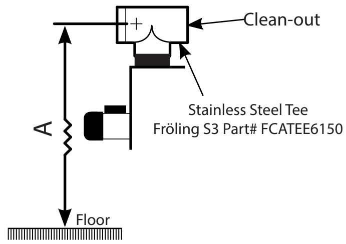
Boiler connected to manufactured chimney.



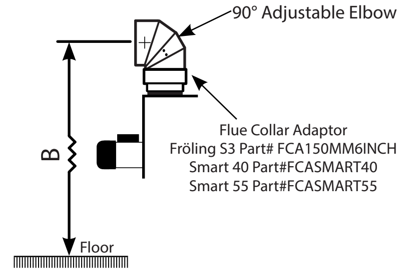
Boiler connected to chimney with minimum ¼" rise per foot. A cleanout tee is recommended for easy ash cleanout.

*18" clearance to combustibles for single-wall pipe. If manufactured chimney is installed, use manufacturers recomended clearance to combustibles.

Smoke Pipe Connection Options



Option A



Option B

Height to Center of Flue Connection		Boiler Model			
Measurement	Units	S3 Turbo 30	S3 Turbo 50	Smart 40	Smart 55
Option A	inches	63⅜	67⅜	Coming Soon	Coming Soon
Option B	inches	66⅞	70⅞	56¾	59¾

Outside Combustion Air

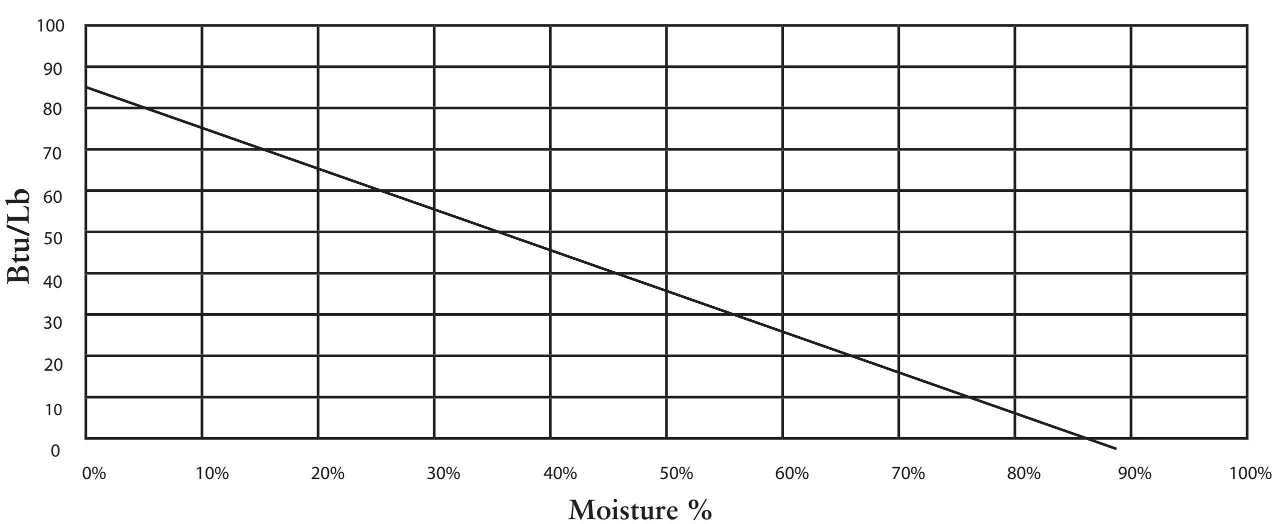
Provision for outside combustion air may be neccessary to ensure that the wood burning appliance does not discharge products of combustion into the building. Guidelines to determine the need for additional combustion air may not be adequate for every situation. If in doubt, it is advisable to provide additional air. The Canadian ANSI/NFPA requirement is 1 in^2, per 1,000 Btu/hr. The European ÖNORM H 5170 standard states that all fan-assisted boilers need a supply cross section of 2 cm^2 per kW (.3 in^2 per 3412 Btu/hr) of rated output. Please follow all applicable local codes.

Electrical Connection

The Fröling S3 Turbo requires a 240 VAC, 4-wire power supply. The electrical connection should be from a dedicated 15 amp circuit breaker. Effecta Smart wood boilers require a 120 VAC, 60 Hz power supply. A dedicated 15 Amp circuit is recommended.

Wood Fuel

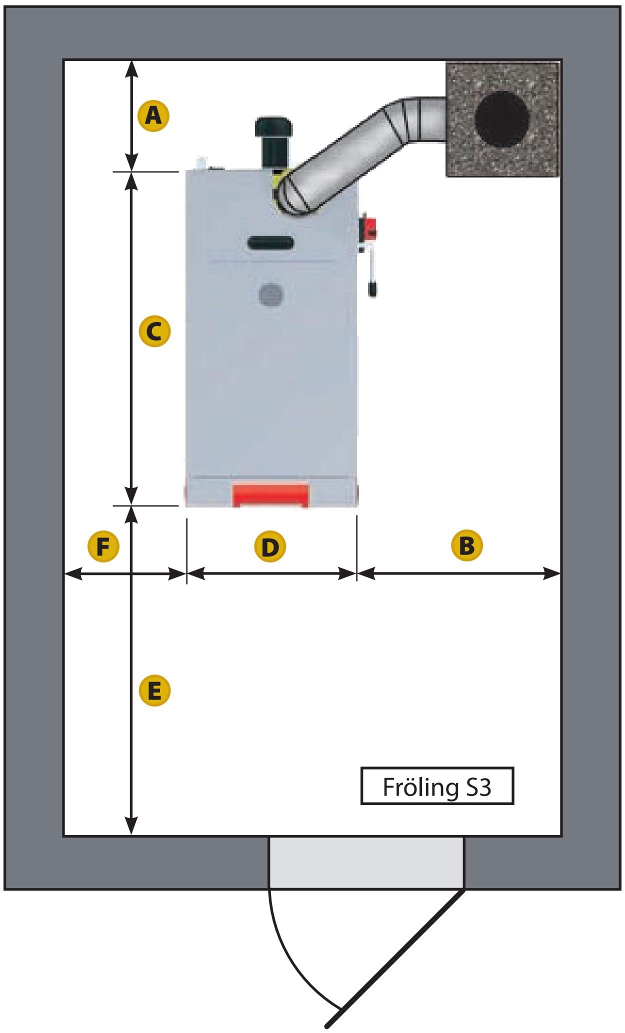
Preparing firewood properly is very important. A common mistake is acquiring firewood too late to allow adequate time for proper drying. A drying time of one to two years is required to properly dry firewood, especially for dense wood species like oak and maple. Tarm Biomass® wood boilers are designed to burn clean, dry cord wood. They can burn any species that is cut and split into pieces not larger than 4-6" thick with lengths between 18-20". Oak ideally is not burned as the only source of wood for long periods because of its high tannic acid content. When oak is the predominant species available, try to mix it with other species. The wood must be dry, with a moisture content between 15-25% (15-18% being ideal). In addition to increasing the likelihood of generating creosote in the boiler and chimney, burning wet wood uses a substantial amount of available energy in the wood to evaporate the water present in the wood, reducing the available energy for heat (see the chart below). Properly preparing, stacking, and covering firewood will result in much less labor in the long run.

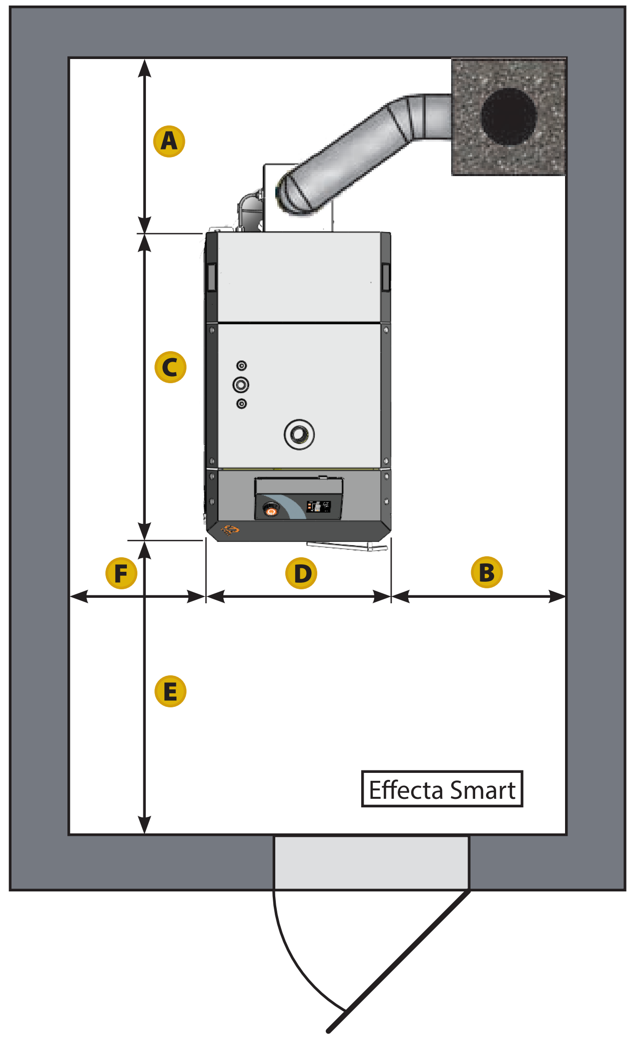


Locating the Boiler and Boiler Clearances

Boilers must be installed with the **minimum installation clearances** to combustible materials outlined below. Clearances may only be reduced by means approved by the regulatory authorities.

- Fröling and Effecta boilers are not suitable for outdoor installation. They must be located in a weather-tight protected space. Conditioned spaces are recommended.
- Boilers must be placed on level, non combustible floors, such as concrete slabs on earth. If boilers are placed 8" above the floor it may be easier to load and to clean.
- If boilers are placed near inhabited room, so that flue gas can penetrate into these rooms, a carbon monoxide alarm must be installed.
- Chimney flue clearances may supercede boiler clearances.





Clearances to Combustibles		Boiler Model			
Measurement	Units	S3 Turbo 30	S3 Turbo 50	Smart 40	Smart 55
A-Backwall to Appliance	inches	14	14	12	12
B-Sidewall to Appliance* (S3 actuator and door side)	inches	32	32	20	20
C-Boiler Depth	inches	45½	50¼	39	41¼
D-Boiler Width	inches	22½	27	23½	29½
E-Distance in Front of Boiler	inches	36	36	36	36
F-Sidewall to Appliance*	inches	9	9	6	6
G-Ceiling to Appliance	inches	24	24	24	24

*Minimum clearance to combustibles are shown. Additional clearance may be desireable for service and maintenance.

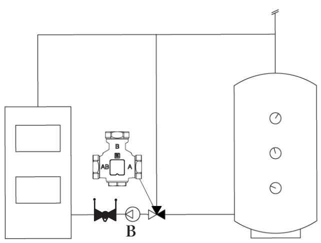
Thermostatic Loading Valve/Unit

A thermostatic loading valve/unit must be incorporated into every wood/pellet storage tank installation. The loading valve/unit is installed to ensure optimal temperature stratification in the thermal storage system and a high return temperature back to the boiler. This increases the efficiency of the boiler system and prevents condensation and creosote within the boiler, which helps prolong the life of the boiler.

Installation and Function

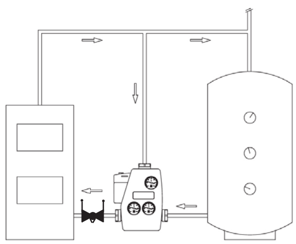
The thermostatic element in the loading valve/unit prevents return of cold return water to the boiler. When the boiler reaches operating temperature, return flow from the system is allowed. As the boiler reaches temperatures above 160° F, the valve/loading unit gradually opens, blending hot boiler water with the cold return water. Once system temperature equalizes (approximately 176° F), the Termovar opens fully to allow flow to and from the heating load (the building and/ or storage tank system).

Two Solutions Available



LK 823 ThermoVar Mixing Valve

Unlike the LK 820, the LK 823 regulates two ports. A balancing valve is not required. When the valve exceeds the nominal opening temperature by 10° C the supply port closes ensuring optimal flow rate through the valve. A circulator (B) must be installed controlled by the boiler or by temperature with an aquastat.



