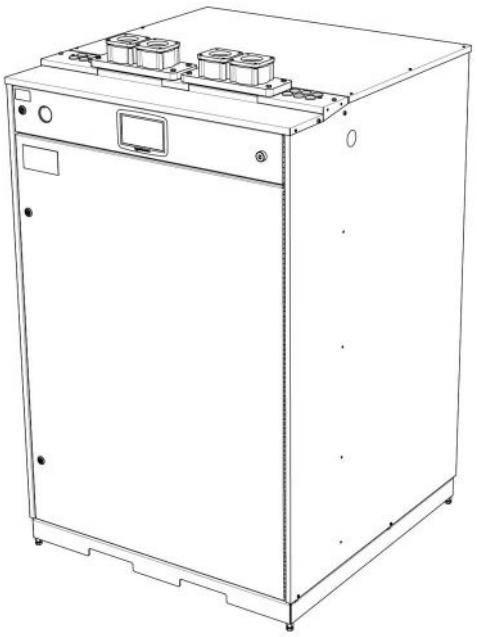
EP G2

Installation and Technical Data



30-stage Electric Boilers

EP 450, EP 510, EP 600 and EP 700 G2 400 V

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1. About the Manual

This manual contains information about and instructions for the installation, operation, and maintenance of electric boilers in the EP G2 series.

Provide the manual to the user. The user must read the manual carefully and understand its contents.

For more information about the control system, see the EP G2 Menus and Control Systems manual.

Store the manuals in the boiler.

2. General Information

The electric boiler is CE-marked. It is classified as a unit and as pressure equipment according to Directive 2014/68/EU, Article 4(3).

Electric boiler supplied with safety equipment has been reviewed by an accredited body and has been deemed to meet the requirements contained in EN 12828.

Factory-fitted safety equipment contains the following:

- 1 or 2 safety valves, depending on opening pressure and boiler power. For more information, see Chapter Technical data - Components.
- 2 x high pressure guards
- 1 x low pressure guard
- 1 x automatic vent valve

Thanks to the factory-fitted safety equipment, the boiler can be installed without emergency protection and steam collection vessel according to EN 12828. A steam collection tank is not required, because the safety valves are fitted directly onto the boiler's safety pipe. The system does not need to be equipped with dual circulation pumps or flow guards.

If national regulations and laws exist for electric boilers, these must be met prior to commissioning.

The service life of the boiler is indefinite. Check for corrosion regularly. If corrosion occurs, the assessment must be renewed.

2.1. Disclaimer

Värmebaronen AB reserves the right to change the specification without prior notice, in accordance with its policy of continuous improvement and development. Illustrations may differ from the actual product. Värmebaronen makes reservations for any proofreading or printing errors.

2.2. Legends - Warnings

Warning! Risk of injury, death or product damage!

Warning! Risk of electrical injury and death!

Warning! Risk of product damage from static electricity!

Important information and user tips!

2.3. Safety

Before installation, operation and maintenance, carefully read the manuals and documentation for connected equipment.

Installation, operation and maintenance of the boiler may only be performed by qualified individuals. Instructions in this manual, as well as applicable standards and norms for heating systems, must be followed.

In cases where the instructions in this manual violate national regulations, the latter must be followed.

Position of boiler

- Do not place the boiler in an earthquake risk area or where abnormal vibrations may occur.
- Do not place the boiler in spaces where explosive atmospheres may occur, for example dust or flammable gases.
- Position the boiler so that only authorised individuals have access.
- The space where the boiler is located must be free from pests.
- The ambient temperature must not exceed 30°C or be lower than 10°C.
- Place the boiler indoors in a heated area with a humidity that does not normally exceed 60%.

Installation, operation, maintenance

- Never disable the safety equipment!
- Only authorised persons may perform work in the boiler.
- Always contact your installation engineer for service matters.
- You are not permitted to make modifications to or convert the boiler.
- Disconnect the boiler from the power supply and lock the switches before service or repairs.
- Never carry out maintenance work/service on hot or pressurised parts.
- Do not store flammable or corrosive products near the boiler.
- Risk of electric shock. Never leave the boiler with an open door or panel, or with plates in the boiler casing removed.
- Do not start the boiler until the water system has been filled and properly vented.
- Do not use the boiler for direct heating of drinking water.

- Do not flush the boiler with water.
- Do not drill into the boiler's cladding panels. Drill shavings can damage the boiler's electronics.
- Always specify the type and manufacturing number of the boiler when contacting Värmebaronen (see the boiler's design label).

2.4. Handling

- Check that the delivery is complete.
- Always transport and store the boiler upright in a dry location.
- Temperature during transportation and storage: -25 to +55°C.
- Use the required personal protective equipment.
- When moving the boiler, never allow people to enter risk zones and never place body parts between, e.g. the boiler and a wall when the boiler is not steady on the floor.
- If the boiler is lifted after the packaging has been removed, the wooden pallet will not follow.
- When handling the boiler, be aware of its centre of gravity:

Boiler model	The boiler's centre of gravity	Slope when the boiler tips over (degrees)	Slope when the boiler tips over (per cent)
EP 150–350 G2	Approx. 65 cm from bottom frame	> 23°C	> 43%
EP 450–700 G2	Approx. 75 cm from bottom frame	> 20°C	> 35%
EP 900–1400 G2	Approx. 80 cm from the bottom frame	> 37°	> 75%

- Use a pallet lifter to transport and position the boiler in the location where it is to stand, leaving a distance from any walls to ensure there is workspace around the boiler.
- Use suitable equipment, such as a pallet lifter, when moving the boiler. In order avoid the risk of the boiler tipping over, for example, on stairs or slopes, use a crane.
- The boiler may slide off if it is lifted "steel-on-steel" with a pallet lifter! The boiler may slide or rock if the surface is uneven, and can then exert considerable force.
- When handling the product with a crane or similar device, make sure that the lifting device and other parts are undamaged. Never stand beneath a hoisted product.
- Sort the packaging and submit it to a recycling station.
- At the end of its service life, a boiler must be recycled. Sort the boiler's insulation as insulation, the boiler tank and cladding sheets as scrap metal, and electrical parts and electronic waste as electronic waste.

3. Installation Information

Boiler	Electrical Installer	Plumbing Installer
Serial number:	Name:	Name:
Installation date:	Telephone number:	Telephone number:

Boiler Type

Model ☐ EP 450 G2 Art. no. 5840 ☐ EP 510 G2 Art. no. 5842 ☐ EP 600 G2 Art. no. 5846 ☐ EP 700 G2 Art. no. 5848

Settings

Installed power _____ kW

Load limiter ☐

Main fuse _____ A

Primary transformer _____ (xxxx/5)

Setpoint source ☐ Internal ☐ P20 ☐ P21

Input type ☐ Off ☐ Voltage ☐ Current

External power limiting ☐ Off ☐ Upper limit

Signal source ☐ P20 ☐ P21 ☐ 100%

Max limitation _____ °C Min limitation _____ °C

UTK Settings in case of outside temperature:

-30°C _____ -15°C _____ 0°C _____ 15°C _____

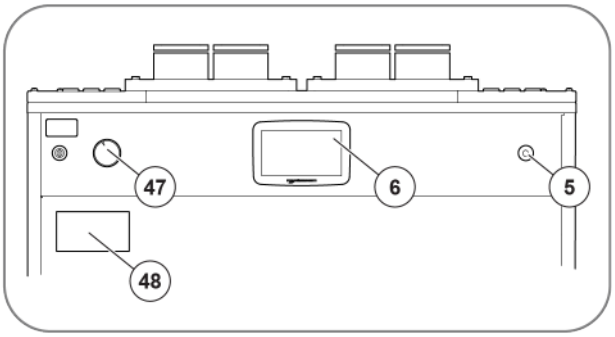
-25°C _____ -10°C _____ 5°C _____ 20°C _____

-20°C _____ -5°C _____ 10°C _____ Parallel displacement: _____

Other Notes

4. Overview

5. Stop button
6. Display
47. Pressure gauge
48. Design label



5. Functions

The EP 450-700 G2 series consists of boilers with power of 450–700 kW.

The boilers adjust the temperature, with thirty power stages that you can limit down to one power stage.

The boilers' standard control range is 20–95°C.

The boiler can be ordered with factory-fitted safety equipment. The safety equipment includes safety valves, pressure guards and an automatic vent valve, and is judged to meet the requirements in EN12828.

5.1. Safety

The boiler is equipped with 1-4 load switches with shunt release. The boiler's overheating protection, stop button or other connected safety equipment controls when the load switches are triggered.

5.2. Alarm Indication

The boiler indicates an alarm on the control panel by the screen flashing, as well as displaying information about the cause of the alarm and when the alarm occurred. Connection for external main alarm indicator exists. It is possible to send information about the cause of the alarm and the time of the alarm via e-mail (requires network connection).

5.3. Zero-voltage Switching

The boiler requires manual restart after a power failure. The "Zero Voltage Protection Tripped" alarm appears on the display, and you have to acknowledge the alarm before the boiler can start.

You can deactivate the function after evaluation by end-users and the accredited body that assesses periodic monitoring of the boiler.

For more information, see Chapter Installation in the EP G2 Menus and Control Systems manual.

5.4. Level Sensor

To protect the immersion heaters from boiling dry, the boiler is equipped with a level guard. The level guard generates a warning and stops the boiler's control if air has accumulated at the top of the boiler.

5.5. Load Limiter

To protect the main fuses against overload, the boiler is equipped with a load limiter. For boilers with an output of up to 63 kW, transformers for direct measurement are included, and for boilers with an output of between 70–750 kW, secondary transformers are included.

5.6. Pump Maintenance Operation

The boiler is equipped with a connection for a circulation pump with a pump maintenance operation function.

5.7. External Power Limiting

The boiler is equipped with a connection for external blocking, analogue control signal 0-10 V or 4-20 mA for control of power.

5.8. External Temperature Setpoint

The boiler is equipped with a connection for external temperature setpoint in the form of a 0–10 V or 4–20 mA signal.

5.9. Output Signal for Present Power and Temperature

The boiler is equipped with a connection for 0-10 V output signals for the number of connected power stages and boiler temperature.

5.10. Aluminium and Copper

The boiler's load switches have connection terminals to which you can connect aluminium or copper cable. No need to splice from aluminium. Use stranded cable. For more information, see Chapter Technical Data - Electrical Specifications.

5.11. Stainless Steel Immersion Heaters

The immersion heaters are made of stainless steel.

5.12. Cooling Fans

The boiler is equipped with 0-3 filtered cooling fans depending on the boiler model. For more information about the maximum number of cooling fans, see Chapter Technical Data - Components.

5.13. Direct Power Control - DPC (Optional)

The DPC is used in processes that require rapid regulation. A superior system is required that monitors the temperature and then controls the boiler power.

5.14. Outdoor Temperature Compensation - UTK (Optional)

The boilers are supplied with control to maintain a constant boiler temperature. To regulate with a variable flow pipe temperature, an outdoor temperature sensor is available as an option.

5.15. Temperature Control in Secondary Circuit (Optional)

When used with, for example, a heat exchanger, the temperature in the secondary circuit can control the boiler.

