Manual

Pellet heating with vacuum suction system, type

PELLEMATIC® Condens_e 10 — 18 kW

FA_V2.09

Pelletronic TOUCH

ENGLISH

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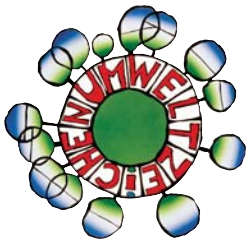
1 Dear Customer

ÖkoFEN is Europe's leading specialist in pellet heating.
Proficiency, innovation and quality combined. This is the tradition on which ÖkoFEN shapes the future.
We are very pleased that you too have decided to purchase a product from ÖkoFEN.

- This manual is intended to help you operate the product safely, properly and economically.
- Please read this manual right through and take note of the safety warnings.
- Keep all documentation supplied with this unit in a safe place for future reference.
  Please pass on the documentation to the new user if you decide to part with the unit at a later date.
- Please contact your authorised dealer if you have any questions.

ÖkoFEN attaches great importance to the development of new products. Our R&D Department repeatedly challenges the effectiveness of tried-and-tested systems and works continuously on improvements. In this way, we secure our technological advantage. We have already received many national and international awards for our products.
All our products comply with European standards in respect of quality, efficiency and emissions.



2 Use only for the purpose intended

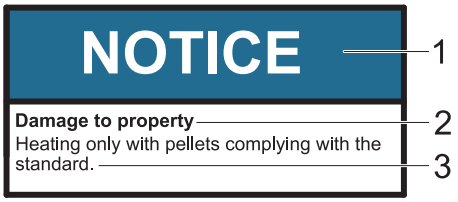
The pellet heating system is designed to heat water for central or other indirect heating systems and hot water supply for buildings. It is not permissible to use the pellet heating system for any other purpose. Reasonable foreseeable inadvertent uses for the heating system are not known.

3 Types of safety warning sign

The warning signs use the following symbols and texts.

Types of safety warning sign

1. Risk of injury
2. Consequences of risk
3. Avoiding risk



1. Risk of injury:

Danger - indicates a situation that could lead to death or life-threatening injury.

Warning - indicates a situation that could lead life-threatening or serious injury.

Caution - indicates a situation that could lead to injury.

Note - indicates a situation that could lead to property damage.

2. Consequences of risk

Effects and consequences resulting from incorrect operation.

3. Avoiding risk

Observing safety instructions ensures that the heating system is operated safely

4 Warnings and safety instructions

Observing safety instructions ensures that the heating system is operated safely.

4.1 Basic safety instructions

- Never get yourself into danger; give own safety the utmost priority.
- Keep children away from the central heating room and storage room.
- Observe all safety warnings on the boiler and in this user manual.
- Observe all instructions relating to maintenance, servicing and cleaning.
- The pellet heating system may only be installed and started up for the first time by an authorised plumber. Professional installation and start up is the prerequisite for safe and economical operation.
- Never make any changes to the heating system or flue gas system.
- Never close or remove safety valves.

4.2 Warning signs

DANGER

Risk of poisoning
Make sure that the pellet boiler is supplied with sufficient combustion air.
The openings in the combustion air inlet must never be partially or completely closed.
Ventilation systems, central vacuum cleaning systems, extractor fans, air conditioning systems, flue gas blowers, dryers or similar equipment must never be allowed to draw air from the central heating room and cause a drop in pressure.
The boiler must be connected tight to the chimney using a flue gas tube.
Clean the chimney and the flue gas tube at regular intervals.
The central heating room and pellet storage room must be sufficiently supplied with air and ventilated.
Before entering the storage room it must be ventilated with sufficient air and the heating system switched off.

DANGER

Risk of electric shock
Switch off the system before performing work on the boiler.

DANGER

Risk of explosion
Never burn petrol, diesel, engine oil or other explosive materials.
Never use liquids or chemicals to ignite the pellets.
Switch off the heating system before filling the storage room.

DANGER

Risk of fire
Do not store any flammable materials in the central heating room. Do not hang out any washing in the central heating room.
Always close the boiler door.

WARNING

Risk of burns
Do not touch the flue spigot or the flue gas tube.
Do not reach into the ash chamber.
Use gloves to empty the ash box.
Do not clean the boiler until it has been allowed to cool down.

CAUTION

Risk of cut injuries due to sharp edges.
Use gloves for performing all work on the boiler.

NOTICE

Damage to property
Heat the pellet heating system using pellets that comply with EN ISO 17225–2 class A1 only.

NOTICE

Damage to property
Do not use the heating system if it, or any of its components, come into contact with water.
If water damage occurs, have the heating system checked by an service technician and have any damaged parts replaced.

4.3 What to do in an emergency

DANGER

Risk to life
Never get yourself into danger; give own safety the utmost priority.

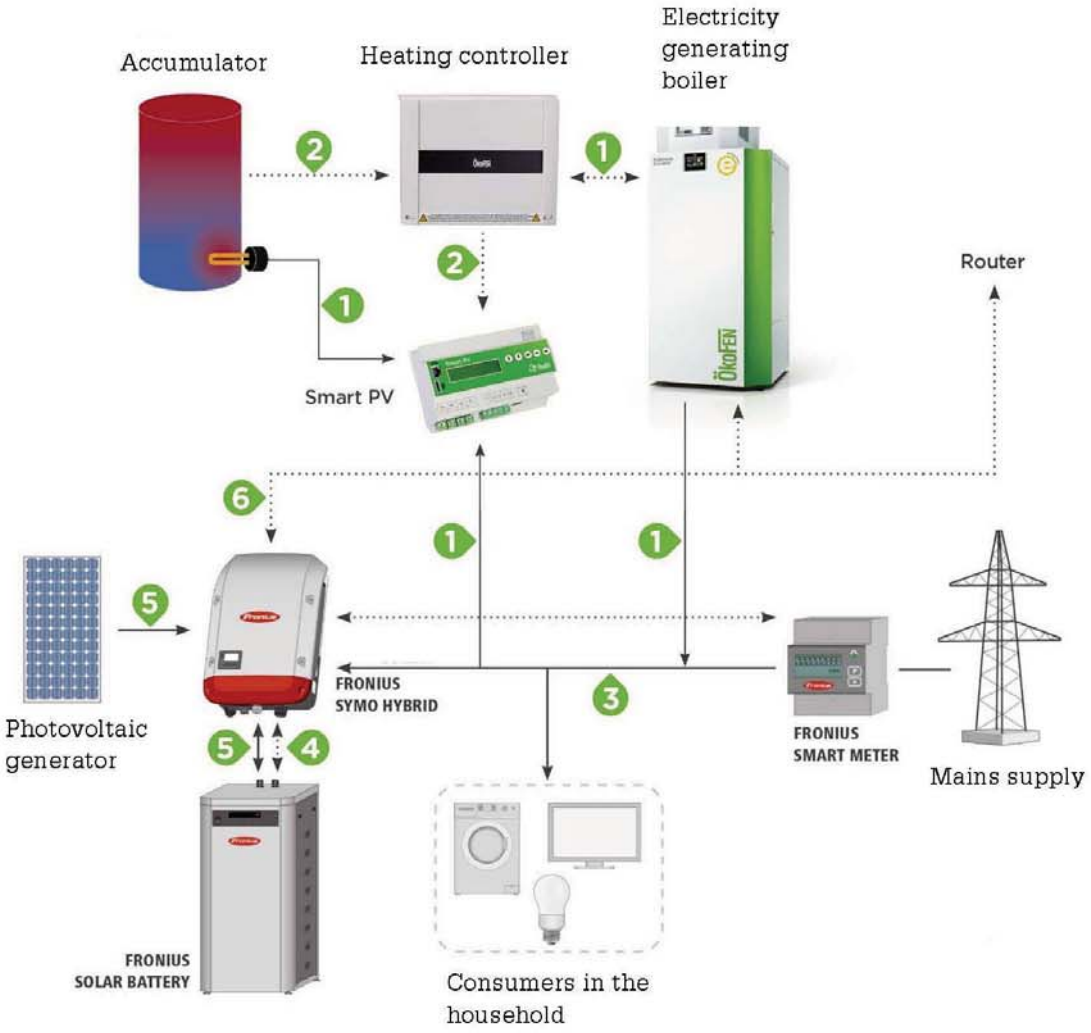
What to do in the event of a fire

- Switch off the heating system.
- Call the fire brigade
- Use approved fire extinguishers (fire protection class ABC).

What to do if you smell smoke

- Switch off the heating system.
- Close the doors leading to living areas.
- Ventilate the central heating room.

5 Cable specification



Nr.	Cable type
1	NYM-J 3x1,5mm²
2	YMM-O 2x0,75mm²
3	NYM-J 5x2,5mm²
4	YSLCY-JZ 4X0,75mm²
5	PV1-F 1x6mm² (2x)
6	Ethernet

Note:
An emergency power switchover must be made in accordance with the specifications of the local electricity supply company!