LK 810 ThermoMat Loading Unit

The easiest to install option. The LK 810 loading unit combines all the features of the LK 823 with the boiler's circulator. It saves time and space with installation and also includes insulation and temperature gauges on all three ports.

Pipe Sizing

It is crucial to install the proper size pipe between the wood boiler and the thermal storage tank system. Most residential systems are designed for a 20° F temperature drop. In a wood system the temperature drop between the supply and return can range between 10-40° F based on the temperature of the thermal storage tank. The thermostatic mixing valve will guarentee at least a return temperature of 135° F. As the thermal storage tank temperature gets closer to boiler operating temperature the the temperature drop will decrease. Use the chart below to properly size the pipe size.

Pipe Flow Rates (Based on Copper Piping)

Pipe Size (inches)	Maximum Flow Rate (GPM)	Maximum BTU/Hr at a Temperature Drop of:			
		10° F	20° F	30° F	40° F
1"	9	45,000	90,000	135,000	180,000
1¼"	15	75,000	150,000	225,000	300,000
1½"	20	100,000	200,000	300,000	400,000
2"	35	175,000	350,000	525,000	700,000

Adjusting Flow Rates

A balancing valve with built-in flow meter like the one pictured enables precise and simple adjustment. The volume flow rate is measured in gallons per minute (GPM). The volume flow rate value can be set using the scale of the meter integrated into the bypass. There is only flow through the bypass if the handle is pulled. If the systems are not balanced correctly, there is the possibility of excessive high flow volume through the boiler, which results in a relatively low temperature difference between the boiler flow and return. Flowsettes are also useful diagnostic tools.

Recommended Wood Boiler Flow Rates

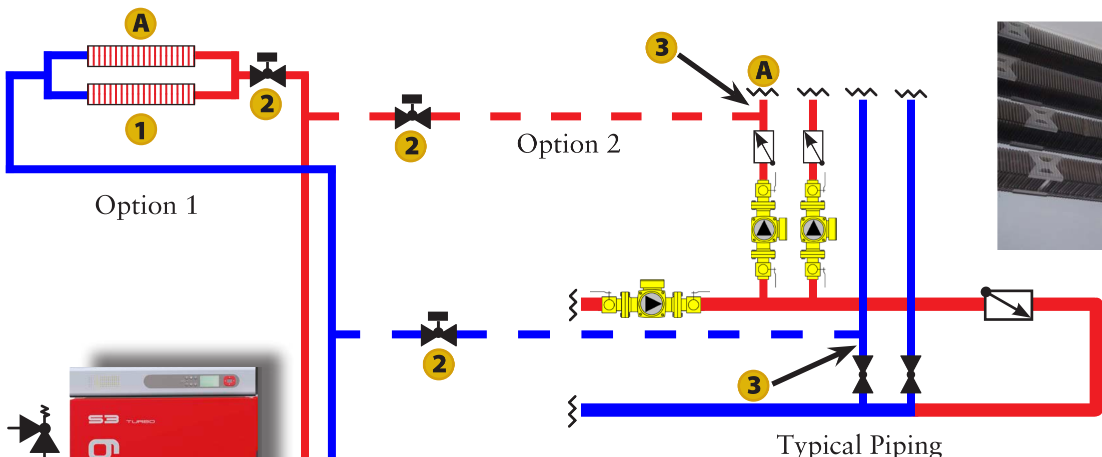
Use the chart below for recommended starting points for maximum volume flow through the boiler.

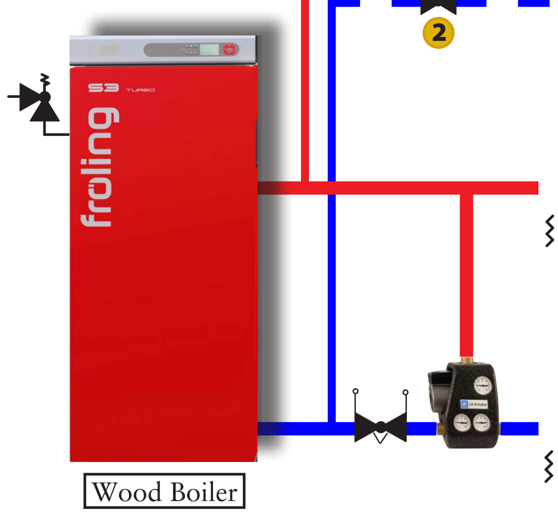
Required Flow Rate		Wood Boiler Model			
ΔT	Units	Frӧling S3 Turbo 30	Effecta Smart 40	Frӧling S3 Turbo 50	Effecta Smart 55
20º F	gpm	13	16	20	22

Overheat Loop with Loss of Power

The piping and controls must be connected to the boiler in such a way that in the event of a power failure there is at least one loop of radiation available for gravity circulation. This loop must not be obstructed by any valves or other fittings which could prevent gravity circulation during a power failure. The piping is plumbed in such a way that excessive pressure will not be developed in any portion of the boiler or system. The loop must be large enough to dissipate 10-20% of the boiler's maximum rated heat output, assuming an ambient temperature temperature of 65° F (18° C) and a mean water boiler temperature of 180° F (82° C).

The minimum pipe size for this loop is ¾" (1"is recommended) and if possible, the loop should be located and pitched to maximize natural thermal convection of the water. The loop must be positioned above the boiler. The design of the loop must be such that it can be made inoperative only in a deliberate manual action. If large enough, an existing heating radiation zone may be used for the over-heat loop. The loop must be equipped with a zone valve which will open automatically during a power failure. We recommend **AutoMag Zone Valves** for this application (offered as an accessory).





Option 1: A seperate zone (**1**) above the boiler usually in the ceiling or on the wall of the boiler room. One Automag zone valve (**2**) mounted horizontally on the supply or return line.

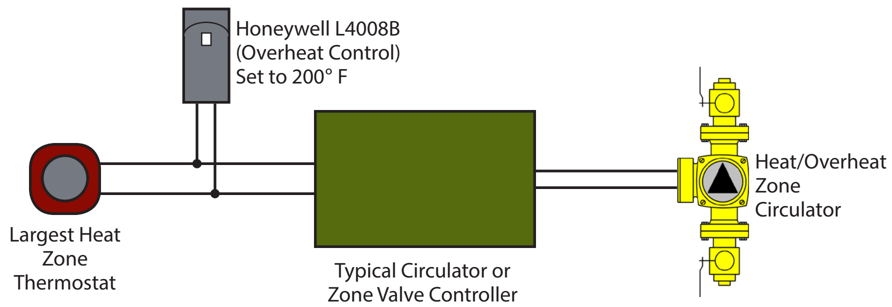
Option 2: Utilizing an existing heating zone in the house that is above the boiler that is large enough to dissipate 10-20% of the boiler's maximum rated heat output. This must be a high temperature zone (180° F (82° C). Two Automag zone valves (**2**) are required one each on the supply and return line. This is to prevent ghost flow during normal operation. Supply and Return connections to the zone must be connected after any restrictive components like check valves and circulators (**3**).

Suggested Minimum Baseboard Length (In Feet)	
Boiler Output	A
30kW (100,000 BTU/Hr)	20*
40kW (136,500 BTU/Hr)	25*
50kW (172,000 BTU/Hr)	30*
55kW (188,000 BTU/Hr)	40*

* These are only suggested lengths, the installer is responsible for final specifications. The overheat loop should be tested periodically, especially if the system has been serviced.

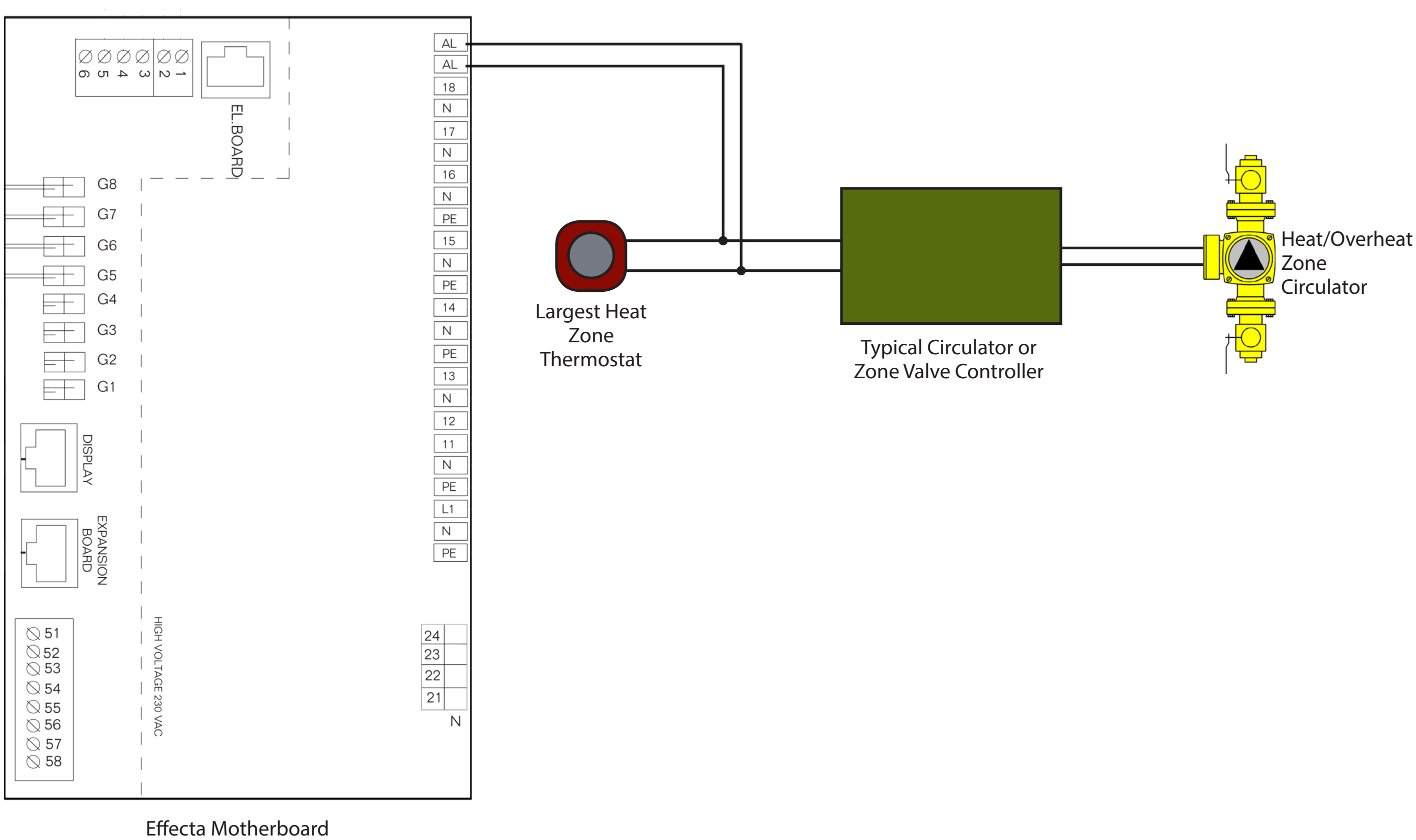
Overheat Aquastat Wiring Connections

Tarm Biomass wood boilers require the use of a zone in the event the boiler overheats. The zone must be able to take hot water and must not be controlled by a mixing valve (i.e. radiant floor zone). A HONEYWELL L4008b close-on-rise or equivalent aquastat is used to start a pump to begin cooling the boiler. If an existing zone of heat is suitable for use as a dump zone, the L4008b can be wired in parallel with the thermostat on the zone with the most heating capacity in the main living area (dump zone). Upon reaching the aquastat set point (200° F), the dump zone will be activated, pulling heat away from the boiler. The home owner is alerted to a potential problem with the boiler by an overly warm living space. Use the wiring diagram below for a typical installation.