5.16. Modbus (Optional)

The boiler is prepared for Modbus RTU (RS485) or TCP communication.

5.17. BACnet (Optional)

The boiler is prepared for BACnet.

6. Installation

6.1. Installation Overview

1. Prepare accessories and installation materials that are not included in the boiler delivery.
2. Install the boiler.
3. Install the pipe system.
4. Fill with water.
5. Install the electricity.
6. Test the boiler in accordance with the Installation engineer's checklist.
7. Demonstrate the boiler to the customer.
8. Fill in the installation engineer's notes for the user.

6.2. Water Quality

If the water deviates from the recommended values, it can cause corrosion or deposits, which will shorten the service life of the boiler.

The oxygen content in the system water should be <10 µ/kg. If the oxygen content is higher, investigate the source and take action.

Perform a technical water analysis to check diluted water and system water quality. If the water's values deviate from the recommended values, adjust the values or use an alternative water source. To achieve an accurate analysis value, especially regarding oxygen concentration, perform sampling correctly and analyse the sample immediately. Consult a water chemistry laboratory before sampling.

From a corrosion perspective, the presence of oxygen that is supplied via air or oxygen-rich water is the biggest problem. Keep the amount of diluted water as low as possible, to avoid unnecessary oxygenation.

Hardness in water causes deposits on the boiler's heating elements. These deposits can lead to local overheating, which damages the elements.

High chloride content combined with deposits can lead to point and stress corrosion cracking, which destroys the elements in a short space of time.

Small systems

In small systems, you can usually use good quality tap water for filling and as diluting water, without degassing. Degassing of the water takes place in the boiler and the oxygen is diverted as air via air vent valves. The residue will react with the metal in the boiler, but will not cause significant corrosion as the amount of oxygen is small.

Large systems

For large systems, the requirements regarding water quality are higher. Degassing and consumption of residual oxygen last for longer and therefore cause more corrosion. Use degassed water or oxygen-consuming additives if necessary. For large systems, softened and desalinated water should be used.

Degassing

For effective degassing, heat the system immediately after filling. The boiler and system temperatures should be as high as possible during degassing.

Subject	Recommended value	Risk in the event of deviating value
pH value	7.5-8.5 pH	Lower values can result in corrosion damage.
Alkalinity	At least 60 mg/l	Corrosion.
Carbonic acid content	Max. 25 mg/l	Corrosion. Carbonic acid in combination with low pH and hardness values makes the water aggressive.
Sulphate content	Max. 100 mg/l	Corrosion. If the sulphate content is higher than the chloride content, copper corrosion may occur.
Chloride levels	Max. 100 mg/l	Corrosion. The aggressiveness of the chloride increases in combination with the presence of deposits.
Hard/Soft water	5-6 dH°	Hard water gives rise to deposits (boiler scale). Very soft water may cause corrosion damage.

6.3. Flow Requirements

To function optimally, the boiler must have a constant, sufficiently high flow. Dimension the flow so that it is within specified limits. The boiler's delta t must be between 5 and 25°C

Insufficient water flow may result in the following:

- The difference between the temperature setting and the actual temperature achieved in the boiler increases.
- Volatile regulation and increased wear on the boiler's contactors, which shorten the service life of the boiler.

Excessive water flow may result in the following:

- Vibrations and noise in the immersion heaters with reduced service life as a result.
- Unnecessary wear on the system's other components.

Recommended flow results in a Δt of 10°C at maximum boiler output.

From a safety point of view, the boiler is designed to withstand zero flow without damage. If forced circulation ceases, for example because of a closed valve or a pump that has been stopped, and only self-circulation occurs, the boiler remains unaffected and remains protected from damage.

For more information, see Chapter Technical Data - HVAC Specifications.

6.4. Install the Boiler

If you add glycol to the system, the glycol must contain corrosion-inhibiting additives.

From a safety perspective, the boiler is designed to cope with zero flow. As a result, you do not need to install a flow guard or double circulation pumps.

Remember not to block the boiler's cover plate when installing pipes and electricity.

The boiler should be positioned and assembled as follows:

- Install the boiler indoors where the ambient temperature does not exceed 30°C and does not drop below 10°C.
- The room should have a floor drain.
- Place the boiler indoors in a location that is dimensioned for the boiler's weight when it is filled with water.
- Place the boiler on a firm surface, preferably a concrete foundation.
- If the product is to stand on a soft surface, base plates must be placed under the boiler's adjustable foot bolts.
- Adjust the foot bolts so that the boiler is horizontal.
- Observe the electrical installation rules' requirements regarding free space in front of connection equipment, including when the boiler's open door or control panel limits the amount of space.
- Leave sufficient free space behind and to the sides of the boiler for routing cables/pipes, and accessibility during servicing/maintenance.
- Ensure there is sufficient ceiling height to allow the immersion heaters to be changed. For more information, see Chapter Technical Data - HVAC Specifications.

6.5. Pipe Installation

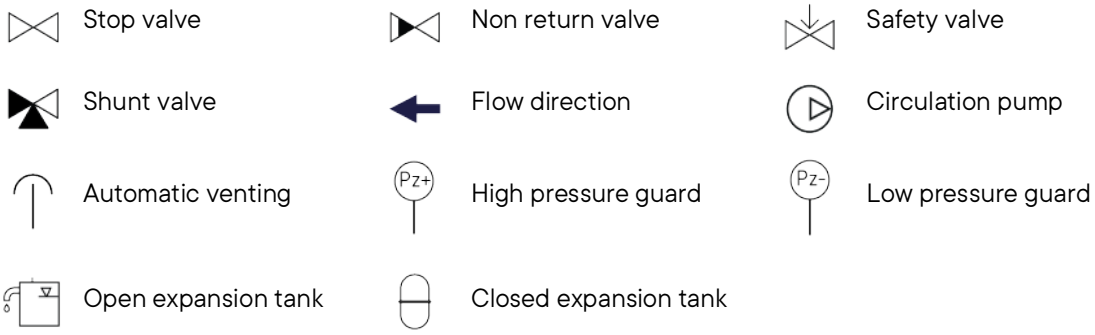
When installing pipes, keep the following in mind:

National regulations may require checks or the inspection of the boiler by an accredited body. If such regulations exist, they must be satisfied before commissioning. Inspections can include checking that the required safety equipment is available and that it is correctly dimensioned.

- Select the opening pressure of the safety valve according to the system component that tolerates the lowest pressure.
- Suitable safety equipment is specified in Swedish standard EN12828, which covers temperature, pressure, level, flow guards and safety valves.
- Perform the pipe installation so that forces from the pipe system are not transferred to the boiler.
- Insulate all pipe connections to the boiler so as to avoid the risk of burns.
- Any additional equipment must be installed as indicated by the manufacturer of the product.
- Perform the pipe installation so that vibrations are not transferred to the boiler.
- The boiler can cope with zero flow from a safety perspective, but the boiler should have an even and constant flow.
- Images showing examples of pipe systems are system principles. Design the pipe system in accordance with current regulations and standards.
- The boiler has built-in overheating protection and built-in over-temperature protection.
- Always install shut-off valves on the boiler's flow and return pipes.
- Install the circulation pump on the return pipe so that the circulation pump presses the flow through the boiler.

- Connect a fixed filling pipe with a filling valve if the system is only filled with water. Be sure to prevent backflow of the system water.
- For filling with water that is mixed with chemicals, such as glycol or corrosion-limiting additives, the filling valve must not be connected to the water supply network. Filling can be performed via a special filling station.
- When choosing the size of the expansion tank, bear in mind the change in the water volume during heating and cooling.
- Add oxygen-consuming agents if there is a risk that the water may become oxygenated. Oxygenation can occur in the event the system is leaking or is refilled frequently. If you do not add oxygen-consuming agents, corrosion may damage the immersion heaters.

6.5.1. System Principles - Legends

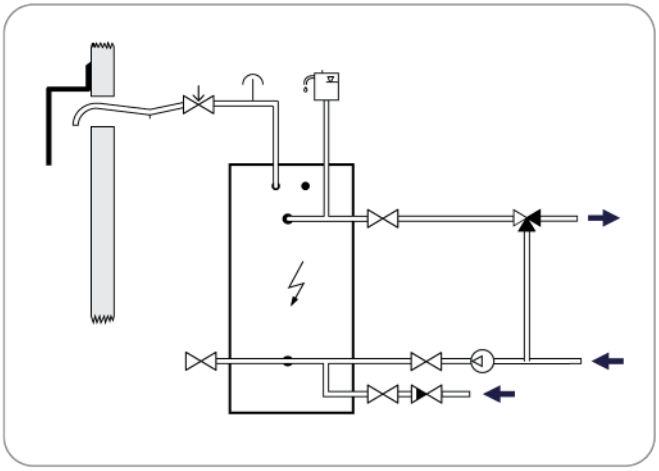


6.5.2. System Principle - Open System

Fit the boiler with a safety valve to avoid damage in the event of any blockage in the expansion system.

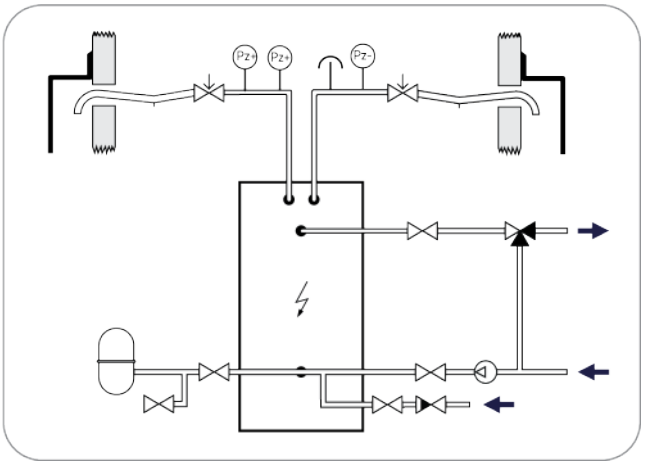
When assembling an open system, keep the following in mind:

- Connect the expansion tank to the boiler's flow pipe. The safety pipe should rise all the way to the expansion tank, without obstruction or possibility of shutdown.
- Dimension expansion tanks to accommodate changes in water volume due to heating and cooling.
- Expansion tanks with associated pipes must be installed in a way that protects against freezing.
- To avoid oxygenating the water, install the open expansion tank at least 2.5 metres above the highest point in the system. The height must be sufficient to avoid cavitation on the suction side of the circulation pump.



6.5.3. System Principle - Closed System Without Release Tank

When installing the boiler in a closed system, bear in mind the following:



- Fit the boiler with approved safety equipment that prevents the boiler's pressure and temperature limits from being exceeded.
- Select the opening pressure for the safety valve based on the component in the system that tolerates the lowest pressure.
- Lock the valve to the expansion vessel in the open position to ensure correct function.
- Divert steam and liquid flowing out of the safety valve in accordance with the requirements of SS-EN 12828. The pipes should normally end on the outside of the building or be connected to an expansion tank.
- Dimension the safety valve's discharge pipe so that the pressure drop does not exceed 10% of the safety valve's opening pressure.
- Route the discharge pipe so that water pockets cannot form.
- To avoid freezing, the discharge pipe passing through the outer wall must have an inward fall. Drain the pipe at the discharge pipe's lowest point.