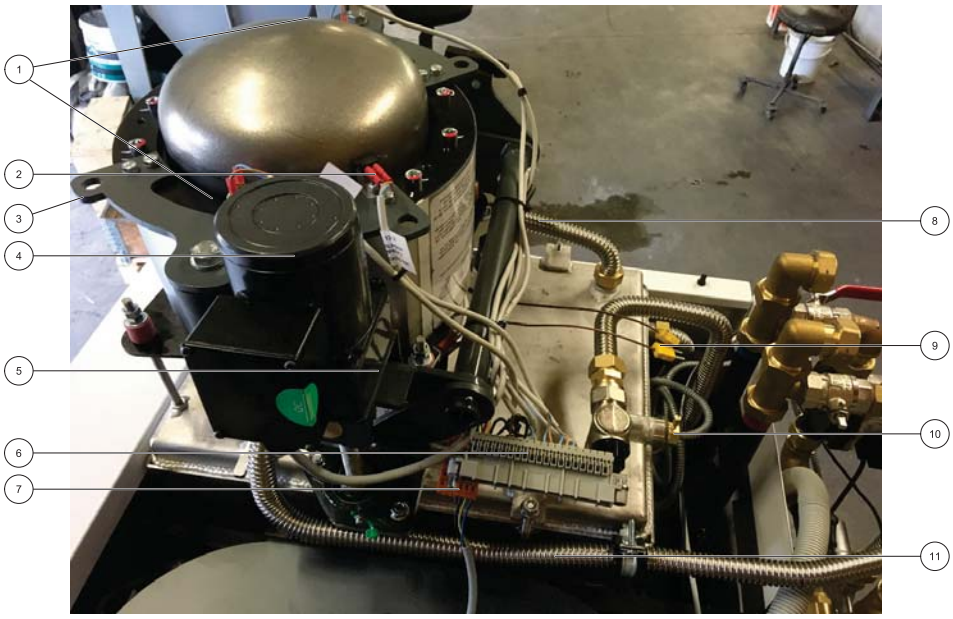
6 Overview of additional units for electricity generation

6.1 Functional description Stirling engine

The MEC Linear Free Piston Stirling Engine Generator uses the stirling circuit to provide mechanical power.

A displacer piston moves gas from the heated head section to the cooled section creating a pressure wave which drives the power piston / magnets in simple harmonic motion past the alternator coils and generates electricity. The linear alternator inside the engine produces high quality single phase electrical power and an external capacitor is used ensure near perfect power factor on electricity grid.
The engine voltage and frequency are set by the electricity grid. The power output from the engine will increase with the heater head temperature and reduce with increasing cooler temperatures.
If the head is heated to around 500° C and the engine cooler is cooled to 30° C – 60° C the engine will provide around 1kW of electricity.
The engine is mechanically tuned to the grid frequency for all moving parts and incorporates a tuned absorber system to minimize vibration.

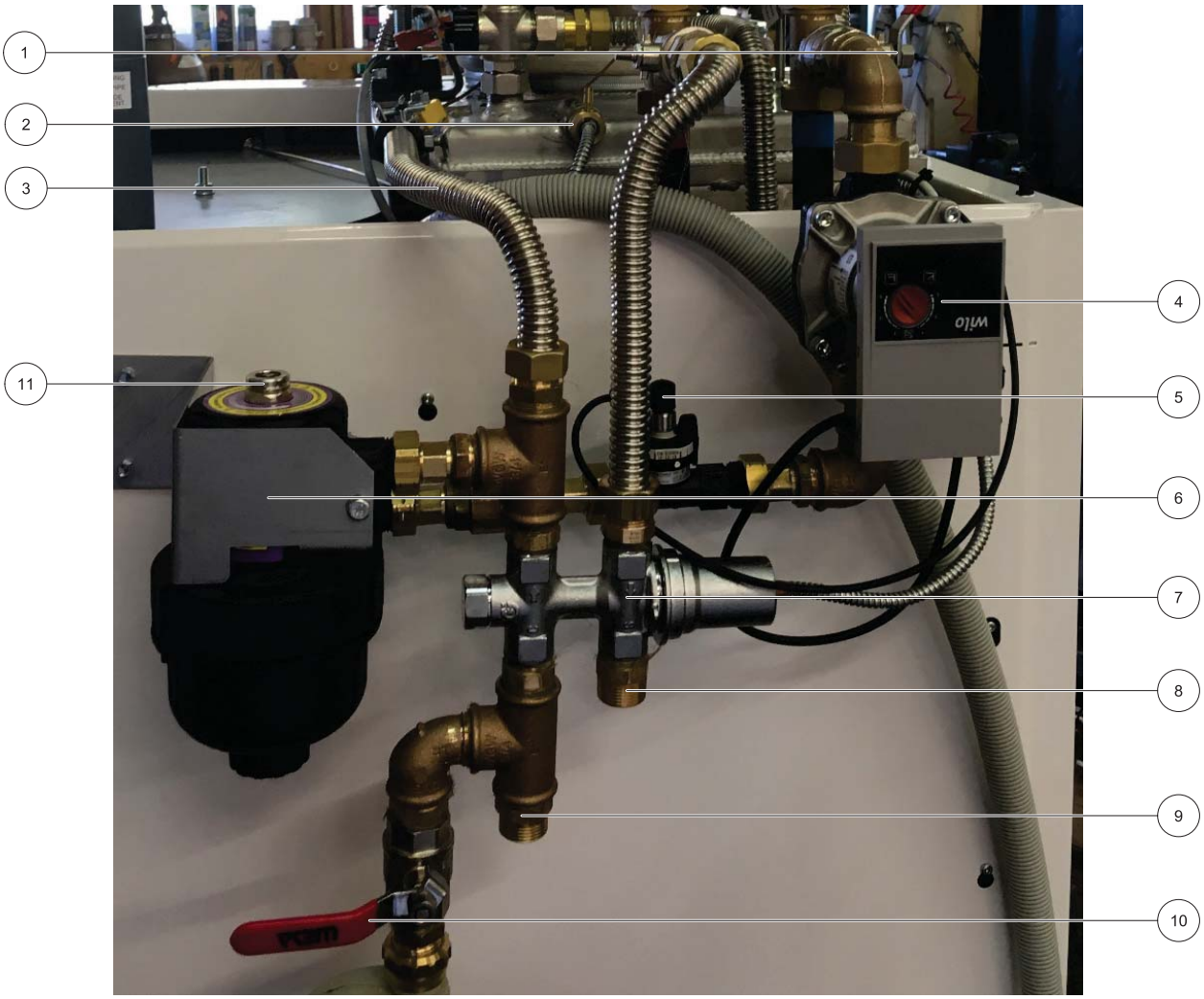
6.2 Components of the Stirling engine and sensor positions



1	Dynamic vibration absorber (2-on-1)	9	Thermocouple heater head (2-on-1)
2	Temperature sensor stirliing head	10	Thermometer pocket for thermal discharge safety
3	Crane support	11	Cooling supply inlet port stirling engine
4	Lifting and lowering device	12	Temperature sensor cooling supply outlet port
5	Ambient temperature sensor	13	Power cable generator
6	Ambient temperature sensor (under casing)	14	Helium filling pipe for stirling engine
7	Connection for lifting and lowering device	15	Fixing nuts for stirling attachment
8	Cooling supply outlet port stirling engine	16	Temperature sensor cooling supply inlet port

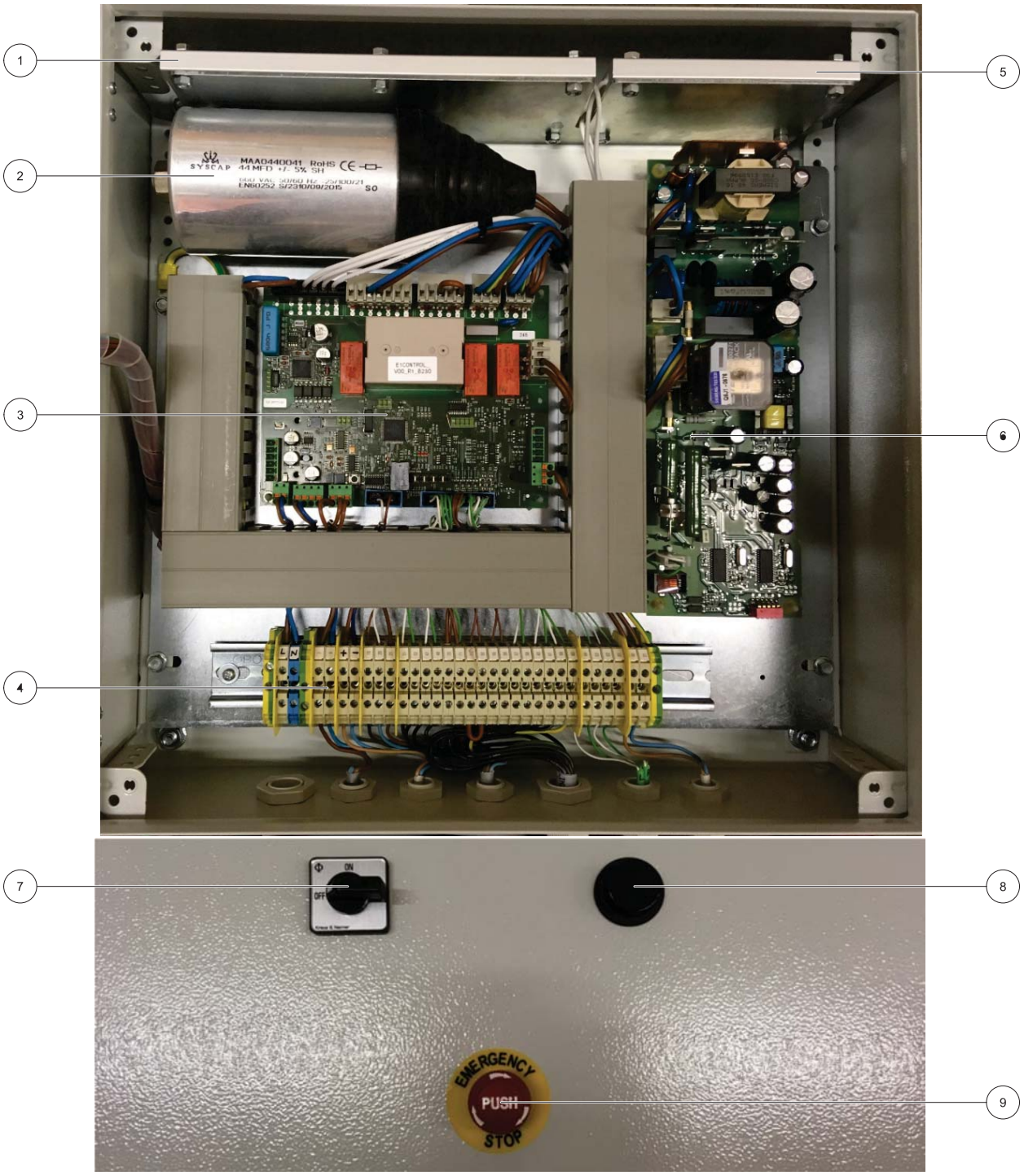
6.3 Cooling circuit Stirling engine

The Stirling engine is cooled by a separate return pump. The water must be as cold as possible to ensure an optimum generator operation.
Therefore, the return is taken from the lower area of the accumulator. The pump is controlled by the boiler controller and is attached on terminal AV (52|PE|51). The flow rate is monitored by a pulse volume meter and is displayed on the Touch operating device.
The flow rate should be at least 8 l/min and should be set to <10 l / min at the pump to avoid excessive malfunctions of the stratification.
Furthermore, the cooling circuit is provided with a magnetic particle filter to protect the fine cooling fins of the Stirling engine from contamination.
The filter should be cleaned as part of the maintenance, as well as to examine in the case of a low flow rate.



