



Burners : RP-150 T RP-250 T RP-280 T

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1. General

1.1. Forewords

Thank you for using Oilon-products. We hope you are content with the product and our service. This manual is intended to guide operation and maintenance of the product. We pursue to improve our products and services. Therefore we readily accept feedback about on our operation and maintenance manuals. Feedback may be sent to info@oilon.com




Installation and maintenance of the device must be performed by a certified personnel. If you need help with maintenance issues, please contact your nearest representative or Oilon Oy technical support. Contact information can be found on our website at www.oilon.com

1.2. Conventions in this Manual

1.2.1 Warning symbols in this manual

Read these instructions carefully before installation, commissioning or maintenance of the burner. The given instructions must be followed.

Symbols used are :

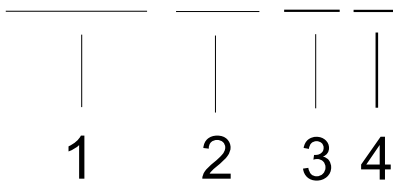
 DANGER!	<p>Be careful. The DANGER symbol indicates a possible danger of bodily harm or lethal injury.</p>
 CAUTION	<p>Pay attention. The CAUTION sign indicates a possible danger of damage to the device, components or surroundings.</p>
 Note	<p>Notes indicate tips, hints and other essential information.</p>

KEEP THIS MANUAL ALONG WITH THE INSTALLATION RECORD AND THE ELECTRICAL SCHEMES AVAILABLE NEAR THE BURNER!

1.3. Type labelling on Oilon burners

1.3.1 Example of type labelling

GRP-150 M-II



Label element 1: Fuel

KP	Light fuel oil
RP	Heavy fuel oil
GP	Gas
GKP	Gas + light fuel oil
GRP	Gas + heavy fuel oil

Label element 2: burner size categorization

Label element 3: method of control

H	Two-stage
T	Three-stage
M	Modulating
ME	Modulating with a separate fan
P	High-Low or modulating with an electronic controller
LH	High-low with a preheater
	On-Off


Label element 4: possible additional code


1.4. General information


1.4.1 Burner features and general information

BURNER CONTROL	Oilon T-burners are fully automatic 3-stage burners
BURNER APPLICATIONS	Most heating appliances such as hot water boilers, steam boilers, air heaters and thermo fluid boilers
APPLICABLE FUEL	<ul style="list-style-type: none"> The burners are suitable for use on heavy fuel oil, with a viscosity of max. 380 mm²/s (cSt) at a temperature of +50 °C and on burners with electric tracing max. 700 mm²/s (cSt) at a temperature of +50 °C. Temporarily light fuel oil
MINIMUM VISCOSITY FOR IN-LET OIL	1.5 mm ² /s (cSt)
IN-LET OIL TEMPERATURE	The temperature of oil coming to the burner should be from 60 to 100 degrees Celsius.
OIL FILTRATION	The oil coming to the burner must be filtered before the oil pump. Maximum filtration degree is 125 µm.
PREHEATER	Oil is preheated in the burner's preheater to the atomizing temperature. The oil temperature is controlled by an electronic regulator.
HEAT CARTRIDGES	Oil pump and solenoid valves are equipped with heat cartridges.
ADDITIONAL HEATING	The burner pipes are equipped with trace heating
HEAVY FUEL OIL ATOMIZING VISCOSITY	Oil coming to the nozzles should be between 14 and 16 mm ² /s (cSt)
LIGHT FUEL OIL ATOMIZING VISCOSITY	1.5 to 12 mm ² /s (cSt) at a temperature of +20 °C
OIL ATOMIZING PRESSURE	25 - 30 bar for heavy fuel oil 20 - 25 bar for light fuel oil
OIL PUMP	RP 150 T : TA2 RP 250 T : TA2 RP 280 T : TA2
NUMBER OF NOZZLES	3
NOZZLE CONTROL	Three nozzles are controlled with separate solenoid valves
BURNER MAX. TURNDOWN RATIO	1:2,5 (100 - 40 %)

COMBUSTION AIR FAN	The fan provides the air needed in the combustion. It is dimensioned to provide a sufficiently high and even air pressure for efficient combustion in modern combustion chamber.
REQUIRED COMBUSTION AIR QUANTITY	15 m ³ of combustion air for each burnt kilo of oil
SERVOMOTOR AND COMPOUND REGULATOR	Controls the burner capacity and the air/fuel ratio according to the capacity demand.
OPERATING TEMPERATURE	0... + 45 C°

 DANGER!	<ul style="list-style-type: none"> • The burner must be installed firmly. Vibrations may damage burner or its components. • Never store any inflammable material in the boiler room. • Never use a naked flame while checking the burner or the boiler. • Keep the boiler door closed while starting the burner and during burner operation. • Do not touch the oil pipes during burner operation. They may be hot. • Do not touch the levers of the compound-regulator or adjusting rod leading out from the compound-regulator, and do not leave things lying close to them when burner is operating. • Wear hearing protectors, if there is noise in the boiler room.
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 DANGER!	<ul style="list-style-type: none"> • IN CASE OF FIRE OR OTHER EMERGENCY • Switch off the main switch. • Close the main fuel shut-off valve outside the plant. • Take appropriate actions.
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 Note	<ul style="list-style-type: none"> • Local regulations and requirements must be adhered to when installing or servicing the burner. • Correct installation and adjustment together with regular servicing are the most reliable guarantees of trouble-free burner operation. • The burner has to be installed in such a way that the motor shaft lies horizontally; however, it is not allowed to install the burner upside down. • Use only original spare parts. When ordering spare parts please give the burner type and serial number indicated on the burner nameplate.
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1.5. Inspecting boiler room

1.5.1 Take care of the boiler room

- Maintain tidiness in the boiler room and keep the door closed
- Make sure there is always enough water (pressure) in the heating system.
- Make sure the boiler and the chimney are swept regularly, at least once a year
- Check the correct adjustment of the flue damper and the gate valve regularly.

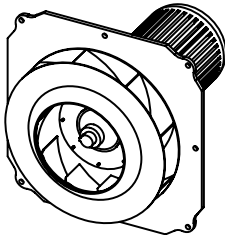
- Make sure the burner room combustion air gap (air in-let hole) is open.
- Make sure the shut-off valves on pressure gauges are shut.
- Make sure tightness of the pipeworks, safety appliances of the boiler system, pipeworks, and the burner are checked regularly according to rules and regulations of public authorities.
- Check boiler and it's components.
- Making a maintenance contract is recommended.

 DANGER!	Never use a naked flame while checking the burner or the boiler. Never store any inflammable material in the boiler room. Wear hearing protectors, if there is noise in the boiler room.
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2. Burner operation

2.1. Burner operation 3-stage (T) burners

2.1.1 Combustion air



A burner device has been provided with a fan that is tailored to produce high and steady enough air pressure that is required to get a flawless ignition and good combustion in a modern combustion chamber. A servomotor controls the amount of air fed according to the amount of fuel combusted.

2.1.2 Pre-ventilation, purging and ignition

Before ignition the burner runs through the pre-ventilation and purging periods.

During the pre-ventilation period the burner fan is ran with full load settings to exhaust explosive fumes from the boiler.

Purging period flushes the nozzle valves and the utilisation circuit. The nozzle valve is preheated and the oil temperature controller ensures adequate temperature has been reached for fuel atomizing.

During purging period solenoid valves (NC) are closed and solenoid valve (NO) is open. During this time oil flows through the stage-1 nozzle control circuit but as not wnough pressure to open the nozzle since the solenoid valve (NO) is open allowing a return flow to the tank.

After the end of the purging period servomotor turns the air dampers to stage-1 position and solenoid valve (NO) closes. The oil pressure begins to take effect on the nozzle piston and the spring-loaded nozzle valve opens. Oil flows from nozzle 1. Spark between the ignition electrodes ignites oil spraying from the nozzle. Burner operates at stage 1.

2.1.3 Atomizing

To get a sufficient viscosity for the fuel atomizing the oil temperature is raised with a preheater device. The temperature of the heated oil is controlled electronically.

In-let oil pressure to the pump varies case-specificly; See 'Pump adjustments'.

Atomizing pressure is provided by the burner oil pump.

If the boiler temperature or pressure exceeds the set value of control device of stage 2, burner remains operating at stage 1.

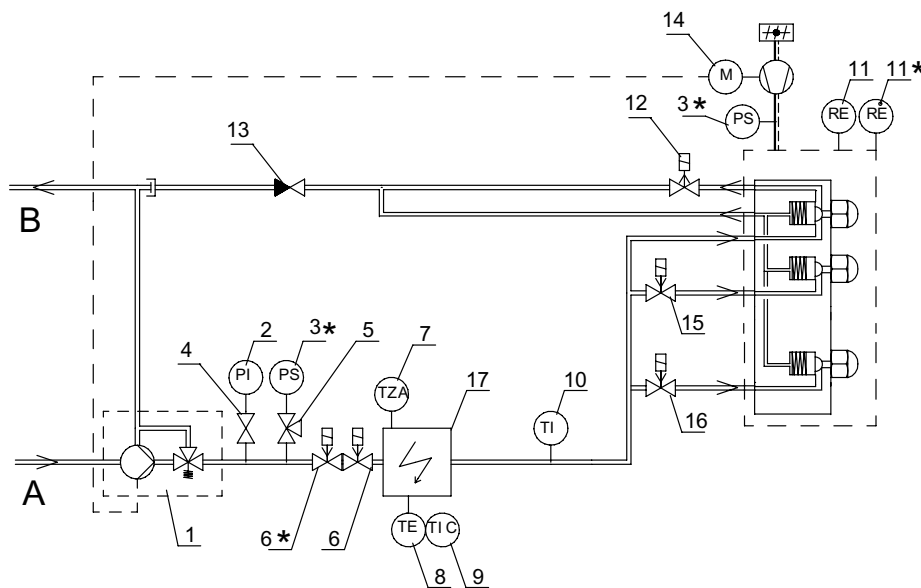
If the boiler temperature or pressure is below the set value of control device of stage 2, the air quantity increases and solenoid valve for stage 2 opens. Oil is delivered to the nozzle of stage 2. The air dampers turn to the position of stage 2. Burner operates at stage 2.

If the boiler temperature or pressure is below the set value of control device of stage 3, the air quantity increases and solenoid valve for stage 3 opens. Oil is delivered to the nozzle of stage 3. The air dampers turn to the position of stage 3. Burner operates at stage 3.

When the boiler temperature or pressure exceeds the set value of control device of stage 3 burner runs to stage 2 or 1.

When the boiler temperature or pressure exceeds the set value of control device of stage 1, burner shuts down (air dampers close).

2.1.4 PI-diagram of a 3-stage (T)burner



1. Oil pump, By-pass plug removed
2. Pressure gauge
3. Pressure switch
4. Closing valve, closed by default
5. Three-way valve
6. Main solenoid valves, closed by default
7. Limit thermostat preheater
8. Temperature sensor
9. Temperature indicator and controller
10. Temperature indicator
11. Flame detector
12. Solenoid valve, stage 1, open by default
13. Non-return valve
14. Servo motor

- 15. Solenoid valve, closed by default + throttle plug diam. 1,2 mm
- 16. Solenoid valve, stage 3, closed by default
- 17. Preheater