6.5.4. Filling and Draining

Filling During Installation

Fill the boiler until the pressure, in the case of a cold boiler, is just above the minimum recommended pressure in the system. After installation, air may remain in the system for a period of time, making it necessary to perform repeated venting. Add more water if necessary.

For more information about water quality and degassing, see Chapter Installation - Water Quality.

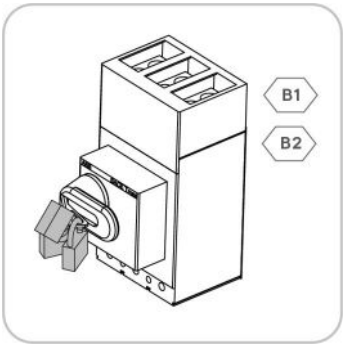
Draining

Follow local regulations for handling water that is mixed with chemicals.

Always cut the power to the boiler and lock all load-break switches before draining the water!

1. Disconnect power to the boiler and lock load-break switches B1 and B2 as shown.
2. Drain the boiler through the drain valve.

For more information, see Chapter Technical Data - Component placement.



6.6. Electrical Installation

6.6.1. Electrical Safety

Electrical installation must be carried out in accordance with the applicable regulations, by an authorised electrical installer or by someone who is covered by the company's self-inspection programme. Dimension and route cables according to current electrical installation rules. For more information about the recommended cable, see Chapter Technical Data.

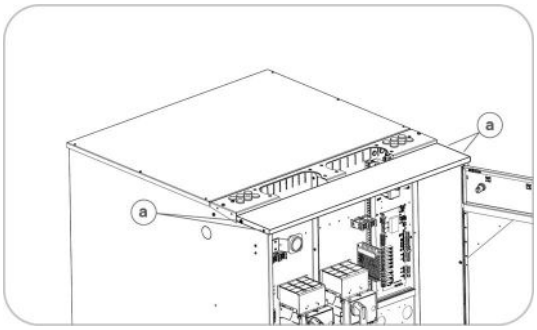
Always shut off the power before carrying out work on the boiler.

- Do not start the boiler until the heating system has been filled with water and properly vented.
- Risk of electric shock. Never leave the boiler with an open door or panel, or with plates in the boiler casing removed.
- Do not drill into the boiler's cover plates. Swarf can damage the boiler's electrical equipment. M6 bolts are available for fastening cable trays.
- To avoid disruption, do not lay light-current cables in direct connection with power cables.
- Lay cables so that it is possible to open doors and remove the roof plate for servicing.
- Dimension incoming cables in accordance with current regulations. Take into account e.g. ambient temperature, installation method and cable length. For more information about the recommended cable area, see Chapter Technical Data - Electrical Specifications.

6.6.2. Power Supply

Re-tighten power cable connections using torque tools 500 hrs after installation.

Connect the power cables:



1. Remove the 4 screws (a) and angle the front edge of the roof plate 90° upwards.
2. Lift the roof plate straight up.
3. Slide cable flanges and gaskets onto the power cables.
4. Grease aluminium cable with neutral contact grease.
5. Bind together and connect the power cables.
6. Install the roof plate.
7. Screw the cable flanges in place using the gaskets.
6. Connect PE 4-conductor cables to load switches and earth clamps.
    - The tightening torque for load switches is 31 Nm.
    - The tightening torque for earth clamps is 40 Nm.
9. Anchor incoming cables.

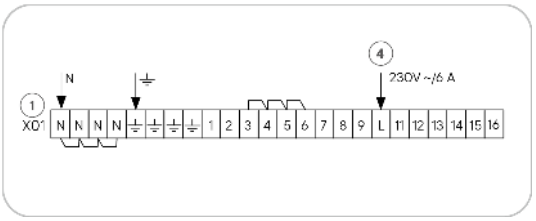
For more information, see Chapter Technical Data - Component Placement.

6.6.3. Operating Voltage

The boiler control circuit is supplied by an external power supply of 230V ~, fused with 6A.

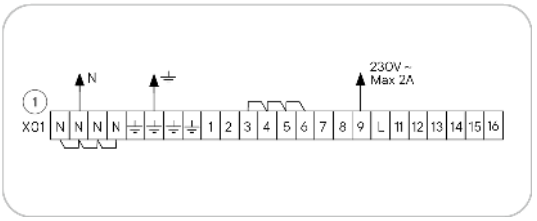
An all-pole switch with a minimum break distance of 3 mm must be installed before the boiler.

For more information, see Chapter Technical data - Control circuit.



6.6.4. Power Supply to External Unit

Power supply to external unit. The maximum output load is 230V ~, 2A.



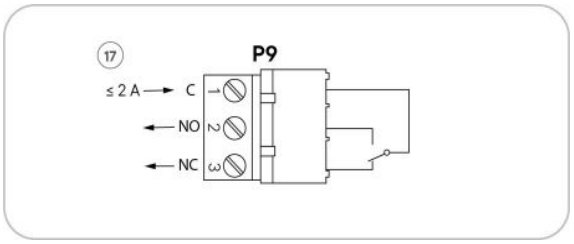
6.6.5. External Indication of Sum Alarm

Potential-free contact for indication of sum, alarms.

Connect the signal cables to output P9.

- Terminals 1–3, C-NC, are closed during operation.
- Terminals 1–2, C-NO, are closed during alarm.

The maximum output load is 230 V~, 2 A.



For more information, see Chapter Technical Data - Control Circuit.

Buzzer alarms are triggered when the following happens:

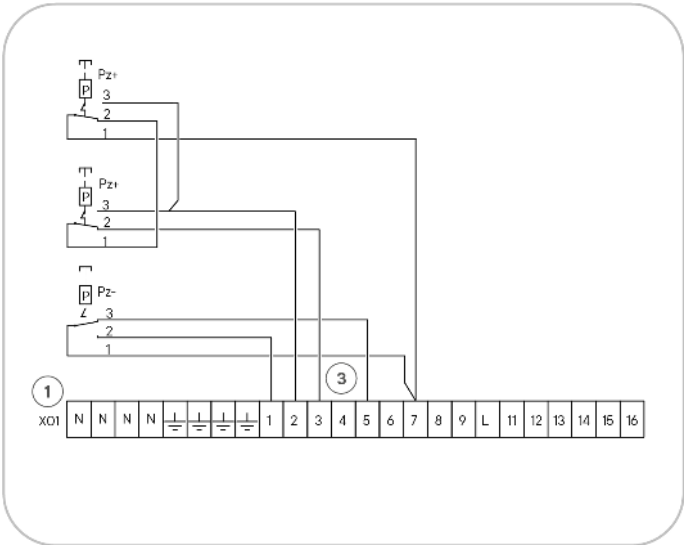
- External alarm
- Load-switch triggered or in Off position
- Pressure guard triggered
- Overheating protection triggered

6.6.6. Safety Equipment - Pressure Guards

If the boiler was supplied without pressure guards, the installation must be supplemented with these before commissioning.

Connect external safety equipment as shown in the image below.

For more information, see Chapter Technical Data - Control Circuit.



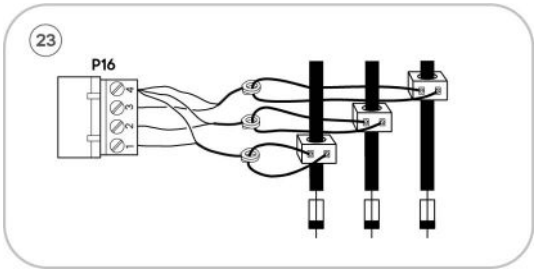
6.6.7. Load Limiter Secondary Measurement

Short circuit the current transformer when switching on/off, otherwise the circuit board can be damaged!

Only install the current transformers when the load limiter is in use.

Metering is done with primary/secondary current transformers. The electrical installer provides primary transformers, adapted to the specific needs of the facility (xxxx/5A). Secondary current transformers are supplied with boilers from 70 kW up to 750 kW.

Install secondary metering:



1. Connect with a high-voltage insulated cable with a minimum area of 0.75 mm^2.
2. Install the current transformers on the cables from the fuses, which must be protected.
3. Route the cable from the primary current transformer through the secondary current transformer once.
4. Connect to input P16, with common conductor to P16:4.

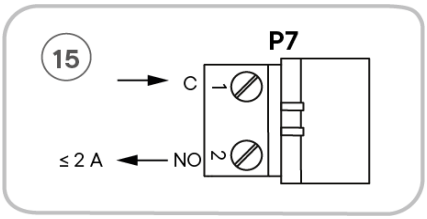
   The load limiter is not phase-sensitive.

For more information, see Chapter Technical Data - Control Circuit.

For more information about the configuration of the load limiter, see Chapter Load limiter in the EP G2 Menus and Control Systems manual.

6.6.8. Circulation Pump

Potential-free closing contact for control to circulation pump. If the boiler controls the circulation pump, mark the circulation pump, indicating it is controlled by the boiler. The maximum output load is 230 V~, 2 A.



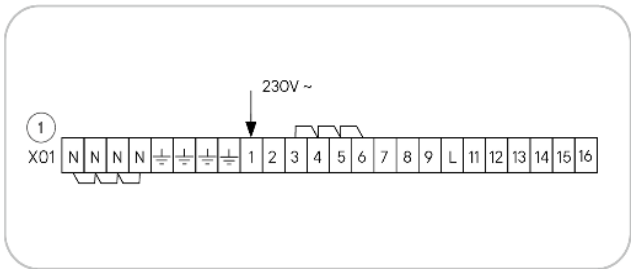
For more information, see Chapter Technical Data - Control Circuit.

For more information about the configuration of the circulation pump, see Chapter Installation - Fan and Pump in the EP G2 Menus and Control Systems manual.

6.6.9. Shared Safety Equipment

The alarm signal must use the same phase as boiler control!

If the boiler has to share safety equipment with other boilers in the system, connect alarm signal 230 V~ from existing safety equipment to terminal 1 in terminal block X01.



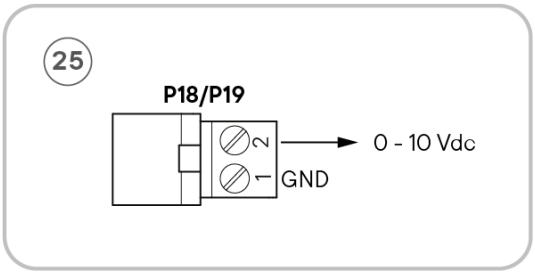
6.6.10. Output Signal of Connected Power

Read current power input at output P18 or P19 in the form of a 0-10 VDC signal. 0-10 V is equivalent to 0-100% of installed power.

Connect the signal cables to output P18 or P19.

For more information, see Chapter Technical Data - Control Circuit.

For more information about configuration of the output signal, see Chapter Installation - Analogue Output P18 or P19 in the EP G2 Menus and Control Systems manual.