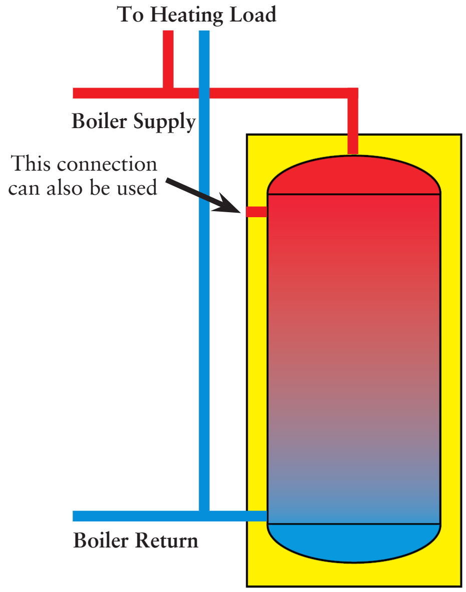
Effecta Smart Overheat Wiring Connections

With the Effecta Smart wood boiler the above can be used or the Alarm contacts can be utilized. This function must be activated under the Effect Control Menu. The boiler must have Software Version 2.6 or higher.

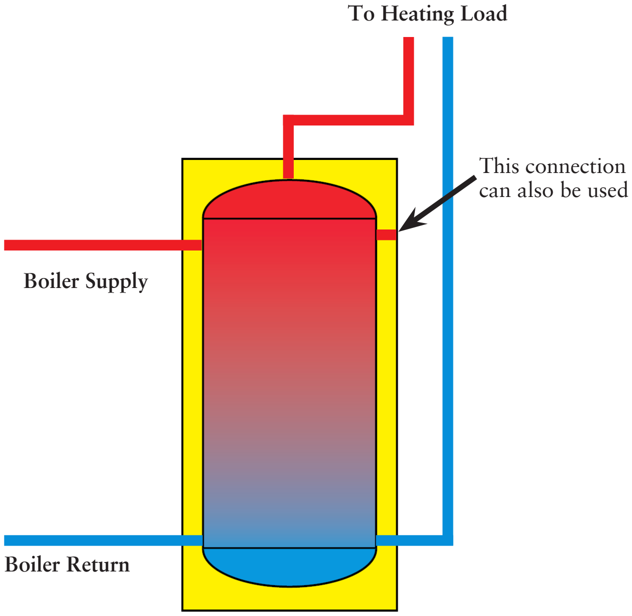


Pipe Connections at the Thermal Storage Tank

Single Tank Connections



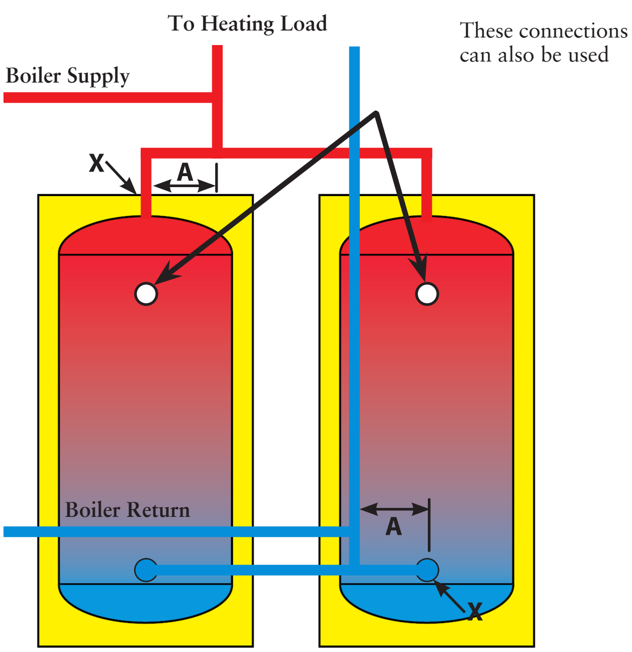
Example A



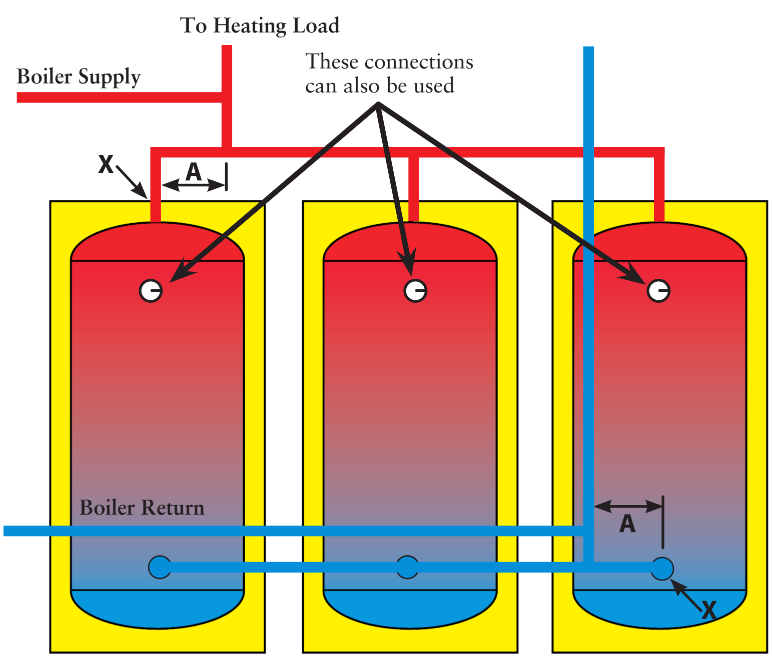
Example B

The above examples represent the best ways to pipe to a single pressurized thermal storage tank. Example **A** is piped to two connections on the tank. Supply and return connections to the heating load are pulled off before the tank. In example **B**, the wood boiler is piped to one side of the tank and the heating load is piped on the other side. The tank now acts as a large hydraulic seperator.

Multiple Tank Connections



Note: "A" distance must be equal
Example C



Note: "A" distance must be equal
Example D

The above examples show multiple tank connections. The tanks are manifolded together. To guarantee equal flow through the tanks, it is important to use approximately the same pipe length to the tanks. This is accomplished by connecting to the tanks diagonally (X-X). When piped this way the tanks act as one. Sometimes this is called reverse return piping.

System Integration
Controlling Flow

It is important to have a balanced system. Heat being produced by the wood boiler needs to be able to move to the heating circuits and thermal storage tanks efficently. Most homes have multiple zones with some of the zones being small or the heating system is using low temperature water as with radiant floor heat or panel radiators. This means the heating system is only taking a small portion of the heat being produced by the wood boiler. The solution for this problem is to integrate a 3-way diverting valve or a temperature controlled mixing valve. These valves will provide the proper amount of flow to the heating system while still allowng flow to the tank for charging, preventing the boiler from short-cycling.

LK 821 DIVERTING VALVE

LK 821 Diverting Valve is a 3-way thermostatic valve designed to change the direction of flow based upon the temperature of the water. When the valve senses return water 165° F and above, it moves (shunts) flow back through the port connected to the heating zones. If the return temperature is below 165° F it opens the port to the wood boiler and thermal storage tank allowing the heating system to receive hot water. The result is both the heating zones and the termal storage tank receives heat from the boiler preventing short-cycling of the boiler and an overall more efficient system and responsive heating system. The Tarm Biomass Boiler Tank Control can be used to control the back-up boiler. When the heating system is controlled with zone valves, an energy efficent circulator can be utilized.

LK SMART COMFORT

LK Armatur Smart Comfort is a simple, patent pending, energy efficient option that replaces the diverting valve with a mixing valve and an active temperature controller with outdoor reset capabilities. The LK Armatur Smart Comfort valve responds to outdoor or indoor temperature to send the proper water temperature to the heating zones. Minimum and maximum temperatures along a curve can be set. An energy efficient circulator can also be utilized providing the correct flow. The LK Armatur Smart Comfort extends the energy capacity of the thermal storage tank system while making the house more comfortable. A Tarm Biomass Boiler Tank Control Switch or aquastat responding to tank temperature can be used to control a back-up boiler.

LK Smart Comfort is available in three models:
LK 110 Smart Comfort-includes outdoor sensor.
LK 120 Smart Comfort-includes indoor sensor.
LK 130 Smart Comfort-includes indoor and outdoor sensor.

BOILER TANK CONTROL

Boiler Tank Control System (BLT) is the perfect option for integrating into an existing heating system or for heating systems that require high temperature water like heat exchangers used in forced hot air systems. The heart of the system is the BLT Switch control with three mode operation: automatic back-up, back-up only, or wood only modes.


LK 840 MIXING VALVE

LK 840 ThermoMix Valve is a 3-way valve that can be used as a mixing valve or as a diverting valve in heating systems.
The valve can be mounted at any angle. The LK 840 TheromMix can easily be adapted for right or left hand mounting.
The LK 840 is offered in sizes ranging between ¾" to 2".

How it works:

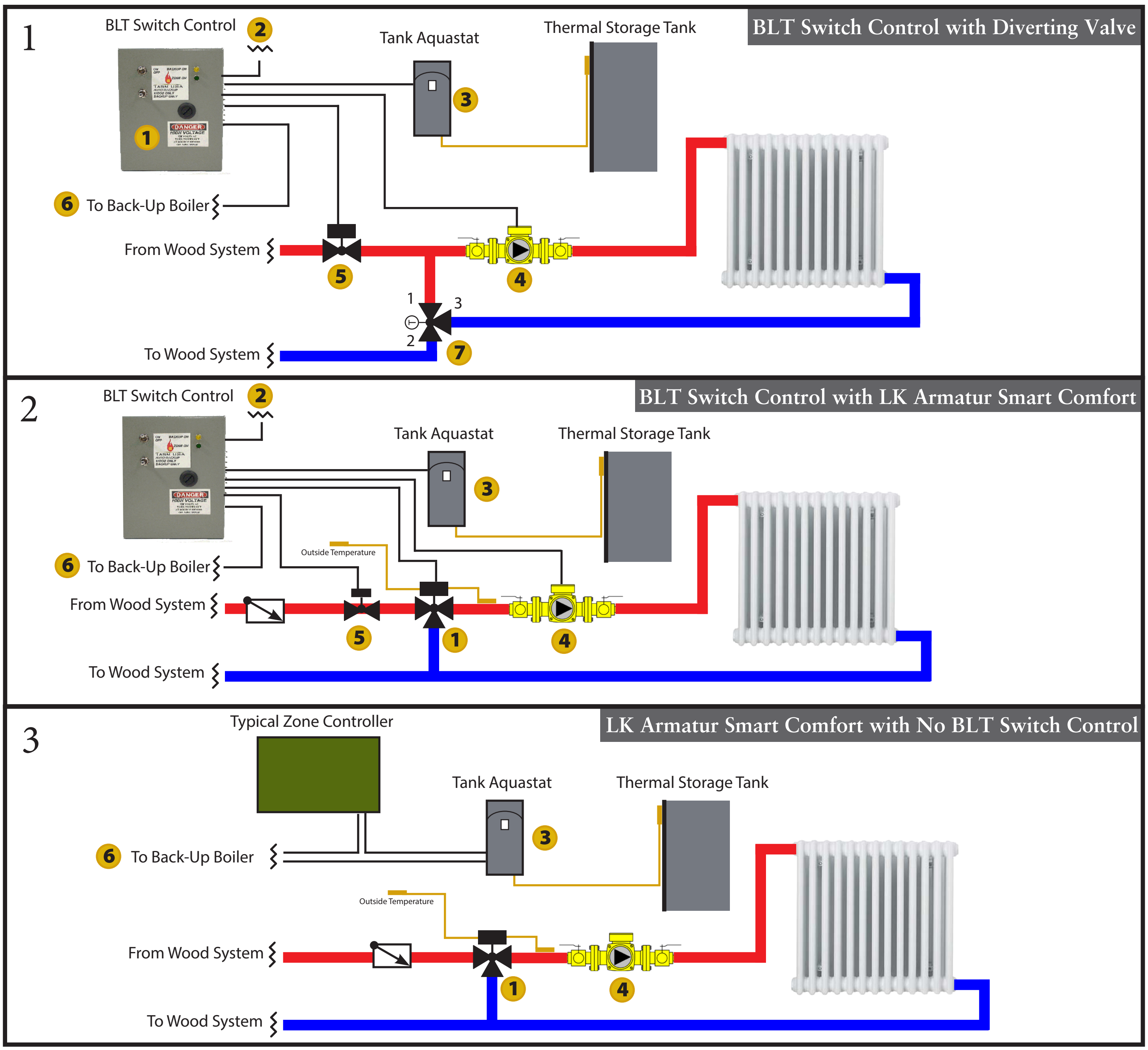
Option One: BLT Switch Control with Diverting Valve-The BLT Switch control (1) takes input from a zone relay control (thermostat call) (2) and determines based on thermal storage tank temperature (tank aquastat) (3) whether to pull heat from the storage tank system/woodboiler or the back-up boiler (6). If however, upon a call for heat, the temperature in the thermal storage tank is below the tank aquastat set point, the circulator (4) will cease operation. The zone valve (5) will close. The back-up boiler will be energized through the BLT Switch control to meet the heat demand (8).

