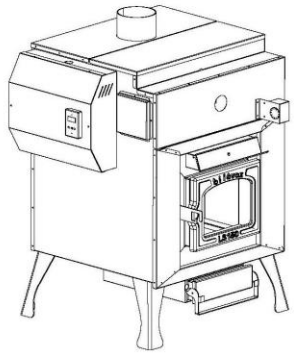
L.S. Bilodeau INC.
STEEL PRODUCT MANUFACTURING

INSTALLATION, MAINTENANCE AND USER MANUAL FOR *BILOVAX LS150* WOOD-FIRED HOT WATER BOILER AND, FOR DUAL FUEL (WOOD-ELECTRIC) OPERATION, ALSO AVAILABLE WITH OPTIONAL ELECTRIC ELEMENTS.

ONCE THIS BOILER HAS BEEN INSTALLED, THIS DOCUMENT WILL BE KEPT IN A SAFE PLACE NEAR THE BOILER FOR FUTURE CONSULTATION BY THE OWNER AND SERVICE PERSONNEL.

SHOWN: DUAL-FUEL (WOOD-ELECTRIC) *BILOVAX LS150*



CAUTION: IF THE INSTRUCTIONS AND WARNINGS CONTAINED IN THIS MANUAL ARE NOT ADHERED TO, THIS COULD CAUSE AN EXPLOSION OR A FIRE WHICH COULD RESULT IN LOSS OF LIFE OR SERIOUS INJURIES AND/OR IMPORTANT MATERIAL DAMAGES.

CAUTION: AN IMPROPER INSTALLATION, ADJUSTMENTS, INCORRECT SERVICE OR MAINTENANCE MAY CAUSE AN EXPLOSION OR A FIRE WHICH COULD RESULT IN LOSS OF LIFE OR SERIOUS INJURIES AND/OR IMPORTANT MATERIAL DAMAGES. TO OBTAIN FURTHER INFORMATION OR ASSISTANCE, PLEASE CONSULT A QUALIFIED INSTALLER, A COMPETENT SERVICE COMPANY OR THE MANUFACTURER.

Certified by:

INTERTEK Warnock Hersey

Manufactured by: L.S. Bilodeau inc.

281,route 108 Est, Saint-Éphrem-de Beauce
Quebec, G0M 1R0
Tel.: 418 484-2013

CAN/CSA B366.1-M91
CAN/CSA C22.2 #236
Also meets:
CAN/CSA B415.1

2015-07-09

Your *Bilovax LS150* boiler has been carefully assembled and factory tested to provide years of trouble-free operation. This manual contains the instructions and security measures necessary for the proper installation, putting in service, maintenance and use of this appliance.

GENERAL INFORMATION

CAUTION:

It is most important to respect the minimum clearances to combustible materials as indicated on the certification plate to prevent an explosion or a fire which could result in loss of life or major injuries and/or serious property damages.
To side walls: Left side 60 cm (24″) Right side 5,1 cm (2″)
To wall at rear of appliance: 30 cm (12″) To wall at front of appliance door: 1,22 m (48″)
From smoke pipe to any combustible surface : single wall 45 cm (18″) - double wall 15 cm (6″)
Floor: combustible or non-combustible
This appliance must not be installed in a room of a height less than 213 cm (84'').

NOTICE TO THE CONSUMER

With the *Bilovax LS150* wood-fired boiler, *L.S. Bilodeau inc.,* an important Canadian manufacturer of wood-heating appliances, redefines the design of the wood-fired and dual-energy boiler by proposing a powerful yet simple to use appliance. This power comes from a uniquely designed heat exchanger combined with a high efficiency wood-burning combustion system. The combustion chamber of the *Bilovax LS150* is lined with refractory tiles and equipped with a robust thermally insulated steel door complete with ceramic glass window to permit observation of the flames. The principal characteristics of the *Bilovax LS150* which make it a controlled combustion boiler are its perfect air-tightness and its automatic combustion air damper. Together these two features result in perfect combustion control whilst maintaining an optimum quantity of oxygen in the combustion chamber. This allows the water in the heating loop to rapidly attain desired temperature even under adverse climatic conditions. We congratulate you on your excellent acquisition and wish to help you on attaining the highest level of satisfaction possible with your *Bilovax LS150* boiler. In the following pages, we would like to propose to you useful advice on wood heating and on controlled combustion and we will inform you of the particular technical data pertaining to the installation, utilization and maintenance of your *Bilovax LS150*.

TABLE OF CONTENTS:

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SECTION 1 : GENERAL INFORMATION

1.1) DANGER, CAUTION OR WARNING

Please understand the full meaning of the following words: **DANGER, CAUTION or WARNING**. These words are associated with safety and it's symbols. You will find them in the manual in the following manner:

DANGER
The word **DANGER** indicates the gravest of dangers, those that **will** result in loss of life or major injuries and/or serious property damages

CAUTION
The word **CAUTION** indicates a danger which **could** result in loss of life or major injuries and/or serious property damages.

WARNING
The word **WARNING** is used to indicate the dangerous practices which **could** result in light injuries and/or minor property damages.

Your boiler must be installed by a licensed technician to maintain it's warranty.

CAUTION
It is not safe to burn treated wood, wood granules or any other fuel except wood logs in the *Bilovax LS150* boiler. Do not store or utilize gasoline or other flammable vapors or liquids in the immediate proximity of the boiler as this could cause an explosion or a fire which could result in loss of life or major injuries and/or serious property damages.

Introduction: This manual contains instructions for the installation, use, maintenance and troubleshooting of the *Bilovax LS150* wood-fired boiler. It also contains a list of components that will assure the safe use and maintenance of the *Bilovax LS150*. L.S. Bilodeau Inc. strongly recommends that the installer consult this manual attentively before installing the *Bilovax LS150* boiler. If, after having consulted this manual, the installer still has unanswered questions, he is invited to communicate

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with the local distributor or with the factory to obtain the information. After completing the installation of the *Bilovax LS150* boiler, the installer must hand over this manual to the consumer for preservation and future consultation.

SECTION 2. HEATING CAPACITY OF THE *BILOVAX LS150* BOILER

The factors determining the capacity of the *Bilovax LS150* boiler to heat a building comprise the building's heat loss, based on the difference of temperature (▲T) to be maintained between the interior design temperature and the exterior regional design temperature. The *Bilovax LS150* boiler has a heat input of up to 150 000 BTU with a full charge hard and dry wood. The user will have to determine, by a series of tests, the capacity of a full charge of wood to maintain the ideal temperature inside his building during a given period depending on the outside temperature.

SECTION 3. INSTALLATION OF THE *BILOVAX LS150* BOILER AND IT'S CHIMNEY

Reception and inspection of the appliance:

Upon reception of the appliance, inspect the exterior packaging of the boiler to discover any signs of damage, if the exterior packaging shows any damage, please mention it immediately to the carrier so that he may make note of it on the bill of lading. Then unpack the boiler and inspect the exterior and the interior carefully to determine if any damage has occurred during transportation or handling. All claims for damage or missing equipment must be made to the carrier.

Important notice: The instructions contained in this document are to be used and adhered to by an authorized technician, who has received formal training and his experienced in the installation of this type of boiler. Certain provinces and jurisdictions require that the persons carrying out this type of installation must hold a licence to that effect. If this is the case, make sure that the installer is in possession of said licence before allowing him to proceed with the installation.

CAUTION

Failure to heed the instructions relative to the installation of this appliance, of it's vent and of the service and maintenance instructions contained in this manual could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damages.

EMPLACEMENT

The boiler must be installed as close as possible to the chimney so that the vent connector is as short and as straight as possible.

Compliance with standards and codes : The boiler will be installed in compliance with all national, provincial and local codes. The installation of this appliance as well as the dimension of the smoke pipe, it's installation and connection will have to comply with the following standards: *CAN/CSA-B140.12-03, CAN/CSA-B365-M*, *CAN/CSA-B366.1-M91,CAN/CSA-B415-1* ,and *ULC S629* as well as with *CAN/CSA-C22.10-07* Canadian Electrical Code, First Part, Eighteenth Edition for the electrical part of the installation. This boiler can only be installed within a building with venting through a 2100°F (650°C) chimney built to ULC standard S629 and with a minimum diameter of 15 cm (6‴) respecting le national, provincial and local codes.

CAUTION

This appliance can only be installed in a room with a minimum height of 213 cm (84"). The following minimum clearances to combustible materials must be respected; failure to heed this caution could cause an explosion or a fire which could result in loss of life or major injuries and/or serious property damages.
Side walls: Left side 60 cm (24″) and Right side 5,1 cm (2″), wall to back of appliance: 30 cm(12″),
wall to front of door of the appliance: 1,2 m (48"), combustible or non-combustible floor, minimum from smoke pipe to any combustible surface: single wall 45 cm (18″)–double wall 15 cm (6″) as shown in Figure 6.

CAUTION

Do not store wood or other combustible materials within the security clearances specified above. **Failure to heed this caution could cause an explosion or a fire which could result in loss of life or major injuries and/or serious property damages.**

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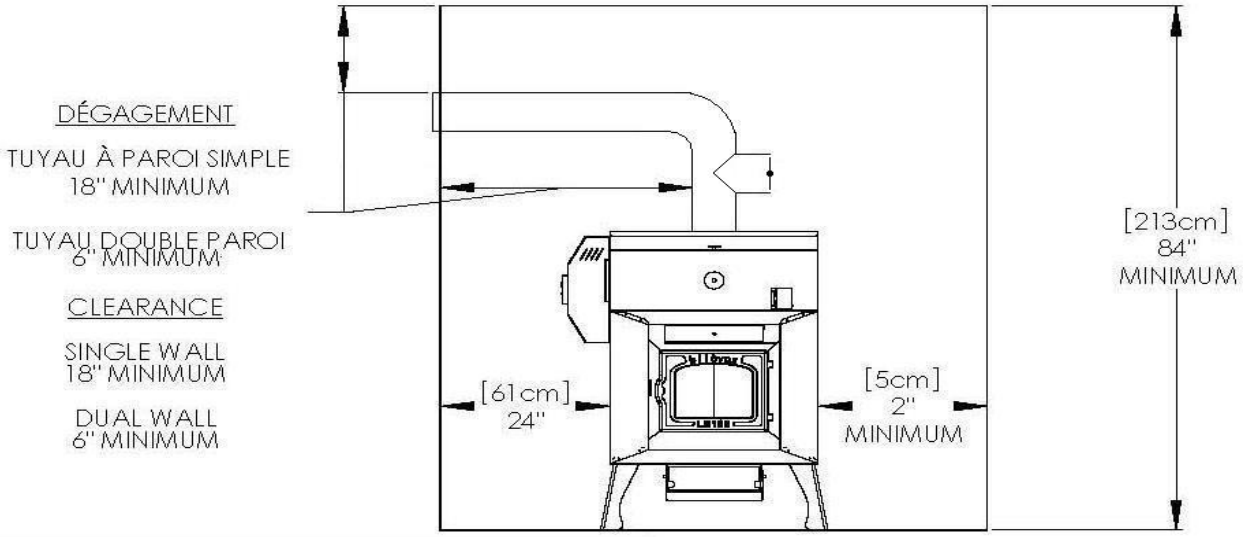
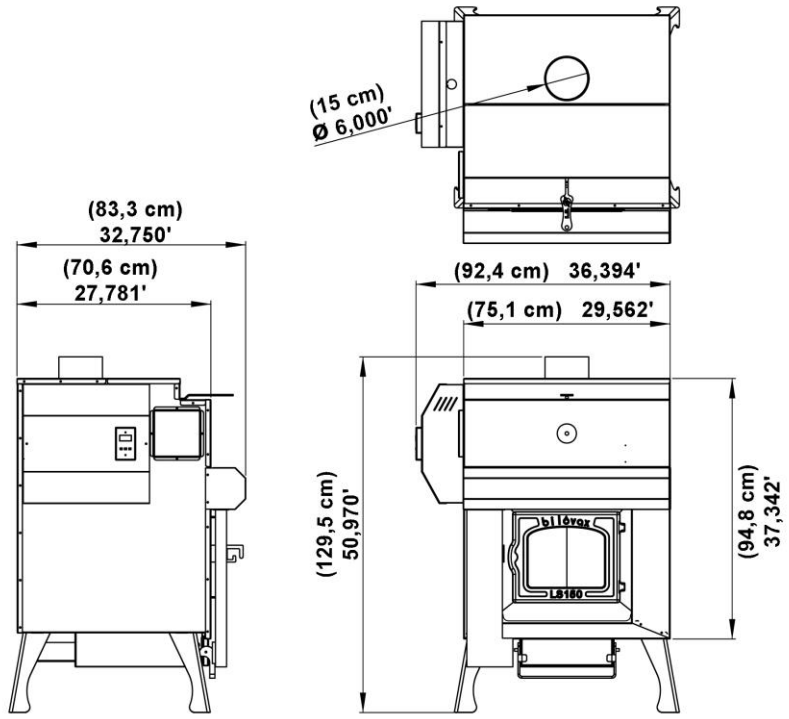