A Oil, suction

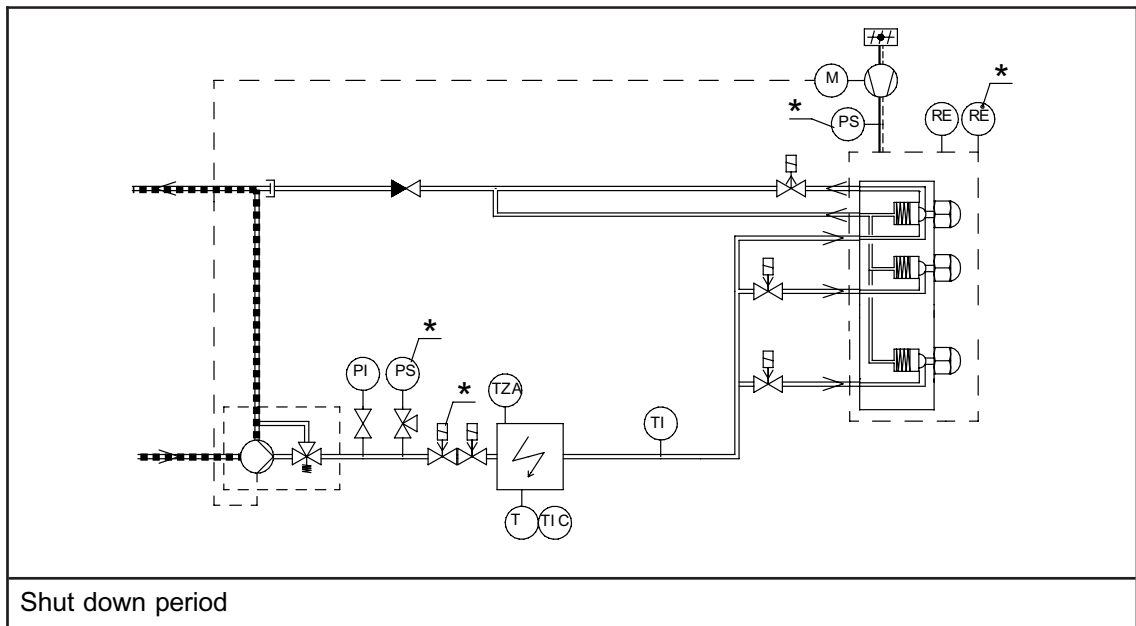
B Oil, return

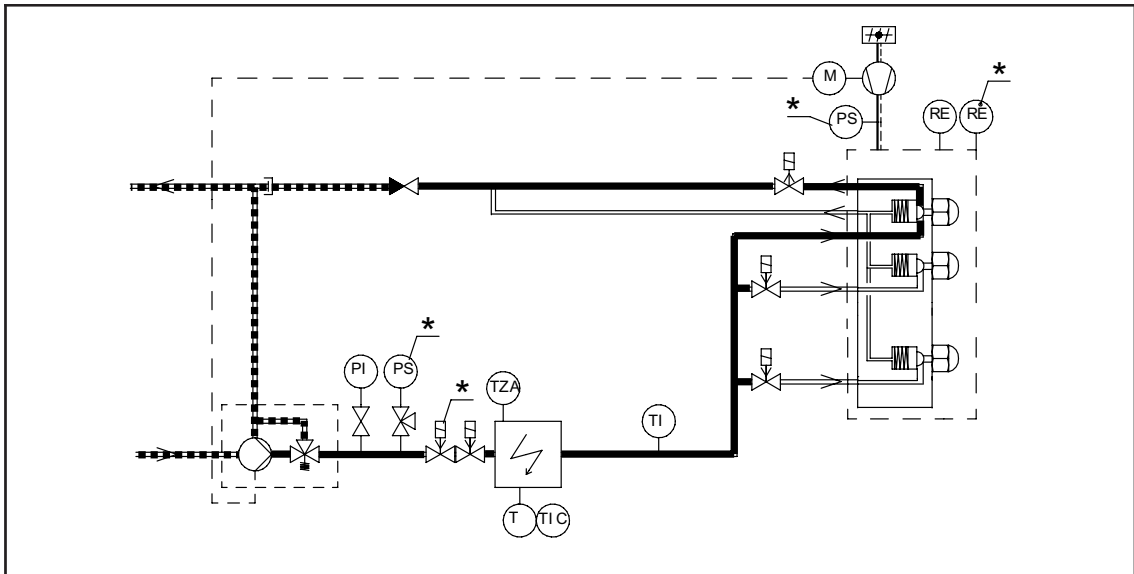
* Components marked with a star symbol may be included or excluded according to class and customer requirements

! Note The burner has to be connected to the oil circulation system according to the oil supply diagram.

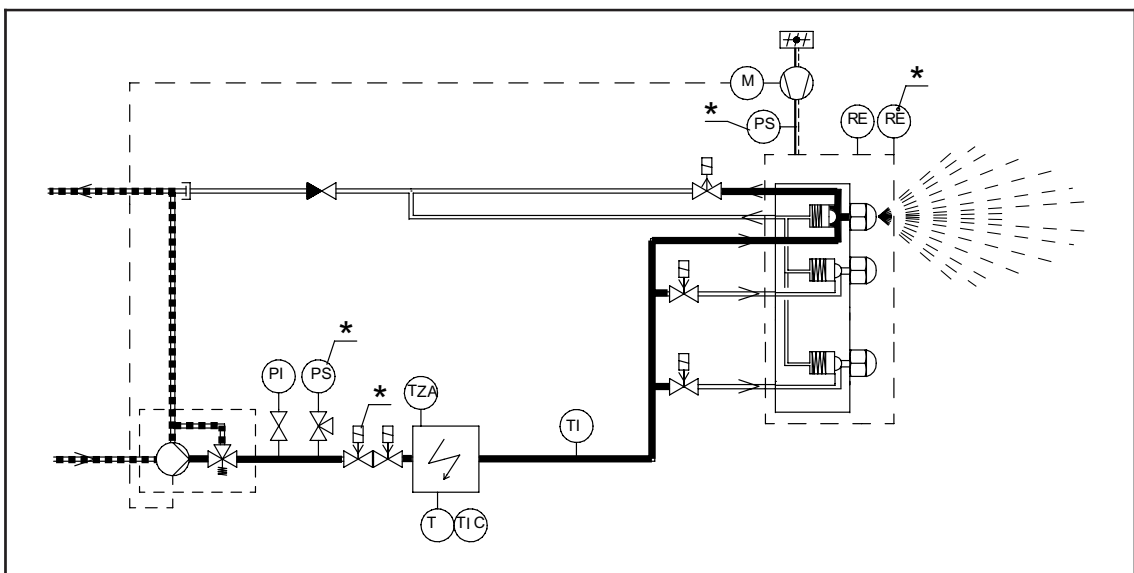
2.2. Oil circulation in burner

2.2.1 Oil circulation phases on T- burners

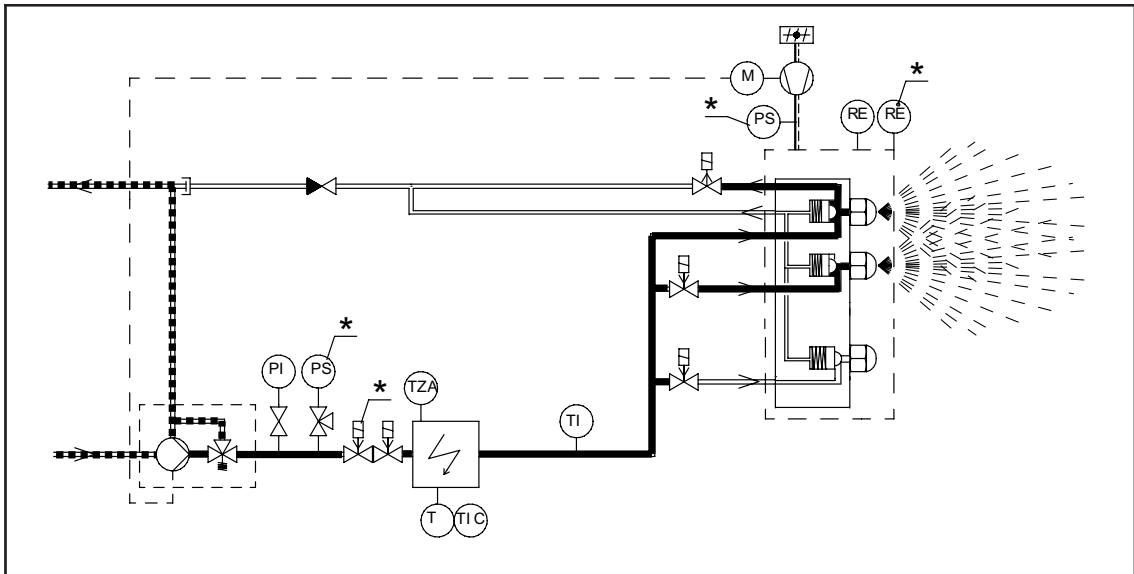




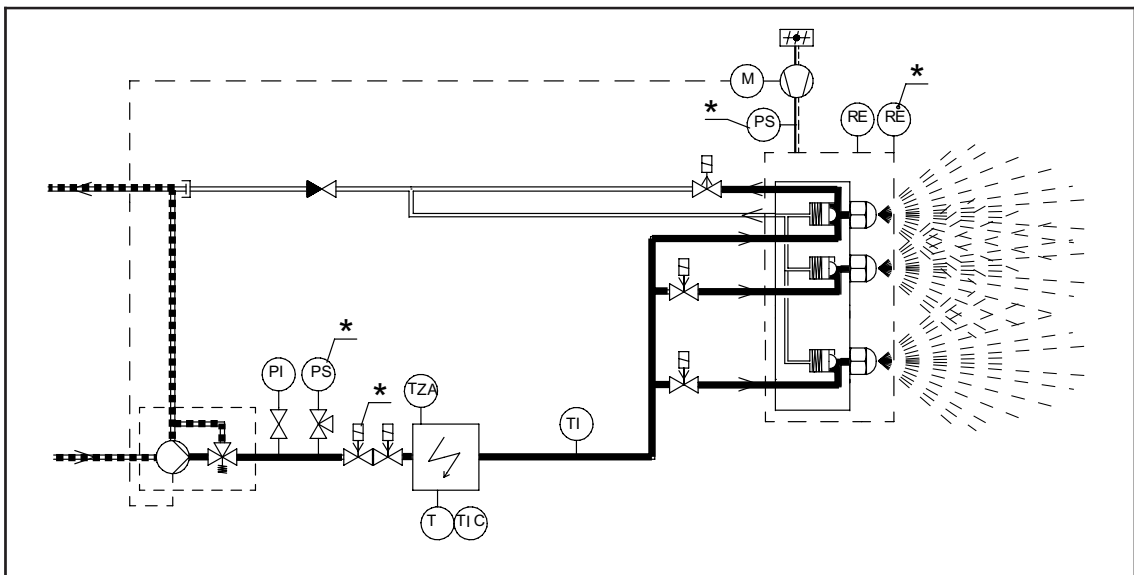
Purging period



Stage 1



Stage 2

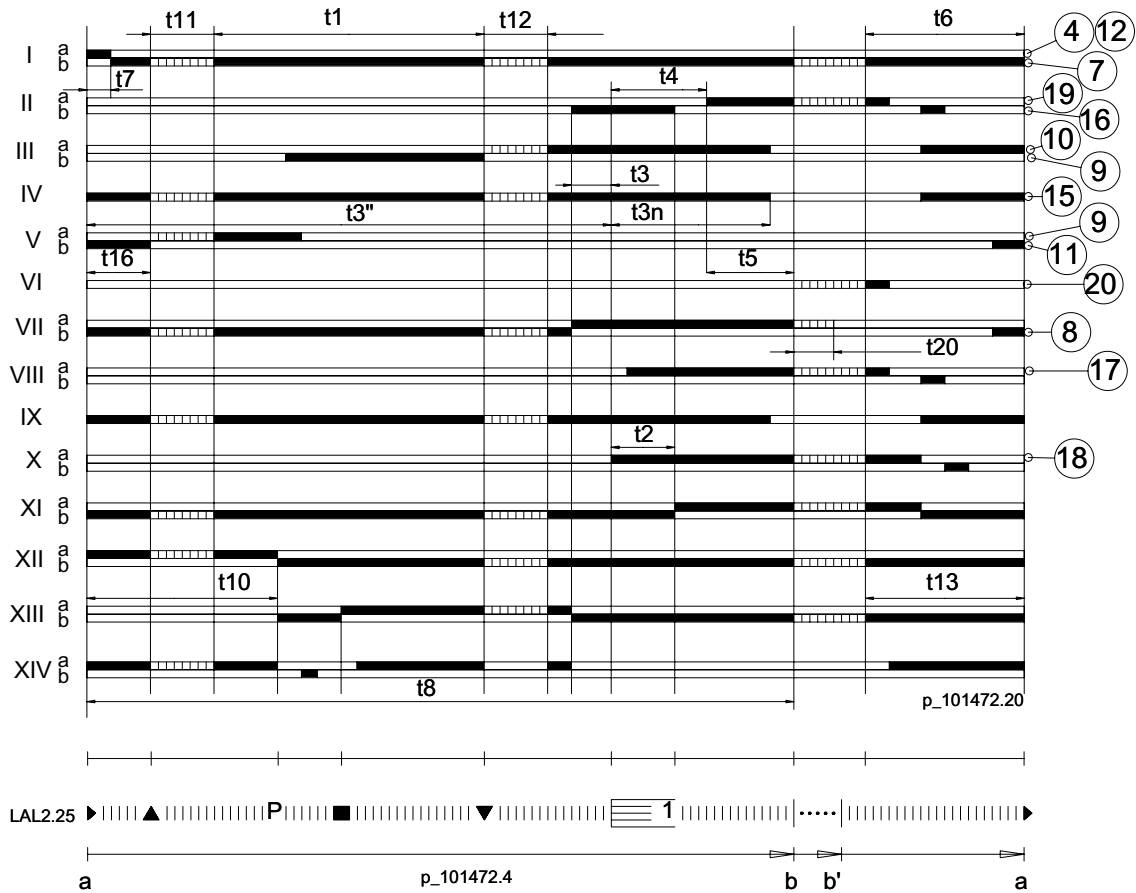


Stage 3

* Components marked with a star symbol may be included or excluded according to class and customer requirements