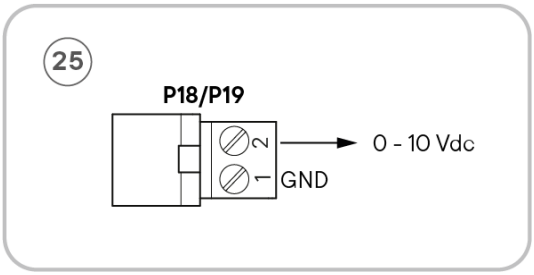
6.6.11. Output Signal of Current Boiler Temperature

Read current boiler temperature in the form of a 0-10 V signal at output P18 or P19.

Connect the signal cables to output P18 or P19.

For more information, see Chapter Technical Data - Control Circuit.

For more information about configuration of the output signal, see Chapter Installation - Analogue output P18 or P19 in the EP G2 Menus and Control Systems manual.

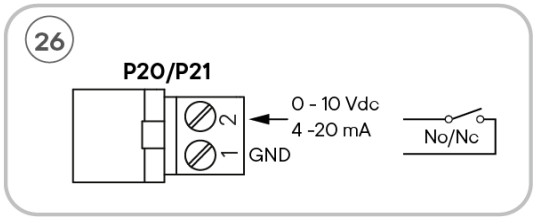


6.6.12. External Power Limiting

Control the number of connected power stages through 4-20 mA or 0-10 VDC. Alternatively, block the power stages with a closing or breaking relay.

To control the number of power stages through current or voltage, connect the signal cables to input P20 or P21.

For more information, see Chapter Technical Data - Control Circuit.

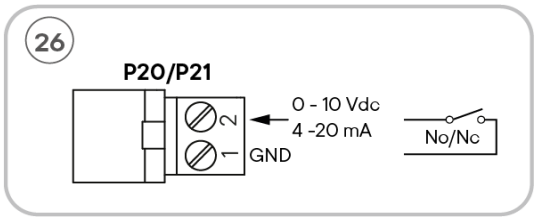


For more information about the configuration of control signal, see Chapters Regulation - Control Signal and Installation - Analogue Input P20 or P21 in the EP G2 Menus and Control Systems manual.

6.6.13. External Temperature Setpoint

Controls the temperature set point through 4-20 mA or 0-10 VDC. Alternatively, the temperature setpoint can switch between the minimum and maximum limits using a closing or breaking relay.

To control the external temperature setpoint through current or voltage, connect the signal cables to input P20 or P21.



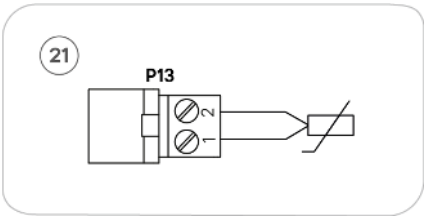
For more information, see Chapter Technical Data - Control Circuit.

For more information about the configuration of control signal, see Chapters Regulation, Setpoint Source, Installation - Analogue Input P20 or P21 in the EP G2 Menus and Control Systems manual.

6.6.14. Outdoor Sensor (Optional)

Position the outdoor sensor:

- On an outdoor wall, about 2 metres from the ground.
- In a corner facing north or northwest, so that the outdoor sensor is not exposed to morning sun.
- So that the outdoor sensor is not affected by escaping hot air from vents, doors or windows.



Connect the outdoor sensor to the boiler using a cable with a cross section of at least 0.5 mm^2 and a maximum length of 30 metres. Connect the outdoor sensor to input P13.

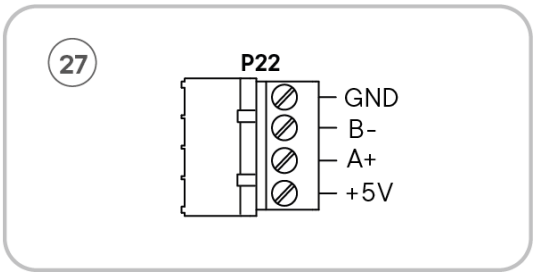
For more information, see Chapter Technical Data - Control Circuit. For more information about the configuration of outdoor sensors, see Chapter Regulation - UTK in the EP G2 Menus and Control Systems manual.

6.6.15. Modbus (Optional)

Connect RS 485 communication to input P22. Use contact P26 for network communication.

For more information, see Chapter Technical Data - Control Circuit.

For more information about the configuration of RTU communication, see Chapter Communication - Modbus in the EP G2 Menus and Control Systems manual.



6.6.16. BACnet (Optional)

Connect network cable to contact P26. For more information, see Chapter Technical Data - Control Circuit.

7. After Installation

7.1. Checklist Before Start-up

- [ ] Has the electrical installation been adapted to the local power supply?
- [ ] Are the boiler and heating system filled with water and vented?
- [ ] Is the pressure correct?
- [ ] Are all pipe connections are leakproof?
- [ ] Is the vent valve open so that the air can escape?
- [ ] Are all necessary valves open?
- [ ] Are the power cable connections tightened to the specified torque?
- [ ] Is the flow direction for the circulation pump correct?
- [ ] Do all safety valves work?
- [ ] Is the space behind the busbar system free of tools or similar?
- [ ] Does all safety equipment work?

7.2. Checklist After Start-up

- [ ] Check that the circulation pump is properly set up and functioning correctly.
- [ ] If an outdoor sensor is installed, check that the outdoor sensor displays the correct. temperature
- [ ] Fill in the installation information.
- [ ] Demonstrate the boiler for the customer, in accordance with the Customer Demonstration/Handover section.

7.3. Customer Demonstration

Once the boiler is installed, perform the following steps:

- Indicate where the manuals are stored.
- Demonstrate the boiler's parts and functions.
- Show how the user should fill the system with water via the filling valve.
- Explain display home screen.
- Show how the user increases and decreases the boiler's temperature, or the heating curve level, using the optional outdoor sensor.
- Demonstrate how to set the time and date.
- Explain alarms, warnings and limitations.
- Show how to acknowledge an alarm or warning.
- Show how to reset the overheating protection devices.
- Show how to reset the pressure guards.

8. Operation and Maintenance

8.1. Safety Valve

Operate the heating system's safety valves regularly to maintain the safety function.

8.2. Cooling Fans

Check and clean the fans' dirt filter at least once a year, or more frequently depending on the environment in which the boiler is installed. Dirty filters may lead to downtime.

8.3. Action in the Event of a Risk of Freezing - Frost Protection

If you suspect that any part of the heating system is frozen, the boiler must not be operated.
Call an installation engineer!

Adding glycol to the water affects the dimensioning of the expansion tank.

At very low temperatures, all parts of the heating system must remain in operation, otherwise there is a risk of frost wedging.

If the heating system is to be switched off for an extended period, the system should either be drained, or the system heating water mixed with up to 30 % glycol. Mixing glycol into the water reduces the heat capacity of the water, which may require an increased flow through the boiler. If glycol is added to the system water, it is important to ensure that the glycol contains corrosion-protective additives in sufficient quantities. When glycol breaks down, carbonic acid is formed as a by-product, increasing the risk of corrosion in the system.

8.4. Venting - Water Pressure

The pressure in a heating system varies with the temperature. Do not add water unnecessarily.

Regularly check that the system's water pressure is correct. For cold systems, the pressure must be just above the minimum recommended pressure in the system. Add water if necessary.

8.5. Alarm, Load Switches and Safety Guards

Always check the cause of a guard being triggered.

Remedy the cause if the guards are triggered repeatedly.

The boiler's load break switches are always triggered when a guard is triggered.

The following applies to guards:

- The display shows which limiter(s) has/have been triggered.

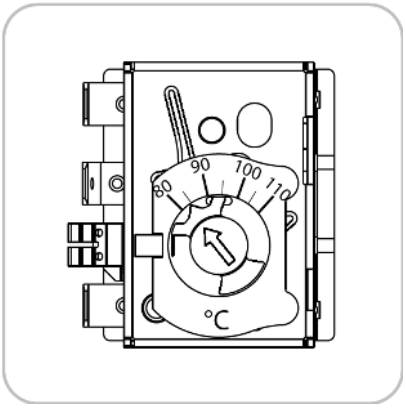
- The boiler emits a buzzer alarm and a red indicator flashes in the lower left part of the display.
- In a system in which the boiler shares safety equipment with other boilers in the system and this safety equipment is triggered, only the alarm signalling the triggering of the load switches is displayed. For more information about shared safety equipment, see Chapter Electrical Installation - Shared Safety Equipment.

8.5.1. Check the Overheating Protection Devices

To check the overheating protection devices:

1. Stop the flow through the boiler.
2. Adjust the cut-off temperature to 80°C on the back of overheating protection devices 8 and 9. See figure.
3. Adjust the boiler temperature setpoint to 90°C.

   When the boiler temperature reaches the cut-off temperature, the overheating protection devices should be triggered together with the load switch.
4. Once the inspection is finished, re-adjust the cut-off temperature to 105°C.



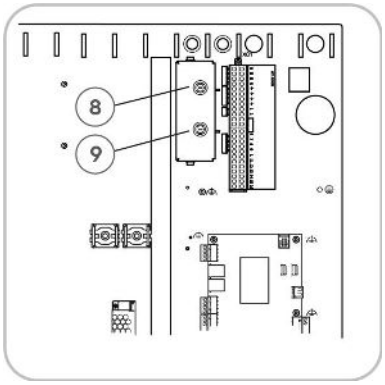
8.5.2. Reset Overheating Protection

If the temperature exceeds 105°C, the overheating protection is triggered and stops the boiler.

To reset the overheating protection devices:

1. Check that the boiler temperature is below 80°C.
2. Press the buttons on the overheating protection devices.

   See numbers 8 and 9 in the image.

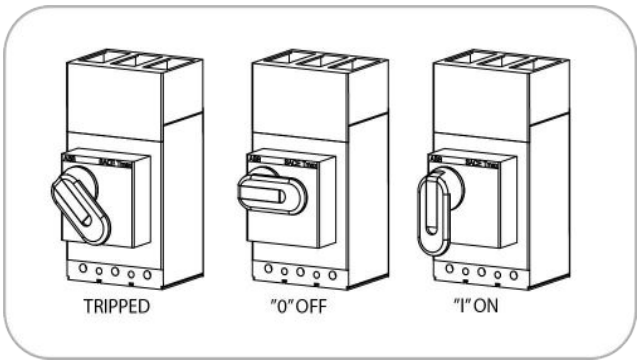


8.5.3. Reset Load Switch

The load switches are set to tripped when a safety guard is triggered or when you press the STOP button on the boiler's panel.

To reset a load switch:

1. Press the "PAUSE" button next to the "Load-switch off" alarm, which appears on the boiler display.
2. Reset the load switch by turning the knob to "OFF" and then to "ON".