Figure 6

Model	Height	Width	Depth	Weight
Bilovax LS150	129,5 cm (51″)	81,9 cm (32-1/4″)	84,7 cm (33-3/8″) c/w primary air intake	452 kg (995 lbs)
Bilovax LS150-E18 c/w 18 kW Bilovax LS150-E24 c/w 24 kW Dual-fuel Option	129,5 cm (51″)	96,2 cm (37-7/8″)	84,7 cm (33-3/8″) c/w primary air intake	461 kg (1,015 lbs)

Dual-Energy Model shown



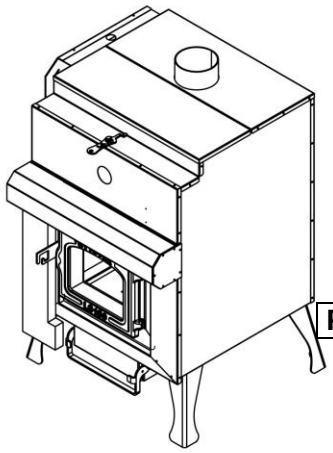


Figure 7

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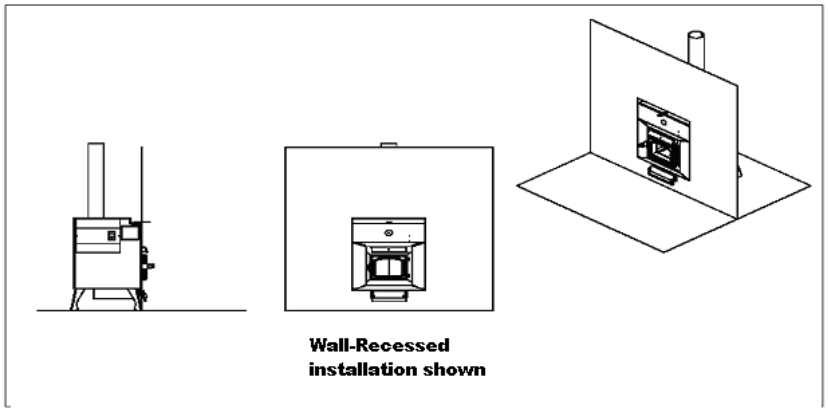

Wall-Recessed installation shown

Figure 8

HIGH LIMITS, OPERATIONAL CONTROLS AND ELEMENTS OF PROTECTION AND SECURITY

High limits and operational controls are installed and connected at the factory and a 15amp.@ 120 Vac 60hz circuit is required if the appliance is of the wood-fired type. It is mandatory to install the furnished water pressure relief valve so that it can be manually operated in case of an electrical power failure. The combination pressure regulator and safety pressure relief valve, connected to the aqueduct, must have maximum pressure release point of 124,1kPa (18psi). A draft regulator must be installed and calibrated to 0.05″ water column, never exceed this value or else it will be impossible to control the combustion. An expansion tank and an air bleed must also be installed in accordance with the water volume of the installation. Furthermore, in all installations of this appliance and under the control of the high-limit controller, a diverting zone of sufficient capacity must be provided with it's own dedicated circulating pump or zone valve to dissipate all the heat if and when any overheating of the system occurs. For the *Bilovax LS150* boiler, the diverting zone is more than 20,000 BTU/h or 6 kW /h.

COMBUSTION AIR SUPPLY:

Because of it's important needs in combustion air, the *Bilovax LS150* boiler must have it's own combustion air supply. In order to meet this requirement, a dedicated air intake of 12.7 cm (5") minimum diameter and of 3 m (10′) maximum length must be provided to draw fresh air from outside the building. A combustion air supply kit is available from your local distributor of *L.S. Bilodeau inc*. products.

VENTING PRODUCTS OF COMBUSTION THROUGH A CHIMNEY:

Smoke pipe/vent connector: When using a single wall smoke pipe for the *Bilovax LS150*, It is most important to respect the clearances to combustible surfaces surrounding it which must be at least 45 cm (18″). On the other hand, if these clearances cannot be respected, then a double wall smoke pipe must be used where the minimum clearances to combustibles are 15 cm (6″). Since the diameter of the outlet pipe of the *Bilovax LS150* is 15 cm (6″), please make sure that the diameter of the smoke pipe and of the chimney match the diameter of the outlet pipe. The smoke pipe/vent connector must be made of black or aluminized steel of 24 gauge minimum either single or dual wall according to code requirements and the safety clearances to be respected. The vent connector will be assembled with the male ends of the pipes facing towards the boiler and all sections will be mechanically joined by three equally spaced sheet metal screws around the circumference of the joints. Please make sure that the smoke pipe/vent connector between the appliance and the chimney is installed as straight and has short as possible. Please refrain from using too many elbows, two 90^{o} elbows or the equivalent being permitted. On all horizontal lengths install a support at every meter (39.37") and maintain a downward slope towards the appliance of 6 mm (¼″) per 30 cm (12″) of pipe. To insure a good draft, the total length of the smoke pipe/vent connector must never exceed 2.5 m (8′) to 3 m (10′)**.**

CAUTION

The smoke pipe/vent connector must not go through the ceiling, storage spaces, the floors or any other combustible partitions. Failure to heed this caution could cause a fire which could result in loss of life or major injuries and/or serious property damages.

THE CHIMNEY AND IT'S CONNECTOR:

The smoke pipe/vent connector of the *Bilovax LS150* boiler must be connected to a prefabricated chimney of the 2100^{o}F (650^{o}C) type of 15 cm (6″) minimum diameter certified to the ULC S629 Standard. The chimney must be installed as per the manufacturer's instructions. The internal diameter of the chimney must be as described above, because an inadequate chimney will cause draft problems, leading to the formation of creosote deposits which will increase the risks of chimney fires.

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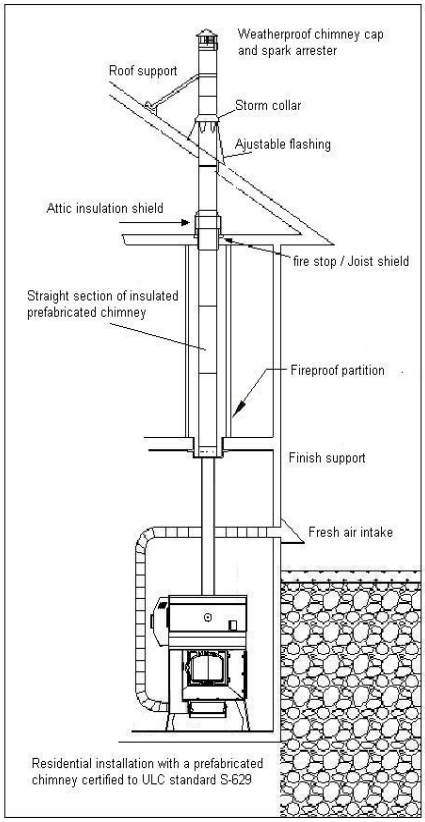
Please abide by the following recommendations during the selection and installation of the chimney:

1) The weatherproof chimney cap must exceed the roof by at least 90 cm (3′).
2) The highest part of the chimney must exceed any part of the building or other obstruction situated within a radius of 3 m (10′) by at least 60 cm (24″)
3) The installation of the chimney within the walls of the building is highly recommended in order to help it retain it's heat and thus facilitate it's draft. To also help for the draft, we recommend the Novoclimat™ system offered in option. (see SECTION 10). If there is no other alternative to an installation outside the walls, the chimney will have to be covered with a well-insulated chimney box.
4) Do not connect any other heating appliance to the chimney dedicated to the *Bilovax LS150*.
5) For a safe installation, follow to the letter the installation instructions of the manufacturer of the chimney.



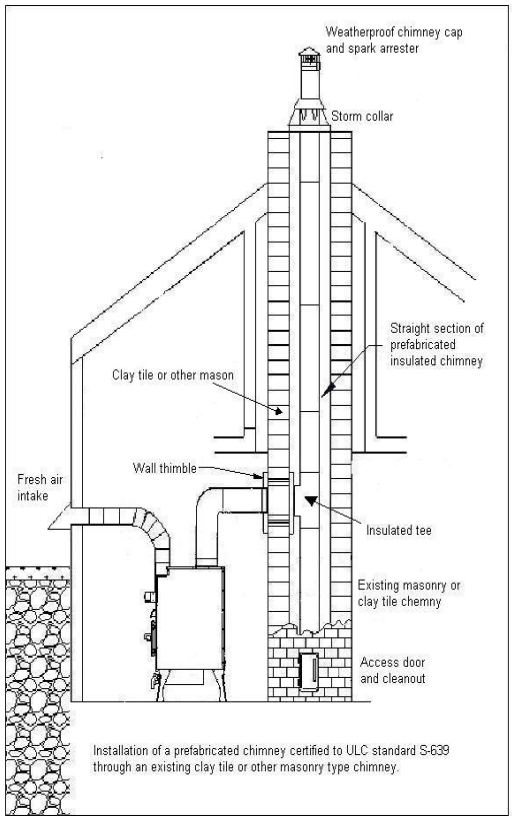


Figure 9 **Figure 10**

PLUMBING CONNECTIONS AND PIPING

The *Bilovax LS150* boiler has been designed so that it's total restriction to water flowing through it does not exceed the equivalent of 3 m (10′) of 3,8 cm (1-½″) pipe approved for continuous operation at 100°C (212°F). The return and supply connections of the boiler are of 3,8 cm (1-½″) diameter and easily adaptable to the network of pipes of the building's heating system. The supply connection to the heating loop is situated on top of the boiler and the return connection is situated in the lower part of the boiler, both are NPT male threaded pipes of 3,8 cm (1-½″) diameter. It is strongly recommended to install unions on the supply and return pipes to facilitate the removal of the boiler, if necessary, during maintenance of the boiler or of the heating loop. In the case of steel-copper connections, use dielectric unions so as to protect the boiler and the loop piping from galvanic action. To easily isolate the heating loop and not have to empty it if major service must be done on the boiler, it is recommended to install a by-pass loop with 1/4 turn ball valves. Only use new and clean pipes to connect the heating loop to the boiler, the codes and local regulations stipulate exactly what type of pipes to use. It is preferable that the piping not go through an unheated space, on the other hand if this cannot be avoided, it is most important to thermally insulate the piping and to install heating cables to eliminate any and all risks of freezing of the pipes. Even where the piping of the heating loop goes through a heated space, it is a good practice to insulate the pipes to minimize heat losses. It is recommended to install thermometers on the supply as well as on the return pipes. Plug all unused openings on the boiler.