2.3. Control Program of the Sequence Switch

2.3.1 Control program diagram



Lockout indication

- a - b = start-up sequence
- b - b' = idle steps (operation)
- b(b') - a = post-purge sequence (reset of control unit)

Numbers 4...20 are the control output contacts from the sequence switch relay

2.3.2 Switching times (in seconds) of the control program of the sequence mechanism

t1	Pre-purge time with air dampers open	22,5
t2	Safety time	5
t3	Pre-ignition time "SHORT" (transformer connected to terminal 16)	2,5
t3"	Pre-ignition time "LONG" (transformer connected to terminal 15)	from start command
t3n	Post-ignition time (transformer connected to terminal 15)	15

t4	Interval between beginning of t2 and release of voltage at terminal 19	7,5
t5	Interval between end of t4 and release of voltage at terminal 20	7,5
t6	Post-purge time	15
t7	Interval between start-up command and release of voltage at terminal 7	2,5
t8	Duration of start-up (without t11 and t12)	47,5
t11	Running time for air dampers to OPEN position (air dampers position control)	optional
t12	Running time for air dampers to IGNITION position (air dampers position control)	optional
t13	Permissible after-burn time	15
t16	Interval from start-up to OPEN command for air dampers	5
t20	Interval up to the self-shutdown of the sequence mechanism (idle steps)	35

Switching times in seconds in the sequence of the burner start-up are valid for frequency of 50 Hz. For 60 Hz frequency, switching times are reduced by approx. 20 %.

2.4. Control Program under Fault Conditions and Lockout Indication

2.4.1 Principle

In case of any fault fuel injection is stopped immediatly. The sequence mechanism stops along with the lockout indicator. The symbol above the reading mark of the indicator gives the type of fault.

2.4.2 Fault indications on a modulating burner

SYMBOL	FAULT	CAUSE	Note
◀	Lockout	the CLOSE signal has not been delivered to terminal 8 from air damper servomotor or contact have not been closed between terminals 12 and 4 or 4 and 5.	
◀	Lockout	Extraneous light (e.g. non-extinguished flame, leaking fuel valves, defect flame supervision circuit, etc.).	
▲	Interruption of start-up sequence	the OPEN signal has not been delivered to terminal 8 from the air damper servomotor.	Terminals 6, 7 and 15 remain under voltage until the fault is corrected!
P	Lockout	Lockout because the air pressure signal has not been received at the start of the air pressure control.	From this point on till controlled shut down every air pressure failure triggers a lockout. Too little difference in air pressure (<min.) triggers a lockout when differential air pressure switch connector (C/NC) engages a control signal to control unit terminal 13.
■	Lockout	Fault in the flame detection circuit	
▼	Interruption of start-up sequence	The ignition position signal has not been delivered to terminal 8 from air damper servomotor	Terminals 6, 7 and 15 remain under voltage until the fault is corrected!

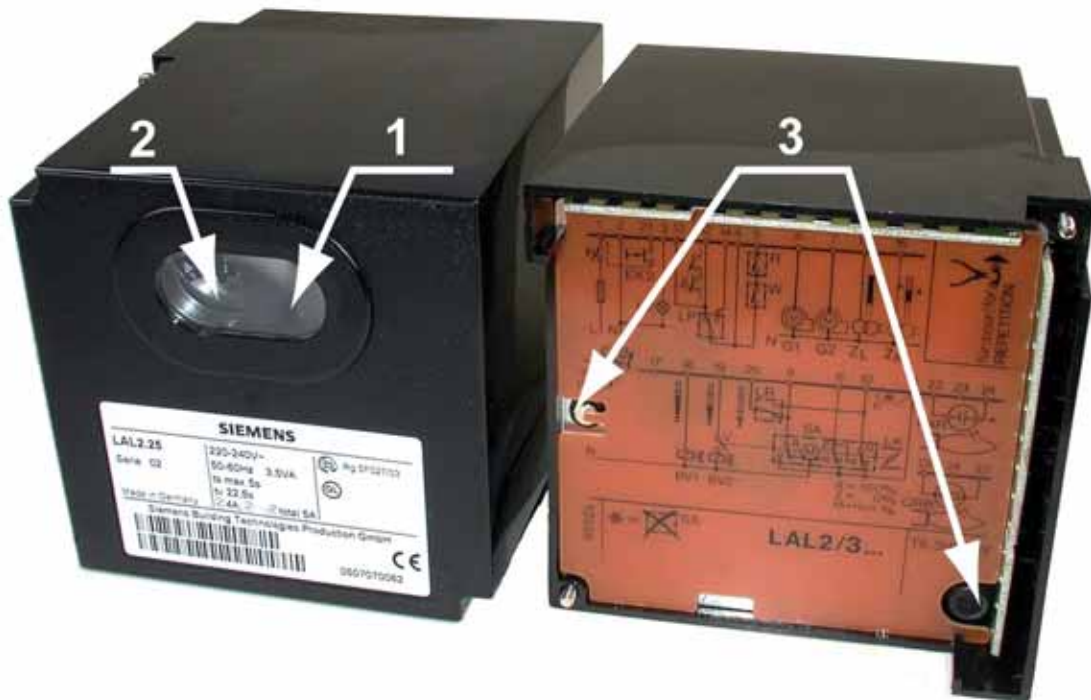
1	Lockout	Flame signal has not been received during safety time.	Every flame signal failure after safety time sequence leads to a lockout
1	Lockout	Return line pressure switch (max) triggering stops fuel injection.	Pressure switch is optional component. May not be included to delivery.
	Lockout	The flame signal has been lost during burner operation	If the wire link B has been cut from the plug section of the control unit, repetition of startup sequence follows
	Lockout	Air pressure signal lost during operation	

2.4.3 Restart


The control unit can be reset immediately after a lockout has occurred. After resetting (as well as after correction of a fault, which resulted in a controlled shutdown, or after each mains failure) the sequence switch always returns to its start position, whereby only terminals 7, 9, 10 and 11 receive voltage in accordance with the control program. It is only then that the control unit begins with a new burner start-up.

Do not keep the reset button pressed for more than 10 seconds.

2.4.4 Control unit LAL 2.25



1. Reset button
2. Program indicator
3. Fuses

 CAUTION	<ul style="list-style-type: none"> • Control unit is a safety device. It is NOT allowed to open nor make alterations or adjustments to it. • The control unit must be completely separated from supply voltage before carrying out any procedures to it. • All safety functions must always be tested when using for the first time and after changing the fuse. • The control unit must be kept safe from water drops and sprays at all times
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2.5. Additional heating

2.5.1 Description

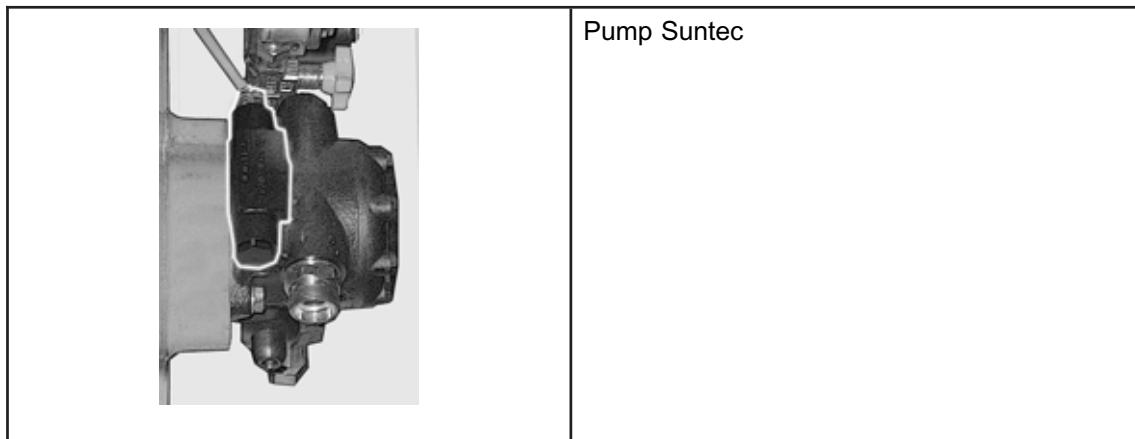
Additional heating keeps the burner ready for use. Additional heater devices ensure oil fluency by keeping oil viscosity adequately low.

Keep heating on at all times. If the heaters are turned off they must be turned ON AT LEAST 2 HOURS BEFORE starting the burner.

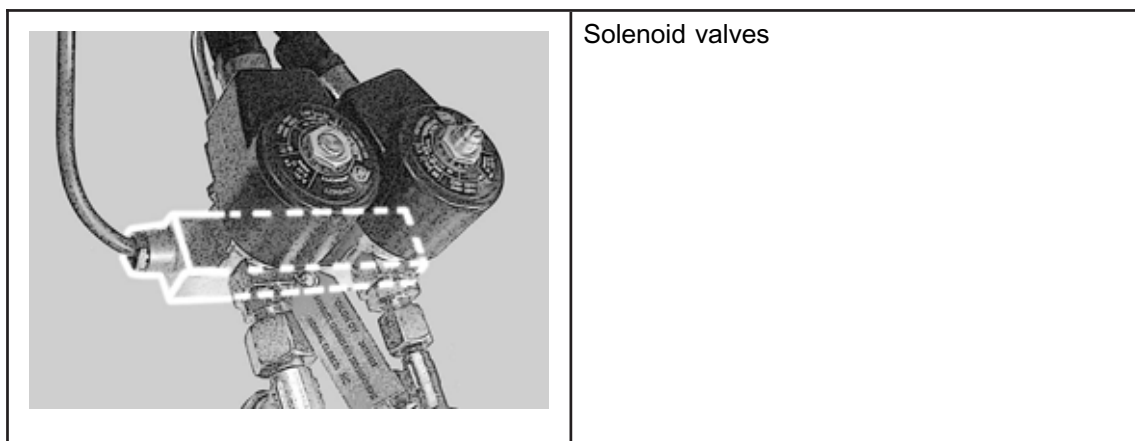
If the oil viscosity is too high :

- ignition does not happen or it is difficult
- the oil pump and sealing components are overstressed which may lead to premature degrading.

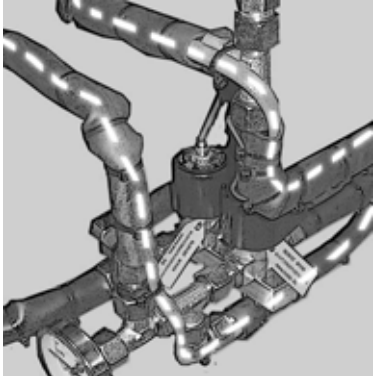
2.5.2 Heating cartridges on pumps



2.5.3 Heating cartridges on solenoid valves




2.5.4 Heating the pipes and hoses with heating cables

	<p>The heating cables must run in direct contact with the pipe surface. Loose cable does not conduct heat into the pipings.</p>
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2.5.5 Technical data

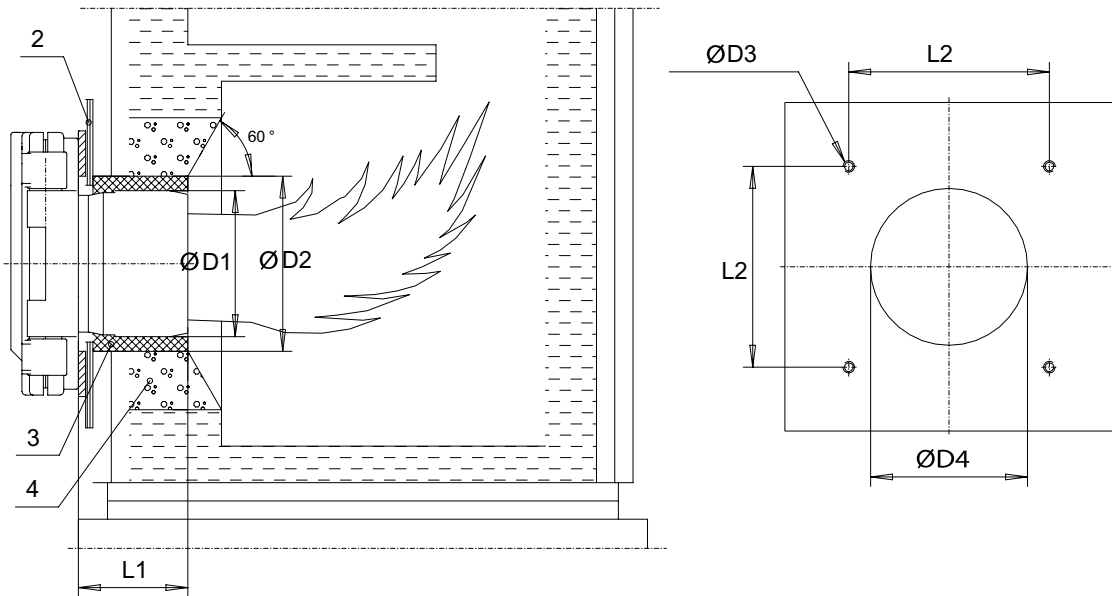
Heating cartridge capacity	40 W/230 V
Heating cartridge dimensions	10 x 50 mm
Heating cartridge electric cable	2500 mm
Heating cable	Self adjusting - capacity decreases as the pipe temperature rises.
Heating cable capacity	230 V 45 W/m in +10 C°

	<p>Heating cartridge case may be hot</p>
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3. Installing the burner

3.1. Burner Installation

3.1.1 Mounting dimensions



1. Gasket
2. Mounting plate
3. Ceramic wool or similar
4. Refractory

Burner	Dimensions in mm					
	D1	D2	D3	D4	L1	L2
RP150	270	310	M16	285	230	275
RP250	270	310	M16	290	300	365
RP280	300	340	M16	320	312	365

3.1.2 Burner mounting


The boiler front plate must be prepared in accordance with the given dimensions.