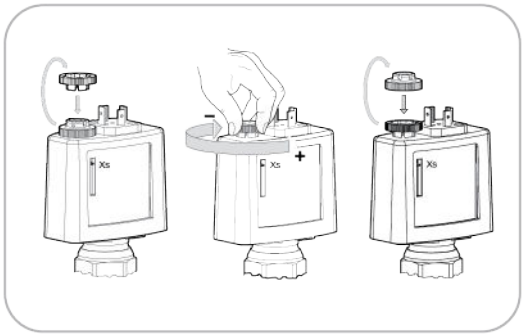
8.5.4. Adjust Pressure Guards (Optional)

High Pressure Guard

Set the high pressure guard so that the trigger pressure is between the boiler's normal operating pressure and the safety valves' opening pressure.

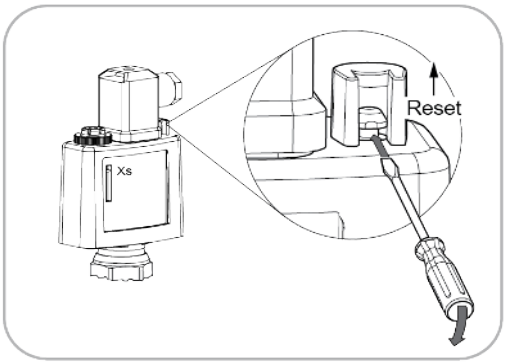
Low Pressure Guard

Set the low pressure guard so that the trigger pressure is slightly below the system pressure when the system is not heated up.



8.5.5. Reset Pressure Guards (Optional)

Using a screwdriver or a narrow object, reset the pressure guard by lifting the pin.



8.5.6. Zero-voltage Protection

The boiler does not restart automatically after a power cut. Manual acknowledgement is required.

It is possible to activate automatic restart, but if there are national regulations relating to restarting, perform an evaluation before activation.

For more information, see Chapter Installation in the EP G2 Menus and Control Systems manual.

8.5.7. Level Sensor

The level guard generates a warning and stops the boiler's control if air has accumulated at the top of the boiler. No acknowledgement is required, but the warning remains on the display until the fault has been remedied.

9. Troubleshooting

9.1. Irregular Operation

If the electric boiler steps up a number of stages and immediately steps down again, the reason may be that the boiler has too low a flow.

Troubleshoot the boiler by following these steps:

1. Check that circulation pumps are working.
2. Check that valves are working.
3. If no error has been detected, check that the water flow is within the desired range.

To get an estimate of the flow:

4. Limit the power stages of the boiler so that the power is constant.
5. Allow the boiler's temperature to stabilise.
6. Measure the temperature increase between the flow and return pipes of the boiler.
7. Calculate the flow through the boiler using the following formula: $q = P / (\Delta t \times 1.16)$
8. Check against the details in the chapter Technical Data, to determine whether the flow is adequate.

Formula Description

Value	Explanation
q	Water flow in m^3/h (m^3/h x 1000/3600 = litres/second)
P	The electric boiler's power output in kW
Δt	Temperature difference (°C) between the boiler's flow and return pipes
1.16	The water's thermal absorption coefficient

9.2. Troubleshooting Temperature Sensors

The boiler temperature sensor must not be connected to the circuit board during resistance measurement. When the boiler is energised, measure the voltage in the sensor's connection points on the circuit board.

Applies to P10, P11 and P12

°C	kΩ	Vdc	°C	kΩ	V	°C	kΩ	Vdc
5	141.9	3.1	45	24.6	2.37	85	5.9	1.25
10	111.6	3.03	50	20.2	2.17	90	5	1.12
15	88.3	2	55	16.7	2.04	95	4.3	0.99
20	70.3	2.9	60	13.9	1.91	100	3.7	0.86
25	56.3	2.83	65	11.6	1.78	105	3.2	0.79
30	45.4	2.7	70	9.7	1.65	110	2.7	0.66
35	36.8	2.57	75	8.2	1.52			
40	30	2.5	80	6.9	1.32			

10. Technical Data

10.1. Limitation Levels

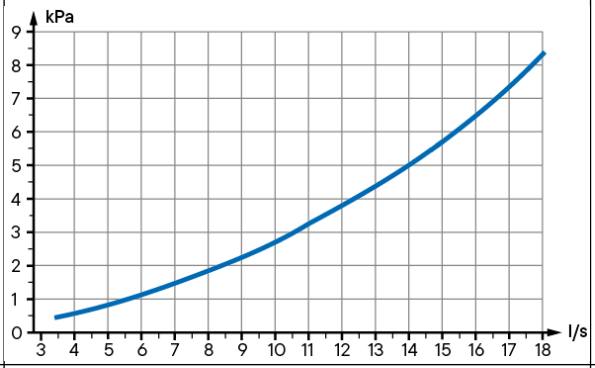
	EP 450 G2		EP 510 G2		EP 600 G2		EP 700 G2	
Stage	kW	A	kW	A	kW	A	kW	A
1	15	21.6	17	24.5	20	28.9	23.3	33.7
2	30	43.3	34	49.1	40	57.7	46.7	67.4
3	45	65.0	51	73.6	60	86.6	70.0	101.0
4	60	86.6	68	98.1	80	115.5	93.3	134.7
5	75	108.3	85	122.7	100	144.3	116.6	168.4
6	90	129.9	102	147.2	120	173.2	140.0	202.1
7	105	151.6	119	171.8	140	202.1	163.3	235.8
8	120	173.2	136	196.3	160	230.9	186.6	269.4
9	135	194.9	153	220.8	180	259.8	210.0	303.1
10	150	216.5	170	245.4	200	288.7	233.3	336.8
11	165	238.2	187	269.9	220	317.5	256.6	370.5
12	180	259.8	204	294.4	240	346.4	280.0	404.1
13	195	281.5	221	319.0	260	375.3	303.3	437.8
14	210	303.1	238	343.5	280	404.1	326.6	471.5
15	225	324.8	255	368.1	300	433.0	350.0	505.2
16	240	346.4	272	392.6	320	461.9	373.3	538.9
17	255	368.1	289	417.1	340	490.7	396.6	572.5
18	270	389.7	306	441.7	360	519.6	419.9	606.2
19	285	411.4	323	466.2	380	548.5	443.3	639.9
20	300	433.0	340	490.7	400	577.4	466.6	673.6
21	315	454.7	357	515.3	420	606.2	490.0	707.3
22	330	476.3	374	539.8	440	635.1	513.3	740.9
23	345	498.0	391	564.4	460	664.0	536.6	774.6
24	360	519.6	408	588.9	480	692.8	559.9	808.3
25	375	541.3	425	613.4	500	721.7	583.3	842.0
26	390	562.9	442	638.0	520	750.6	606.6	875.6
27	405	584.6	459	662.5	540	779.4	629.9	909.3
28	420	606.2	476	687.0	560	808.3	653.2	943.0
29	435	627.9	493	711.6	580	837.2	676.6	976.7
30	450	649.5	510	736.1	600	866.0	700.0	1010.4

10.2. Electrical Specifications

Model	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2	
Art. no.	5840	5842	5846	5848	
Voltage, power	400 V3~				
Voltage, power control	230 V~				
Voltage tolerance	≤ ± 10%				
Frequency	50 Hz				
Enclosure class	IP x 1				
Power supply system	TN				
Short-circuit resistance	10 kA				
Power	450	510	600	700	kW
Load switch B1	225	255	300	350	kW
Load switch B2	225	255	300	350	kW
Current	650	736	866	1010	A
Load switch B1	325	368	433	505	A
Load switch B2	325	368	433	505	A
Fuse protection power, max	4 groups of 200	4 groups of 315	4 groups of 315	4 groups of 315	A
Fuse protection power, rec.	4 groups of 200	4 groups of 250	4 groups of 250	4 groups of 315	A
Fuse protection, control	6	6	6	6	A
Number of stages	30, can be limited down to 1 stage				
Power, stage size	15	17	20	23.3	kW
Current, stage size	21.6	24.5	28.9	33.7	A
Cable flange	2 x FL 33.2 x Ø 60 mm				
Wired area	4 x 70 - 240 Al/Cu Connect up to 240 mm² round-pressed stranded cable.				mm²
Rec. cable area, Al	≥AXQJ 4x185	≥AXQJ 4x240	≥AXQJ 4x240	≥AXQJ 4x240	mm²
Rec. cable area, Cu	≥FXQJ 4x150	≥FXQJ 4x185	≥FXQJ 4x185	≥FXQJ 4x185	mm²

10.3. HVAC Specifications

Model	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2	
Art. no.	5840	5842	5846	5848	
Volume	315				Litres
Design pressure	0.6				MPa
Design pressure	6				Bar
Test pressure	0.86				MPa
Test pressure	8.6				Bar
Design temperature	110				°C
Operating temperature	20-95				°C
Ambient temperature	≤ 10-30				°C
Connection, flow/return	DN 100 PN 16				
Safety pipe	2 x R32 ext.				
Flow requirement, recommended Δt=10°C	10.7	12.2	14.3	16.7	Litres/sec
Flow requirements, min/max	4.3/18	4.9/18	5.7/18	6.7/18	Litres/sec
Weight (empty)	470	470	485	485	kg
Weight (filled with water)	782	785	800	815	kg

Model	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2	
Pressure drop					
Ceiling height for immersion heater replacement	>2430				mm
Manufactured to	PED 2014/68/EU article 4.3				
EMC environment	Immunity and emission for industrial environments				

10.4. Components

Art. no.	Description	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2
110035	Immersion heater, 15 kW	4	3	--	--
110036	Immersion heater, 17 kW	--	7	--	--
110038	Immersion heater, 20 kW	9	1	30	--
110039	Immersion heater, 23.3 kW	9	14	--	30
170080	Contactor AF 116	K6-K8	K3-K8	K3-K8	K3-K9
170081	Contactor AF 96	K3-K5	--	K9	--
170085	Contactor AF 26	K1	K1	K1	K1
170087	Contactor AF 40	K2	K2	--	--
170088	Contactor AF 52	--	--	K2	K2
180060	Blade fuse 35 A	F1	F1	--	--
180061	Blade fuse 50 A	--	--	F1	F1
180063	Blade fuse 80 A	F2	F2	F2	--
180064	Blade fuse 100 A	--	--	--	F2
180065	Blade fuse 125 A	F3-F5	F3-F5	F9	--
180066	Blade fuse 160 A	F6-F8	F6-F8	F3-F8	F3-F9
130075	Load switch XT 5, 400 A	2	--	--	--
130076	Load switch XT 5, 630 A	--	2	2	2
210074	Display EP G2 with contact board	1	1	1	1
210250	Circuit board, power	1	1	1	1
218005	Switched power supply, 110W	1	1	1	1
700564	Temperature sensor, boiler temperature	1	1	1	1
210206	Temperature sensor, ambient temperature	1	1	1	1
360020	Current transformer, load limiter (secondary transformers)	3	3	3	3
120022	Overheating protection	2	2	2	2
130034	Pressure switch “STOP”	1	1	1	1
240350	Drain valve	1	1	1	1
380023	Manometer	1	1	1	1

Art. no.	Description	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2
380002	Check valve for 380023	1	1	1	1
300016	O-ring for check valve	1	1	1	1
300017	O-ring, 1 for each immersion heater/blind plug	1	1	1	1
500030	Filter fan	1	1	--	3