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PRINCIPAL AND PROTECTION COMPONENTS:

The external circuit of the *Bilovax LS150* boiler must be provided with a safety relief valve sensitive to water pressure (furnished), an expansion tank, a circulating pump, a combined pressure regulator and pressure relief valve, a combined manometer-thermometer and a drain cock. Also allow for a dump zone in case of overheating of the boiler. **The diverting or dump zone is more than 20,000 BTU/h or 6 kW /h.** All these controls and protection components are required for the safe operation of the *Bilovax LS150* wood-fired boiler.

BACKFLOW PREVENTER

If the heating system uses only one circulating pump, a backflow preventer must be installed to prevent gravity flow and the inefficient heat losses associated with it during periods of no heating demand. Also install backflow preventers on each zone when using circulating pumps for zoning purposes.

WATER PRESSURE SAFETY RELIEF VALVE

A water pressure safety relief valve is furnished with the boiler and is an essential safety component, not a control component. The release point of the safety relief valve is set to 207kPa (30psi) which is in accordance with the ASME Boiler and Pressure Vessel Code to limit the maximum service pressure of the boiler. The capacity of the safety relief valve in BTU/hour is equal to or greater than the heating capacity of the boiler as inscribed on the nameplate. During the installation, connect the outlet of the safety relief valve to a smooth unthreaded copper drain pipe of the same diameter as the outlet of the valve aimed at the floor and whose end will be situated at the most 15 cm (6") from a suitable floor drain and kept distant from any electrical appliance or component. Make sure that the drain pipe empties completely when the safety relief valve operates and see that it is protected from freezing. This drain pipe must not be connected to any other tap or valve; it is for the exclusive use of the safety relief valve. The installation of water pressure safety relief valves is also governed by local authorities.

MAINTENANCE OF INTERNAL PRESSURE BY AN EXPANSION TANK

The membrane expansion tank with preset pressure helps to maintain a constant pressure inside the heating loop in order that all it's components can function efficiently and safely in spite of all the variations in temperature and volume occurring inside of it. The expansion tank must be able to absorb the increase in volume of water when the heating loop water rises to maximum temperature whilst maintaining, at the same time, the optimum design pressure. It must also maintain the optimum design pressure even when the water in the heating loop cools down. The connection point of the expansion tank must be carefully chosen so that the closing of zone or check valves does not isolate it from the boiler or any active part of the heating loop. The expansion tank must be situated on the inlet to the circulating pump as close as possible to the boiler, either upstream or downstream from it. The expansion tank must work conjointly with the combined pressure regulator and pressure relief valve to always maintain an adequate volume of water and an optimum pressure of 124,1kPa (18psi) in the heating loop.

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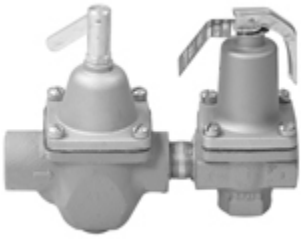
AUTOMATIC AIR PURGE

This device purges the air from the piping, helps to prevent cavitation at the inlet of the circulating pump and also inhibits corrosion. It also minimizes new water intake into the system. The installation of an automatic air purge prevents the accumulation of air in the heating loop. To function properly, it must be installed at the highest point in the heating loop thus eliminating any air accumulation during the putting in service of the system and maintaining afterwards the water-tightness of the system.

COMBINED PRESSURE REGULATOR AND PRESSURE RELIEF VALVE

The installation of a combined pressure regulator and pressure relief valve must be done in conformance with all codes and local regulations. This module must automatically maintain an adequate volume of water and optimum pressure in the heating loop of a max. 124,1kPa (18psi) and be provided with a backflow preventer.



ZONING WITH CIRCULATING PUMPS

The suggested location for each motorized zone pump is on the supply side of the heating loop, the expansion tank being situated between the boiler and each zone pump. A backflow preventer must be installed in each zone, at the outlet of each pump, to prevent a backflow of heated water to the zones without a heating demand.

ZONING WITH MOTORIZED VALVES

The suggested location for each motorized zone valve is on the supply side of the heating loop, the expansion tank being situated between the boiler and each zone valve. However, the installation of motorized zone valves on the return of each zone is also acceptable if the circulating pump is situated downstream from the valves on the main return to the boiler. It is recommended to use low-pressure drop motorized zone valves in zoning applications.

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MAIN CIRCULATING PUMP

The suggested location of the main circulating pump is on the supply side of the heating loop, the expansion tank being situated between the boiler and the pump.

SECTION 4. DESIGN CRITERIA OF THE CIRCULATING PUMP AND THE HEATING LOOP PIPING

Criteria 1: ▲T or Temperature Drop of the heating medium in the heating loop

A simplified method is commonly used based on a ▲T of 20°F (11°C) between the supply and the return of the boiler. Such a method gives good results when applied correctly. One must presume of a constant supply temperature less the return temperature from the heating loop. For example, a boiler may have a supply temperature of 180°F and a return temperature of 160°F, the ▲T is then 20°F (11°C) 180 °F – 160 °F.

▲T or TEMPERATURE DROP THROUGH THE HEATING LOOP

Type of system	Boiler Supply Temperature	Boiler Return Temperature	▲T or Temperature Drop Through Boiler
Baseboards	190° to 140°F (88°- 60°C)	170° to 120°F (77°- 49°C)	20° to 40°F (11°- 22°C)
Cast-Iron Radi tors	160° to 130°F (71°- 55°C)	140° to 110°F (60°- 43°C)	20° to 40°F (11°- 22°C)
In-Floor Heating	130° to 90°F (55°- 32°C)	110° to 70°F (60°- 21°C)	20° to40°F (11°- 22°C)

N.B. The operating supply temperature of the boiler can vary from 180°F to 160°F (82°- 71°C) without any problem of condensation but a plate heat exchanger must be inserted between the boiler and the heating loop if the heating loop temperature differs from the boiler temperature.

The following formula helps to select the main circulating pump and other components of the heating loop depending on the type of system to be installed.

$$\text{Pump capacity in GPM (US)} = \frac{\text{Boiler heat output in BTU/h}}{500 \times \blacktriangle T \text{ (supply temp. - return temp.)}}$$

The capacity of the pump is expressed in US gallons par minute (USGPM)
The required heat output of the boiler (in BTU/h) is the maximum heat output fed into the heating loop which can respond to the maximum heating demand of a given building at it's exterior design temperature.
(▲T) or Drop in temperature of the heat transfer medium is measured between the boiler supply and return.

For example, if the system is designed for a temperature drop (▲T) of 20°F (11°C) and has electric elements of 24 kW with a net heat output of 82,000 BTU/h, the formula to calculate the pump flow is: 82,000 ÷ 10,000 = 8,2 USGPM, one must then install a pump with a minimum flow of 9,0 USGPM. This will also be the pump flow required for the *Bilovax LS150* wood-fired boiler.

SECTION 5. VERIFICATION AND START-UP BY THE INSTALLER

Generalities:

The boiler and the heating loop must be in working order to carry out the following tests. Please consult this manual to understand the lighting/starting and stopping procedures of the boiler. Make sure that all the air has been purged from the heating loop and boiler before lighting it.

Inspection of water pipes and leak tests: It is recommended to clean the piping with a cleanser (check with your dealer) or plain water to remove impurities that have accumulated in the pipes. Allow water to enter into the boiler and the heating loop. To purge all the air from the boiler and the heating loop, pull on the lever of the safety relief valve and push on the plunger of the automatic air purge (by first removing cap). When the boiler and the heating loop have been completely purged of air and filled with water, make sure that all the connections are watertight and that water is not leaking or oozing from the joints between the appliance and it's inlet and outlet pipes and all other pipes of the heating loop. If there are leaks, carefully seal all the leaks before proceeding with the other tests. Turn on the system for 4 to 6 hours and drain. Refill with water or water / glycol.

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WARNING FOR HEAT TRANSFER LIQUID

The heat transfer liquid must be water or any other nontoxic fluid which has a toxicity class or ratio of 1, as listed in the current edition of the Toxicological Repertory of Commercial Products.
In a system with liquid water only, use natural water. We recommend distilled or softened water, when used in water / glycol mixture, and that in the device Bilovax LS150 and in the piping network.
The liquid volume of the *Bilovax LS150* boiler is 25 imperial gallons (114 l).
Also read the WARNINGS mention and typical percentages of mix water / antifreeze at page 12.

It is strongly advised to test the water when the system is connected directly to the aqueduct. Outstanding results may require the use of a treatment or the addition of a filtration system.
(consult your distributor)
The *warranty is void* if (see complete warranty attached)

1- **Installation where the heating loop water circulates through a polybutylene pipe installation without an oxygen absorption barrier; or**
2- **Installation where the pH of heating loop water is non-standard for a hot-water heating system: less than 8.5 and more than 10.5 or the calcium hardness exceeds 300 ppm and / or impurities exceed 200 mg / l;**

CAUTION

The loading door of the *Bilovax LS150* is equipped with a two-stage opening safety door latch. This design has been chosen to prevent, during the opening of the loading door, a flashback of combustion gases from occurring if there is a sudden and uncontrolled draft. Do not attempt to force or modify in any way, shape or form the safety door latch which assures the safe functioning of the appliance. The failure to heed this caution could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damage.

Lighting and test firing of wood heating: Open the loading door of the *Bilovax LS150* boiler and make sure that nothing inside it can hinder it's proper functioning, that all of the refractory tiles are undamaged and well secured. Check that the combustion air damper is well adjusted and that it will open and close without hindrance. Place crumpled sheets of dry newspaper on the bottom and cover them with kindling and a sufficient quantity of dry logs, maximum 45 cm (18'') long, just enough so that the combustion chamber is half-full. Light the newspaper whilst keeping the loading door half-open, making sure that the fire is well lit before closing the loading door. Monitor the temperature of the *Bilovax LS150* during this part of the functional tests. ***Once the boiler has attained it's normal operating temperature, check that the combustion air damper opens and closes in accordance with the cycles of the aquastat. Also verify that the circulating pump starts at the proper temperature.***

CAUTION

Do not use flammable liquids or chemical products to light this appliance. The failure to heed this caution could cause a fire or an explosion which could result in loss of life or major injuries and/or serious property damage.