The diverting valve (7). Port 3 of the valve receives water from the return manifold. Port 1 is connected to the supply manifold and Port 2 is connected to the return of the boiler and the thermal storage tank system. When the thermostatic valve senses water above 165° F and above, it shunts water from Port 2 to Port 1. The result is both the heating zones and the thermal storage tank receive hot water from the boiler. This prevents short-cycling of the boiler and an overall more efficient system and responsive heating system.

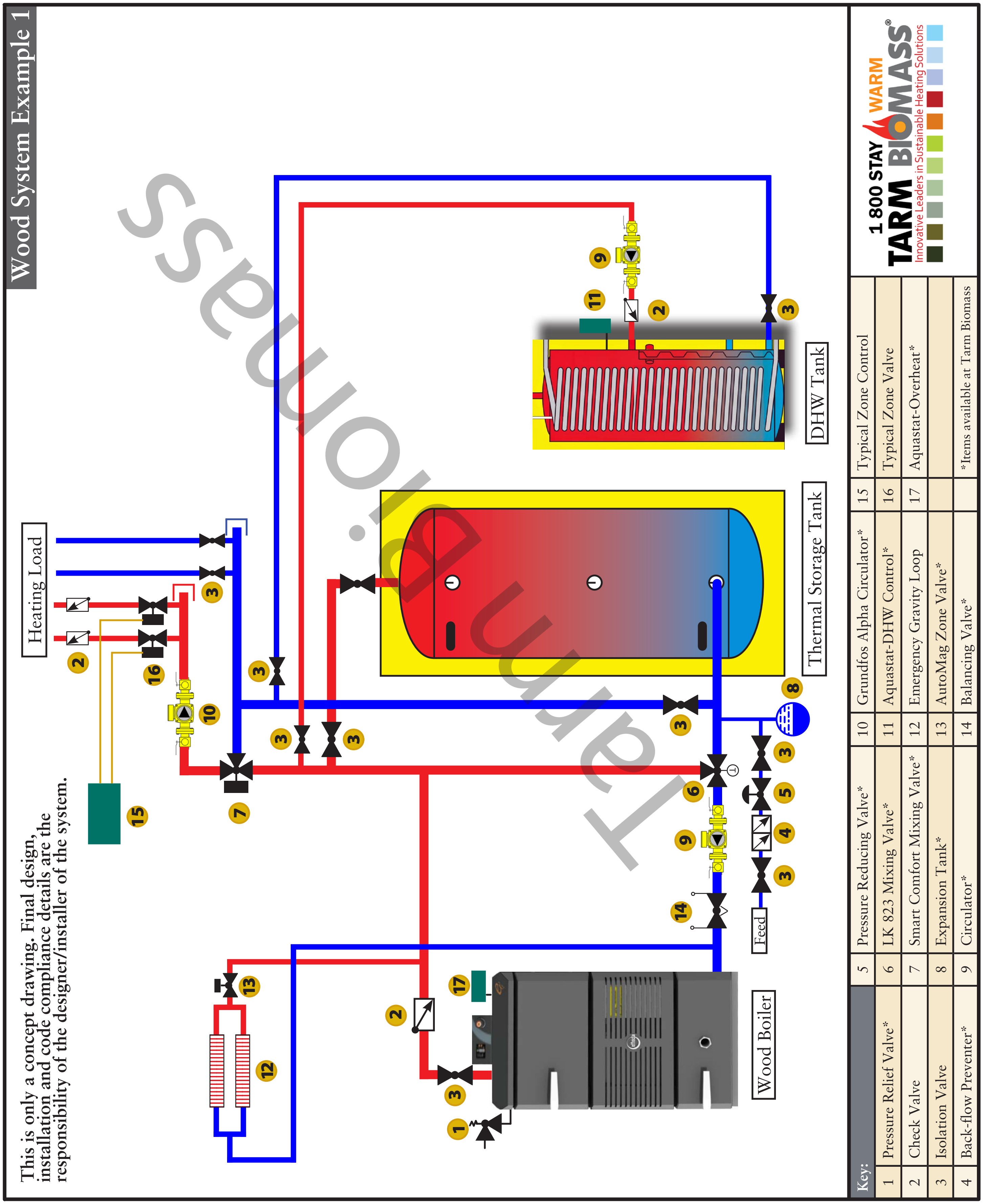
Option Two: Boiler Tank Control System with Smart Comfort-It is the same as **option one** except the diverting valve is replaced with the LK Armatur Smart Comfort (1).

Option Three: Similar to Option Two, but without the BLT Switch Control. This system works well with Grundfos Alpha circulator or other ΔP circulators and zone valves. With no BLT Switch Control you lose the Wood Only function.

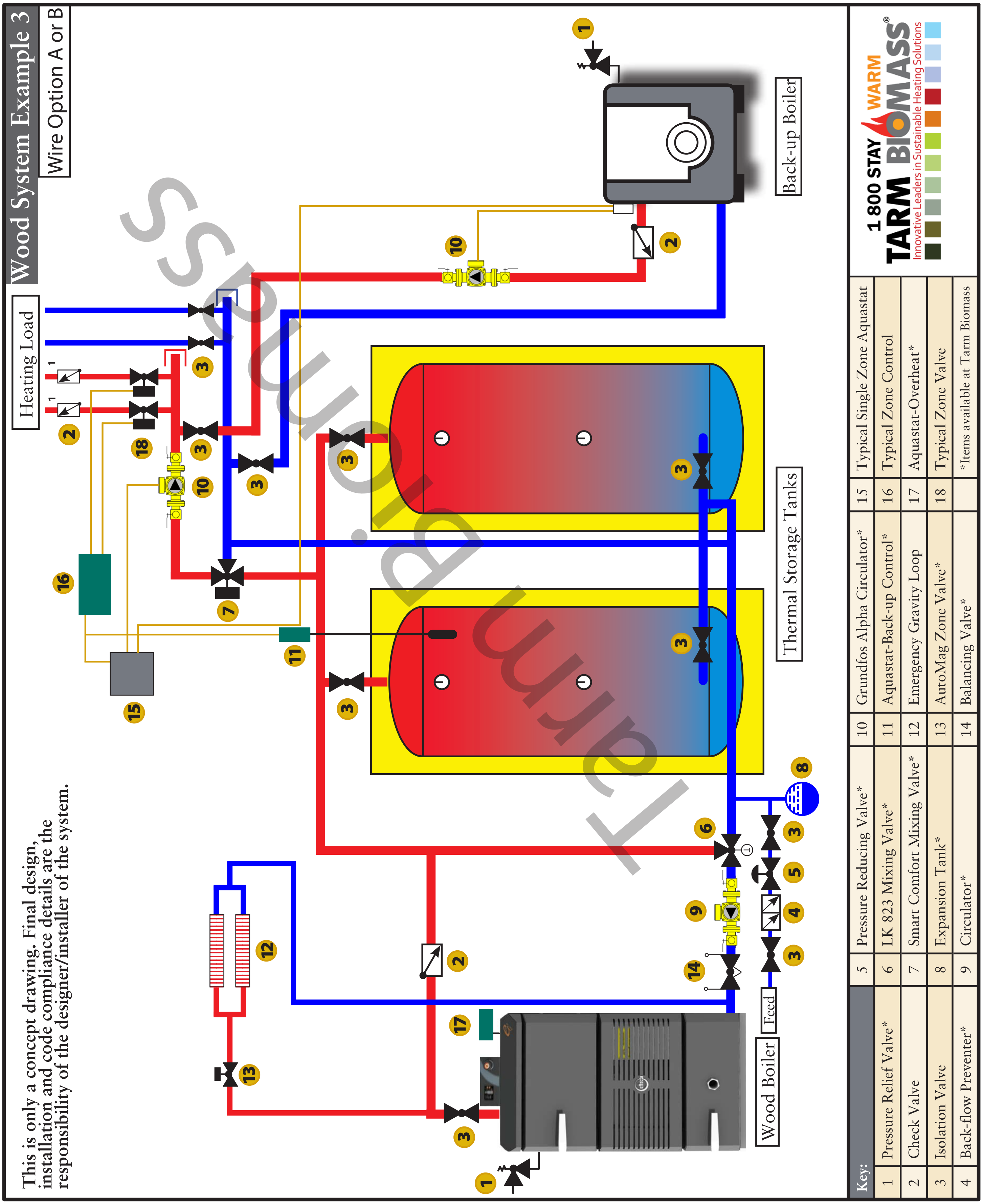
Refer to **Appendix A** for wiring options.



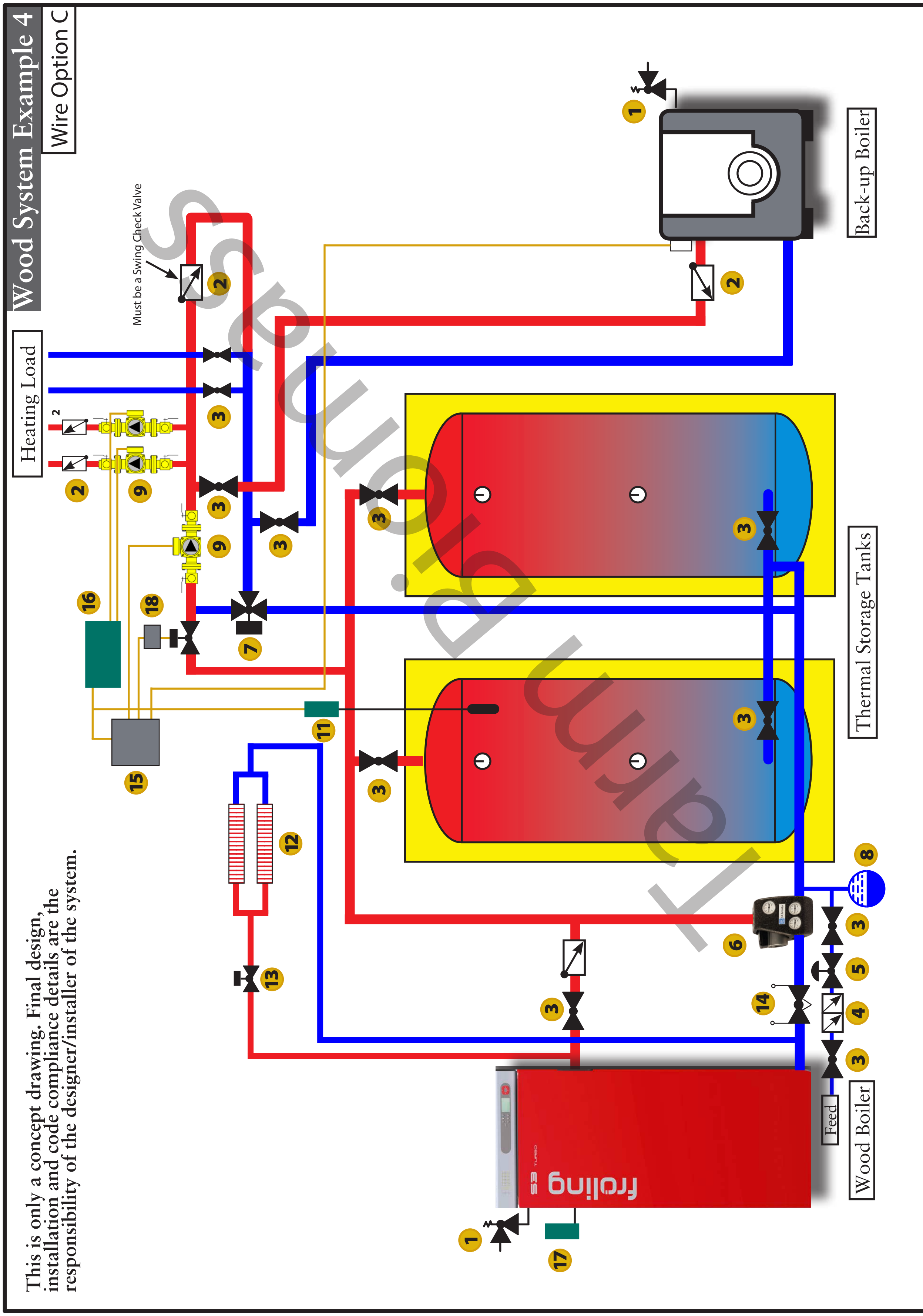
Wood System Example 1 - Single tank with no back-up boiler. Very simple and efficient design using the LK Smart Comfort Control, ΔT circulator, and zone valves.