1	Cutoff cooling circuit	7	Thermal discharge safety
2	Thermal element thermal discharge safety	8	Connected load in drain of the safety valve
3	Cooling supply inlet port stirling engine	9	Connected load safety valve cold water
4	Cooling circuit pump	10	Stopcock cleaning
5	Pulse volume meter	11	Venting possibility
6	Magnetic particle filter		

6.4 Components of the electrical cabinet of the Stirling engine



1	Start resistor	6	Network monitoring module & 24VDC
2	Operating capacitor	7	All pole load breaker - Stirling engine
3	Control board - Stirling engine	8	Malfuncion release - Stirling engine
4	Terminal strip - electrical cabinet	9	Emergency stop switch
5	Stop resistor		

6.5 Control elements for the Stirling engine on the touch operating device

Select **Stirling** in the Main menu.

Afterwards all measured values are listed (scroll down for further values):

Inflow temperature 1 + 2

These two sensors are located on the heater head inside on the hot side of the Stirling engine exceeds one of these temperatures a certain threshold value, the source requirement is disabled as long as the temperatures are again within the limit values.
The temperature should reach about 500° C during normal operation.

Inflow difference

Difference between the two inflow temperatures.
The difference should be as low as possible and is a measurement of the evenly temperature rise of the Stirling engine heater head.

Flow temperature

Water temperature at Stirling engine output.

Return temperature

Water temperature at Stirling engine input

Ambient temperature

Temperature sensor within the sound protection hood.

Flow rate

Flow rate through the cooler of the Stirling engine.

Voltage

Mains voltage, displayed only when Stirling engine is in operation

Current

Generated electricity, displayed only when Stirling engine is in operation.

Frequency

Current mains frequency, displayed only when Stirling engine is in operation.

Phase angle

Phase shifting between voltage and current, displayed only when Stirling engine is in operation

Realpower

The effectively delivered energy.

Total active power
The entire delivered energy

Note:
You can set a new start date by pressing the date..

Power yesterday / today

The effectively delivered energy from yesterday / today.

Requirement source

Connected to the switch on the Stirling switch cabinet. Should always be set to ON (switch closed).

Gen requirement

A requirement (heating, DHW, ...) must occur first to the Stirling engine. If the Stirling engine receives a requirement, this requirement will be transmitted to the source and the Pellematic Condens_e starts.

State

Status displays of the Stirling engine:

Off : The requirement switch on the electrical cabinet is open, there is an active error in the stirling engine

Startup: If all operating parameters are within the normal range, the stirling engine starts as soon as an inflow temperature of 200° C is reached.

Operation: The Stirling engine operates as a generator.
Overheating: There is an excess temperature in the stirling engine.

Shutdown: The Stirling engine is stopped.

Error: There is an active error in the Stirling engine.

Run time

Run time of the Stirling engine.

Power on counter

Number of starts of the Stirling engine

Safety shutdown

Number of safety shutdowns.

Error code

In the event of an error, the malfunction can be detected with the help of the error code. A list of all possible malfunction messages is attached at the end of this manual.

Max. Power

Maximum limitation stirling engine (900 W)
This function serves to protect the system and ensure its long service life.

Lifting / lowering device

Set version 2
This function causes the stirling engine to lift and lower itself after the suction process.

Maintenance Warning

If the power of the Stirling motor drops below 300 W, a maintenance alert is displayed because it is assumed that the generator needs to be cleaned

Power regulation

Raises and lowers the Stirling head for optimal yield.

Power regulation Min. Ex. Van. Speed
Power regulation Max. Ex. Van. Speed

The stirling head raises or lowers if the blower fan speed exceeds the limits of min. 85% and max. 90%.

Power adjustment

On: The power is increased to the maximum power using stages 1 and 2.

Off: Power adjustment inactive.
The boiler starts with 10kW nominal power.
If the accumulator temperature is not reached after 3 hours, the boiler output increasesto 12 kW.
f the accumulator temperature is not reached after 5 hours, the boiler output increasesto 14 kW.
f the accumulator temperature is not reached after 6 hours, the boiler output increasesto 116 kW.

Power adjustment time step 1

Power adjustment time step 2

Power request max. Accutemperature
Activation of a single charge.
Delete

Resetting the yield counter.

Power Req.

Single charge activation.

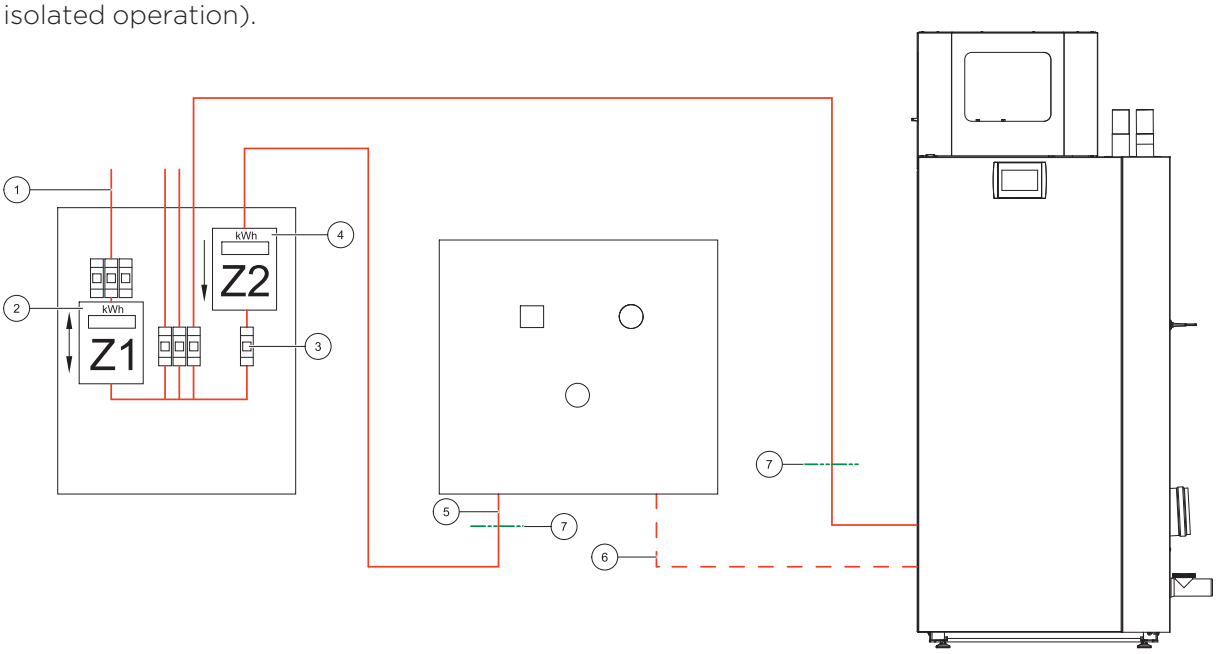
Cleaning

Flue gas fan runs at 100% (cleaning mode).

7 Installation Stirling

7.1 Electrical installation

The installation of an own power generation plant has some specific features in comparison to a normal heating plant.
The stirling engine has its own electrical cabinet which must be also connected to the electrical supply separately.
Integrated in the electrical cabinet there is next to the control unit of the Stirling engine a module for mains protection and system protection.
It constantly monitors the mains parameters, voltage and frequency. If these values are outside the country-specific limits, this module separates the Stirling engine from the power supply and sends a signal to the boiler controller of the Pellematic Condens_e, which stops the burner.
It also prevents, that in case of a mains failure, no voltage is generated by the device anymore (prevention of isolated operation).



1	Electrical supply 400V/3P	5	Connection electrical cabinet Stirling engine
2	Z1 offset electric meter	6	Connection Pellematic Smart_e
3	Circuit breaker C16A / RCBO C16A	7	Delivery scope
4	Z2 optional generation meter		

The electrical connection of the Pellematic Condens_e is shown in the picture above.
The limit of supply is respectively at the electrical cabinet of the Stirling engine and the Pellematic Condens_e.
The supply line to the electrical cabinet should be kept as short as possible. For longer distances a 2.5 mm^2 cable should be used.
The electric meter Z1, a so-called 4-quadrant meter, is usually tested on capability during registration of the system by the energy provider.
He must be offset, for example if electricity is fed on one phase conductor into the public net then this current must be set off against the currents on the other two phase conductors.
Conventional Ferraris electric meters are offset in principle, but they are often not provided with a reverse lock. Smart meters are able to perform in both procedures, therefore should be paid attention that an offset electric meter is used.
A calibrated generation meter Z2 must be used when it is required due to the local funding rules.