The threads of the bolts must be coated with graphite-bearing grease prior to fitting

The burner has to be installed in such a way that the motor shaft lies horizontally; however, it is not allowed to install the burner upside down.

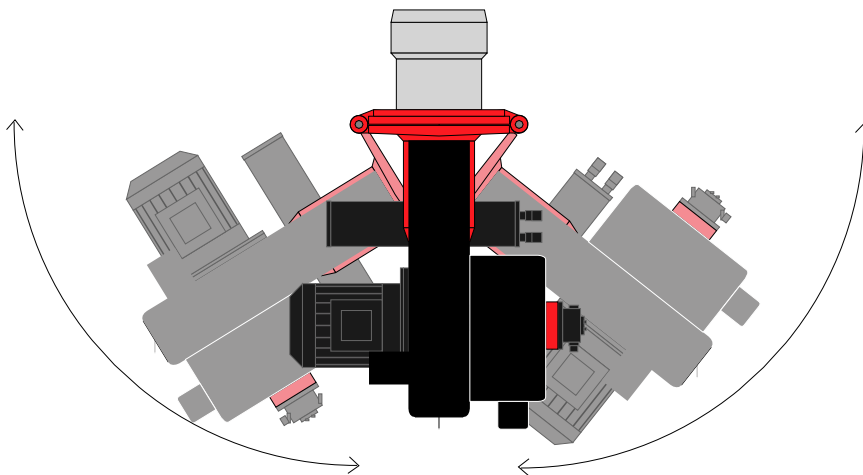
Remove the transportation bracket after the burner is attached to the boiler

Make sure there is enough free space on the side to allow the burner to swing fully open


 <p>CAUTION</p>	<p>The burner must be installed firmly. Vibrations may damage burner or its components.</p>
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3.2. Burner hinges

3.2.1 Standard composition

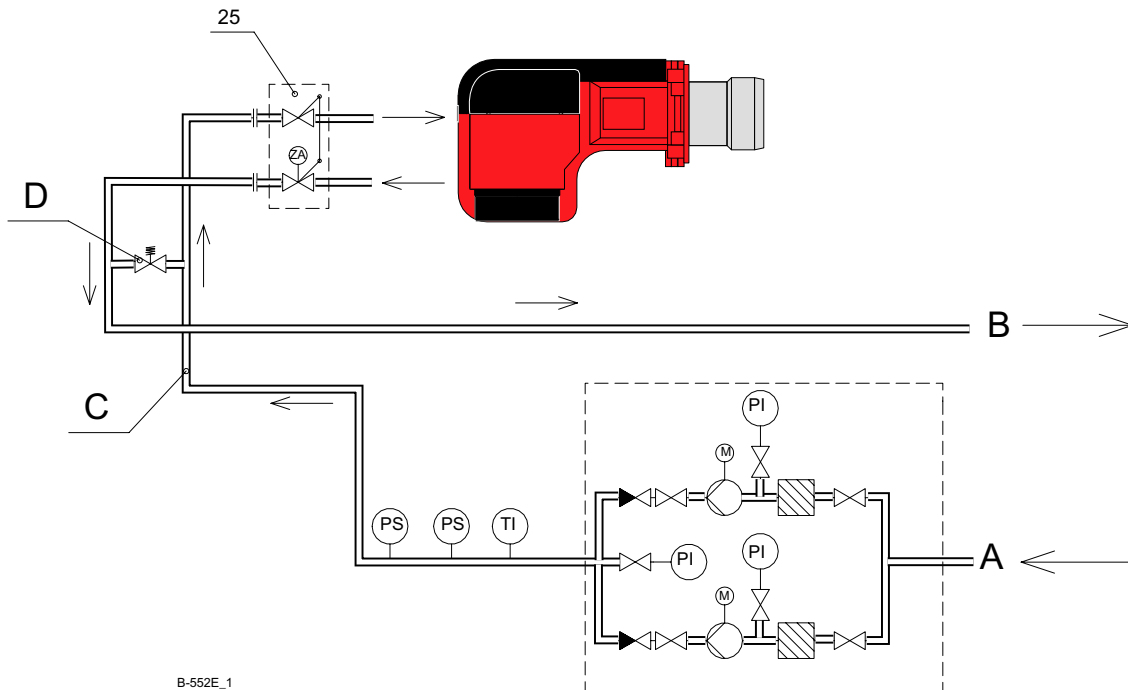


As standard the burner can be hinged to the left. The burner can be changed to be hinged to the right by changing the position of the hinge pins.

 <p>CAUTION</p>	<p>Switch off the electric power from your burner before burner swing-out.</p>
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3.3. Exemplary Oil supply diagram

3.3.1 Oil supply diagram



25 - double closing valve (accessory)

A - Oil from tank

B - Return line to tank

C - Oil from pumping unit

D - Pressure regulating valve

The oil throughput from the pumping unit must be at least $1,2 \times$ quantity of oil to be burned $\text{kg/h} + 150 \text{ kg/h}$

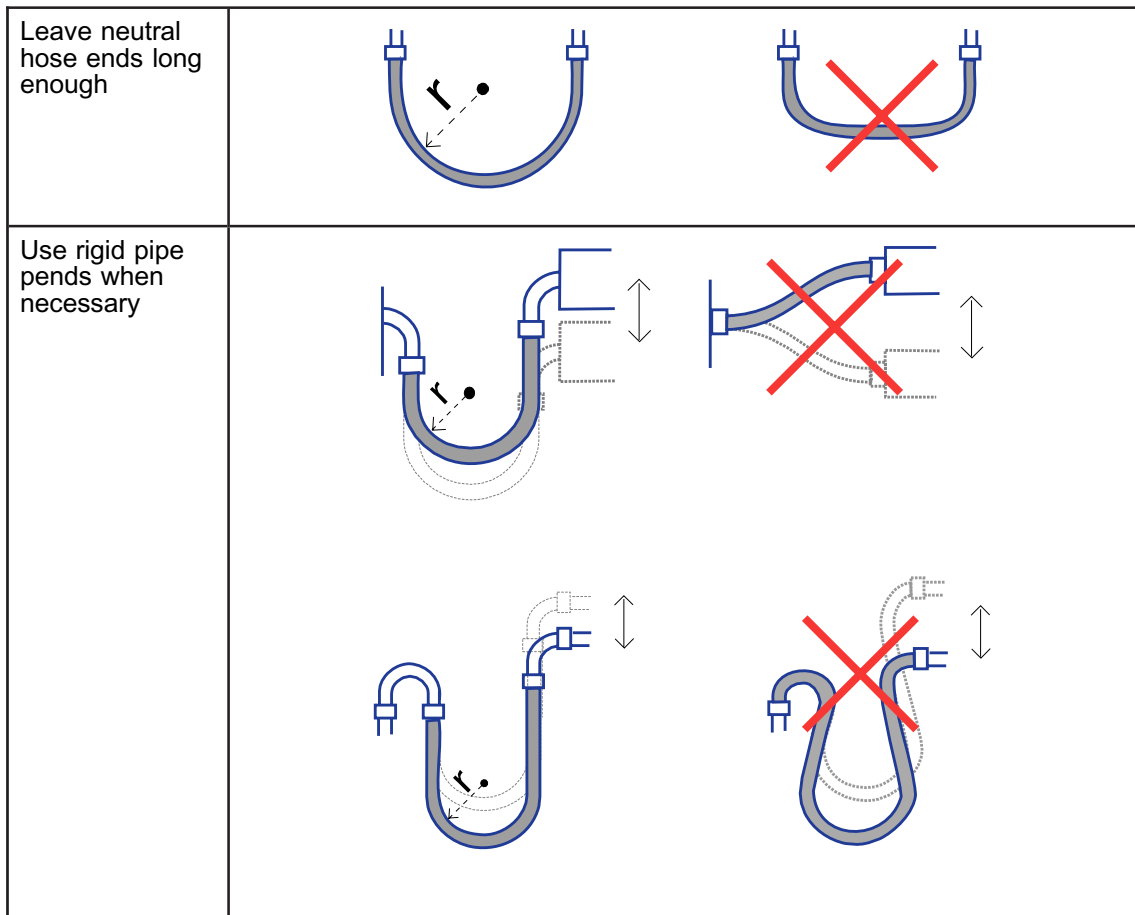
Example

If	Then
burner capacity is 200kg/h	throughput must be $1,2 \times 200 \text{ kg/h} + 150 \text{ kg/h} = 390 \text{ kg/h}$

! Note	Pay attention to instructions from the pump manufacturer when dimensioning the pipeworks.
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3.4. Installing hoses

3.4.1 Avoid torsion stress on hoses

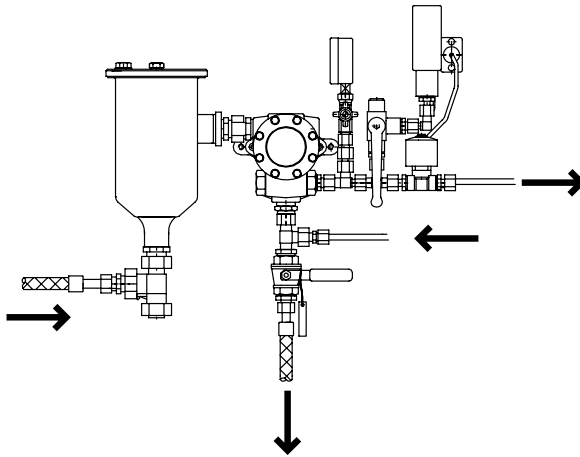


3.4.2 Minimum bend radius

Hose diameter	Minimum bend radius (r)
Ø 12	130 mm
Ø 15	130 mm
Ø 22	170 mm

3.5. Installing the oil filter

3.5.1 Installation illustration



Pay attention to oil flow directions


3.6. Electric connections

3.6.1 Connections

The burner must be connected according to the electrical diagrams delivered together with the burner. General and local standards and regulations as well as requirements of electrical equipment on electrical connections must be adhered to. Burner instrumentation has to be configured with a switch that allows it to be disconnected from the low-voltage supply mains.