Optional

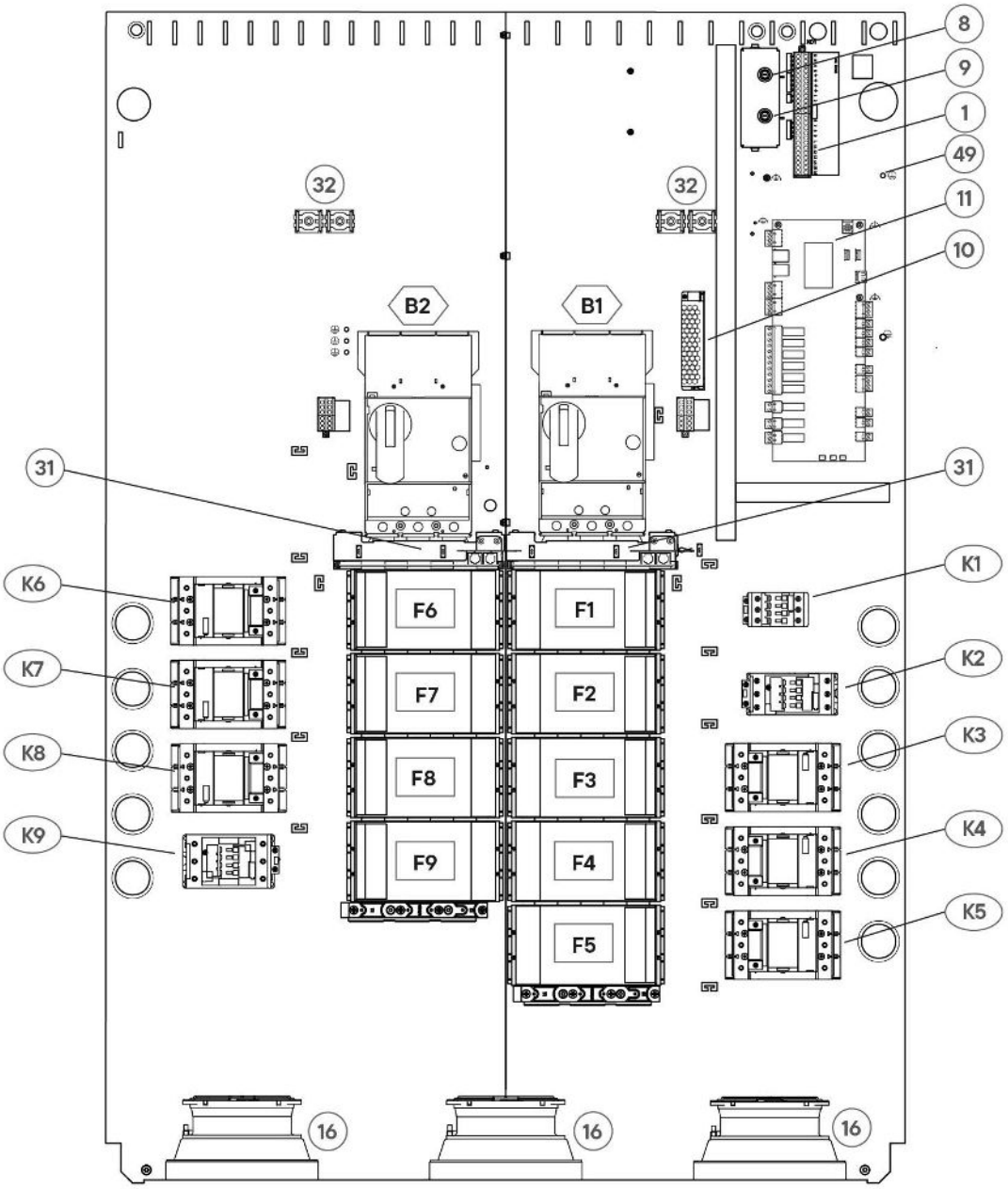
Art. no.	Description	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2
1921	Outdoor sensor (for UTK)	1	1	1	1
4764	Expansion board EP-VP G2 (EP 150-1400 G2)	1	1	1	1
500030	Extra filter fan	1 (max 2)	1 (max 2)	1 (max 3)	--
500031	Replacement filter for 500030	1	1	1	1

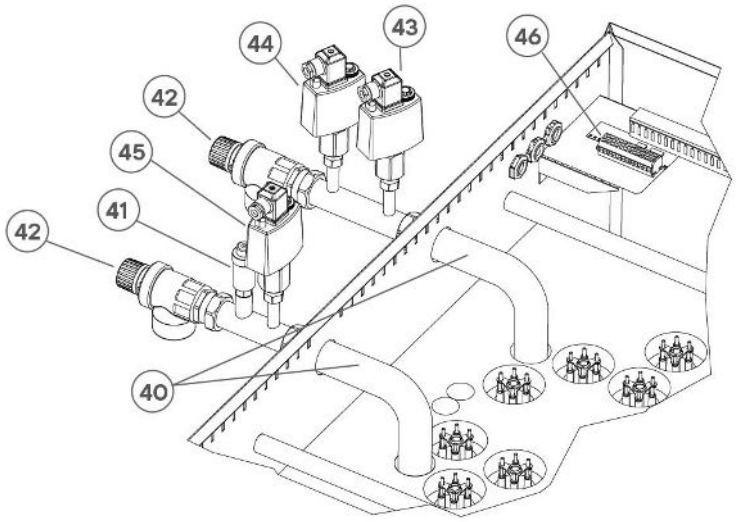
Opening pressure (bar)	EP 450 G2	EP 510 G2	EP 600 G2	EP 700 G2
1.5	4885	--	--	--
2.5	4891	4891	--	--
3.0	4859	4892	4892	4892
4.0	4888	4888	4894	4894
6.0	4893	4893	4893	4893

Included in safety equipment

Art. no.	Description	Quantity
440196	Pressostat, DSH 0-6 bar	2
440197	Pressostat, DSL 0-6 bar	1
245076	Check valve for automatic air bleed valve	1
245078	Automatic air bleed valve	
	Safety valve	1-2

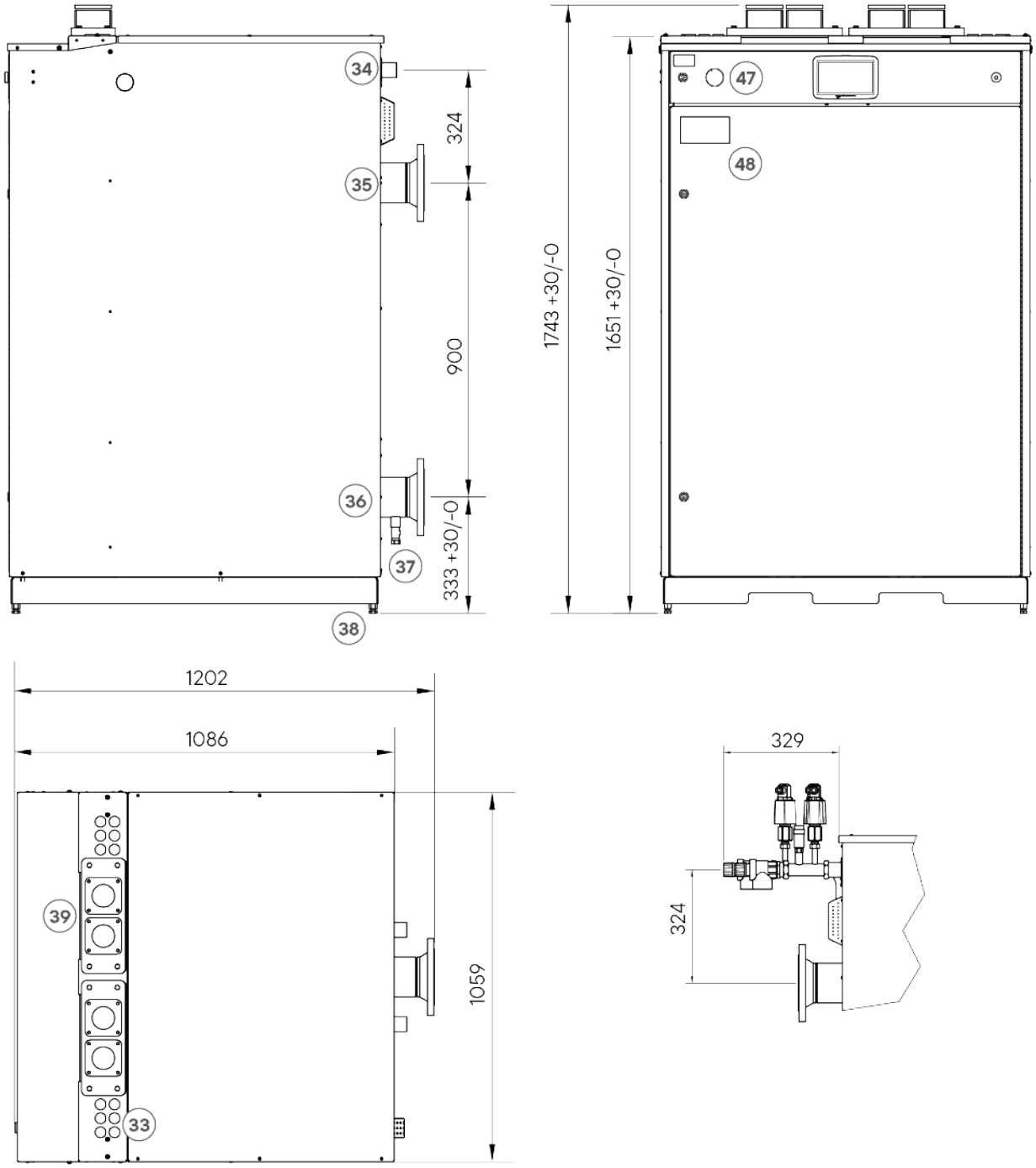
10.5. Component Location





1.	Terminal block, X01, control circuit	F1.	Fuse for Power Group 1
8.	Overheating protection 1, maximum temperature limiter (STB)	F2.	Fuse for Power Group 2
9.	Overheating protection 2, maximum temperature limiter (STB)	F3.	Fuses for Power Group 3
10.	Switched power supply, 230 VAC/24 VDC	F4-F5.	Fuses for Power Group 4
11.	Circuit board, power	F6-F9.	Fuses for Power Group 5
16.	Cooling fans		
31.	Current measurement circuit board	K1.	Contactor, Power Group 1
32.	Connection, PE conductor	K2.	Contactor, Power Group 2
40.	Safety pipes	K3.	Contactors, Power Group 3
41.	Automatic air vent valve	K4-K5.	Contactors, Power Group 4
42.	Safety valves	K6-K9.	Contactors, Power Group 5
43.	High pressure guard 1	B1.	Load switch with auxiliary contact
44.	High pressure guard 2	B2.	Load switch with auxiliary contact
45.	Low pressure guard		
46.	Terminal block, X02, for pressure guards		
49	Connection potential equalisation		