Wood System Example 3 - Multiple tanks with back-up boiler. This design can also be used with single or three tank configurations. This Option does not use the BLTCONTROL. Use wire option A or B.



Wood System Example 4 - Multiple tanks with back-up boiler. This design can also be used with single or three tank configurations. This design is using the LK Smart Comfort Control. Use wire option C.



Key:	5	Pressure Reducing Valve*	10	Full Port Zone Valve (ZV1)*	15	Typical Single Zone Aquastat
1 Pressure Relief Valve*	6	LK 810 Loading Unit*	11	Aquastat-Back-up Control*	16	Typical Zone Control
2 Check Valve	7	Smart Comfort Mixing Valve*	12	Emergency Gravity Loop	17	Aquastat-Overheat*
3 Isolation Valve	8	Expansion Tank*	13	AutoMag Zone Valve*	18	24V Transformer*
4 Back-flow Preventer*	9	Circulator*	14	Balancing Valve*		*Items available at Tarm Biomass

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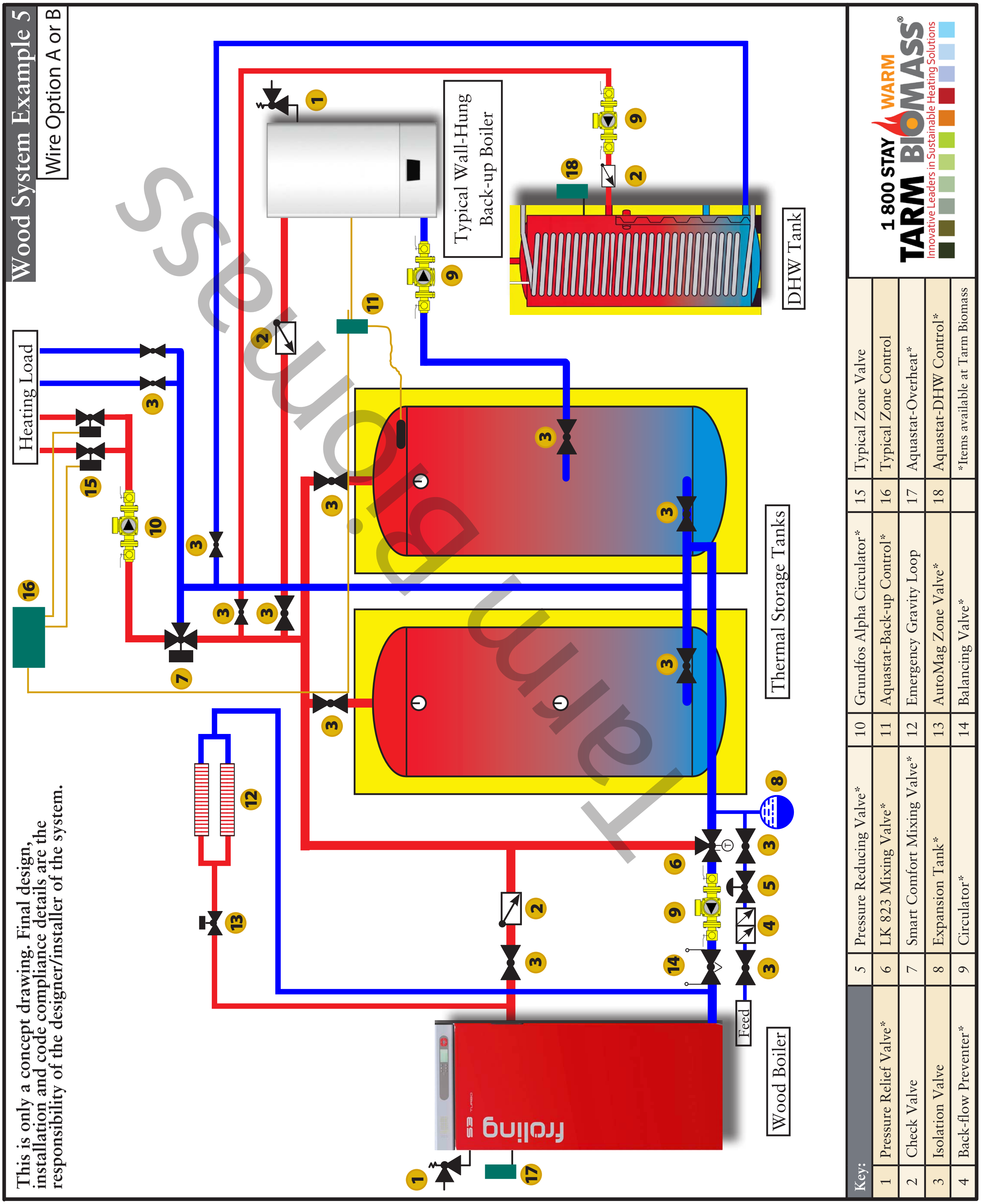
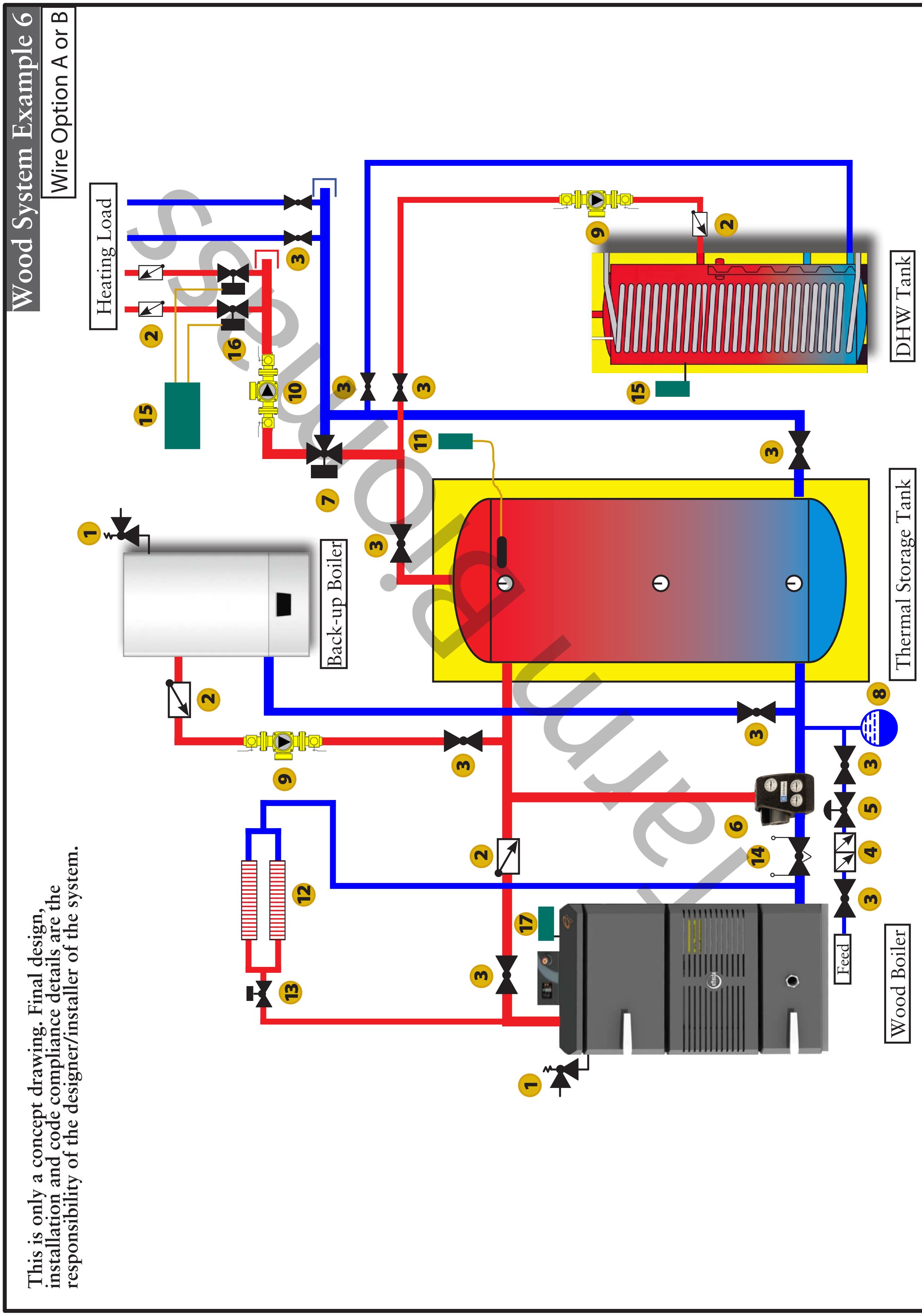
Wood System Example 5 - Multiple tanks with wall-hung back-up boiler. Use wire option A or B. This design can also be used with single or three tank configurations. Very simple and efficient design using the LK Smart Comfort Control, ΔT circulator, and zone valves. Use wire option A or B.



Wood System Example 6 - Single tank with wall hung back-up boiler (single tank option only). This design is using the LK Smart Comfort Control. Use wire option A or B.



Key:			
	5 Pressure Reducing Valve*	10 Grundfos Alpha Circulator*	15 Typical Zone Control
1 Pressure Relief Valve*	6 LK 823 Mixing Valve*	11 Aquastat-Back-up Control*	16 Typical Zone Valve
2 Check Valve	7 Smart Comfort Mixing Valve*	12 Emergency Gravity Loop	17 Aquastat-Overheat*
3 Isolation Valve	8 Expansion Tank*	13 AutoMag Zone Valve*	
4 Back-flow Preventer*	9 Circulator*	14 Balancing Valve*	*Items available at Tarm Biomass