4. First start-up and adjusting

4.1. First start-up and adjusting

 <p>DANGER!</p>	<p>Keep the boiler doors closed during ignition and operation.</p>
---	--

4.1.1 Preparatory to first start up


- Check the boiler and it's components are in proper working order
- Check the pipings are installed correctly and the joints are tight and have no leaks
- Check there is sufficiently water in the heating system
- Check there is adequate air inlet to the boiler room for the burner to have sufficiently air for combustion
- Check there is fuel in the oil tank
- Check electrical connection points (inputs/outputs) are correct


 <p>CAUTION</p>	<p>Prior to first start-up the oil pump must be vented. The pump must not operate without oil. See chapter "Oil Pump".</p>
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4.1.2 First startup with heavy fuel oil

1. Connect main voltage.
2. Switch ON additional heaters at least 2 hours before start-up.
3. Check the installation of the drilled ball valve on the return line. Check that the valve is CLOSED.
4. Check oil supply pressure and temperature. See further instructions from 'adjusting the pump'.
5. Check there is oil in the pump.
6. Check direction of rotation of the burner motor. (The electric connections are made correctly) Check direction of rotation of fan motor and pump motor. (The electric connections are made correctly)
7. Check atomizing temperature is correct. See further instructions from 'nozzle capacity charts'.
8. Move the adjustment ring on burner head to middle position.
9. Check the condition and correct settings of ignition electrodes and cables.
10. Check the correct size and type of the three nozzles.
11. Check the cam positions on air damper servomotor.
12. Switch the burner ON to stage-1 capacity.
13. Check the atomizing pressure is correct.

14. Use an oil flow meter to check capacity for stages 1,2 and 3.
15. Use a gas analyzer to adjust optimum values for the combustion.
16. Test the safety equipments on the burner.

 DANGER!	<p>Never use a naked flame while checking the burner or the boiler. Never store any inflammable material in the boiler room.</p>
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 DANGER!	<p>Wear hearing protectors, if there is noise in the boiler room.</p>
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4.2. Adjusting capacity

4.2.1 Capacity adjustments

Adjust the burner capacity by altering the size of the nozzle and atomizing pressure from the oil pump.

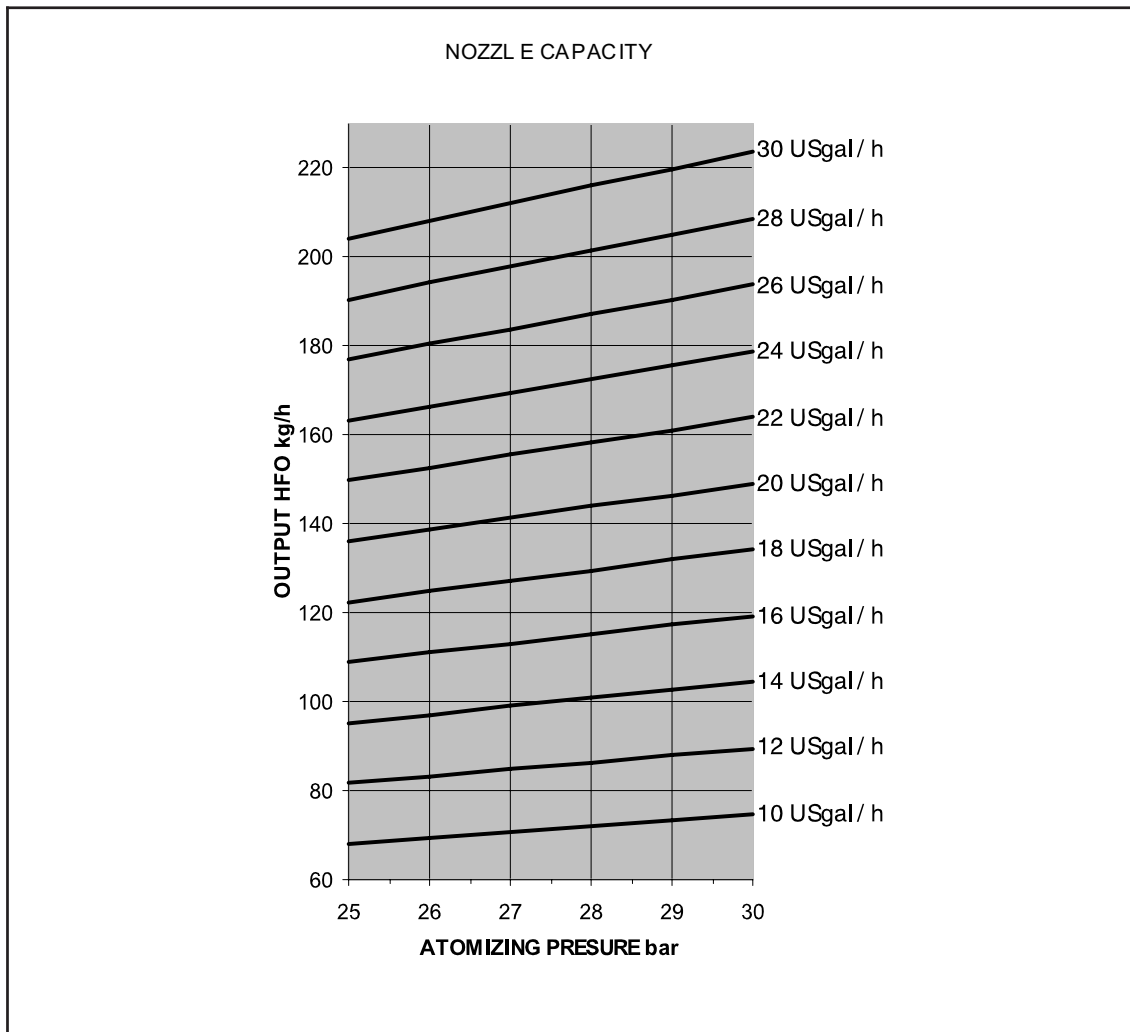
On 3-stage burners (T-burners) individual nozzle capacities of the total nozzles capacity divides as follows.

- nozzle-1 : 40%
- nozzle-2 : 30%
- nozzle-3 : 30%

Burner capacity must not be adjusted below minimum capacity. Minimum capacity is printed on the type label on the burner.

Nozzle size is determined by the boiler capacity.

4.2.2 Nozzle capacity chart USgal / h




FOR EXAMPLE


Oil viscosity	Atomizing temperature
180 mm ² /s at 50 °C	110...115 °C
380 mm ² /s at 50 °C	125...130 °C
700 mm ² /s at 50 °C	135...140 °C


4.2.3 Fuel consumption by boiler capacity

$q = P/\mu * Q$	P = boiler capacity kW μ = boiler efficiency, 0,80-0,95 Q = heat value, kWh/kg q = fuel demand, kg/h (Note! all nozzles)
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Heat value for light fuel oil approx. 11,86 kWh/kg and for heavy fuel oil approx. 11,22 kWh/kg. Check exact values from supplier.

 CAUTION	Turn OFF preheater when using light fuel oil
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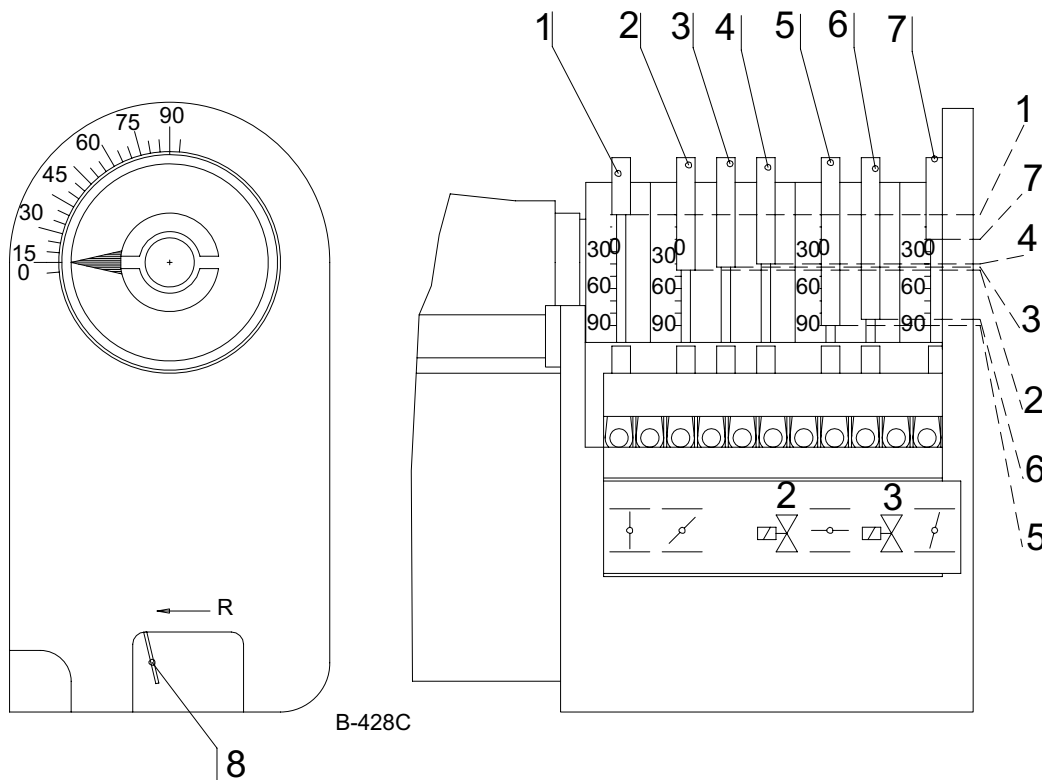
 Note	The shape of the boiler combustion chamber affects to type of nozzle needed. Correct nozzle may differ from nozzle types suggested here.
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 Note	After changing the nozzle - check the quantity of combustion air and the position of the adjustment ring in the combustion head
--	---

4.3. Adjusting combustion air

 Note	Do a flue gas analyzis to verify adjustments
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4.3.1 Cam switch positions in principle



- 1. Air damper closure
- 2. Air regulation, stage 2
- 3. Switching point of correcting movement of stage 2
- 4. Switching point of solenoid valve of stage 2
- 5. Air regulation, stage 3
- 6. Control of solenoid valve of stage 3
- 7. Air regulation, stage 1
- 8. Release lever (Not in use)

4.3.2 Functions of cam switches in servomotor Conectron LKS 160-09

Use a screwdriver to set the switching points of the cam switches.

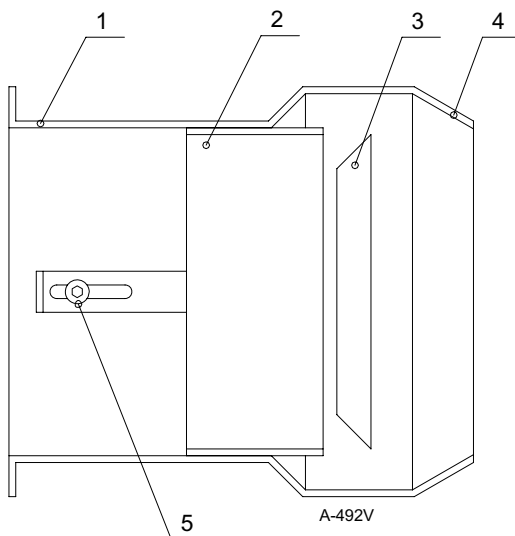
- | | | |
|---|--------|--|
| 1 | Blue | Air dampers closed-position / degree. (factory setting 0°) |
| 2 | Orange | Air dampers position at stage 2. Adjustment of this cam switch affects adjustments of cam switches 3 and 4. (factory setting 45°) |
| 3 | Orange | Correcting movement of stage 2, moves together with cam switch 2. It is NOT allowed to adjust this cam switch! |

4	Orange	Switching point of solenoid valve stage 2, moves together with cam switch 2. The setting of this cam switch is between 7 and 2. (factory setting 40°)
5	Red	Air dampers position at stage 3 /degree . Adjustment of this cam switch affects adjustment of 6. (factory setting 90°)
6	Red	Switching point of solenoid valve stage 3, moves together with cam switch 5. The setting of this cam switch is between 2 and 5. (factory setting 85°)
7	Black	Air dampers position at stage 1 /degree (factory setting 20°)

Release switch NOT in use.

4.4. Adjusting pressure drop in combustion head

4.4.1 Combustion head components



1. Flame tube
2. Adjustment ring
3. Diffuser disc
4. Combustion head extension
5. Locking of adjustment ring

4.4.2 Effect of the adjustment ring

Position of the adjustment ring effects on the pressure drop in the combustion head. Pressure drop is adjusted by moving the adjustment ring back and forth thus altering the gap between the adjustment ring and the diffuser plate. With a small load the adjustment ring is positioned to the front and with a full load in the rear.

If...	Then...	And...
the adjustment ring is not positioned rear enough with a fuller load	there is too much pressure drop in the combustion head	the ignition is poor OR improper burning due to inadequate amount of air (high CO-content) OR flame tear-off from the diffuser disc when switching to fuller load
the adjustment ring is too rear with a lesser load	there is not enough pressure drop	deficient combustion (O ₂ -values too high)

Combustion head pressure drop minimum

- with gas 2 mbar
- with heavy fuel oil 4 mbar
- with light fuel oil 3 mbar

4.4.3 Note!

If the position of the adjustment ring has to be altered in relation to the diffuser disc, the air velocity and quantity in the combustion head will change. Check the combustion values by flue gas analysis and, if necessary, adjust the combustion air quantity to be adequate.