Functional and safety verifications:
After 30 minutes of operation where everything seems normal, slowly and carefully crack open the loading door of the Bilovax LS150 without forcing the safety door latch past the first detent, pull on the bypass damper lever to evacuate all the smoke and unburned gases from the combustion chamber, after 30 seconds to a minute, open the loading door fully and put in a full charge of wood on the embers, close the bypass damper fully and then the loading door. The normal combustion cycle should restart within a short delay. With a full charge of dry wood, the Bilovax LS150 should operate from 2 to 3 hours at full fire (depending on the type of wood) and during this time, it will be possible to do all the required functional tests.

SECTION 6 INSTRUCTIONS FOR USE AND BASIC MAINTENANCE BY THE END USER

Cautions and Warnings for the end user:

WARNINGS

1-As a safety measure, the boiler loading door must remain closed during the operation of the appliance.
2-If the combustion is no longer under your control, maintain water circulation through the boiler and also make sure that the combustion air damper and the loading door are fully closed. Also keep an eye on the air-tightness seal of the loading door and make sure it remains intact. If flames start leaking out around the loading door, immediately call the fire department.
3-Do not use the boiler during a power outage as this could damage the appliance and prevent it from functioning in a normal manner afterwards.

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CAUTION

Do not burn garbage, gasoline, naphtha, used motor oil, or other flammable liquids or chemical products in the boiler. The failure to heed this caution could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damage.

WARNING

Once the appliance has been put into service, if the heat transfer liquid is water (We strongly recommend the use of a treatment to prevent the possibility of premature corrosion that can be caused by missing and / or contained minerals in the water and also to help to increase the life of the system. A system of filtration can also be recommended when there is a high rate of particles.), a temperature above 5°C (40°F) must always be maintained in the room where the boiler is installed to protect it from freezing. With a mixture of water and 54% propylene glycol or ethylene glycol, it is possible to protect the boiler and the heating loop piping upto –40 °C (-40°F). Before lighting the boiler for the first time, make sure that there is no air trapped neither in the water circuit of the boiler nor in the heating loop. Purge all the air from the boiler by lightly pulling on the lever of the safety relief valve. Purge all the air from the heating loop by pressing on the valve stem of the automatic air purge (remove cap). If air is present, wait until clear water is evacuated before releasing the lever of the safety relief valve or the automatic air purge valve stem.

Typical percentages of a mix of water / propylene glycol antifreeze («Dowfrost») in boilers and heating loop piping to protect them from freezing at the given temperatures.

Temperature °C	Temperature °F	% of antifreeze in solution with water to prevent freezing at the different temperatures shown
-12	(10)	29%
-18	(0)	36%
-23	(-10)	42%
-29	(-20)	46%
-34	(-30)	50%
-40	(-40)	54%
-46	(-50)	57%

CAUTION

The loading door of the *Bilovax LS150* is equipped with a two-stage opening safety door latch. This design has been chosen to prevent, during the opening of the loading door, a flashback of combustion gases from occurring if there is a sudden and uncontrolled draft. Do not attempt to force or modify in any way, shape or form the safety door latch which assures the safe functioning of the appliance. The failure to heed this caution could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damage.

LIGHTING INSTRUCTIONS:

Open the loading door and inspect the combustion chamber to make sure that there are no ashes on the bottom. If there are ashes, sweep them into the built-in ashtray. Place crumpled sheets of dry newspaper on the bottom and cover them with kindling and a sufficient quantity of dry logs 45 cm (18") long maximum, up to the middle of the combustion chamber. Light the newspaper whilst keeping the loading door half-open. Make sure that the fire is well lit before closing the loading door. After an hour or so, crack open the loading door of the *Bilovax LS150* slowly and carefully to the first detent without using any force against the safety latch. Pull on the smoke bypass damper lever to evacuate all the smoke and unburned gases from the combustion chamber. *After 30 seconds to a minute,* open the loading door fully, past the second detent, and put a full load of wood in the *Bilovax LS150* on the embers. Then firmly close the bypass damper and the loading door, this should allow for a wood-burning cycle of two to three hours depending on the type of wood and it's dryness. As much as possible, always use dry wood for a better efficiency and less chance of sooting up the appliance and the chimney. If it is not desirable to prolong the heating cycle beyond three hours, simply let the fire die down by itself in the boiler.

Weekly maintenance during the heating season:

At least once a week during the heating season, open the access panel on top of the boiler to inspect and, if necessary, clean the smoke passages situated above the combustion chamber, (see figure 11). If there are any ashes in the combustion chamber, sweep them into the ashtray. Once the ashtray is full, empty the ashes into a metal container with a hermetic lid and then store the container outdoors.

Preparations for stopping the boiler during the summer period:

In temperate regions, the *Bilovax LS150* boiler can continue to operate during the cold spells of early to mid-spring. Before stopping the boiler for the summer, open the access panel on top of the boiler to inspect and, if necessary, clean the smoke passages situated above the combustion chamber (see figure 11), If there are any ashes in the combustion chamber, sweep them into the ashtray. Dump the ashes from the ashtray into a metal container with a hermetic lid and then store the container outdoors. Also make sure that the refractory tiles are undamaged and all in their proper place. If some refractory tiles are damaged, they must be replaced by new tiles, see page 27. The smoke pipe / connector and chimney must also be inspected and swept before stopping the boiler for the summer period.

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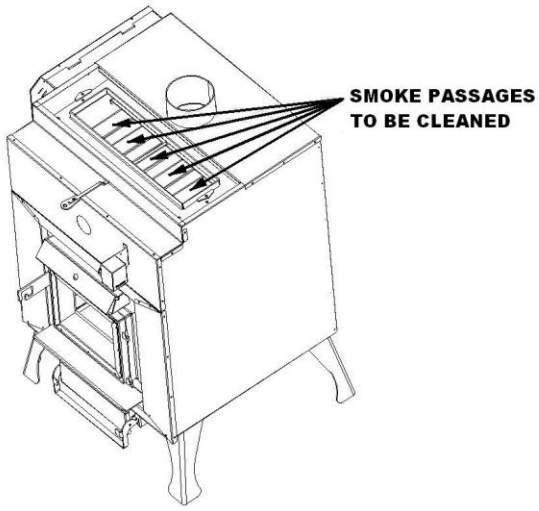

FIGURE 11 (Showing the smoke passages to be cleaned above the combustion chamber)

SECTION 7. INSPECTIONS AND FALL MAINTENANCE BY A LICENSED TECHNICIAN

Generalities :

IMPORTANT: Only qualified technicians, in possession of the required license, are authorized to maintain and repair the *Bilovax LS150* boiler. It is important to remember that all the components of the system can affect the safe functioning of the appliance.

CAUTION :

Do not modify or alter the boiler itself in any way or any of it's components. For all repairs, only use new replacement parts furnished by the manufacturer of this appliance, never utilize or try to utilize used parts to repair the *Bilovax LS150* boiler. The failure to heed this caution could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damage.

A regular inspection program, at least once a year, constitutes a good preventative maintenance measure. Keep this manual in a safe place so as to be able to consult it if the need presents itself or if a licensed service contractor needs to consult it when inspecting or repairing this appliance.

The following inspection points are to be monitored so as to maximize the useful life of the *Bilovax LS150*.

Periodical inspections:

The *Bilovax LS150* boiler is designed and manufactured to have a long useful life when installed and used as per the recommendations and instructions of the manufacturer. An annual inspection by a licensed service contractor, preferably done prior to the heating season, is recommended so as to maintain the boiler in full operating condition.

Maintenance:

To ensure safe operation of the boiler, it is required that a licensed service contractor perform the following inspections and maintenance within the scope of an annual visit.

Inspection and cleaning of the combustion chamber:

IMPORTANT: Inspect the combustion chamber to check that all the refractory tiles are undamaged and in their proper place. If refractory tiles are damaged, they must be replaced by new tiles, see page 27. To do so, remove the front sheet metal panel of the boiler, take off the removable front of the combustion chamber and replace the damaged tiles.

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Inspection of the combustion chamber door and it's air-tightness seal
Make sure that the combustion chamber door safety lock and it's air-tightness seal are in good condition and can be reused safely during another heating season. If the seal is worn or damaged in any way, it must be replaced.

Verification of the combustion air damper and fresh air intake
Check that the combustion air damper operates freely and that the fresh air intake of the boiler is not obstructed.

Inspection of the smoke pipe / chimney connections
Check that the smoke pipe / connector is solidly fixed to the appliance and to the visible part of the chimney. Make sure that everything is functional, secured and safe. Have the smoke pipe / connector and chimney swept if necessary.

Maintenance of safety clearances to combustibles
Always maintain the safety clearances free of any rubbish, combustible material, gasoline or other flammable liquid or vapours. Never store any fuel wood within the safety clearances.

Cleaning of smoke passages and disposal of ashes
Every week of utilization, one must open the access panel situated on top of the boiler to inspect and clean, if required, the smoke passages situated above the combustion chamber (see Figure 11). If there are any ashes in the combustion chamber, sweep them into the ashtray. Then empty the ashtray in a metal container provided with an hermetically sealed cover and store it outdoors.

Water testing: To ensure that the water is still within the standards specified and recheck the need for treatment or adjustment of existing treatment.

Fall Start-up:
Inspect and clean the boiler by making sure the combustion chamber is free of any ash, check that all the refractory tiles are undamaged and are solidly fixed. Make sure that all the safe clearances to combustibles are respected. Inspect the smoke pipe / connector and the chimney. If it was not done during the summer, please have the smoke pipe / connector and the chimney swept before beginning another heating season. Purge all the air from the boiler by lightly pulling on the lever of the safety relief valve. Purge all the air from the heating loop by pressing on the valve stem of the air purge (remove cap). If air is present, wait until clear water is evacuated before releasing the lever of the safety relief valve or the air purge valve stem. Check that the circulating pump and the combustion air damper are both fully functional.

Inspection of the controls:
Open the control panel and verify that there has not been any water infiltration which could have damaged certain of the electrical components within. If there has been water infiltration please correct it at once. If a component must be replaced, identify each of it's wires before removing them to prevent any chance of miswiring, as this could cause inappropriate or unsafe operation. After the inspection, reinstall the cover making sure that it fits tightly.

SECTION 8. ELECTRICAL SUPPLY AND CONTROL OF THE BOILER

Generalities:

CAUTION

On this appliance, any and all electrical work or repair must be done by a licensed electrical firm. The failure to heed this caution could cause an explosion or fire which could result in loss of life or major injuries and/or serious property damage.

CRITICAL COMMENT

If all or part of the original wiring must be replaced, please respect the original color code and only use wire of the same type rated for 105°C or more.