7.2 Lifting and lowering device

The function Lifting and lowering device is located in the menu Stirling.

Note:
The lifting/lowering device can be controlled in the menu output test.

Functioning of power control:

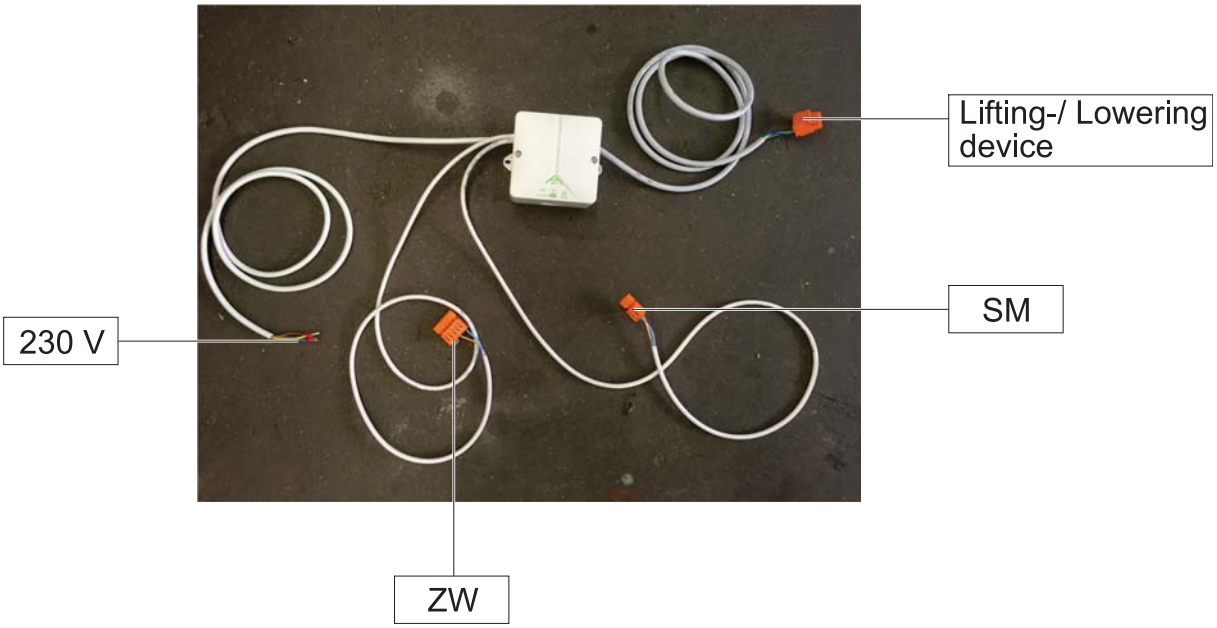
If the boiler is in the state burning at full power for 5 minutes, the control of the Stirling engine starts.If the speed of the suction draft is lower than the set **Power regulation Min. Ex. Van. Speed** is lowered for 0,5 seconds.
A new evaluation takes place after 1 minute. → If the speed of the suction draft is still lower than the set **Power regulation Min. Ex. Van. Speed**, the stirling engine is lowered again for 0.5 seconds.
If the speed of the suction fan is higher than the set **Power regulation Max. Ex. Van. Speed**, the stirling engine is lifted for 0.5 seconds. A new evaluation takes place after 1 minute.
By pressing the button the suction fan is set to 100 %.

Operation cleaning:

After each start and each suction process of the boiler, the lifting / lowering device of the stirling engine is activated.
The stirling engine moves to the upper limit switch (basic position) and to the lower limit switch.

7.2.1 Subsequent installation of the relay box for the lifting and lowering device

Connection relay box



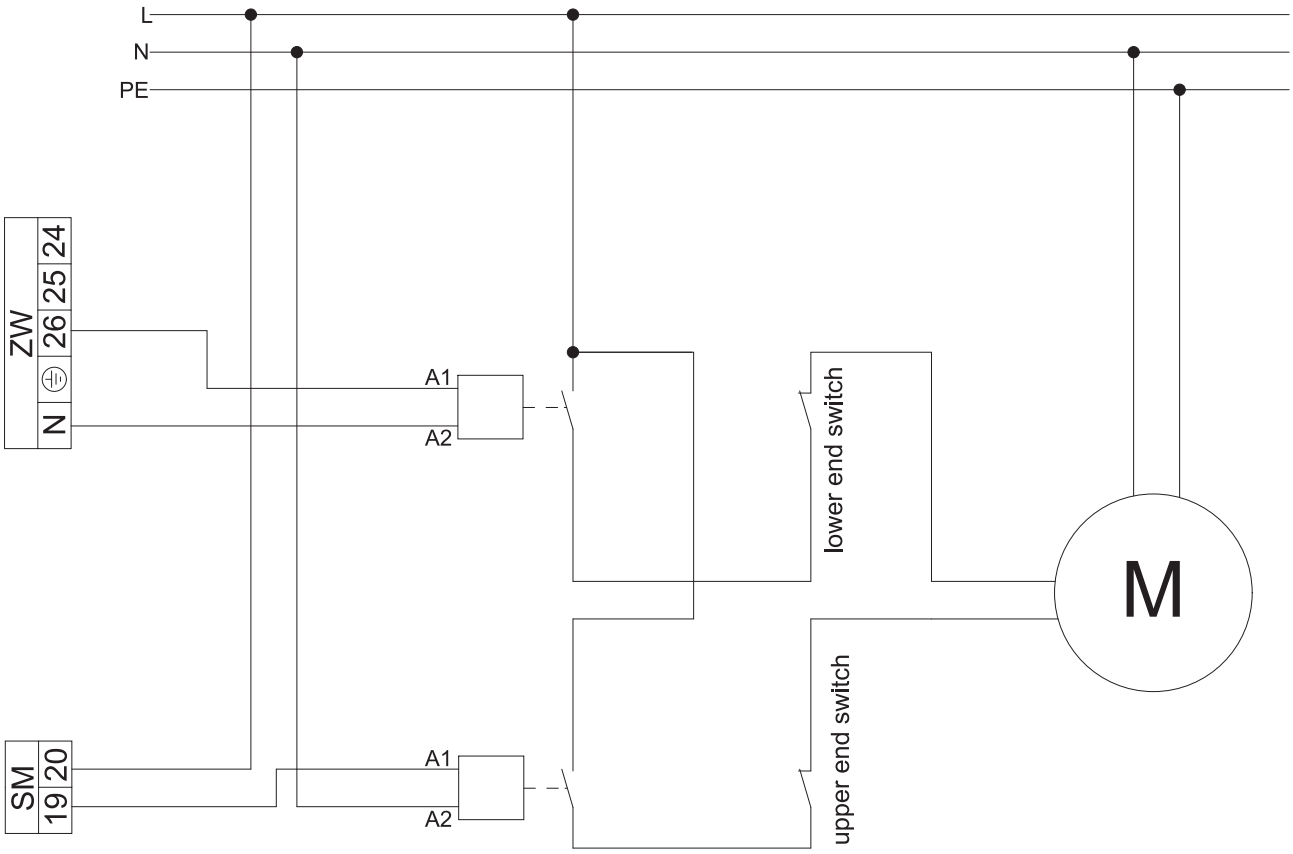
Installation recommendation of the relay box::

ÖkoFEN recommends installing the relay box under the boiler control..

Wiring:

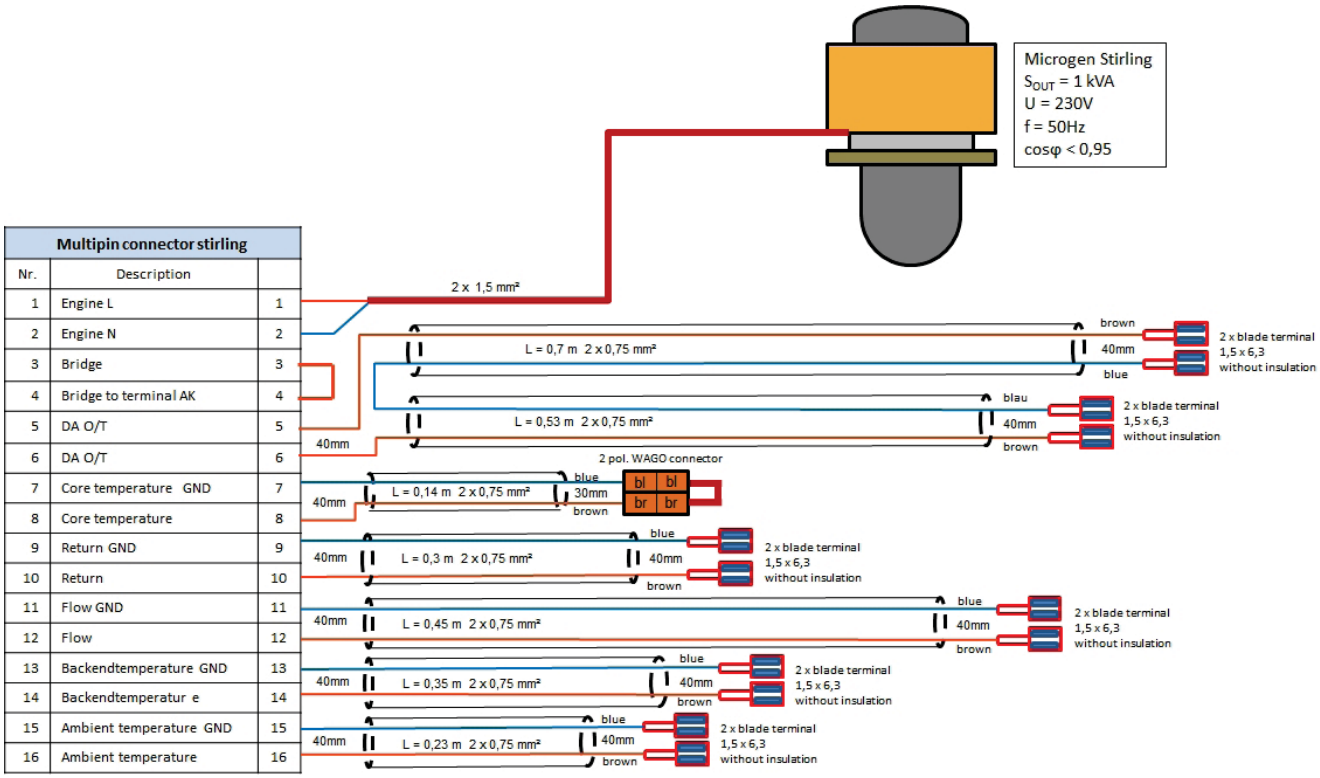
When wiring, make sure that the cables are installed in the cable ducts provided for this purpose and that they do not come into contact with hot boiler parts