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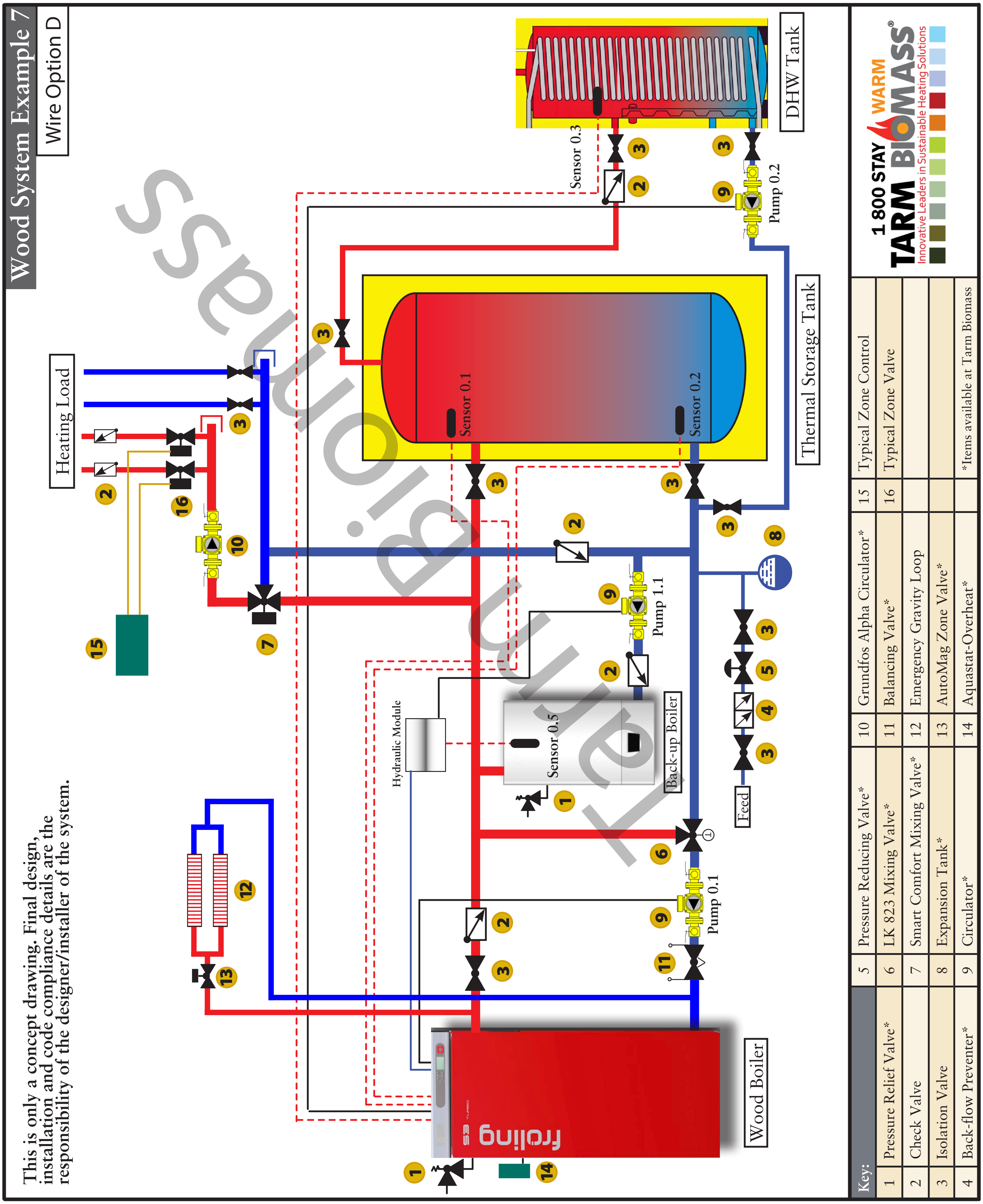
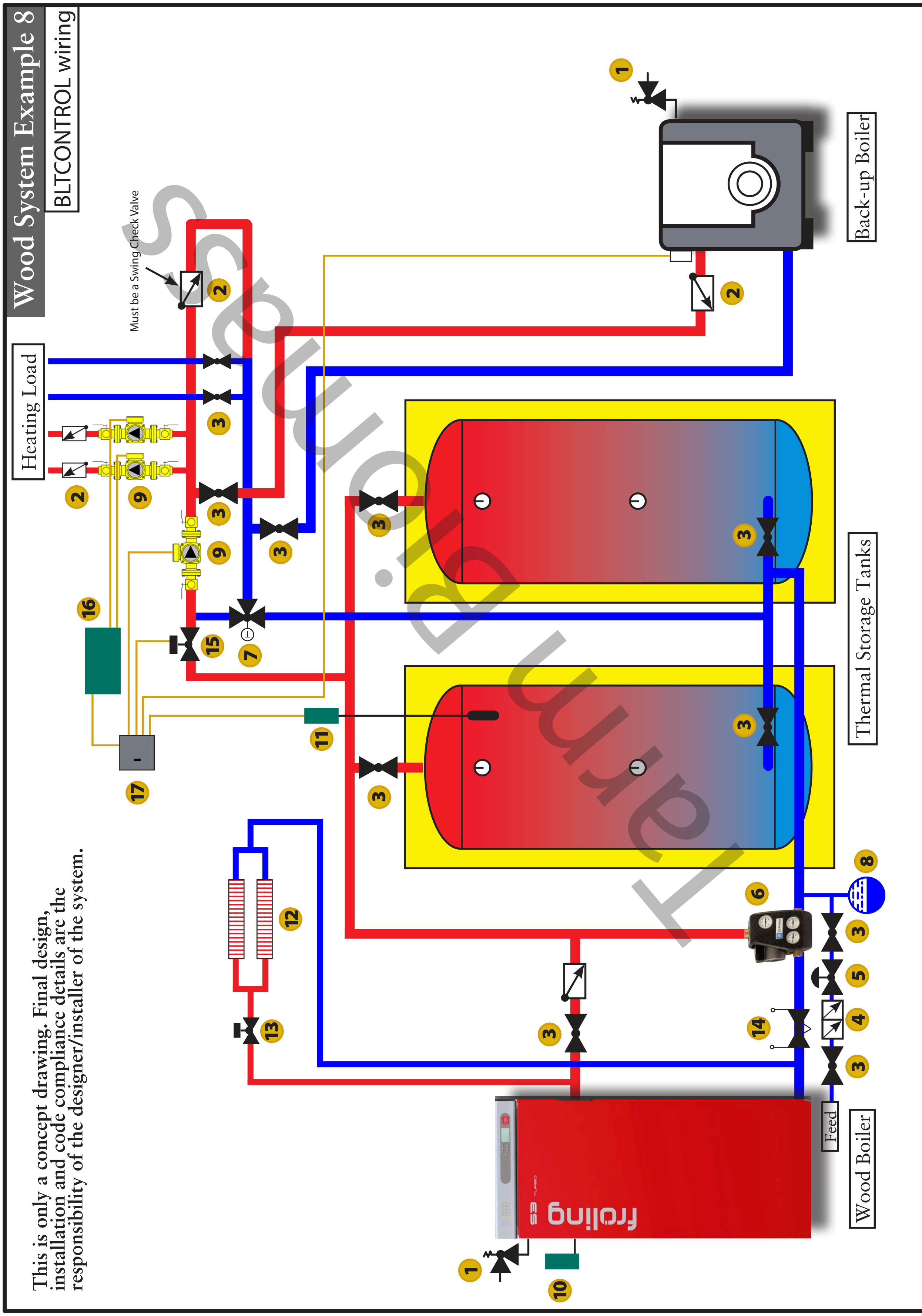
Wood System Example 7 - Fröling S3 Lambdatronic controlled option. Back-up boiler and indirect water heater is controlled by the Lambdatronic control. Solar is also an option. Use wire option D.



Key:			
	5 Pressure Reducing Valve*	10 Grundfos Alpha Circulator*	15 Typical Zone Control
1 Pressure Relief Valve*	6 LK 823 Mixing Valve*	11 Balancing Valve*	16 Typical Zone Valve
2 Check Valve	7 Smart Comfort Mixing Valve*	12 Emergency Gravity Loop	
3 Isolation Valve	8 Expansion Tank*	13 AutoMag Zone Valve*	
4 Back-flow Preventer*	9 Circulator*	14 Aquastat-Overheat*	*Items available at Tarm Biomass

Wood System Example 8 - Multiple tanks with back-up boiler using BLTCONTROL. Zones are using circulators. This design can also be used with single or three tank configurations. Use BLTCONTROL wiring.



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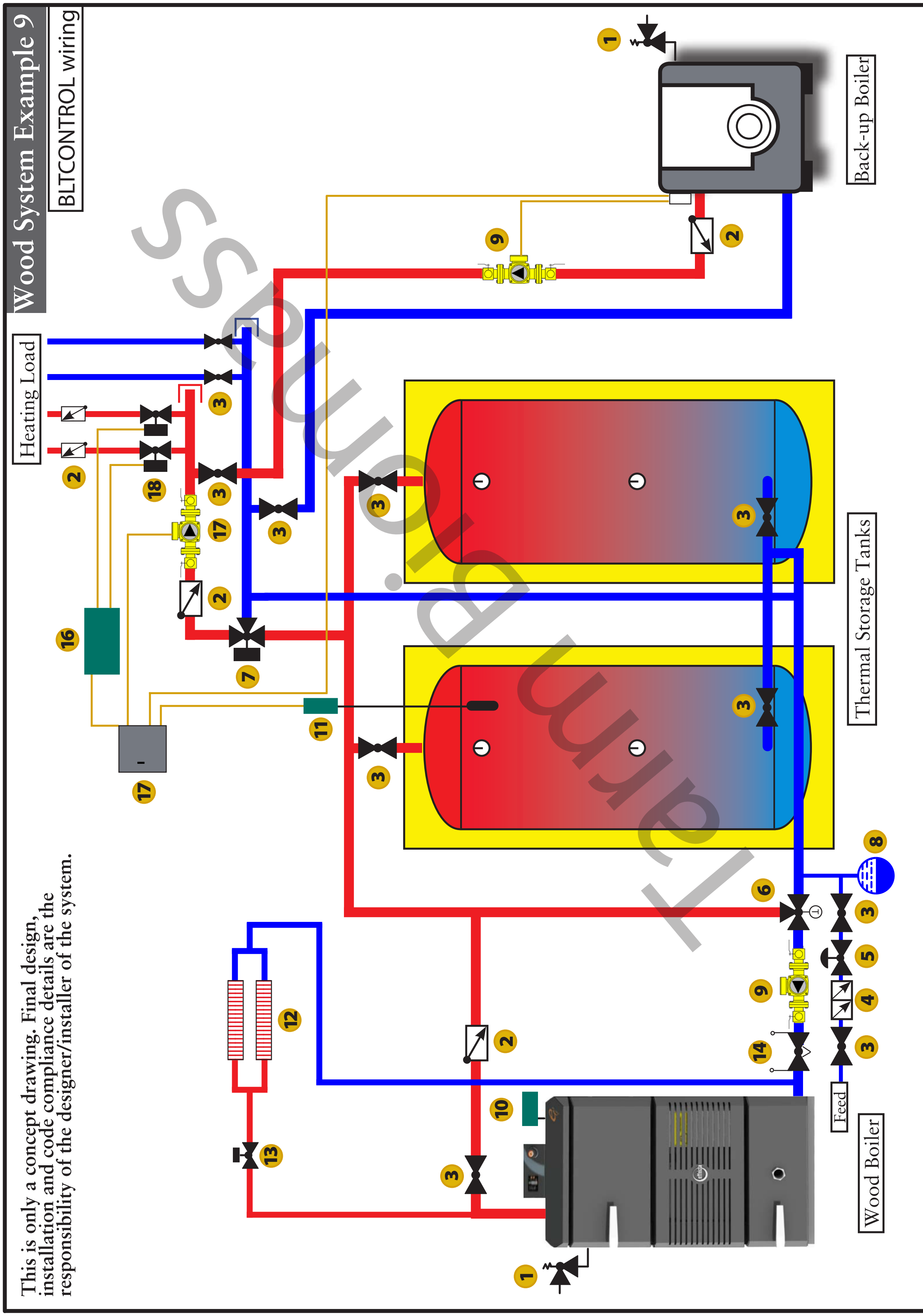
Key:			
1 Pressure Relief Valve*	5 Pressure Reducing Valve*	10 Aquastat-Overheat*	15 ZV-1 Full Port Zone Valve*
2 Check Valve	6 LK 810 Loading Unit*	11 Aquastat-Back-up Control*	16 Typical Zone Control
3 Isolation Valve	7 LK 821 Diverter Valve*	12 Emergency Gravity Loop	17 Tarm BLT Switch Control*
4 Back-flow Preventer*	8 Expansion Tank*	13 AutoMag Zone Valve*	18 Aquastat-DHW Control*
	9 Circulator*	14 Balancing Valve*	*Items available at Tarm Biomass

Wood System Example 9 - Multiple tanks with back-up boiler using BLTCONTROL. Very simple and efficient design using the LK Smart Comfort Control, ΔT circulator, and zone valves. This design can also be used with single or three tank configurations. Use BLTCONTROL wiring.