10.6. Dimensions



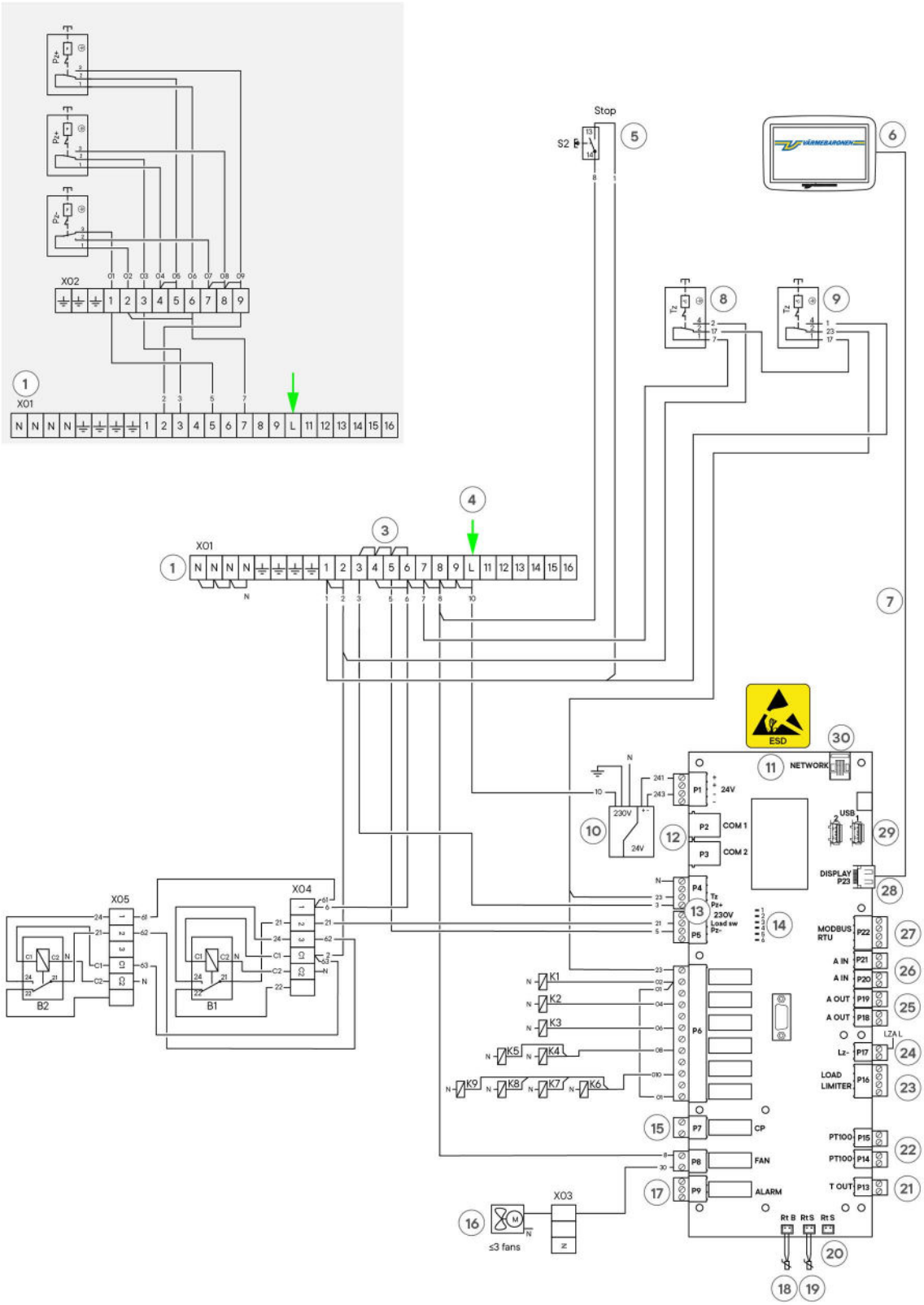
33.	Cable gland	38.	Adjustable foot bolts
34.	Safety pipes	39.	Cable flanges
35.	Flow pipe		
36.	Return pipe	47.	Manometer
37.	Drain valve	48.	Design label

10.7. Control Circuit

Pressure guards are included in factory-fitted safety equipment (optional).

Perform interventions that requires tools in the boiler's electrical equipment under the supervision of a qualified electrician!

The control voltage is not cut by the load switches! External voltage may occur!
To cut the power supply to the boiler, set the load switches in the 0 position. Lock the load switches!



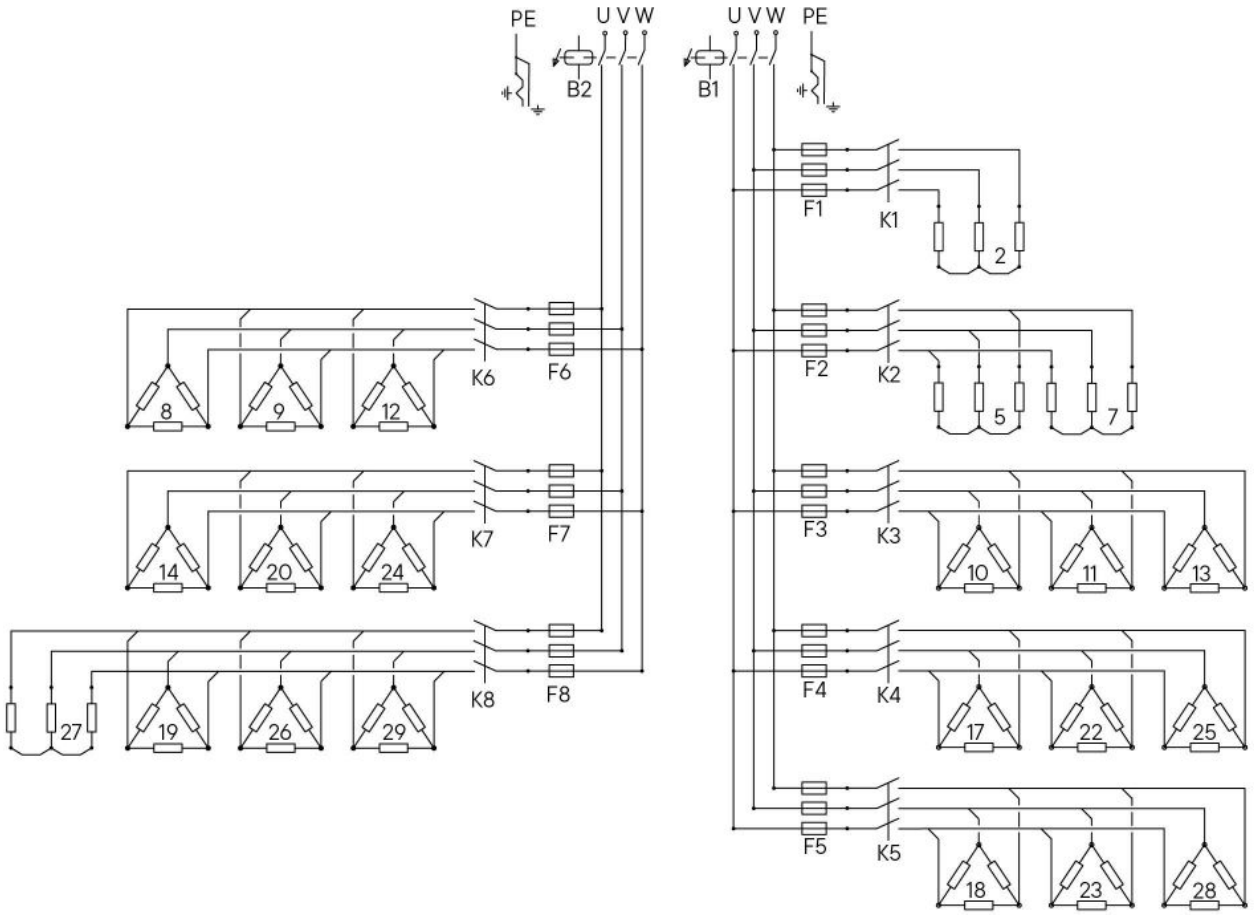
1. Terminal block, X01, control circuit
2. --
3. Connector, clamps 3, 4, 5 and 6.
   Remove when connecting pressure guards or safety equipment
4. Connection, control voltage, 230V ~, to the boiler
5. “STOP” button cuts the power supply to the boiler by tripping the load switch
6. Touch display
7. HDMI cable. Connects power and display circuit boards
8. Overheating protection 1 (STB)
9. Overheating protection 2 (STB)
10. Switched power supply, 230V AC/24V DC for supply to circuit boards
11. Circuit board, power.
12. Connection for current measurement board, P2 (Com 1) and P3 (Com 2)
13. Safety inputs, P4 and P5
14. Indicator, safety inputs. Indicator lights up when:
    1. Reserved
    2. Overheating protection is in operating mode
    3. High pressure guards are in operating mode
    4. Load switch is in operating mode
    5. Low pressure guard in operating mode.
    6. Reserved
15. Potential-free relay output for circulation pump. Max. load 230 V~/2A P7.
16. Cooling fan(s) P8
17. Potential-free relay output for buzzer alarm P9
18. Boiler temperature sensor, P10
19. Environmental temperature sensor, P11
20. Temperature sensor, P12 (Optional)
21. Connection outdoor temperature sensor, boiler with OTC, (Optional) P13.
22. Connection for PT100 sensors, P14 and P15 (Optional)
23. Connection for the load limiter’s current transformers P16.
24. Connection, level sensor, P17
25. Analogue output, P18 and P19
26. Analogue input, P20 and P21
27. Connection Modbus RS485, P22 (Optional)
28. HDMI output for display, P25
29. USB1 and USB 2
30. Network cable connection, P26

B1. Load switch with auxiliary contact, Power groups 1-4
B2. Load switch with auxiliary contact, Power group 5
K1. Contactor, power group 1
K2. Contactor, power group 2
K3. Contactors, power group 3
K4, K5. Contactors, power group 4
K6-K9. Contactors, power group 5
X02. Terminal block, internal connection for safety equipment (Optional)
X03. Terminal block, fan
X04. Terminal block, load switch B1
X05. Terminal block, load switch B2

10.8. Power Circuit, EP 450 G2 400 V

The control voltage is not cut by the load switches! External voltage may occur!

To cut the power supply to the boiler, set the load switches in the 0 position. Lock the load switches!