4.4.4 Adjusting the combustion air

Combustion air volume is adjusted with the adjusting cam.

1. Check the surplus oxygen level from the gas flue after every adjustment with a flue gas analyser.
2. Set the combustion air levels within the operation range of the servomotor

Guideline values

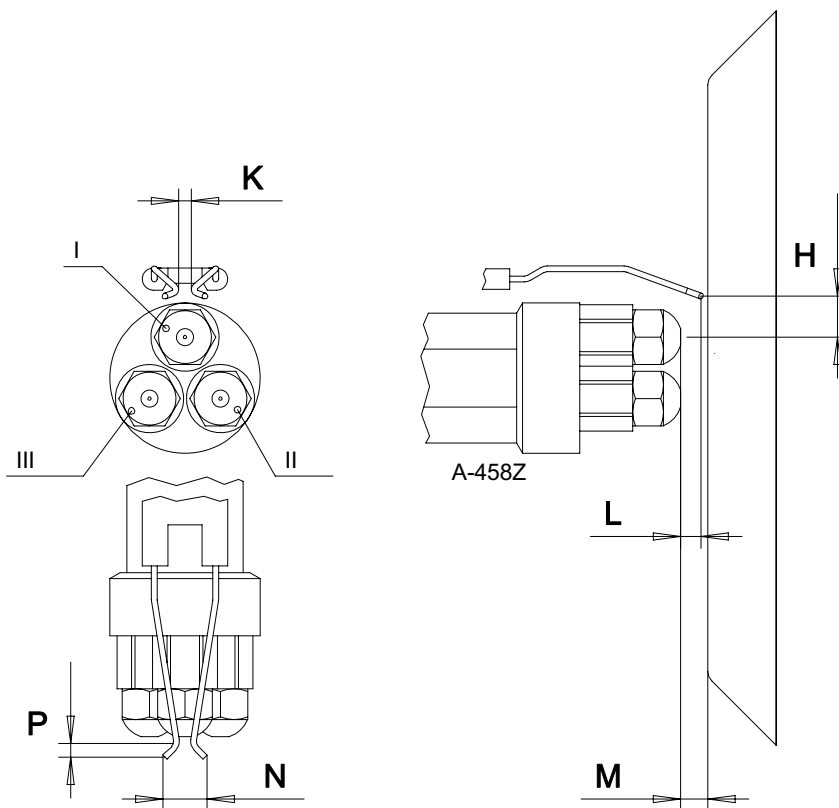
CAPACITY	FUEL	O ₂ -LEVEL %
Ignition, minimum- and part power	Heavy fuel oil	4,5 - 6
Full power	Heavy fuel oil	3 - 4,5
Ignition, minimum- and part power	Light fuel oil	3,5 - 4,5
Full power	Light fuel oil	3 - 4

4.5. Adjusting the burner head

4.5.1 Setting the ignition electrodes

Check and set the ignition electrode spark gap and the distance of the nozzle to the ignition electrodes and diffuser disc as show on the drawing

4.5.2 Setting the ignition electrodes on a T-burner (3-stage)

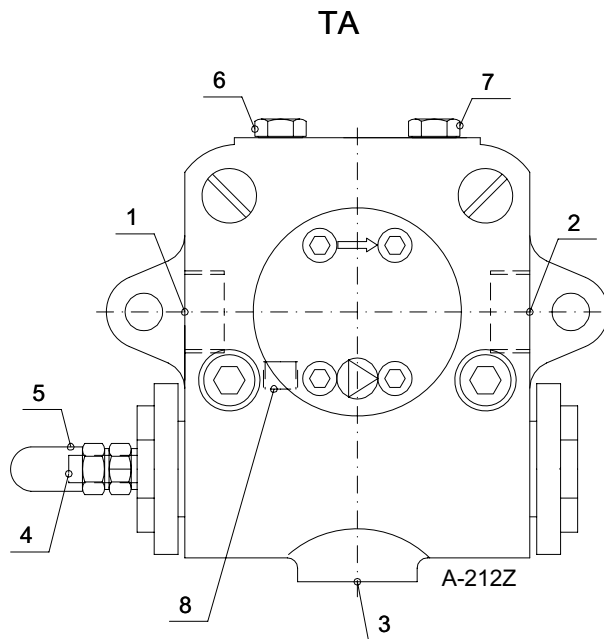


- I Nozzle 1
- II Nozzle 2
- III Nozzle 3

BURNER	H	K	L	N	P	M
RP150T	12	6	8	12	4	8
RP250-280T	17	3,5	6	12	4	8

4.6. Adjusting the oil pump (TA-model)

4.6.1 Oil Pump TA



1. Suction line connection
2. Oil to nozzle
3. Return line connection
4. Pressure adjustment
5. Protective cap
6. Oil inlet pressure gauge port
7. Oil pressure gauge port (to nozzle)/air venting
8. By-pass plug

Pump body includes a drilling to accept an electric preheater.

Note! By-pass plug must be REMOVED when installing to H and T-burners

4.6.2 Pump TA

The pump has an built-in pressure control system

TECHNICAL DATA	PUMP TA
In-let oil viscosity range: Light fuel oil	1.5 - 12 mm ² /s (cSt)
Max. oil inlet pressure to burner	5 bar

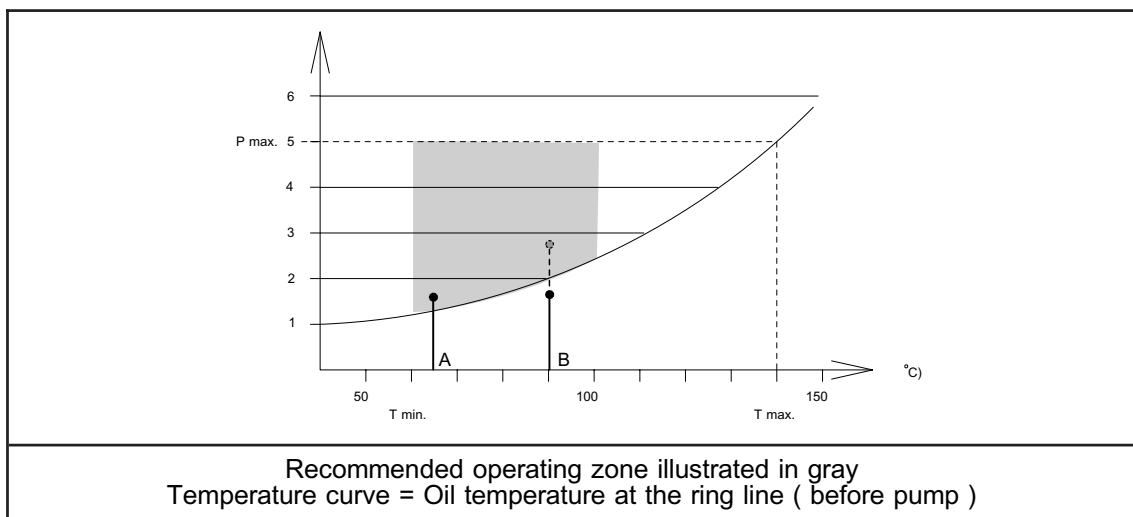
Min. oil inlet pressure to burner	Depending on oil temperature at the pump. See illustration.
In-let oil temperature range: Heavy fuel oil	60 - 100 C°
Pump operating pressure (=atomizing pressure) for heavy fuel oil	25 - 30 bar
Pump operating pressure (=atomizing pressure) for light fuel oil	20 - 25 bar

- Note! 1 bar = 100 kPa.

4.6.3 Adjusting the supply oil pressure

The diagram shows the required oil inlet pressure to the burner.

Check the inlet pressure to the burner from the the pressure gauge fitted to the filter cover.



Example A :

Oil temperature at the ring line	In-let oil pressure to burner	Status
65 C°	1,5 bar	OK

Example B :


Oil temperature at the ring line	In-let oil pressure to burner	Status
90 C°	1,5 bar	LOW PRESSURE ! Pressure must be lifted over 2 bar

4.6.4 Pump pressure adjustment

Use the pressure adjustment screw. Turn the screw clockwise to increase the pressure. Install a pressure gauge/valve -assembly if necessary.

4.6.5 Venting the oil pump

1. Loosen the plug of the pressure gauge port. Note! Do NOT remove the plug.
2. Let the burner operate for a while. Bubbles of air come out of the opening
3. Retighten the plug when no more bubbles appear


 Note	The pump is self-priming. The pump is intended for use in two-pipe system (=ring main system).
--	--

4.7. Burning light fuel oil

Burner is suitable for temporary use of light fuel oil

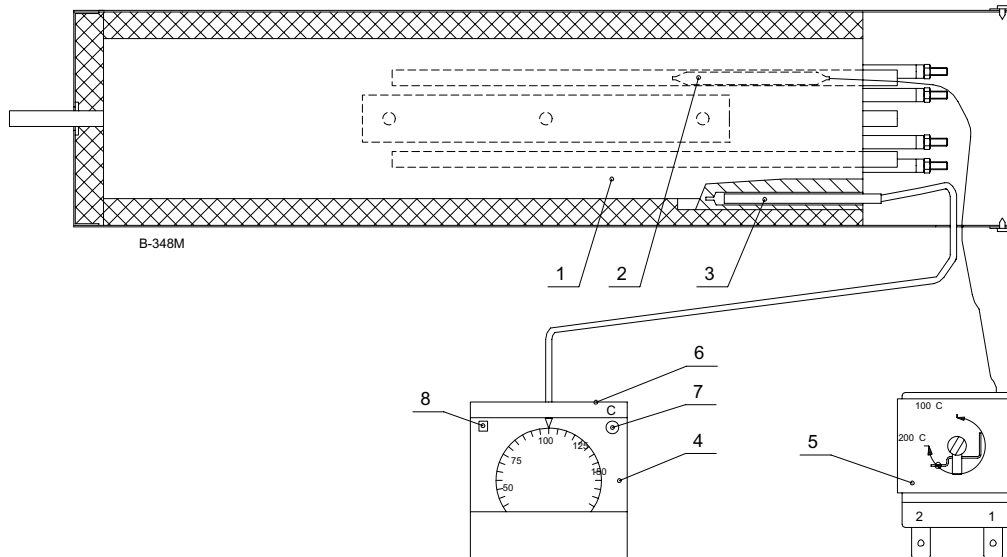
Pay attention to following:

- Turn OFF preheater when burning light fuel oil
- Decrease the atomizing pressure

 CAUTION	Turn OFF preheater when using light fuel oil
--	--


4.8. Preheater

4.8.1 Preheater components



1. Heater
2. Temperature sensor of limit thermostat
3. Controller sensor
4. Temperature controller
5. Limit thermostat
6. Limit set point - Low
7. Signal lamp, temperature low
8. Signal lamp, control

The burners have electrical preheaters which consists of one or several heating units. The heating units have one common regulator, and individual thermostats.

 DANGER!	<p>The connectors in the control box are under voltage. The safety cover is allowed to be opened only by authorized staff.</p>
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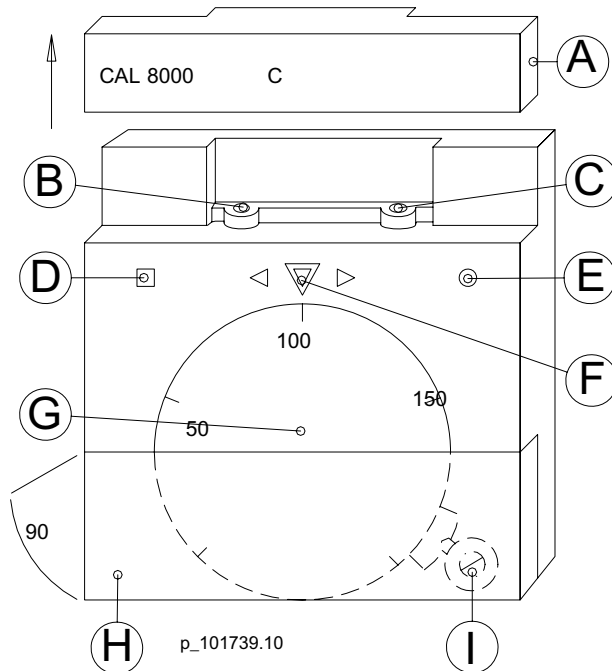
4.8.2 Temperature regulation

Oil atomizing temperature is adjusted with the controller.