Key:

1 Pressure Relief Valve*	5 Pressure Reducing Valve*	10 Aquastat-Overheat*	15 Typical Zone Control
2 Check Valve	6 LK 823 Mixing Valve*	11 Aquastat-Back-up Control*	16 Tarm BLT Switch Control*
3 Isolation Valve	7 Smart Comfort Mixing Valve*	12 Emergency Gravity Loop	17 Grundfos Alpha Circulator*
4 Back-flow Preventer*	8 Expansion Tank*	13 AutoMag Zone Valve*	18 Typical Zone Valve
	9 Circulator*	14 Balancing Valve*	*Items available at Tarm Biomass

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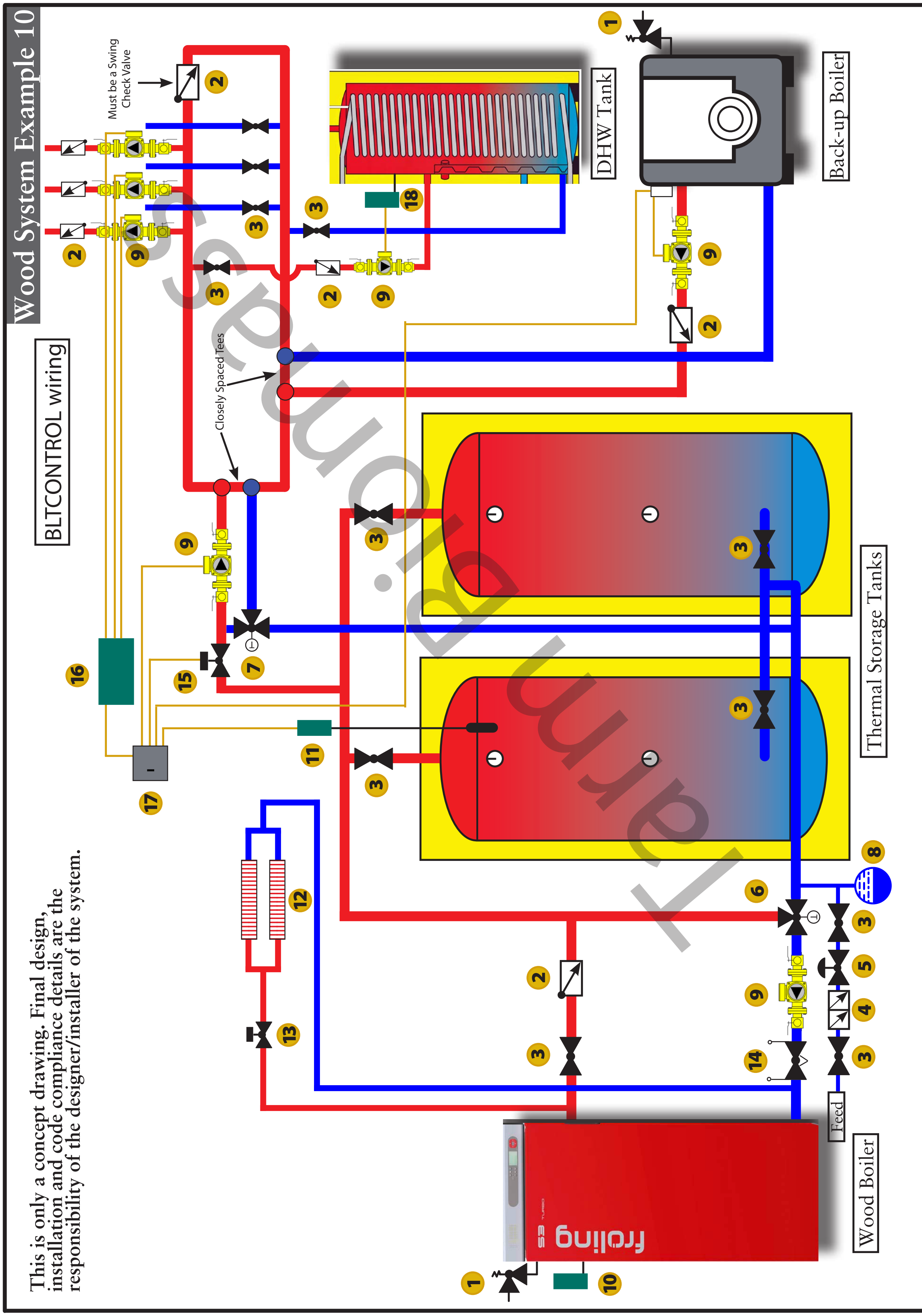
Wood System Example 10 - Multiple tanks with back-up boiler using BLTCONTROL This design can also be used with single or three tank configurations. Primary secondary pipng design option. Use BLTCONTROL wiring.



Key:

1	Pressure Relief Valve*	5	Pressure Reducing Valve*	10	Aquastat-Overheat*
2	Check Valve	6	LK 823 Mixing Valve*	11	Aquastat-Back-up Control*
3	Isolation Valve	7	LK 821 Diverter Valve*	12	Emergency Gravity Loop
4	Back-flow Preventer*	8	Expansion Tank*	13	AutoMag Zone Valve*
		9	Circulator*	14	Balancing Valve*
15	ZV-1 Full Port Zone Valve*	16	Typical Zone Control	17	Tarm BLT Switch Control*
18	Aquastat-DHW Control*		*Items available at Tarm Biomass		

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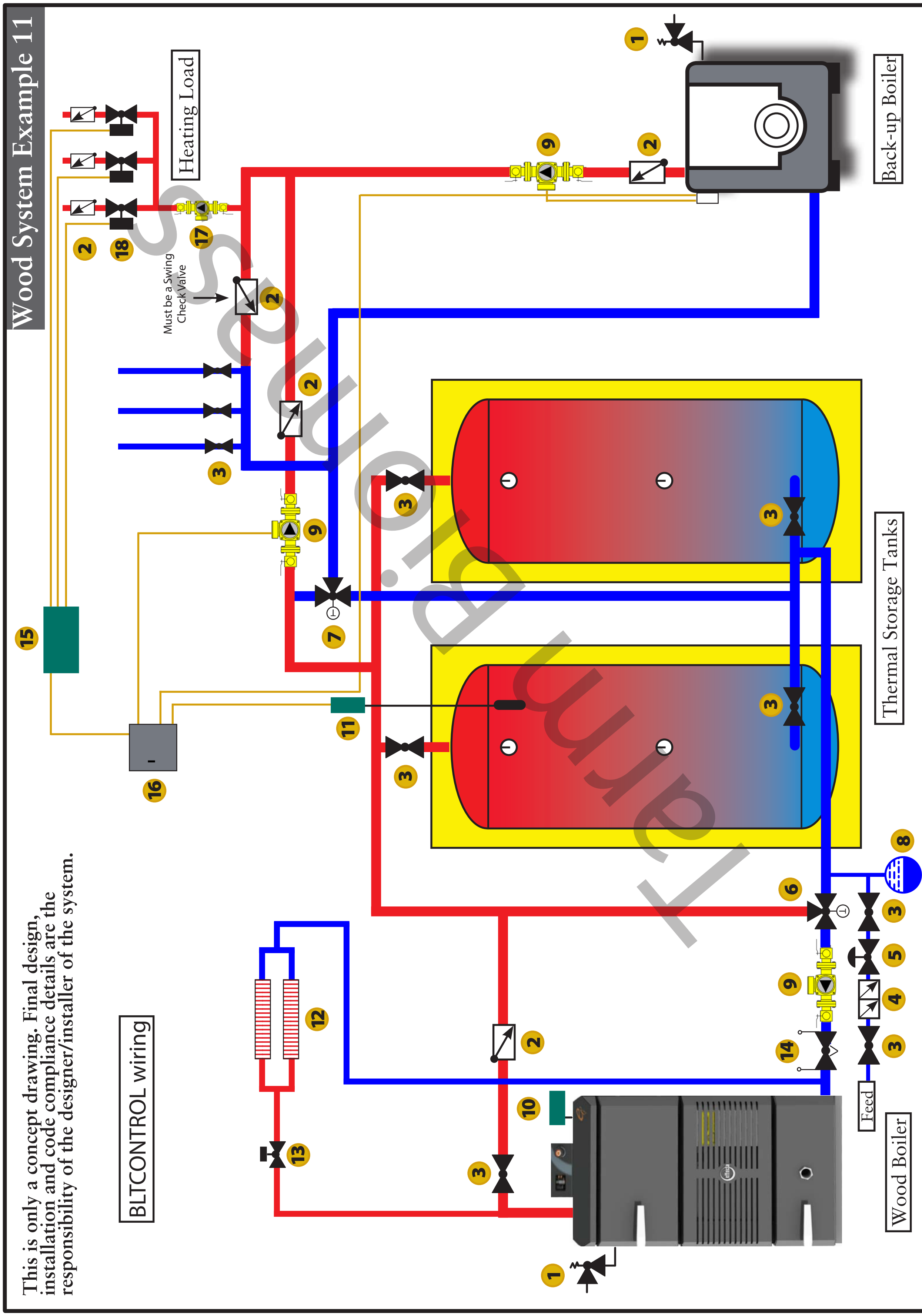
Wood System Example 11 - Multiple tanks with back-up boiler using BLTCONTROL This design can also be used with single or three tank configurations. Zones are controlled with zone valves and ΔT circulator. Use BLTCONTROL wiring.



Key:	5	Pressure Reducing Valve*	10	Aquastat-Overheat*	15	Typical Zone Control
1 Pressure Relief Valve*	6	LK 823 Mixing Valve*	11	Aquastat-Back-up Control*	16	Tarm BLT Switch Control*
2 Check Valve	7	LK 821 Diverter Valve*	12	Emergency Gravity Loop	17	Grundfos Alpha Circulator*
3 Isolation Valve	8	Expansion Tank*	13	AutoMag Zone Valve*	18	Typical Zone Valve
4 Back-flow Preventer*	9	Circulator*	14	Balancing Valve*		*Items available at Tarm Biomass

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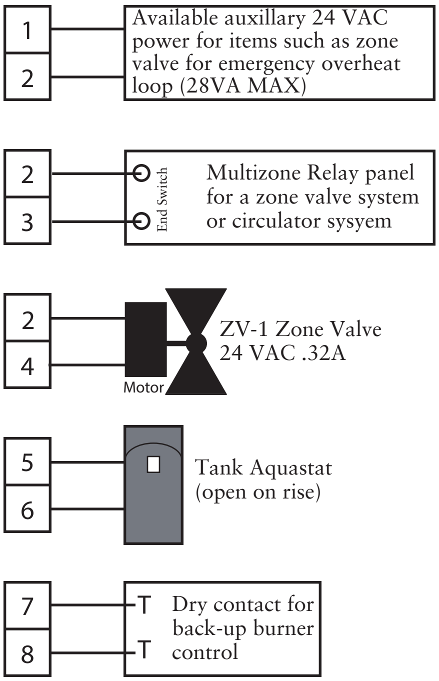
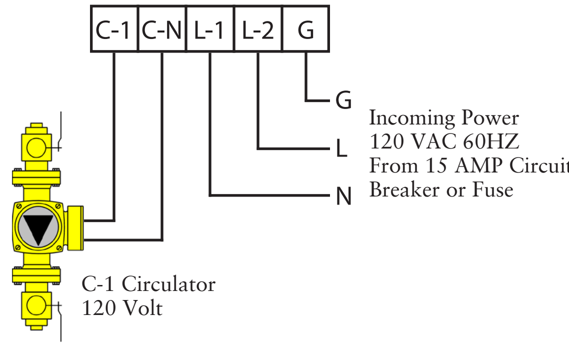
BLTCONTROL Wiring

Low Voltage Connections (Outside of Box)



120 Volt Terminal Strip (In Panel)

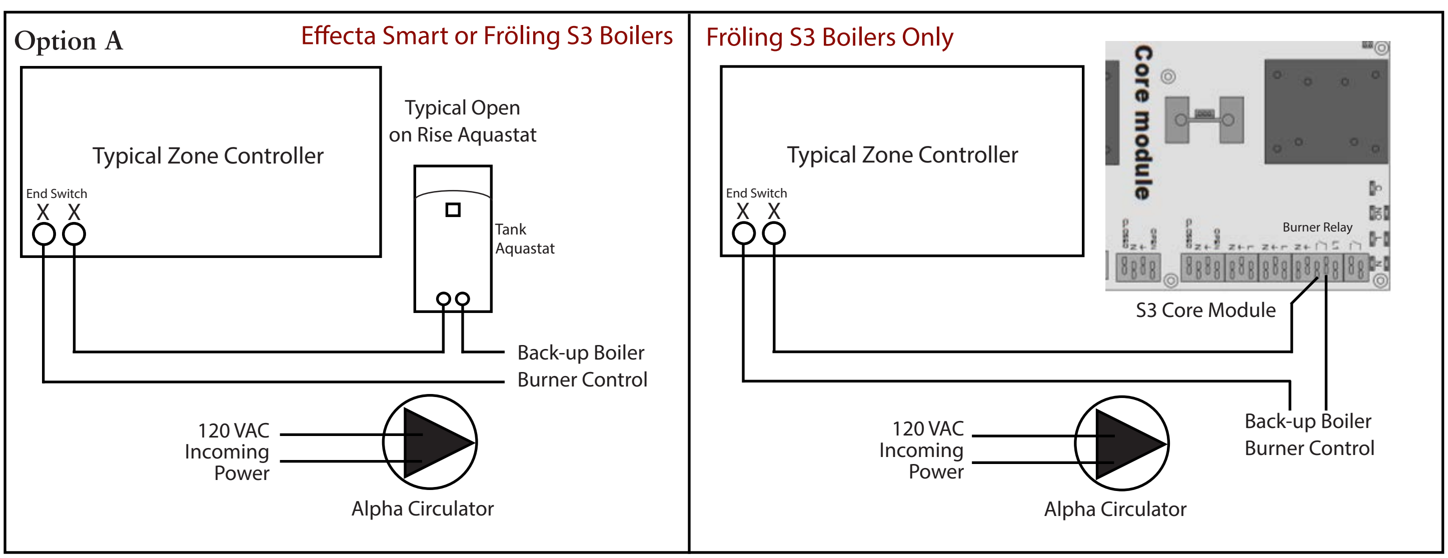


Note:
All wiring must comply with current National Electrical Code and any other applicable codes. Refer to schematic included with panel. 120 volt line voltage wiring shall be a code-approved type 14 gauge minimum. Low voltage wiring shall be 18 or 20 gauge thermostat wire.