Wiring diagram relay box



Electrical connection of the multipin connector

Multipin connector stirling		
Nr.	Description	
1	Engine L	1
2	Engine N	2
3	Bridge	3
4	Bridge to terminal AK	4
5	DA O/T	5
6	DA O/T	6
7	Core temperature GND	7
8	Core temperature	8
9	Return GND	9
10	Return	10
11	Flow GND	11
12	Flow	12
13	Backendtemperature GND	13
14	Backendtemperatur e	14
15	Ambient temperature GND	15
16	Ambient temperature	16



7.2.2 Thermal discharge safety

Functional principle:

The thermal overflow safety device protects the boiler from overheating.
When the set temperature of 100° C is reached, the valve opens and cold water flows through the boiler's heat exchanger and cools the boiler.

Technical data:

Manufacturer:	Caleffi
Type:	544400
Dimension:	½“
Medium:	Water
Set temperature:	100° C (+0° C / -5° C)
Length capillary insert:	1300 mm

7.2.2.1 Installation thermal discharge safety

Connection pipe:

- The filling connection must be connected directly to the valve (without shut-off) at the mains water supply.
- The installation of a strainer is recommended.
- The diameter of the connecting pipe must at least equal to the diameter of the valve inlet.
  The connecting pipe must be made of non-flammable material
  Pay attention to the specified water quality

Drain pipe:

- One liter of water generates 1673 litres of water vapor.

  The drain line must therefore be mounted in a stable manner.

  The diameter of the drain pipe must be at least equal to the diameter of the valve outlet.

  The maximum length of the pipe may not exceed 2 m and 2 bends.

  If these values are exceeded, the cable must be dimensionally larger.

Thermometer pocket

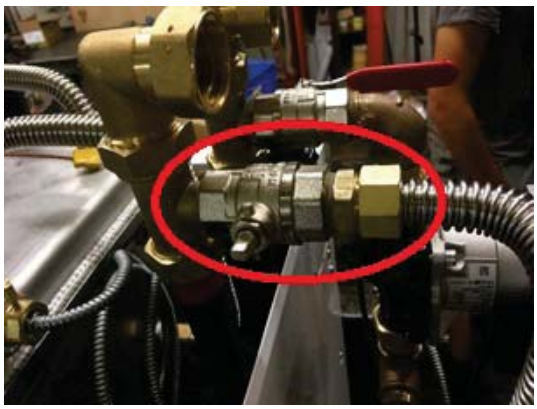
- The thermometer pocket of the thermal discharge safety device may only be replaced by an original thermometer pocket from Caleffi (544400), as otherwise a different heat exchange could occur.

thermo element	thermometer pocket
	

- Before start-up, make sure that the thermo element is secured against unintentional removal with a thermometer pocket (tighten the brass screw)

Check the maintenance shut-off

- The ball valve on the flow connection of the boiler is for maintenance purposes only and may only be shut off when the burner is switched off and cooled down
- Before starting up the boiler, check if the ball valve on the flow pipe is open!
  The responsibility lies with the executing technician and not with ÖkoFEN..
- The handle of the ball valve must be removed and stored for possible maintenance.



7.2.3 Cooling circuit pump

Technical data:

Wilo	
Yonos PARA	
RS15/6-RKA M	
Water	
3-45W	

Operation modes:

	Differential pressure variable (Δp-v): Adjustment left of mid-position
	Differential pressure constant Adjustment right of mid-position
	**Venting programme**: The venting program is not recommended in this case, because the minimum flow rate is not reached and problems can arise when starting the stirling engine
	PWM 1: PWM-Signal direct
	PWM 2:PWM-Signal inverse

Venting the pump and start-up:

- When starting up, set the pump to full power (level 6) to ventilate the cooling circuit.
  The venting program is not recommended in this case, because the minimum flow rate is not reached and problems can arise when starting the stirling engine.
- When no air can be heard, the pump can be set to 8 l/min.For this purpose, the value of the flow sensor can be read off on the touch display
- Because it is a closed cooling circuit, the speed on the right-hand side of the controller can be selected with a constant differential pressure

7.3 Securing of the heating operation

7.3.1 Conditions for the conversion to heating operation

The rebuild of the Pellematic Condens_e to emergency heating operation without electricity is intended as a temporary solution to securing the heating operation until the customer service can repair the system.
If the stirling engine can´t produce electricity for some reason, then heating operation isn´t possible too otherwise the stirling engine would overheat.

Before a rebuild is done, the following causes of error should be excluded:

- The negative draft set value is reached. The revolution speed of the negative draft should be in the range of 30-50%. If the revolution speed is higher, a blockage of the flue gas tract is given, which needs to be eliminated.
- The stirling engine is sufficiently flowed through with coolant (min. 8l/min).
- The emission values are within the permissible range (7,5-8,5% O2, CO below 150mg/m^3).

CAUTION

The conversion must only be carried out after consultation with the factory service! Before starting work, the system and the Stirling motor must be disconnected from the main switch!

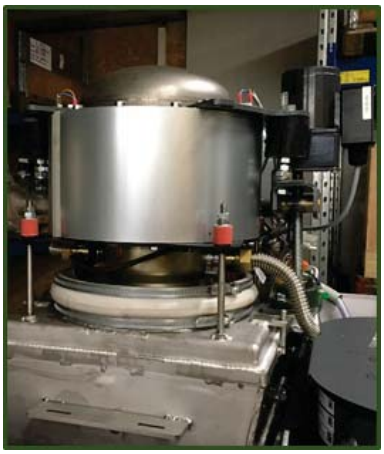
CAUTION

The back pressure valves of the cooling circuit need not to be closed. After completion of the work make sure that the back pressure valves are completely opened and the pump is connected to the boiler controller.

7.3.2 Conversion to emergency heating operation

Below is a step-by-step guide for the annual maintenance of the stirling engine.

1. Set the operation mode on the Display to off and let the system cool down.
2. Set the main switch f the boiler to 0 and the main switch at the switch cabinet to Off.
3. Remove the cover of the stirling engine.

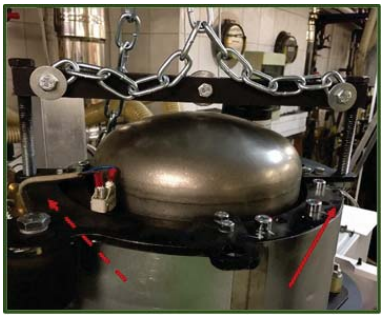


4. Disconnect the multipin connector, plug of the lifting and lowering engine, thermometer pocket for thermal discharge safety and combustion chamber sensor.

5. Loosen 4x M8 nuts from the boiler cover with a 13 mm wrench.

6. Hook the crane into the provided brackets.
   First lower then upper bracket.
   First lower then upper bracket. Check if the crane foot is adjusted correctly.
   The flaps of the crane must be properly hooked in.

7. Fixing the crane to the stirling engine using the two nuts.
   At least 1 thread must be visible under the nut.



Attach the safety chain to the provided hook on tension.

8. Wind the stirling engine carefully upwards.
   Make sure that the stirling engine does not collide with the thread (press softly to the back wall).

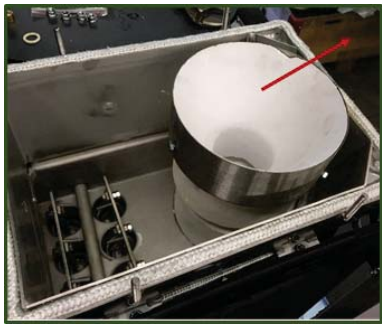
   Do not grab under the Stirling cover!

9. Tense the safety chain!

10. Mount the maintenance bracket using 4 pcs. M8 nuts.
    The bottom holes of the bracket must be inwards.

11. Turn the crane carefully to the right side.

12. Clean the combustion chamber and remove the upper flame tube of the stirling engine.



13. Attach the insulation to the boiler cover.

14. Mount the boiler cover using 4 pcs. M8 nuts.

15. Insert the combustion chamber sensor into the maintenance cover..
    Mount the maintenance bracket using 4 pcs. Screws on the maintenance cover and remove the crane

16. Connect the plug for the emergency operation (adapter plug) which is located on the maintenance cover.

17. Mount the casing.

18. Restore the power supply.
19. Chance the following settings
    - Set++

      FRT Controller: On

      Power regulation Off

      Lifting / lowering device: Off
20. Carry out a test run of the system

8 Annual maintenance of stirling engine

Below is a step-by-step guide for the annual maintenance of the stirling engine.