Check the oil atomizing temperature on the thermometer.

4.9. Temperature Controller for Preheater






4.9.1 CAL 8000




A	Removable top fascia of potentiometers (manual reset and low limit). Remove sliding the fascia parallel with the display panel.
B	Manual reset potentiometer for correction of deviation. With this adjustment the position of P-range with respect to the set point can be altered. Adjust anti-clockwise, if the average temperature of oil stabilises above the set temperature during burner operation. Adjust clockwise, if the average temperature of oil stabilises below the set temperature during burner operation.
C	Setting of oil temperature low limit. Adjust the low limit point 20 to 30 °C below set point by means of the potentiometer. Rotate the definition scale (G) until the LED (F) lights up. Rotate the definition scale 20 to 30 °C above the operation set point. After this rotate the potentiometer (C) first completely anti-clockwise and then clockwise until the LED (E) just lights. Rotate the definition scale back to the right set point (atomising temperature).
D	D LED is lit, when the outlet of control channel is switched on (heating).
E	E LED is lit, when the relay of alarm channel is energised (oil temperature low).
F	Set point indication and together with two adjacent LED's indication of deviation.
G	Definition scale
H	Hinged fascia on scale lock
I	Scale lock. Rotate clockwise or anti-clockwise to unlock. Check after setting and locking the indication of set point.

4.9.2 Temperature deviation indicator

Controller has three LED's, that operate in five steps and indicate the deviation of the actual value from the set point. Each step operates for 2 % (4 °C) of full scale (0...200 °C).

SIGNAL	MEANING
	more than 6 °C below set value
	6 - 2 °C below set value
	Set value \pm 2°C
	2 - 6 °C above set value
	more than 6 °C above set value


 Note	It is possible to modulate the temperature controller for 110 V voltage. Contact Oilon technical support for further assistance.
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4.10. Preheater limit thermostat settings

4.10.1 Limit thermostat setting


The limit thermostat is adjusted at the factory and sealed with paint. Set value is +180°C .

The limit thermostat has a reset button. Use the reset when the limit thermostat is not energized.

 Note	Do not open the sealed locking screw. Breaking the seal voids warranty
--	--

5. Maintenance

5.1. Burner maintenance

 <p>DANGER!</p>	<p>Cut off electric current from the burner and close manual shut-off valves always before any maintenance work. Cutting power is adequate when just inspecting the device.</p>
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5.1.1 To maintain flawless operation it is recommended to do the following at least once a year:

1. Check the burner head extension and change if necessary.
2. Check the diffuser disc and change if necessary.
3. Clean the ignition electrodes and check their setting.
4. Change the oil nozzle if it is worn or damaged.
5. Check the position, condition and cleanness of the flame detector.
6. Clean filters. Filters may have to be cleaned more often depending on circumstantial conditions.
7. Check the air dampers lock screws and the servomotor axle lock. Retighten if necessary.
8. Check and lubricate the joints on adjustment rods.
9. Check the oil pump capacity.
10. Clean your burner from dust and moisture.
11. Check regularly the combustion characteristics by flue gas measurements (after refilling of the storage tank or at least once a year).
12. Check if the oil tank needs to be cleaned. The oil tank must be cleaned at least every 4-5 years.

Correct installation and adjustments and regular maintenance ensure correct operation of the burner.

- Service the burner annually
- Use only original spare parts. When ordering spare parts please give the burner type and serial number indicated on the burner nameplate or manufacturing card

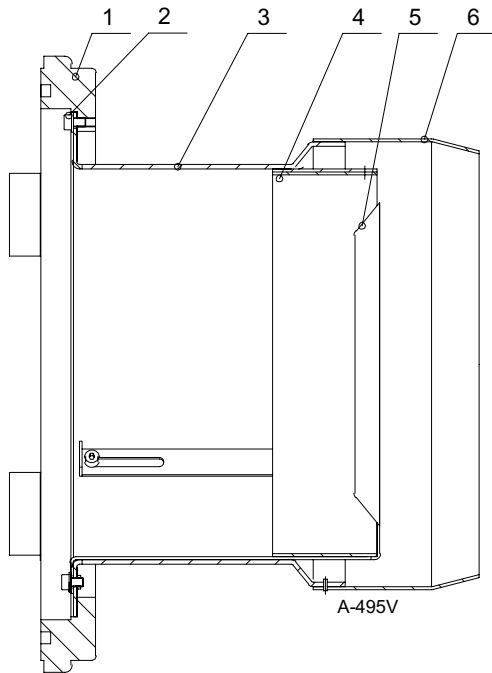
5.1.2 Note!

The burner contains electric and electronic components. Adhere to rules and regulations from local authorities when disposing.

5.2. Dismounting the combustion head

5.2.1 Detaching the combustion head

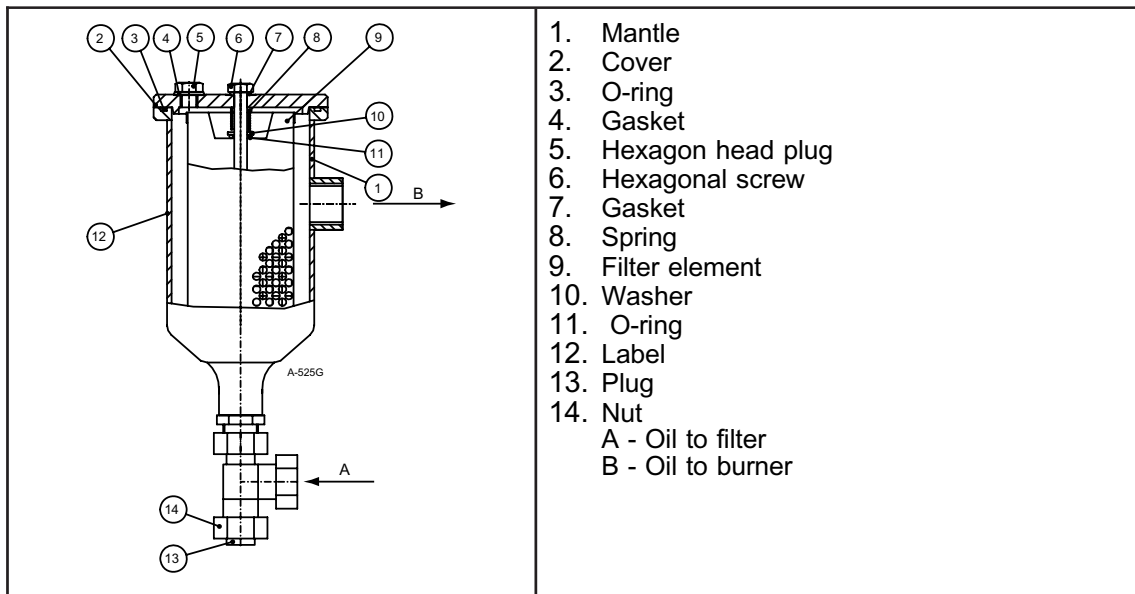
- Unscrew the combustion head screws and pull the combustion head out. Irrota palopään kiinnitysruuvit ja vedä palopää pois paikaltaan. Combustion head extension is attached to combustion head with spring cotters.
- Assemble in reverse order.



1. Burner flange
2. Combustion head screw
3. Combustion head guide
4. Adjustment ring
5. Diffuser disc
6. Combustion head extension

5.3. Oil Filter

5.3.1 Oil Filter components




5.3.2 Note!!

Before cleaning of the filter make sure, that oil does not flow to the filter.

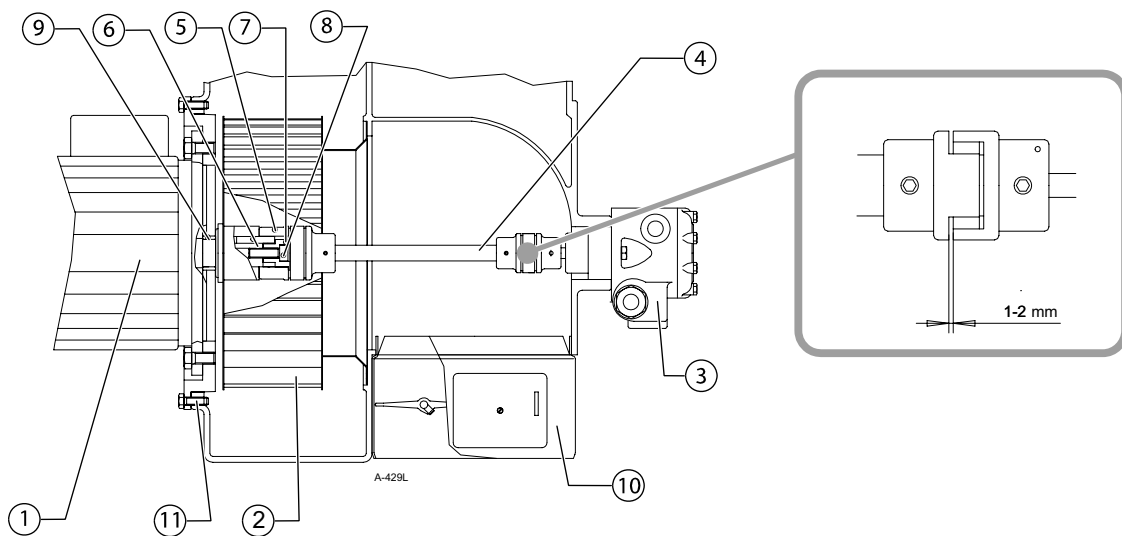
5.3.3 Cleaning

- Remove the plug by loosening the nut.
- Loosen the hexagonal screw and open the filter cover and remove the element. A suitable solvent and a soft brush, which does not damage the screen, can be used for cleaning of the element.
- If there is some dirt in the filter, it can be removed by for ex. vacuuming. Check the condition of O-rings as well as the condition of the washer.
- Lock the plug with nut.
- Place the filter element into the filter and then the cover.
- Fasten the fastening screw on the cover with a torque of 25 - 30 Nm.

5.4. Changing the burner motor

 DANGER!	<p>Switch off the electric power from the burner and ensure the motor is not under voltage. Remove motor fuses if necessary.</p>
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5.4.1 Components



1. Motor
2. Fan wheel
3. Oil pump
4. Intermediate shaft
5. Coupling head
6. Wedge
7. Intermediate bushing
8. Fixing screw for fan wheel
9. Base bushing
10. Air dampers
11. Fixing screw for mounting flange

5.4.2 Dismounting the fan wheel

- Switch off the electric power from the burner.
- Disconnect the electric cable of the motor.
- Remove pressure pipe from the oil pump.
- Remove air dampers. Do not let the air dampers hang on servomotor cable!
- Unscrew screws of oil pump.
- Support with hand the intermediate shaft and withdraw the oil pump.
- Unscrew screws in the mounting flange of the motor and remove the motor (note the weight of the motor).

- Unscrew the fixing screw of the fan wheel.
- Remove intermediate bushing and coupling head.
- Withdraw the fan wheel from the motor shaft using an extractor.
- Loosen the wedge and the base bushing.

5.4.3 Mounting the fan wheel

- Place the base bushing.
- Set the wedge into the shaft slot.
- Pull the fan wheel to its place using a binder plug. The fan wheel lies against the base bushing.
- Place the coupling head and the intermediate bushing.
- Fasten the fan wheel with fixing screws to the motor shaft.
- Place the motor and fasten the screws.
- Support with hand the intermediate shaft and install the oil pump. Fix the pump with locking screws.
- Check the axial gap of the coupling heads (1-2 mm). Adjust, if necessary.
- Place the air dampers.
- Fix the pressure pipe of the oil pump (remember to vent the oil pump).
- Connect the electrical cable to the motor.
- Fix the fuses and connect the burner to the mains (check direction of rotation in the motor).

5.5. Trouble shooting, 3-stage burner, oil use

5.5.1 Basic checks

In the event of fault conditions the basic requirements for correct operation must be first examined:

1. Check the electric supply (control and supply voltages).
2. Check the fuse on the control unit by pressing the control unit reset button. If the fuse is intact this should cause a fault condition lockup.
3. Check that all regulating and control devices are correctly set.
4. Check that all the safety devices are in normal operating condition
5. Check is the burner getting fuel, are the valves in fuel line open, is there oil in the tank
6. Check is there sufficiently water in the heating system?
7. Check that the direction of motor rotation is correct

When it is established, that the fault is not due to above mentioned, the individual burner functions must be checked. Reset the burner control unit if it is in lockout position (signal lamp lights). Burner starts, when the sequence switch has run to its start position and other prerequisites for start are fulfilled (see chapter Burner Automation; Operation"). Observe the burner functions. **The symbol appearing above the reading mark indicates the possible kind of fault** (see chapter "Control Program under Fault Conditions and Lockout Indication"). Measuring instruments can be used for finding of the fault.