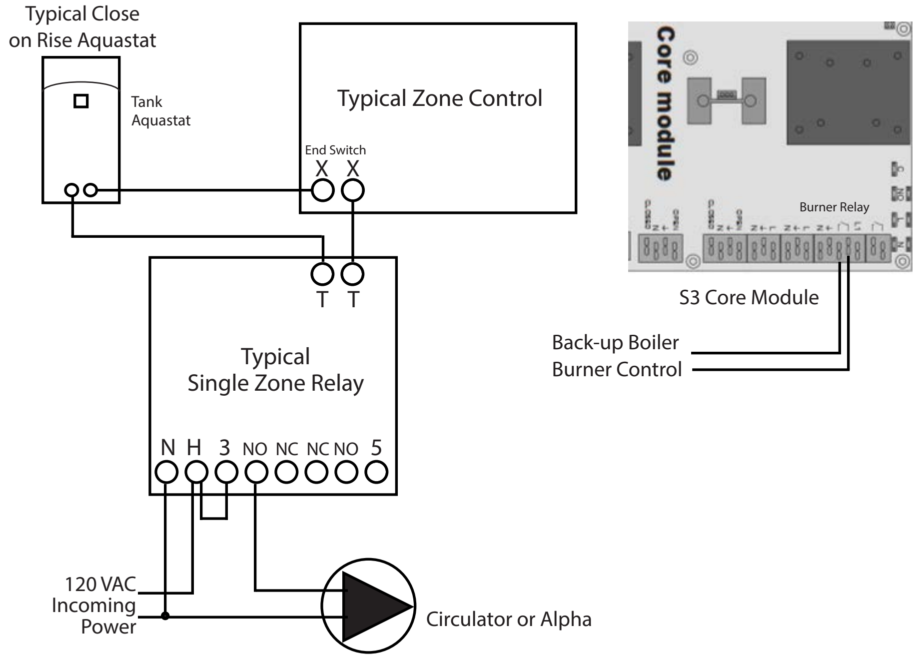
LK Smart Comfort Control System Integration Wiring Options

Below are wiring options for systems using the LK Smart Comfort Control System.

Option A-This wiring option is used when the heating system supply circulator is a Grundfos Alpha or other energy efficient circulator. This is the simpliest wiring option. Back-up boiler is triggered by a minimum tank temperature through an open on rise aquastat or with the Burner Relay contacts on the S3 Boiler. Relay contacts are controlled by the Lambdatronic control using the tank temperature, time, or boiler fault.

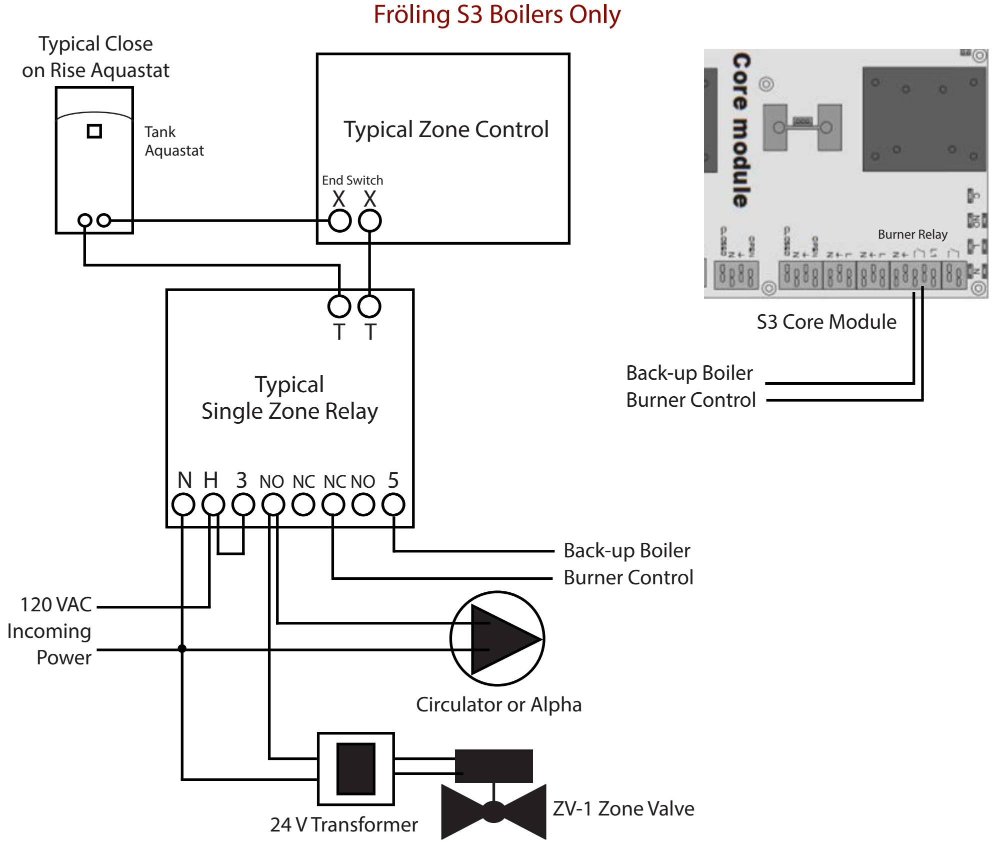


Option B- Fröling S3 Boilers Only - This wiring option is used when the heating system supply circulator needs to be turned on and off (controlled).When there is a call for heat the circulator is turned on or off based on tank temperature. Back-up boiler is also triggered if the S3 Burner Relay contacts are closed.

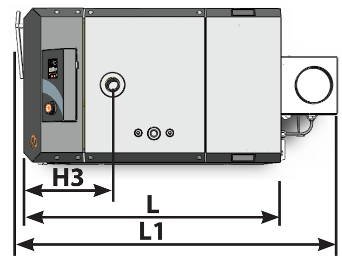


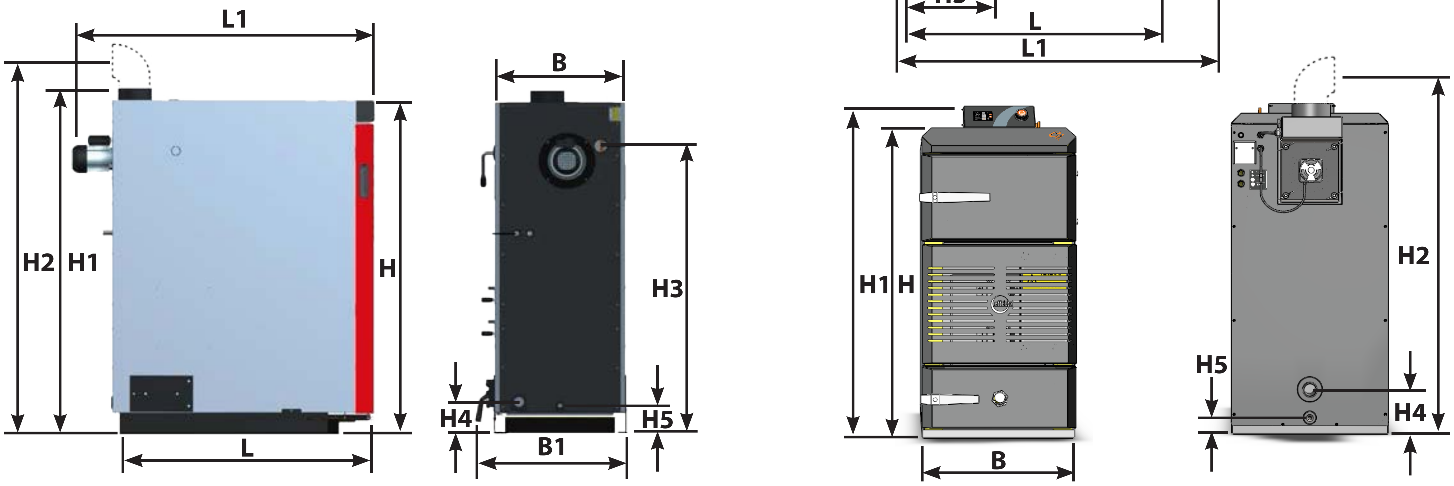
Option C- Fröling S3 Boilers Only -This wiring option is used when the heating system supply circulator needs to be turned on and off (controlled) with the addition of a full port zone valve to prevent ghost flow and proper circulation between thermal storage tanks and the wood boiler. When there is a call for heat the circulator is turned on and the zone valve opens based on the tank temperature. Back-up boiler is also triggered if the S3 Burner Relay contacts are closed.

Fröling S3 Boilers Only



Appendix A. Wood Boiler Specifications





	Dimensions	Units	S3 Turbo 30	S3 Turbo 50	Smart 40	Smart 55
L	Length of Boiler	inches	45⅝	49¼	40	41⅜
L1	Total Length of Boiler	inches	49⅝	53⅛	49⅝	52⅜
B	Width of Boiler	inches	22½	26⅜	23⅝	29½
B1	Total Width of Boiler	inches	26¾	30¾	-	-
H	Height of Boiler	inches	57⅞	61¾	47	49⅛
H1	Total Height of Boiler	inches	60¼	64⅛	50⅜	52¾
H2	Height, Flue Gas Connection (center)	inches	66⅞	70⅞	56¾	59¾
H3	Supply Connection (center)	inches	50⅜	54⅜	13⅜	13⅜
H4	Return Connection (center)	inches	5½	5½	6⅜	3½
H5	Drain Connection (center)	inches	4¾	4¾	2¼	2½
	Flue Collar Diameter	inches	6*	6*	6*	8*

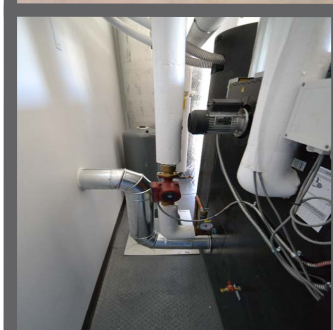
*flue collar adaptor required.

Measurements	Units	S3 Turbo 30	S3 Turbo 50	Smart 40	Smart 55
Weight-Empty	lbs	1179	1366	880	1190
Water Contents	gals	32	50	24	36
Loading Door	inches	13X14½	13X14½	10¼ X 15⅝	12¼ X 19¼
Combustion Chamber Volume	cubic ft.	5	7.4	5.2	6.9
Recommended Wood Length	inches	18-21	18-21	18-21	18-21
Operating Data					
Operating Temperature-Water	°F	180-194	180-194	180-210	180-210
Nominal Output	BTU/Hr	102,500	163,783	136,500	188,000
Electrical Data					
Boiler Power Requirement	-	240V-60Hz/15A	240V-60Hz/15A	110V-60Hz/15A	110V-60Hz/15A
Electrical consumption	W	180	180	250 (est.)	250 (est.)
Piping Data					
Boiler Relief Valve Setting	psi	30	30	30	30
Supply and Return Pipe Stub Size	inches	1½	1½	1¼	1½
Minimum Boiler Loop Size	inches	1¼	1¼	1¼	1½
Fill/Drain Valve Size	inches	½	½	½	½
Minimum Return Water Temperature	°F	131	131	131	131

Notes:

Please visit WOODBOILERS.COM for more information on our boiler systems and links to our blog, Facebook, and You Tube pages.

Join us on Facebook



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September 2018