ELECTRICAL SUPPLY OF THE BOILER
The electrical wiring to the boiler must conform to the Canadian Electrical Code and to the local codes, these having precedence in certain municipalities. In the case of the wood-heating *Bilovax LS150*, provide an electrical circuit of 120Vac, 1ph, 60Hz protected by a breaker of the appropriate capacity. In the case of the Dual-Energy *Bilovax LS150*, provide an electrical circuit of 240Vac, 2ph, 60Hz with an added neutral wire (protected by a breaker of the appropriate capacity accordingly to the presence of the electric elements and other accessories).

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CONTROL OF THE BOILER WITH THE WOOD-HEATING OPTION ONLY

CRITICAL COMMENT

For the *Bilovax LS150* boiler, the dump zone is more than 20,000 BTU/h or 6 kW/h. The warranty will not apply to any installation not involving a diverting zone (SUPPLIED BY THE INSTALLER) to lower the temperature inside the unit from overheating.

With the wood-heating boiler, current flows through the high-limit controller to feed the low-voltage transformer (24 Vac) which, through the n.o. contact of the aquastat, opens and closes the combustion air damper to maintain the water temperature in the boiler and the heating loop around 82°C (180°F). If the water in the boiler overheats, at around 88°C (190°F), the high-limit controller cuts the power to the combustion air damper which closes and, at the same time, starts the shedding zone pump or zone valve **(supplied by the INSTALLER)** to reduce the temperature in the boiler. **Dump zone of more than 20,000 BTU/h or 6 kW /h.**

CONTROL OF THE BOILER WITH THE BASIC DUAL-ENERGY OPTION

CRITICAL COMMENT

For the *Bilovax LS150* boiler, the dump zone is more than 20,000 BTU/h or 6 kW/h. The warranty will not apply to any installation not involving a diverting zone (SUPPLIED BY THE INSTALLER) to lower the temperature inside the unit from overheating.

When the appliance heats with wood, current flows through the high-limit controller to feed the low-voltage transformer (24 Vac) which, through the wood-heating contact of the dual-aquastat, opens and closes the combustion air damper to maintain the water temperature in the boiler and the heating loop around 82°C (180°F). If the water in the boiler overheats, at around 88°C (190°F), the high-limit controller cuts the power to the combustion air damper which closes and, at the same time, starts the shedding zone pump or zone valve **(supplied by the INSTALLER)** to reduce the temperature in the boiler. **Dump zone of more than 20,000 BTU/h or 6 kW /h.** When the appliance heats with electricity, current flows through the high-limit controller to feed the low-voltage transformer (24 Vac) which, through the electric-heating contact of the dual-aquastat, energizes the electric elements of 18 or 24kW to maintain the temperature in the boiler and also in the heating loop around 77°C (170°F). If the water in the boiler overheats, at around 88°C (190°F), the high-limit controller cuts the power to the electric elements and, at the same time, starts the shedding zone pump or zone valve **(supplied by the INSTALLER)** to reduce the temperature in the boiler. **Dump zone of more than 20,000 BTU/h or 6 kW /h.** In this option, there are switches and pilot lights for the wood-heating mode and also, for the electric heating mode, where each element has it's own pilot light. With the Dual-Energy option and the mode switches, it is possible to heat with wood only, with the electric elements only or with both modes working together in a complementary manner. When the two modes are in complementary operation, there is no risk of running out of heat if the fuel wood is completely depleted in the boiler as the electric elements are already programmed to take over when this situation occurs. In the electric heating control loop, there is a jumper on the low-voltage terminal block, which allows the insertion in the control loop, of an outdoor thermostat installed under the eaves on the north side of the building. This will only permit half of the electric elements to go into action if the outside temperature is above -18°C (0 °F) which may allow for certain electrical energy savings. Below -18°C (0 °F) all the elements go into action on a call for heat.

WARNING

IT IS NOT RECOMMANDED THAT THE USER MAKE ANY MODIFICATIONS TO THE WORKING ORDER OR TO THE SETTINGS OF THE DIFFERENT OPERATIONAL CONTROLS AND HIGH-LIMITS IN THE ELECTRICAL JUNCTION BOX. IN ORDER TO PREVENT ANY BREAKDOWN OR DANGEROUS OPERATION OF THE BOILER, ONLY A LICENSED CONTRACTOR OR LICENSED SERVICE TECHNICIAN, WITH THE FULL KNOWLEDGE AND APPROVAL OF THE FACTORY, MAY MAKE ALTERATIONS TO THE SETTINGS OF THE DIFFERENT OPERATIONAL CONTROLS AND HIGH-LIMITS.

OTHER DUAL-ENERGY CONTROL OPTIONS

Other high technology Dual-Energy control options are also available, please consult your local distributor for further information.

Technical Characteristics of Dual-Energy Option

Table 1: Characteristics of electrical elements and accessories @ 240 Vac (Two Phase) :

Model	kW	Amps	Electrical Elements	Heating Stages	Power Relay	Protection Relay	Wire Gauge CU-90 ° C	Breaker Amps.
LS150-E18	18	75	3x 6 kW	3*	▲	▲	3	100
LS150-E24	24	100	4x 6 kW	4*	▲	▲	1	125

When calculating the overcurrent protection, a 1/6 hp @ 120VCA/5 amps. circulating pump (supplied by others) was included.

*Circuits with optional outdoor thermostat

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Admissible current for insulated copper conductors in a sheath or a conduit

Wire Gauge (AWG)	Maximum Current Carrying Capacity of TW @ 60° C	Maximum Current Carrying Capacity of TW @ 75 ° C	Maximum Current Carrying Capacity of RW90 @ 90 ° C
14	15 amp	15 amp	15 amp
12	20 amp	20 amp	20 amp
10	30 amp	30 amp	30 amp
8	40 amp	45 amp	45 amp
6	55 amp	65 amp	65 amp
4	70 amp	85 amp	85 amp
3	80 amp	100 amp	105 amp
2	100 amp	115 amp	120 amp
1	110 amp	130 amp	140 amp
0	125 amp	150 amp	155 amp

SECTION 9. ELECTRICAL SCHEMATICS AND TROUBLESHOOTING

Generalities:

IMPORTANT: These instructions are for the exclusive use of licensed service technicians, to which the responsible authorities have issued the necessary licence and which are the only ones authorized to do the maintenance and repairs to the *Bilovax LS150* boiler and it's different components. Above all it is important to remember that all system components can influence the proper and safe operation of this appliance and that the service technicians must be familiar with the particularities of the appliance before proceeding with any troubleshooting or repair.

CAUTION:

If the service technician decides to use a jumper to bypass an electrical component for troubleshooting purposes, he must remove it after he has finished troubleshooting. Never leave the jumper in place in order to keep the boiler operational. The failure to heed this caution could cause an explosion or a fire which could result in loss of life or major injuries and/or serious property damage.

WARNING:

Before proceeding with the troubleshooting of the boiler, make sure that all the electrical connections are clean and tight and that all the wiring conforms to the wiring diagrams of this appliance, to the Canadian Electrical Code and to all local codes and regulations.

The licenced service technician, before embarking upon any troubleshooting or repairs, will have to consult and comprehend the wiring diagram situated on the electrical junction box cover of this appliance. If he requires further information, he may consult the factory's technical team at **418 484-2013.**

In the following pages, you will find the legend and schematics

- Legend
- Connection to a radiant floor
- Connection to baseboards reverse return
- Connection to a heating coil installed in a forced air system
- Connection to another heating system
- Identification of the electrical panel terminals
- Electric schematic for *Bilovax LS150* wood only
- Electric schematic for Bilovax LS150 dual-fuel wood-electric 18 kW
- Electric schematic for Bilovax LS150 dual-fuel wood-electric 24 kW

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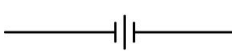
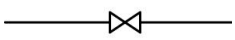
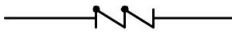
LEGEND

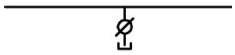
HOT WATER SUPPLY PIPPING

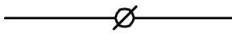
HOT WATER SUPPLY EXISTING PIPPING TO BE DEMOLISHED


FLANGE UNION

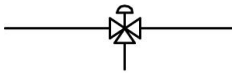

GATE VALVE

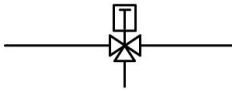

DOUBLE CHECK VALVE

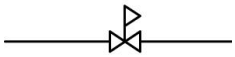

DRAIN VALVE WITH PIPE FITTING AND PLUG

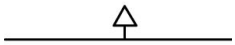

BALL OR BUTTERFLY VALVE DEPENDING ON DIAMETER


2-WAY CONTROL VALVE (N^{O})


3-WAY CONTROL VALVE (N^{O} B AB)


3-WAY THERMOSTATIC CONTROL VALVE

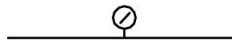

PRESSURE REGULATOR

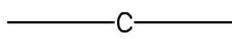

AIR VENT ON HIGH POINT OR NECESSARY C/A STOPCOCK


P1 **RECIRCULATION PUMP**


P2 **SUPPLY PUMP**


SAFETY VALVE ACCORDING TO STANDARD CODE


GAUGE C/A SHUT-OFF VALVE

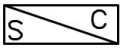


ELECTRIC CONTROL LINE

ROOM TEMPERATURE CONTROLLER (THERMOSTAT)


SEVERAL RELAY CONTACTS

EXPANSION TANK N^{O} 60 MINIMUM



HEATING COIL


AIR SEPARATOR COMPRISING AN AIR PURGE

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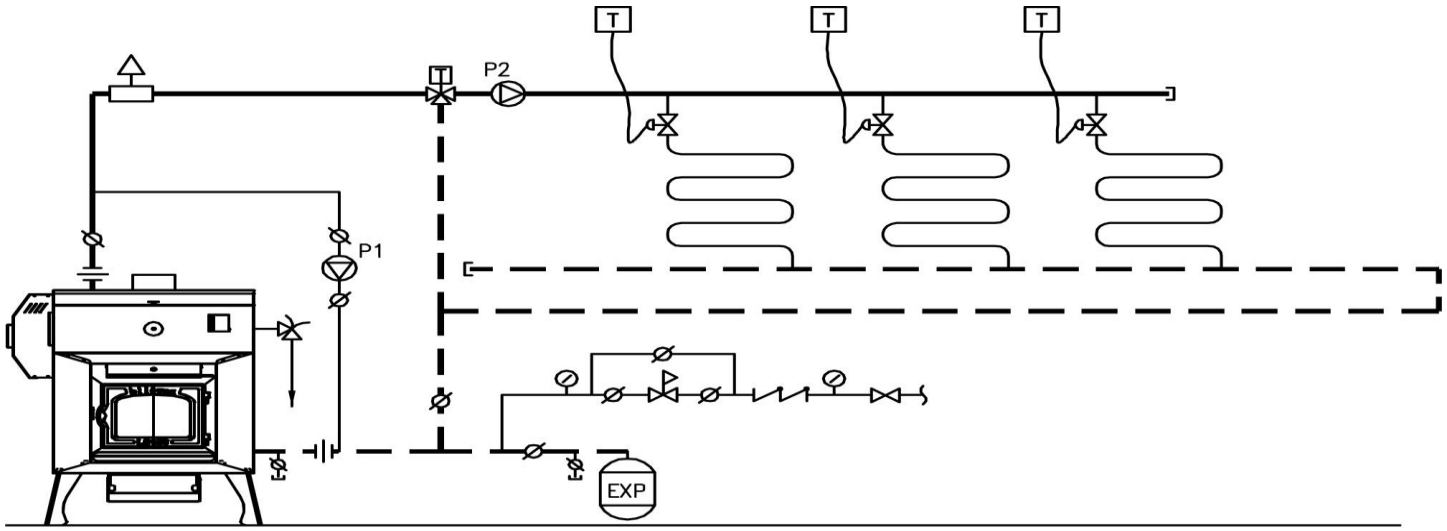