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2. Set the main switch f the boiler to 0 and the main switch at the switch cabinet to Off
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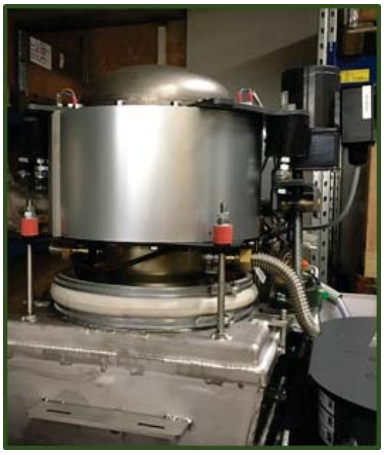


4. Disconnect the multipin connector, plug of the lifting and lowering engine, thermometer pocket for thermal discharge safety and combustion chamber sensor.

5. **Shut off the cooling circuit.**.
   On the boiler base.
   At the cooling pump
   Angle ball valve on the boiler cover.



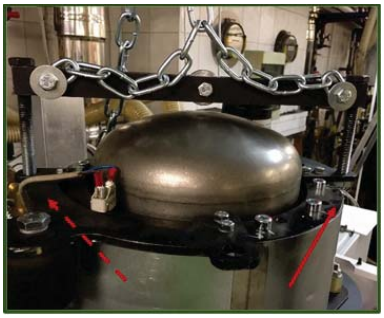
6. Loosen 4x M8 nuts from the boiler cover with a 13 mm wrench.

7. Hook the crane into the provided brackets.

   First lower then upper bracket.
   Check if the crane foot is adjusted correctly.
   The flaps of the crane must be properly hooked in.

8. Fixing the crane to the stirling engine using the two nuts.

   At least 1 thread must be visible under the nut.



9. Attach the safety chain to the provided hook on tension.

10. Wind the stirling engine carefully upwards Make sure that the stirling engine does not collide with the thread (press softly to the back wall).

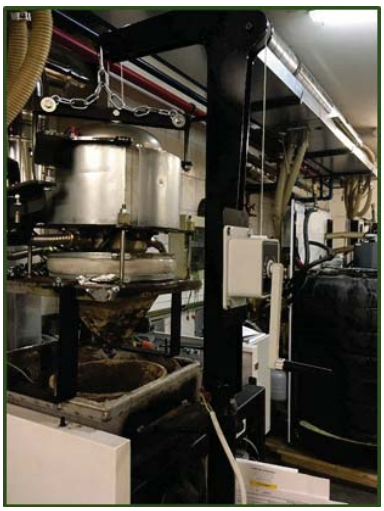
    Do not grab under the Stirling cover!

11. Tense the safety chain!

12. Mount the maintenance bracket using 4 pcs. M8 nuts.

    The bottom holes of the bracket must be inwards.

13. Wind the stirling engine **carefully** downwards and thread it into the threaded rods.



14. Before cleaning, make sure that the crane rope is on tension and the safety catch is hooked in.

15. The stirling engine and the combustion chamber can now be cleaned.

    An ash vacuum cleaner and a spatula are recommended

16. When the cleaning activites are completed, ift the Stirling engine carefully upwards again.
    Hook in the safety catch.
    Disassemble the maintenance set.
    Place the stirling engine on the combustion chamber again.

17. Reassemble the cover of the stirling engine (hydraulic of the cooling circuit, shut-offs, reopen cooling circuits, check tightness).
    Disconnect the multipin connector and the plug of the lifting and lowering engine,

18. Reassemble the maintenance crane.

19. Reassemble the stirling engine and the boiler casing

20. Restore power supply.
    Switch on the Condens_e and set the operating mode to Auto.

21. Carry out the boiler maintenance according to the checklist!

8.1 Cleaning of the magnetic filter

Technical data:

- Magna Clean Twin Tech
- ½“ connections

Procedure cleaning:

Cleaning of the filter is necessary as part of the annual maintenance or when the flow rate of 8l/min is no longer reached.

1. Switch off and let the boiler cool down..
2. Close the angle ball valve on the boiler cover and the ball valve on the cooling circuit pump
3. Mount the magnetic filter with the supplied spanner and empty it into the drip tray..
4. Remove the magnet.
5. Retighten the filter with the spanner..
6. Open the venting screw.
7. Open the ball valves of the cooling circuit
8. Venting the cooling circuit (select level 6 of the pump).
9. Reset the flow rate to 8l/min

9 Maintenance clearance

9.1 Malfunctions - what to do

With a Pellematic Condens_e there are additional malfunction codes, which only affect the operation of the Stirling engine.
The procedure to resolve malfunctions with the Pellematic Condens_e is basically identical to the procedure with the Pellematic Condens.
But there are several malfunctions, which must be resolved manually by pressing the malfunction release button on the electrical cabinet of the Stirling engine.
These malfunctions are marked in the table below with "UR" under reset option. In the annex of this manual is the wiring diagram for tracking the source of error.

9.2 Overview of malfunction alarm texts

Malfunction	**Alarm text**	**Cause and remedy:**	Reset
6010	Coolant outlet temperature sensor shortcircuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR
6011	Coolant outlet temperature sensor opencircuit	Check the wiring between the coolant inletsensor and the control system. sensor and the control system. Check sensor is fitted correctly. Sensor should be 10K NTC thermistor	AR
6012	Coolant outlet temperature sensor shortcircuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR
6013	Coolant outlet temperature sensor opencircuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR
6014	Back end temperature sensor short-circuit	Check back end sensor Check the wiring between the back endsensor and the control system Check sensor is fitted correctly. Sensor should be 10K NTC thermistor.	AR
6015	Back end temperatursensor open-circuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR
6016	Ambient temperature sensor short-circuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR
6017	Ambient temperature sensor open-circuit	Check coolant outlet sensor. Check the wiring between the coolant outletsensor and the control system. Check sensor is fitted correctly Sensor should be 10K NTC thermistor	AR

6301	Inner iron overtemperature	Open-circuit in engine blocking chain Wait for the thermostat to close, which may-take several minutes since it is temperature dependent. The error should automatically reset after 30 seconds, once thermostat has reset. Spurious trip? Visually inspect wiring connections.Check continuity	AR EStop
6303	Dynamic absorber overtravel	Open-circuit in engine blocking chain Wait for the thermostat to close, which may-take several minutes since it is temperature dependent. The error should automatically reset after 30 seconds, once thermostat has reset.Spurious trip? Visually inspect wiring connections. Check continuity	SR EStop
6304	G83/ENS protection	Open-circuit in engine blocking chain. Check G83/ENS configuration (countrysettings) Open-circuit in engine blocking chain. Voltage OK: Output switch should be closed Voltage not OK: Output switch should be open. Spurious trip? Visually inspect wiring connections Check continuity	AR EStop
6306	Alternator overload (where fitted)	Open-circuit in engine blocking chain Visually inspect wiring connections.Check continuity.	SR EStop
6309	Alternator short-circuit	Open-circuit in engine blocking chain. Blocking chain switch on MCB.Switch should operate on high engine current (> 13 A) Possible PCB hardware fault, if this doesn't reset automatically.	AR EStop
6310	Head over-temperature	Head temperature measured by at least one thermocouple exceeds 584 °C Large delta T between thermocouple measurements? Check both head thermocouplemeasurements. Check for large temperature differencesacross the head. Visually inspect thermocouple connections.	SR
6311	Head under-temperature	Head temperature measured by at least on thermocouple is below 103 °C when the engine is grid connected. Large delta T between thermocouple measurements . Check both head thermocouple measurements. If head temperature is cold, wait for head to warm up. Visually inspect thermocouple connections	AR EStop
6312	Stirling Not AUS	Stirling security chain interrupted. Emergency switch on the switch cabinet has responded. Check wiring for continuity.	AR EStop
6404	Remote emergency stop	Open-circuit in engine blocking chain. Visually inspect wiring connections.	UR EStop

		Check continuity.	
6405	Head under-temperature	Control head temperature measurement drops unexpectedly when engine is running (< 150° C) Check thermocouple measurements.	AR
6406	Head over-temperature Head temperature measurement discrepancy	Large delta T (> 100 °C) between headtemperature measurements. Monitor headtemperature measurement during engineoperation.	UR
6407	Control thermocouple	Poor head thermocouple measurement. Poor connection between thermocouple and PCB	UR EStop
6408	Limit thermocouple failure	Poor head thermocouple measurement. Poor connection between thermocouple and PCB	UR EStop
6411	Under-current	No (or too little) current (< 0.1 A) flow duringfirst minute of engine operation. Alternator is not connected to the PCB	UR EStop
6414	Resistor integrity check	Resistor integrity check failed Check start and stop resistors are properly connected to the PCB Check GIM and voltage control shorting links are properly fitted to MCB	SR EStop
6415	24 V d.c. power supply	24 V DC power supply problem. Check for external wiring faults	AR EStop
6420	Control thermocouple open-circuit	Check control thermocouple is connected Check control thermocouple polarityIs head very cold (less than 3 °C)? If yes, warm up the head	AR EStop
6421	Limit thermocouple opencircuit	Check limit thermocouple is connected. Check limit thermocouple polarity. Is head very cold (less than 3 °C)? If yes, warm up the head	AR EStop
6424	Coolant over-temperature	Check coolant flow rate Check actual coolant temperature is less than 70 °C. Check for correct coolant sensor. Check coolant sensor physical location Check coolant sensor wiring to control system	AR
6425	Coolant undertemperature	Check actual coolant temperature is greater than 6 °C. Check for correct coolant sensor check coolant sensor physical location. Check coolant sensor wiring to control	AR
6501	Power meter communications checksum failure	Internal communication problem. Report to MTC: Provide logged data.	AR
6502	Power meter communications timeout	Internal communication problem. Report to MTC: Provide logged data.	AR