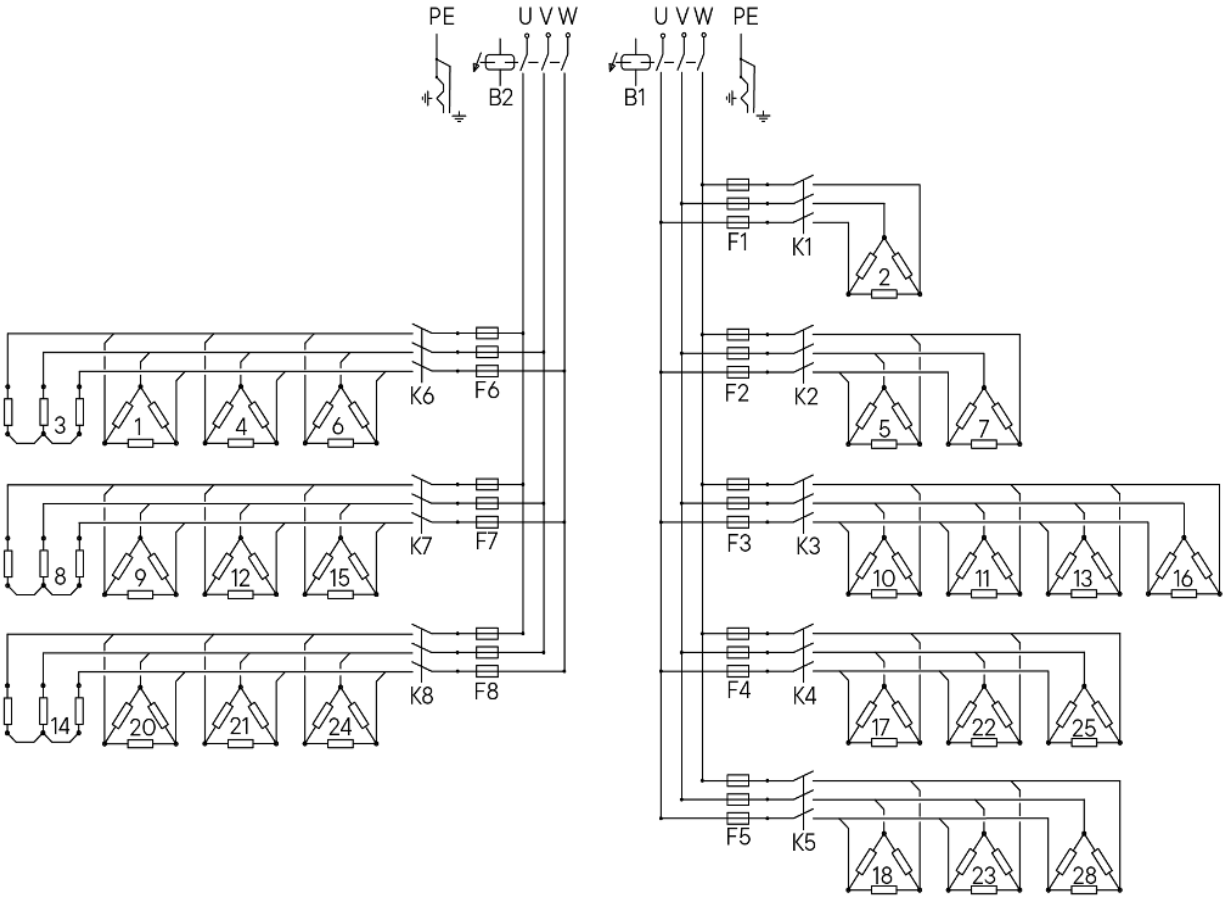
EP 450 G2

Power group	1	2	3	4	5
Power	15 kW	30 kW	60 kW	120 kW	224.7 kW
Load switch	B1	B1	B1	B1	B2
Fuse 3 x 35 A	F1	--	--	--	--
Fuse 3 x 80 A	--	F2	--	--	--
Fuse 3 x 125 A	--	--	F3	F4, F5	--
Fuse 3 x 160 A	--	--	--	--	F6, F7, F8
Contactor	K1	K2	K3	K4, K5	K6, K7, K8
Immersion heater, 15 kW	2	5, 7	--	--	27
Immersion heater, 20 kW	--	--	10, 11, 13	17, 22, 25 18, 23, 28	--
Immersion heater 23.3 kW	--	--	--	--	8, 9, 12, 14, 20, 24, 19, 26, 29

10.9. Power Circuit, EP 510 G2 400 V

The control voltage is not cut by the load switches! External voltage may occur!

To cut the power supply to the boiler, set the load switches in the 0 position. Lock the load switches!



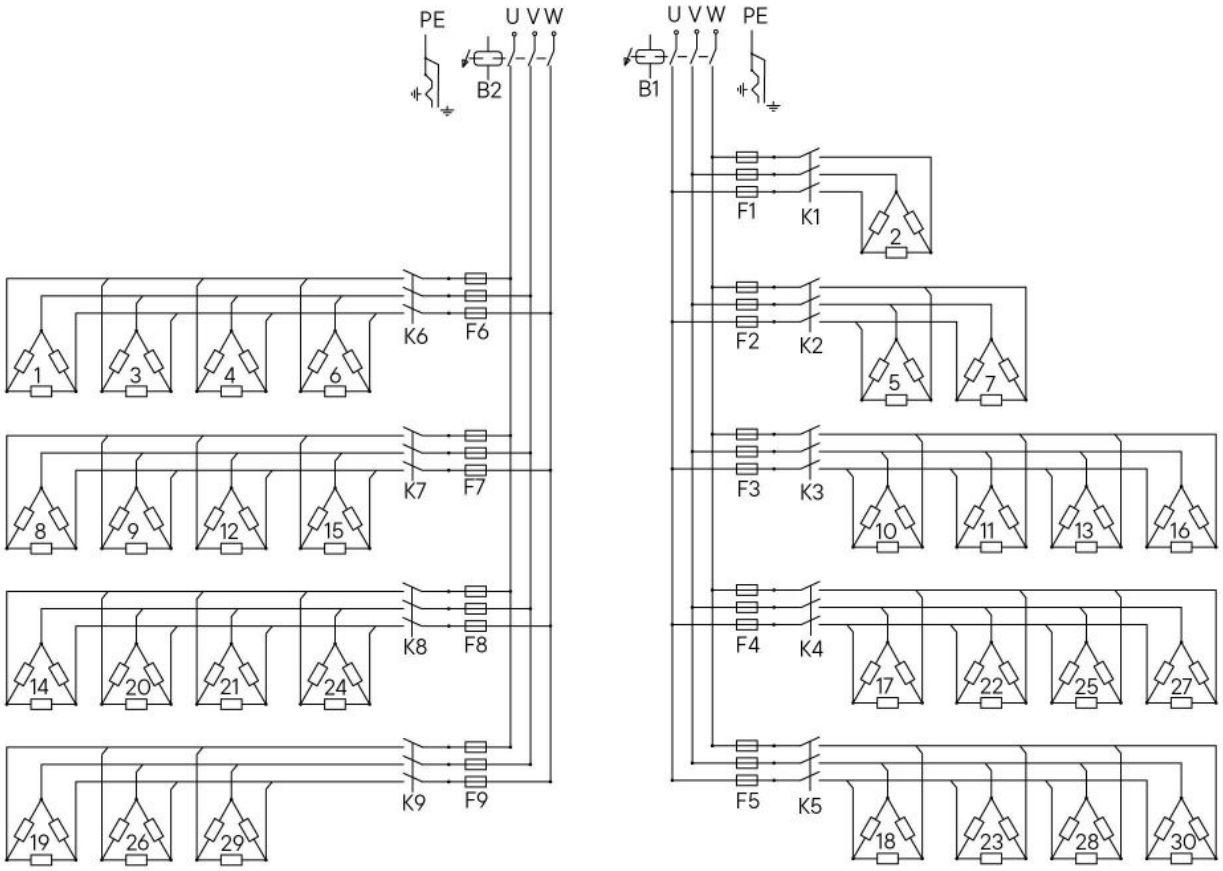
EP 510 G2

Power group	1	2	3	4	5
Power	17 kW	34 kW	68 kW	136.5 kW	254.7 kW
Load switch	B1	B1	B1	B1	B2
Fuse 3 x 35 A	F1	--	--	--	--
Fuse 3 x 80 A	--	F2	--	--	--
Fuse 3 x 125 A	--	--	F3	F4, F5	--
Fuse 3 x 160 A	--	--	--	--	F6, F7. F8
Contactor	K1	K2	K3	K4, K5	K6, K7, K8
Immersion heater, 15 kW	--	--	--	--	3, 8, 14
Immersion heater, 17 kW	2	5, 7	10, 11, 13, 16	--	--
Immersion heater, 20 kW	--	--	--	25	--
Immersion heater 23.3 kW	--	--	--	17, 22, 18, 23, 28	1, 4, 6, 9, 12, 15, 20, 21. 24

10.10. Power Circuit, EP 600 - 700 G2 400 V

The control voltage is not cut by the load switches! External voltage may occur!

To cut the power supply to the boiler, set the load switches in the 0 position. Lock the load switches!



EP 600 G2 400 V

Power group	1	2	3	4	5
Power	20 kW	40 kW	80 kW	160 kW	300 kW
Load switch	B1	B1	B1	B1	B2
Fuse 3 x 50 A	F1	--	--	--	--
Fuse 3 x 80 A	--	F2	--	--	--
Fuse 3 x 125 A	--	--	--	--	F9
Fuse 3 x 160 A			F3	F4, F5	F6, F7, F8
Contactor	K1	K2	K3	K4, K5,	K6, K7, K8, K9
Immersion heater, 20 kW	2	5, 7	10, 11, 13, 16	17, 22, 25, 27 18, 23, 28, 30	1, 3, 4, 6, 8, 9, 12, 15 14, 20, 21, 24, 19, 26, 29

EP 700 G2 400 V

Power group	1	2	3	4	5
Power	23.3 kW	46.6 kW	93.2 kW	186.4 kW	349.5 kW
Load switch	B1	B1	B1	B1	B2
Fuse 3 x 50 A	F1	--	--	--	--
Fuse 3 x 100 A	--	F2	--	--	--
Fuse 3 x 160 A	--	--	F3	F4, F5	F6, F7, F8, F9
Contactor	K1	K2	K3	K4, K5,	K6, K7, K8
Immersion heater 23.3 kW	2	5, 7	10, 11, 13, 16	17, 22, 25, 27 18, 23, 28, 30	1, 3, 4, 6, 8, 9, 12, 15 14, 20, 21, 24, 19, 26, 29

10.11. Placement of Immersion Heaters EP 450 - 700 G2

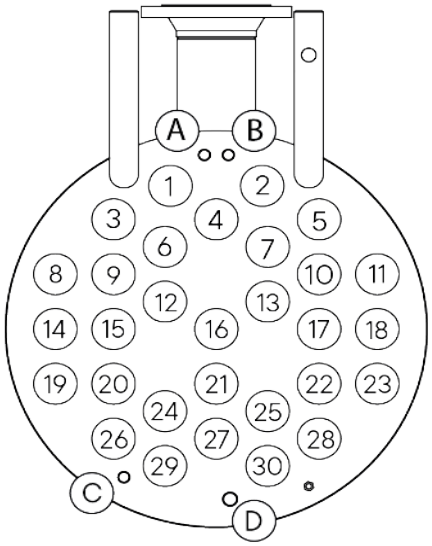
The numbers indicate the location of the immersion heaters as seen from the top of the boiler tank.

A: Temperature sensor

B. Overheating protection.

C. Manometer connection

D. Level sensor



Värmebaronen AB
Arkelstorpsvägen 88
SE-291 94 Kristianstad
Tel +46 44 22 63 20
www.varmebaronen.se
www.varmebaronen.com
info@varmebaronen.se