NOTES:

P1: CONTINUING CIRCULATION FOR MIXING OF WATER

P2: CONNECTION WITH LOW TEMPERATURE CONTROL CONNECTED TO BOILER

LS150 CONNECTION TO A RADIANT FLOOR

SCALE: NONE

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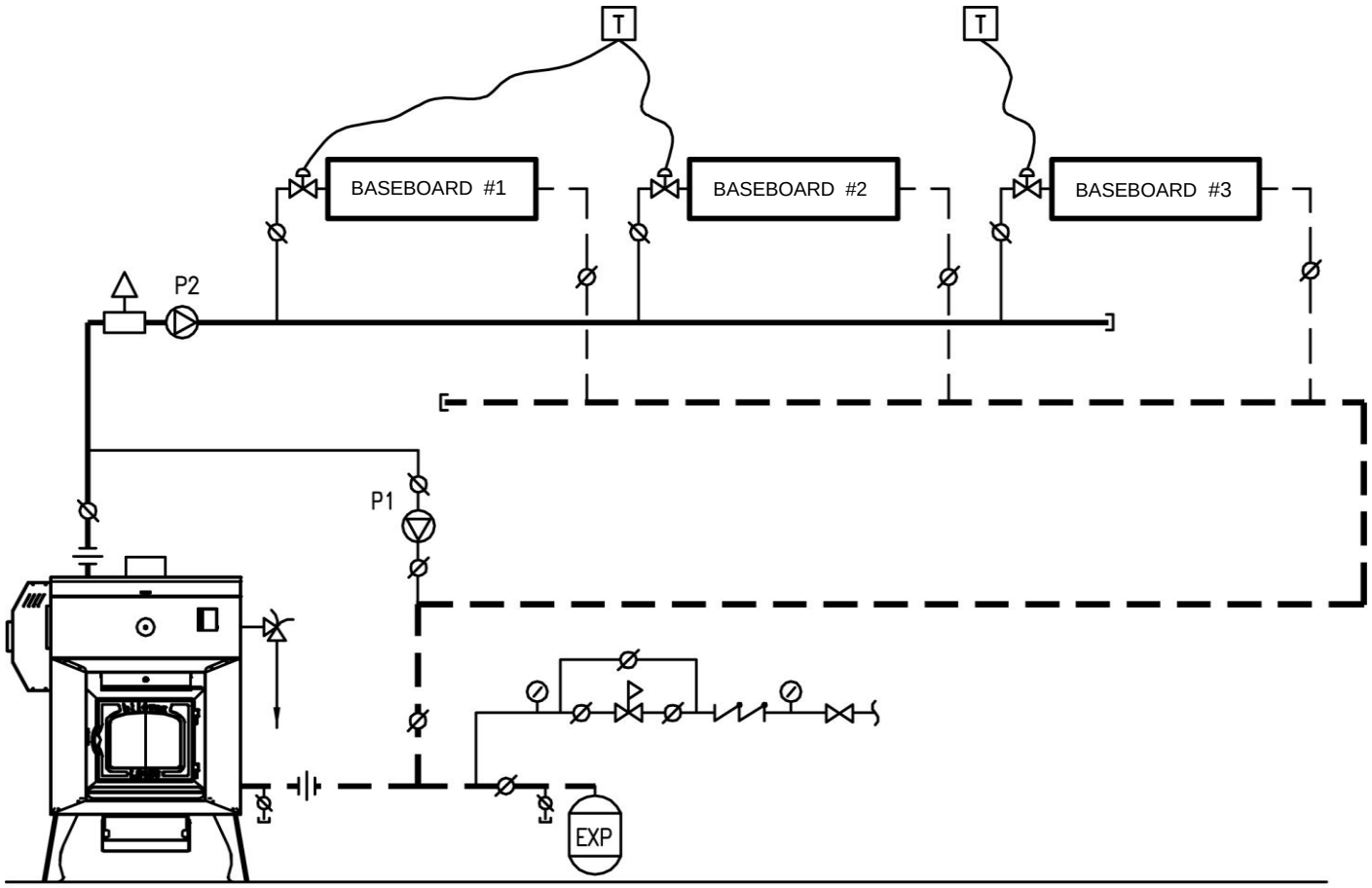

NOTES:

P1: CONTINUING CIRCULATION FOR MIXING OF WATER

P2: CONNECTION WITH LOW TEMPERATURE CONTROL CONNECTED TO BOILER

LS150 CONNECTION TO BASEBOARDS REVERSE RETURN

SCALE: NONE

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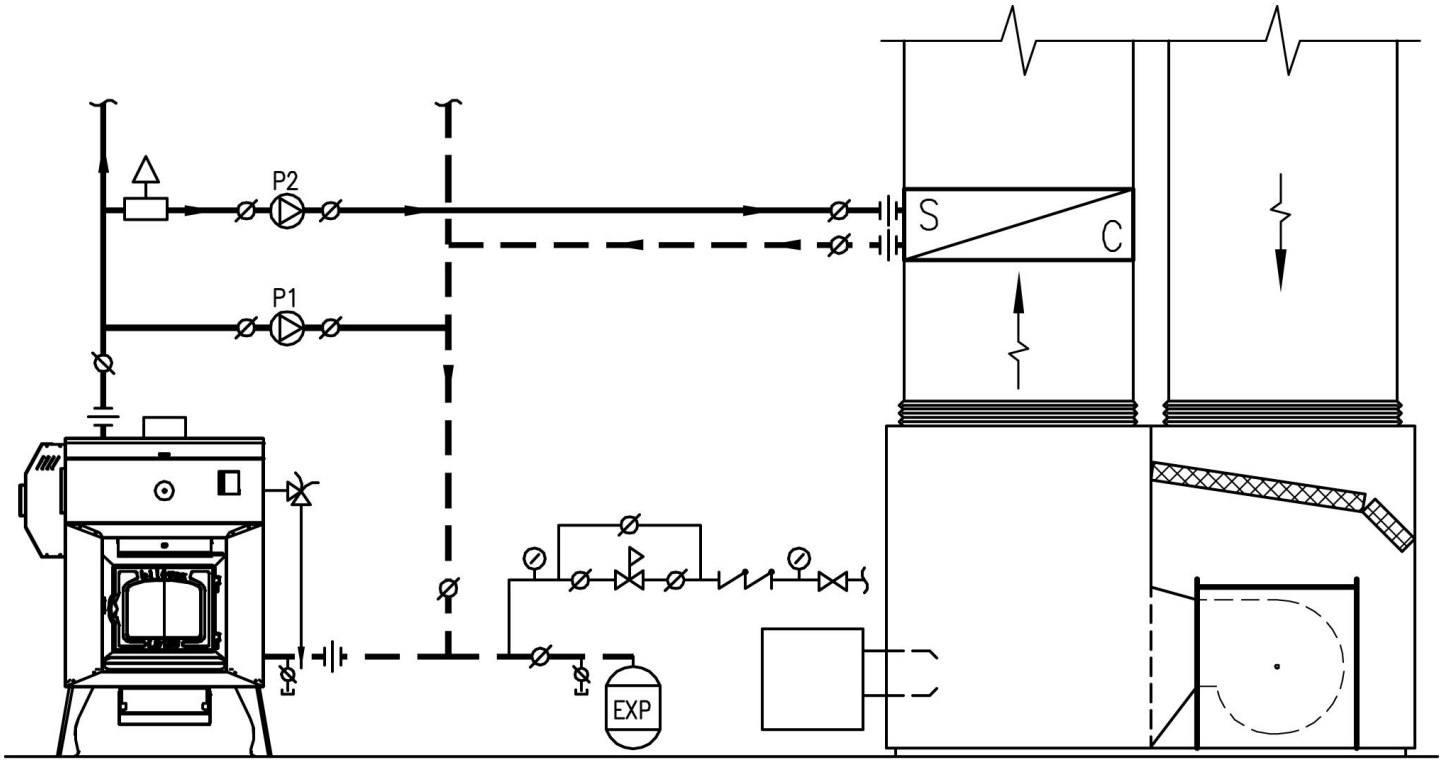

NOTES:

P1: CONTINUING CIRCULATION FOR MIXING OF WATER
P2: CONNECTION WITH LOW TEMPERATURE CONTROL CONNECTED TO BOILER

LS150 CONNECTION TO A HEATING COIL INSTALLED IN AN AIR FORCED SYSTEM

SCALE: NONE

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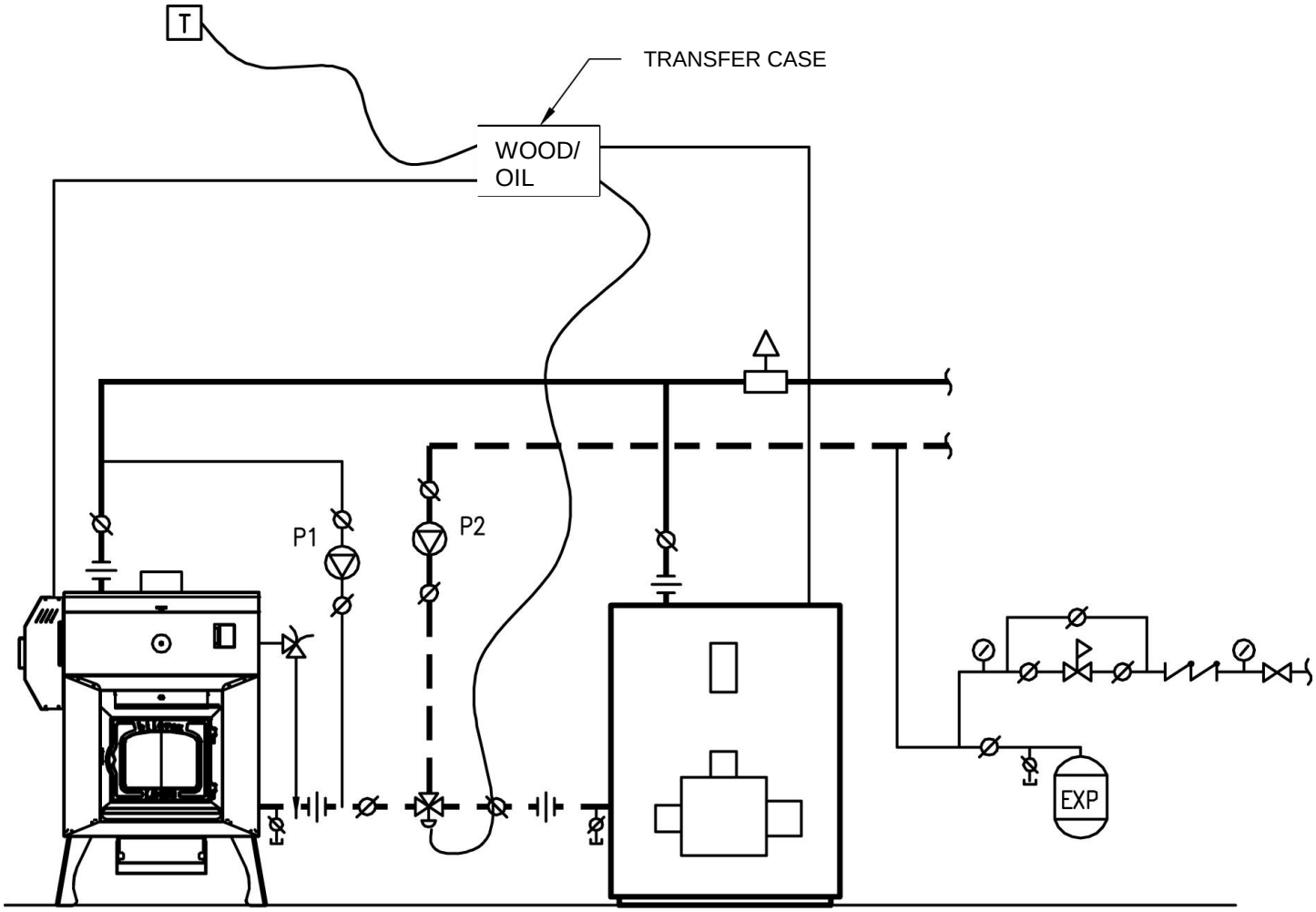