6603	Low coolant flow rate	Check coolant flow rate is greater than 7 litres/minute Check coolant flow sensor and the control system.	AR
6604	Ambient overtemperature	Check the ambient temperature is less than 70°C Check the ambient temperature sensor Check the ambient temperature sensor location. Check the wiring between the ambient temperature sensor and the control system	AR

* Sensor: 10k NTC (25°C ~10kΩ, 60°C ~2,5kΩ)

AR = Automatic reset

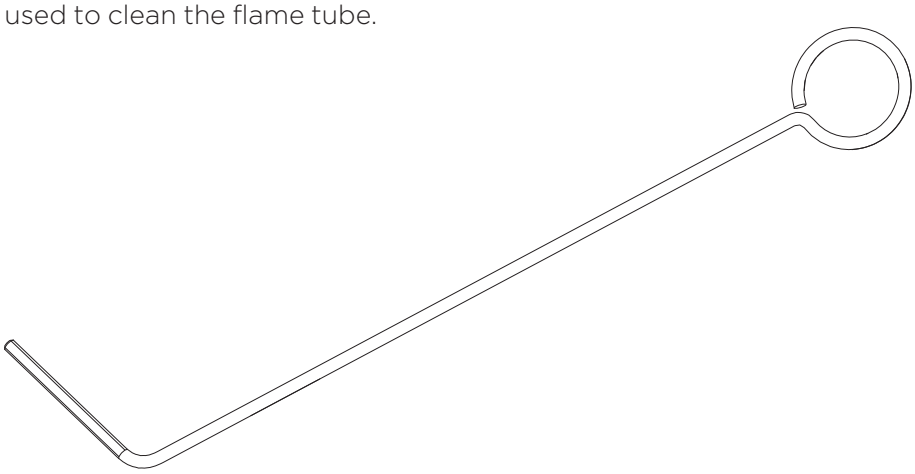
UR = User reset

SR = service reset

Estop = Emergency shutdown

10 Cleaning hook

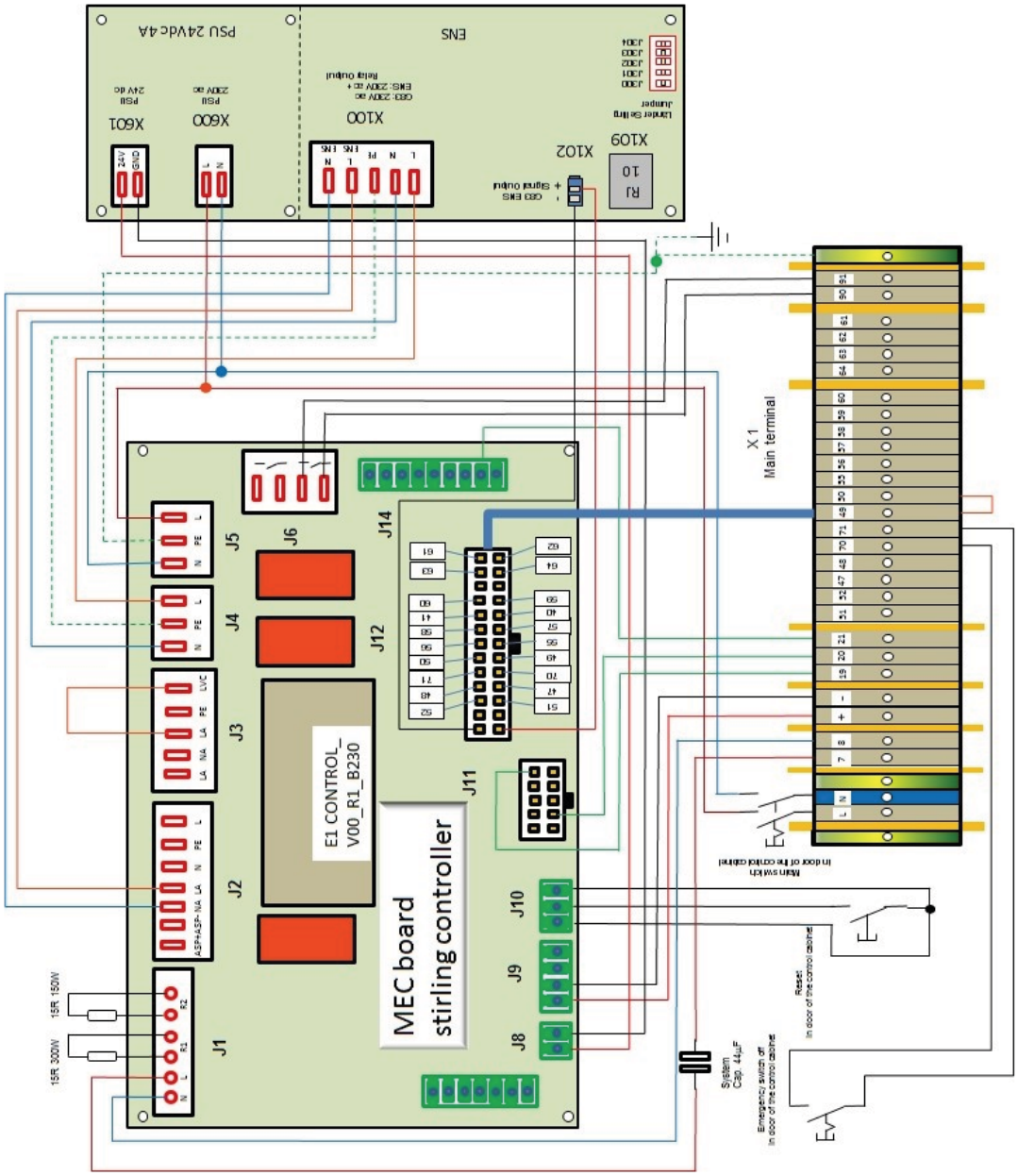
After 500 operating hours of the stirling engine or rather the ash box has been emptied, this hook must be used to clean the flame tube.