NOTES:

P1: CONTINUING CIRCULATION FOR MIXING OF WATER

P2: CONNECTION WITH LOW TEMPERATURE CONTROL CONNECTED TO BOILER

LS150 CONNECTION TO ANOTHER SYSTEM

SCALE: NONE

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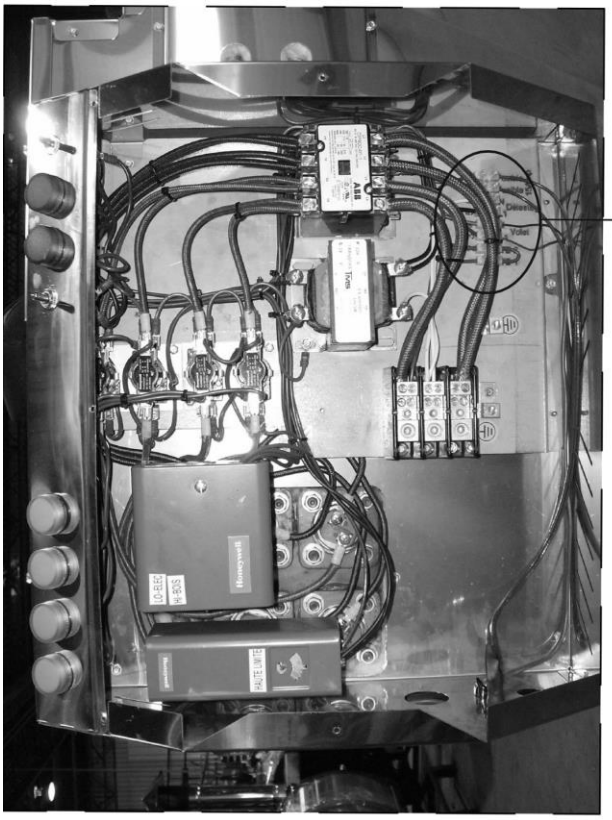
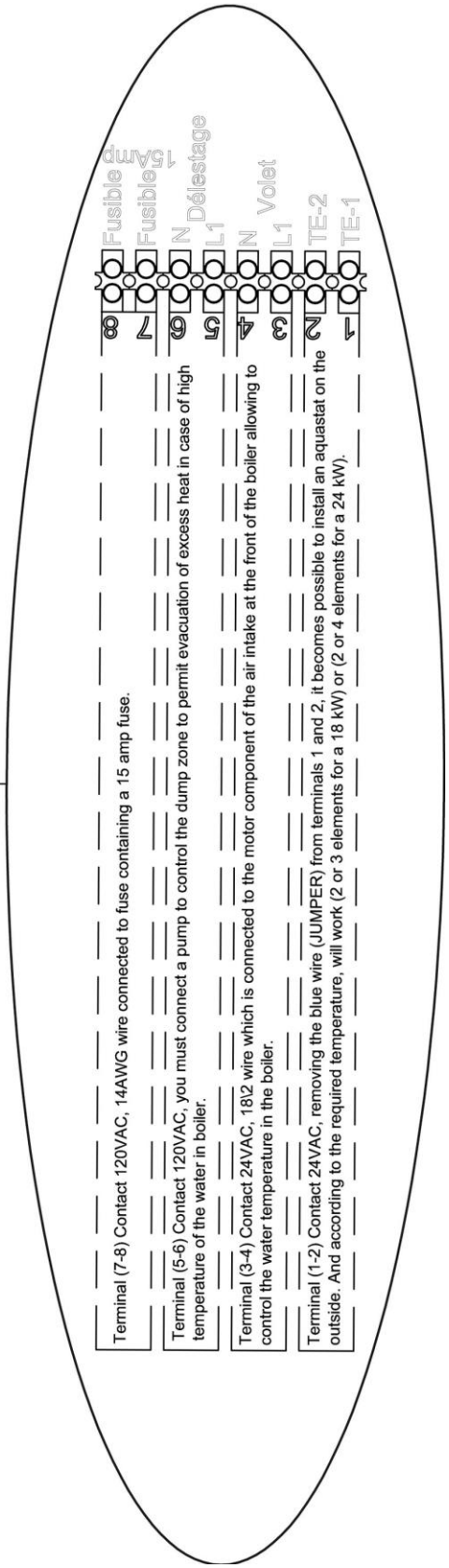
IDENTIFICATION OF THE ELECTRICAL PANEL TERMINALS





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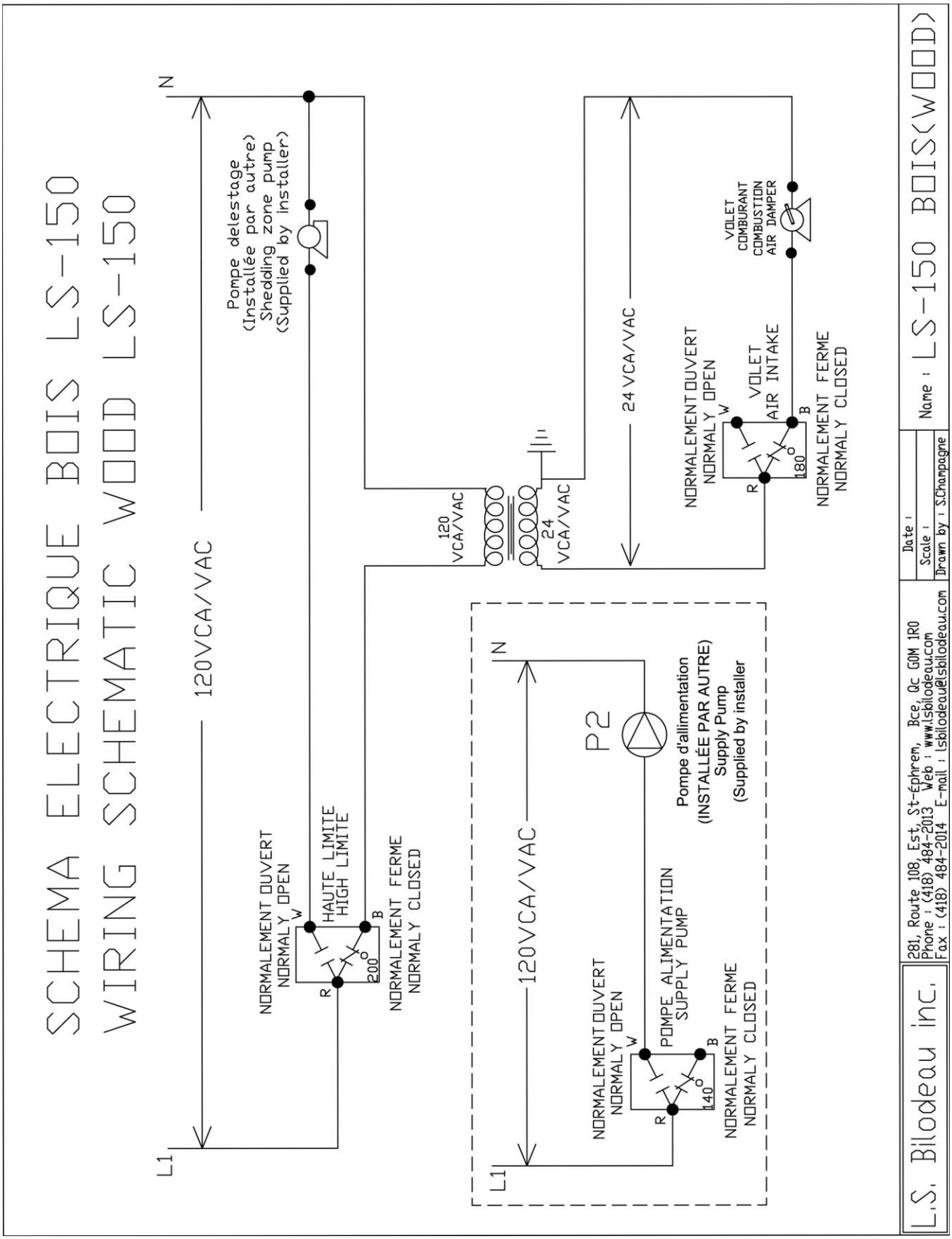