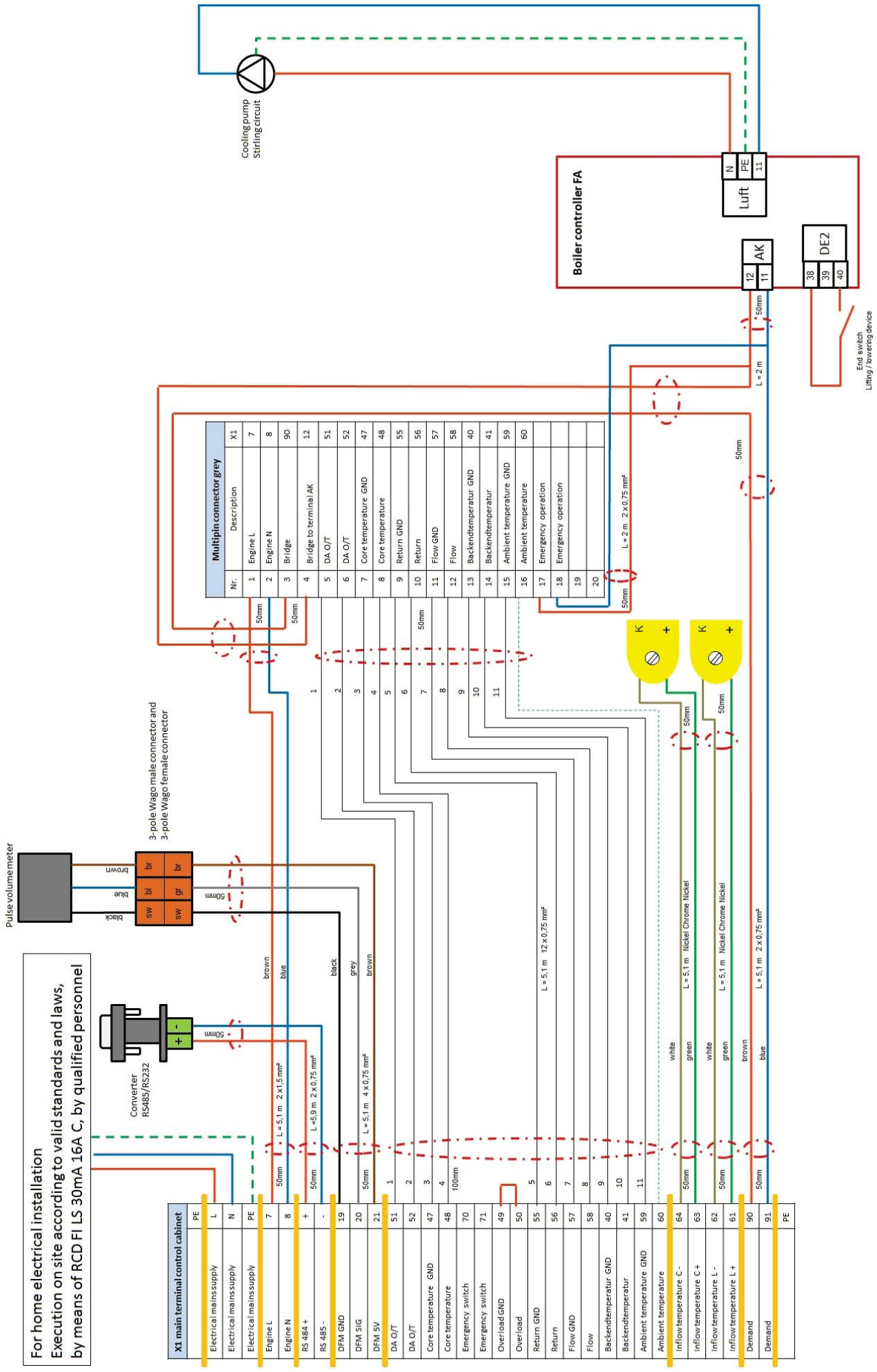
11 Appendix

11.1 Wiring diagrams

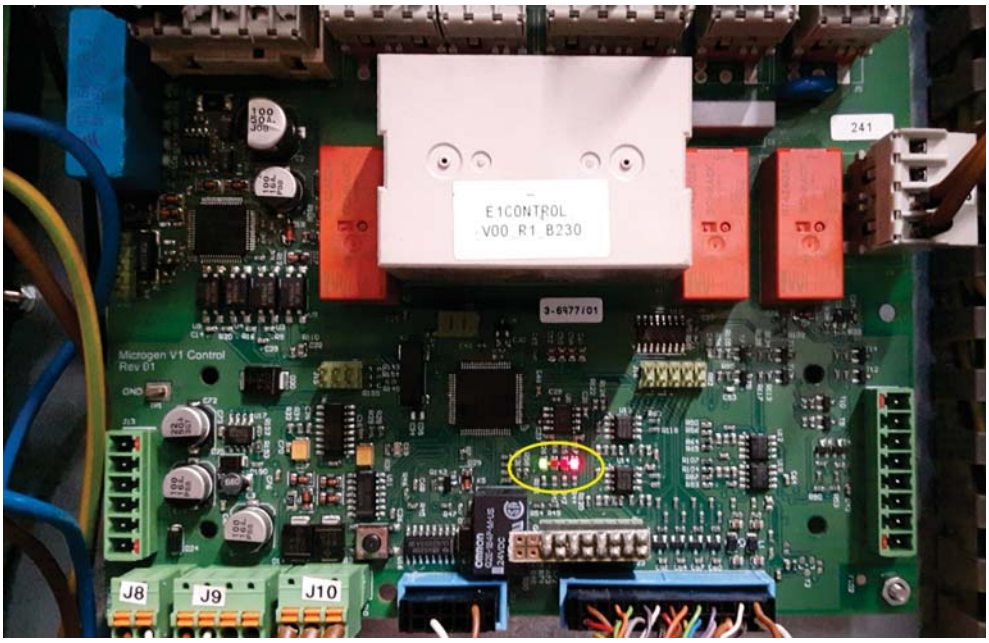
AVS76.392309 (V18 130404B)	Dip. Switch
Country	
Belgium	
Czech R	
Denmark	
Finland	
Ireland	
UK	
NL	
Austria	
France	
Germany/ Switzerland	
Italy	

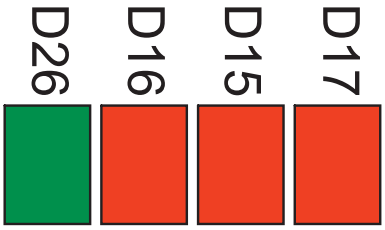


Note:
The country setting NL has no function


For home electrical installation
Execution on site according to valid standards and laws,
by means of RCD FI LS 30mA 16A C, by qualified personnel
X1 main terminal control cabinet
PE
Electrical mainssupply L
Electrical mainssupply N
Electrical mainssupply PE
Engine L 7
Engine N 8
RS 484 + +
RS 485 - -
DFM GND 19
DFM SIG 20
DFM 5V 21
DA O/T 51
DA O/T 52
Core temperature GND 47
Core temperature 48
Emergency switch 70
Emergency switch 71
Overload GND 49
Overload 50
Return GND 55
Return 56
Flow GND 57
Flow 58
Backendtemperatur GND 40
Backendtemperatur 41
Ambient temperature GND 59
Ambient temperature 60
Inflow temperature C- 64
Inflow temperature C+ 63
Inflow temperature L- 62
Inflow temperature L+ 61
Demand 90
Demand 91
PE
L = 5,1 m 2 x1,5 mm²
L =5,9 m 2 x 0,75 mm²
L = 5,1 m 4 x0,75 mm²
L = 5,1 m 12 x 0,75 mm²
L = 5,1 m Nickel Chrome Nickel
L = 5,1 m 2 x 0,75 mm²
50mm
100mm
brown
blue
black
grey
white
green
Converter RS485/RS232
Pulse volume meter
3-pole Wago male connector and 3-pole Wago female connector
Multipin connector grey
Nr. Description X1
1 Engine L 7
2 Engine N 8
3 Bridge 90
4 Bridge to terminal AK 12
5 DA O/T 51
6 DA O/T 52
7 Core temperature GND 47
8 Core temperature 48
9 Return GND 55
10 Return 56
11 Flow GND 57
12 Flow 58
13 Backendtemperatur GND 40
14 Backendtemperatur 41
15 Ambient temperature GND 59
16 Ambient temperature 60
17 Emergency operation
18 Emergency operation
19
20
L = 2 m 2 x 0,75 mm²
Boiler controller FA
Luft N PE 11
AK 12 11
DE2 38 39 40
End switch
Lifting / lowering device
Cooling pump
Stirling circuit
K
+

11.2 LED Status regulation stirling engine





In operation:

LED	Description
D26	LED is on when the 24V power supply is connected.
D16	LED flashes during the initialization phase (firmware starts up). When this process is completed, the LED turns off.
D15	LED is on when an error occurs.
D17	LED is on during operation of the stirling engine.

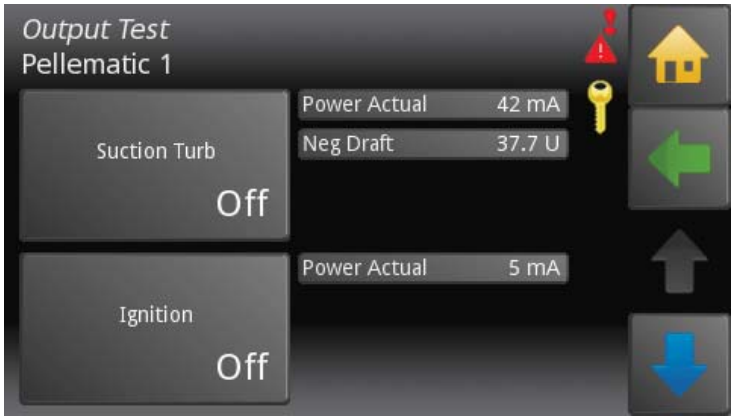
When switching on:

LED **D26** is on when the 24V power supply is connected.
Additionally LED **D16** lights up until ENS realease is reached.
If no LED is on, the 24V power supply must be checked (e.g. connection of flow switch).

11.3 Default values boiler controller

Negative Draft	
Set++	25 EH
Malfunction Time	180 sec.
FRT Controller	
Mode	Off
Min Temp	80° C
Full Power	
Delivery++	10 zs
Boiler Control Pump	
On Temp	55° C
Depends on Require Enable Mode	Dependent
Stirling	
Max. Power	900 W
Lifting / lowering device	Version 2
Maintenance time	300 W
Power adjustment	On
Power adjustment Min Flue Gas Temp	80%
Power adjustment Max Flue Gas Temp	90%
Leistungsbooster	Off
Leistungsbooster Zeit Stufe 1	3 h
Leistungsbooster Zeit Stufe 2	5 h
Settings	
Control Temperature	75° C
Switch Off Temp	83° C
Power Level	12 kW
Emergency operation	
Negative Draft	
Set++	00 EH
FRT Controller	
Mode	On
Stirling	
Power adjustment	Off
Lifting / lowering device	Off

11.4 Output Test



The Output Test serves to check all connected outputs:

- all motors
- relay fault signals
- magnet valves
- boiler controlled pumps

Note:
After choosing of one port, the operation will be interrupted.
By leaving the menu **output test** the normal operation will continue.

The output test is designed to test all outputs connected to the system (e.g. all motors, the alarm signal relay, the solenoid valve and the recirculation pump).

By using the operative device and typing in the code, you can access the item **output test** in the menu **general**.

You can control the required output with ON / OFF and choose the power input 0 -100%.

Designation	Check if	If not, then check
Motor suction fan VAK	the suction fan on the hopper is running	• the suction fan is connected • the fuse is defective • the motor is defective
Ignition ZUEND	the electrode is working: you can view the current draw at the control unit after it has been switched on.	• the wiring is correct • Check the ignition electrode
Motor ash auger AV (optional)	the motor ash auger is running	• the de-ashing system is switched on • the ash box is properly located and locked in position • the ash box is correctly wired up
Solenoid valve MA	the solenoid valve switches over and you can hear it click **Note:** **Low temperature systems only**	• the scrubber is connected • the scrubber is defective
Cleaning motor RM	the cleaning motor raises and releases the cleaning springs	• the terminal bolts on the shaft are tight • the motor is defective
Fault signal relay SM	the relay switches on and off: you can hear it clicking on and off	• the wiring is correct • the fault signal relay is defective
Flue gas fan SZ	the flue gas fan is running	• the wiring is correct • the motor is defective
Boiler controlled pump	the boiler controlled pump is running	• the wiring is correct

Designation	Check if	If not, then check
UW	**Note:** only possible if the boiler controlled pump is connected	• the boiler controlled pump is defective
Motor store room auger RA	the motor auger store room is running **Note:** On suction systems, switch on the suction fan motor first otherwise the motor on the store room auger may become jammed.	• the store room auger motor is connected • the auger rotates easily • the motor is defective
Motor hopper RES 1	**Note:** PES 36–56 only	• the wiring is correct • the motor is defective
Motor burner auger ES	• the motor that feeds pellets to the burner is running auger is correct. • the direction of rotation of the store room auger is correct	• the burner auger motor is connected • the burner auger motor rotates easily • the motor is defective
Cooling circuit pump	if the cooling circuit pump is running	• the wiring is correct • the pump is defective
Lifting- / lowering device	if the motor of the lifting — / lowering device is running	• the wiring is correct • the motor is defective

11.5 Documents Fronius

Via these QR-codes you can download further documents of Fronius.

Examples of emergency power switchover:

Manual Fronius Energy Package:

Author

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