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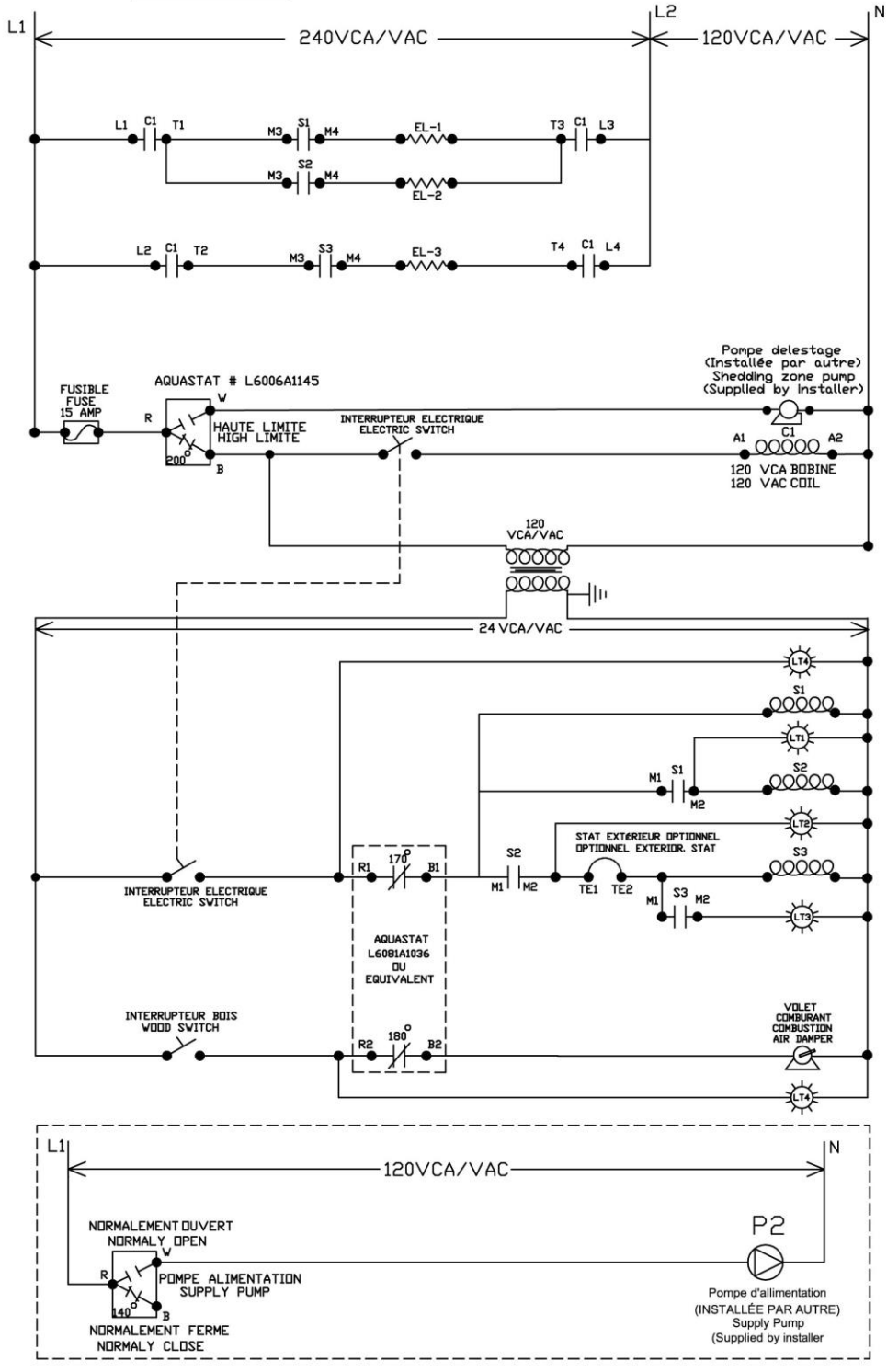
SCHEMA ELECTRIQUE POUR FOURNAISE LS 150
WIRING SCHEMATIC FOR LS 150

SEQUENCER: WHITE ROGERS #24A34-3
HONEYWELL # R14BA1006
MARS #33844

18 KW



L.S. Bilodeau inc.	281, Route 108, Est, St-Éphrem, Bce, Qc G0M 1R0 Phone : (418) 484-2013 Web : www.lsbilodeau.com Fax : (418) 484-2014 E-mail : lsbilodeau@lsbilodeau.com	Date : Scale : Drawn by : S.Champagne	Name : LS 150 18KW

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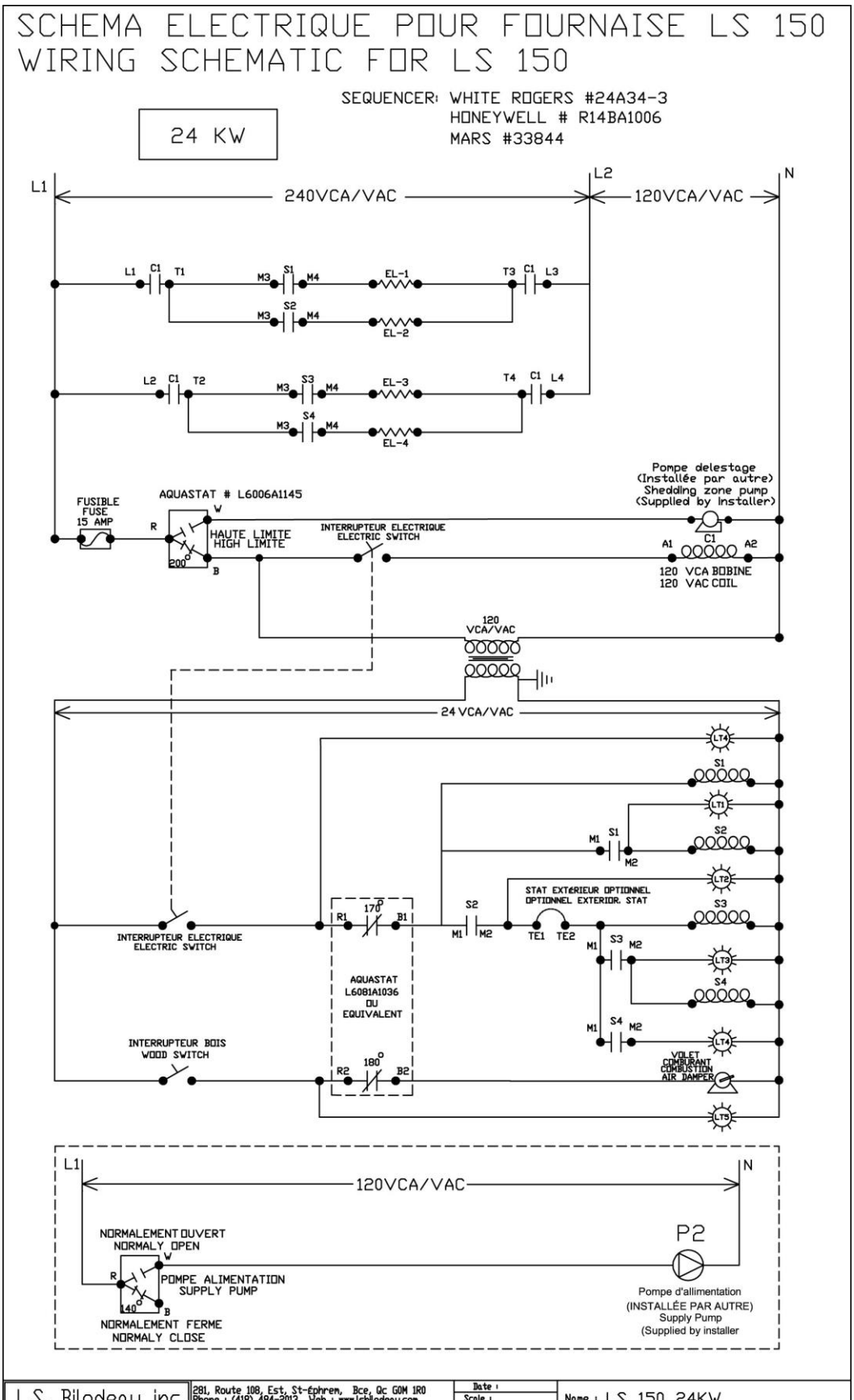
SCHEMA ELECTRIQUE POUR FOURNAISE LS 150
WIRING SCHEMATIC FOR LS 150



L.S. Bilodeau inc.	281, Route 108, Est, St-Éphrem, Bce, Qc G0M 1R0 Phone : (418) 484-2013 Web : www.lsbilodeau.com Fax : (418) 484-2014 E-mail : lsbilodeau@lsbilodeau.com	Date : Scale : Drawn by : SChampagne	Name : LS 150 24KW

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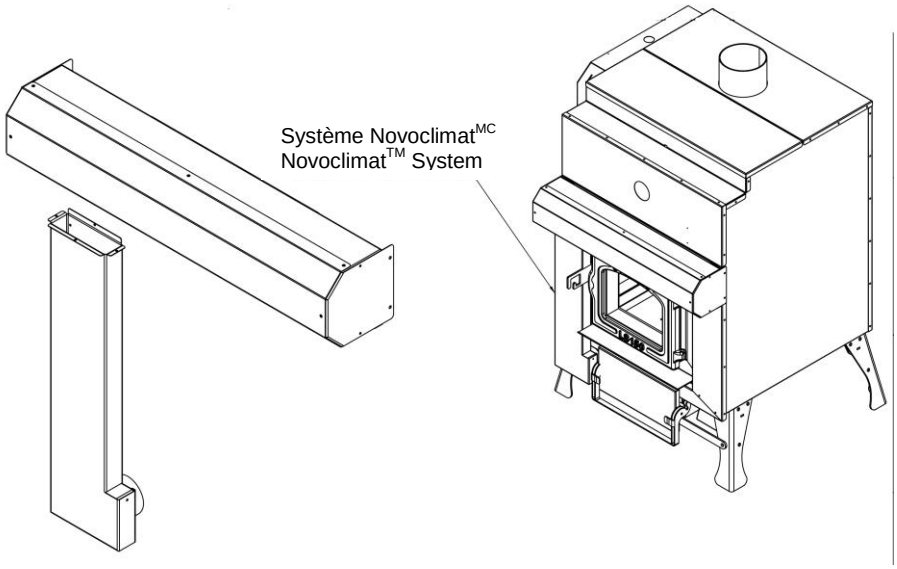
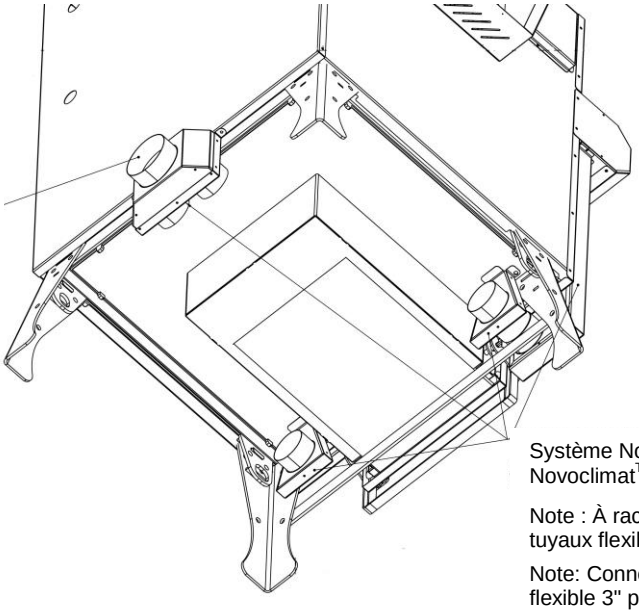
SECTION 10. SCHEMATIC OPTION NOVOCLIMAT™ SYSTEM





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SECTION 11. SCHEMATIC REFRACTORY TILES

No.	TILE NAME	QTY
1	Side tiles	4
2	Front side tiles	2
3	Front tile	1
4	Rear tiles	2
5	Standard bottom tiles	6
6	2.5 inchs bottom tile	1
7	3.25 inchs bottom tiles	2
8	5.75 inchs bottom tiles	2