5.5.2 Start failure

CONDITION	POSSIBLE CAUSE	ACTION
Control loop closed, signal lamp for start limit is on, burner or the start-up program of the control unit does not start. The lockout indicator remains at symbol ◀	<ol style="list-style-type: none"> 1. Break in the control circuit between connectors 6 and 8 in the control unit 2. Faulty control unit 	<ol style="list-style-type: none"> 1. Clear the break 2. Change the control unit
Control loop closed, burner or the start-up program of the control unit does not start. The lockout indicator remains at symbol ◀	<p>The control unit (connector 8) is not receiving required start signal from servomotor (limit switch II)</p> <ol style="list-style-type: none"> 1. A break in control circuit 2. Faulty servomotor 3. Faulty control unit 4. Air dampers are stuck 	<ol style="list-style-type: none"> 1. Clear the break 2. Change the servomotor 3. Change the control unit 4. Release the dampers, lubricate
Burner motor starts, program remains at pre- purge period. Symbol ▲.	<p>Servomotor does not reach the position of stage-3 position:</p> <ol style="list-style-type: none"> 1. Faulty servomotor 2. Faulty limit switch in servomotor 3. Faulty control unit 4. Jammed air dampers 	<ol style="list-style-type: none"> 1. Change the servomotor 2. Change the limit switch 3. Change control unit 4. Release the dampers, lubricate
Burner motor starts, program remains at pre- purge period. Symbol ▼.	<p>Servomotor does not reach the position of stage-1 :</p> <ol style="list-style-type: none"> 1. Faulty servomotor 2. Faulty limit switch in servomotor 3. Faulty control unit 4. Jammed air dampers 	<ol style="list-style-type: none"> 1. Change the servomotor 2. Change the limit switch 3. Change control unit 4. Release the dampers, lubricate

5.5.3 Motor failure

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor does not start. Lockout occurs. Symbol1	<ol style="list-style-type: none"> 1. Break in main circuit 2. Motor overload relay triggered 3. Fuse triggered 4. Faulty motor contactor 5. Faulty motor 	<ol style="list-style-type: none"> 1. Repair break 2. Check relay trigger level , reset or change 3. Reset or change fuse 4. Change motor contactor 5. Change motor
Burner motor does not start. Lockout occurs. Symbol1	<p>Break in the motor control circuit</p> <ol style="list-style-type: none"> 1. Faulty control unit 2. Settings of the air-dampers servomotor camswitches are incorrect 3. Faulty airdampers servomotor 	<p>Repair break</p> <ol style="list-style-type: none"> 1. Change the control unit 2. Fix the setting of camswitches 3. Change servomotor

5.5.4 Ignition failure

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts, control voltage from control unit to ignition transformer IS switched on, ignition does not happen and after a short time lockout occurs. Symbol1	<ol style="list-style-type: none"> 1. Dirty or worn ignition electrodes, insulator cracked 2. Ignition electrodes too far apart 3. Ignition cable damaged 4. Faulty ignition transformer 	<ol style="list-style-type: none"> 1. Clean or change 2. Adjust according to instructions 3. Change the cables 4. Change the transformer
Burner motor starts, control voltage from control unit to ignition transformer IS NOT switched on, ignition does not happen and after a short time lockout occurs. Symbol1	<ol style="list-style-type: none"> 1. Faulty control unit 2. Connection joint of ignition transformer is loose or damaged 	<ol style="list-style-type: none"> 1. Change control unit 2. Attach properly or change the joint

5.5.5 No flame establishment

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts, ignition is operational, after a short period of time a lockout occurs. Symbol 1	<ol style="list-style-type: none"> 1. Solenoid valve does not function 2. Faulty coil on solenoid valve 3. Damaged cable 4. Faulty control unit 	<ol style="list-style-type: none"> 1. Change the valve 2. Change the coil 3. Change the cable 4. Change the control unit
No spray from nozzle	<ol style="list-style-type: none"> 1. Nozzle valve(s) stuck 2. Oil atomizing pressure too low 	<ol style="list-style-type: none"> 1. Fix or change the nozzle 2. See 'pump adjustments'.

5.5.6 Oil pump failure

CONDITION	POSSIBLE CAUSE	ACTION
Supplies no oil or atomizing pressure is too low	<ol style="list-style-type: none"> 1. Dirty filter 2. Leaking suction line of transfer pump 3. Pump capacity decreased / pump is worn or faulty 	<ol style="list-style-type: none"> 1. Clean or change filter 2. Fix the leaks 3. Change the pump
Loud mechanical noise	<ol style="list-style-type: none"> 1. Pump is cavitating / insufficient in-let pressure to the burner 2. In-let oil temperature too low 3. In-let oil pipings connected incorrectly 	<ol style="list-style-type: none"> 1. Tighten joints, Clean the filter, check and adjust pressure 2. Raise in-let oil temperature 3. Check joints

5.5.7 Lock out after flame establishment

CONDITION	POSSIBLE CAUSE	ACTION
Flame established. When burner runs to stage-2 or 3, flame extinguishes, shutdown occurs and then re-start (wire link B cut away from the plug section of the control unit).	<ol style="list-style-type: none"> 1. Incorrect burner adjustment 2. Dirty filters 3. Clogged nozzle 4. Nozzle valve piston stuck 5. Faulty solenoid valve or coil or damaged cable. 	<ol style="list-style-type: none"> 1. Correct settings 2. Clean filters 3. Change the nozzle 4. Repair or change the piston 5. Change faulty component
Flame establishes. Shutdown occurs and then re-start.	<p>Oil temperature is too low</p> <ol style="list-style-type: none"> 1. oil preheater is faulty or preheater's capacity is inadequate 2. Incorrect setting on low limit of oil temperature 	<ol style="list-style-type: none"> 1. Repair or change the preheater 2. Check and adjust the in-let oil temperature

5.5.8 Oil leaks into the combustion chamber

CONDITION	POSSIBLE CAUSE	ACTION
Oil flows into the combustion chamber during burning period	<ol style="list-style-type: none"> 1. Nozzle valve and main oil valve or nozzle valve and non-return valve do not close properly 2. Faulty solenoid valves 	<ol style="list-style-type: none"> 1. Clean, repair or replace the valves 2. Change the valves

5.5.9 Premature flame establishment

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts then lockout (long ignition)	Faulty solenoid valve or leaking nozzlevalve.	Clean or change the valve.

5.5.10 Flame monitoring fault (=lockout)

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts, flame establishes, and then a lockout	<ol style="list-style-type: none"> 1. Incorrect position of flame detector 2. Flame detector is unclean 3. The flame is too weak (not bright enough) 4. Faulty flame detector (due to damage or age) 5. Faulty control unit 6. Incorrect flame signal due to extraneous light 	<ol style="list-style-type: none"> 1. Fix position 2. Clean the flame detector 3. Check burner adjustments 4. Change the flame detector 5. Change control unit 6. Prevent extraneous light from reaching the flame detector
Lockout during pre-purge	<ol style="list-style-type: none"> 1. Faulty flame detector 2. Faulty control unit 3. Incorrect flame signal due to extraneous light 	<ol style="list-style-type: none"> 1. Change the flame detector 2. Change control unit 3. Prevent extraneous light from reaching the flame detector
Lockout during shutdown Symbol ◀	<ol style="list-style-type: none"> 1. Faulty flame detector (due to damage or age) 2. Faulty control unit 3. Incorrect flame signal due to extraneous light 4. Oil or carbon deposits burn in combustion head 5. Valves don not close 	<ol style="list-style-type: none"> 1. Change the flame detector 2. Change control unit 3. Prevent extraneous light from reaching the flame detector 4. See section "Combustion head" 5. Clean, repair or replace

5.5.11 Damage in burner head

CONDITION	POSSIBLE CAUSE	ACTION
Diffuser disc burned-out		Change diffuser disc
Burner head extension damaged		Change burner head extension
Inside of the burner head is oily or has heavy carbon deposits	<ol style="list-style-type: none"> 1. Distance between dif-fuser disc and nozzle in-correct 2. Combustion air settings are not correct 3. Not enough supply air for constant combustion 4. Nozzle incorrectly sized or of wrong type 5. Nozzle is worn 	<ol style="list-style-type: none"> 1. Correct the adjustments 2. Correct the adjustments 3. Enhance air supply 4. Replace with an appro-priate nozzle type of correct size 5. Change the nozzle

6. Technical data

6.1. Technical data

6.1.1 Burner technical data

Weight	RP-150 T : 152 kg RP-250 T : 181 kg RP-280 T : 182 kg
Capacity kW	RP-150 T : 680 - 2700 RP-250 T : 650 - 3200 RP-280 T : 900 - 3500
Capacity kg/h	RP-150 T : 60 - 240 RP-250 T : 58 - 282 RP-280 T : 80 - 308
Control unit	LAL 2.25 / LOK16 / PLC
Oil pump	RP-150 T : TA2 RP-250 T : TA2 RP-280 T : TA2
Oilhose connection (suction)	R ½"
Oilhose connection (return)	R ½"
Degree of protection	IP44
Control voltage	230 V (-15%... +10%), 50 Hz, 1-phase
Control voltage *on request*	230 V, 60 Hz, 1-phase
Control voltage *on request*	110 V, 50 Hz, 1-phase
Control voltage *on request*	110 V, 60 Hz, 1-phase
Supply voltage	380...420 V, 50 Hz, 3-phase
Supply voltage *on request*	440 V, 60 Hz, 3-phase
Supply voltage *on request*	690 V, 50Hz Hz, 3-phase
Supply voltage *on request*	690 V, 60Hz Hz, 3-phase

6.1.2 Suply voltage option 380 V 50 Hz

Burner motor output kW	RP-150 T : 5,5 RP-250 T : 7,5 RP-280 T : 7,5
Burner motor current IN [A]	RP-150 T : 10,5 RP-250 T : 14,7 RP-280 T : 14,7
Burner motor efficiency [%]	RP-150 T : 87,6 RP-250 T : 85,1 RP-280 T : 85,1
Burner motor speed r/min	RP-150 T : 2855 RP-250 T : 2915 RP-280 T : 2915
Preheater capacity kW	RP-150 T : 12 RP-250 T : 12 RP-280 T : 12
Preheater current A	RP-150 T : 17,4 RP-250 T : 17,4 RP-280 T : 17,4

6.1.3 Suply voltage option 440 V 60 Hz

Burner motor capacity kW	RP-150 T : 6,4 RP-250 T : 8,6 RP-280 T : 8,6
Burner motor current A	RP-150 T : 10,4 RP-250 T : 14,6 RP-280 T : 14,6
Burner motor speed r/min	RP-150 T : 3445 RP-250 T : 3430 RP-280 T : 3430
Burner motor efficiency %	RP-150 T : 87,6 RP-250 T : 86,5 RP-280 T : 86,5
Preheater capacity kW	RP-150 T : 14,4 RP-250 T : 14,4 RP-280 T : 14,4
Preheater current A	RP-150 T : 19,2 RP-250 T : 19,2 RP-280 T : 19,2

6.1.4 Suply voltage option 690 V 50 Hz

Burner motor output kW	RP-150 T : 5,5 RP-250 T : 7,5 RP-280 T : 7,5
Burner motor current A	RP-150 T : 5,7 RP-250 T : 8,1 RP-280 T : 8,1
Burner motor speed r/min	RP-150 T : 2855 RP-250 T : 2855 RP-280 T : 2855
Burner motor efficiency %	RP-150 T : 86,5 RP-250 T : 87 RP-280 T : 87
Preheater capacity kW	RP-150 T : 12 RP-250 T : 12 RP-280 T : 12
Preheater current A	RP-150 T : 10 RP-250 T : 10 RP-280 T : 10

6.1.5 Suply voltage option 690 V 60 Hz

Burner motor capacity kW	RP-150 T : 6,4 RP-250 T : 8,6 RP-280 T : 8,6
Burner motor current A	RP-150 T : 6,6 RP-250 T : 9,1 RP-280 T : 9,1
Burner motor speed r/min	RP-150 T : 3455 RP-250 T : 3455 RP-280 T : 3455
Burner motor efficiency %	RP-150 T : 87,5 RP-250 T : 85,6 RP-280 T : 85,6
Preheater capacity kW	RP-150 T : 12 RP-250 T : 12 RP-280 T : 12
Preheater current A	RP-150 T : 10 RP-250 T : 10 RP-280 T : 10

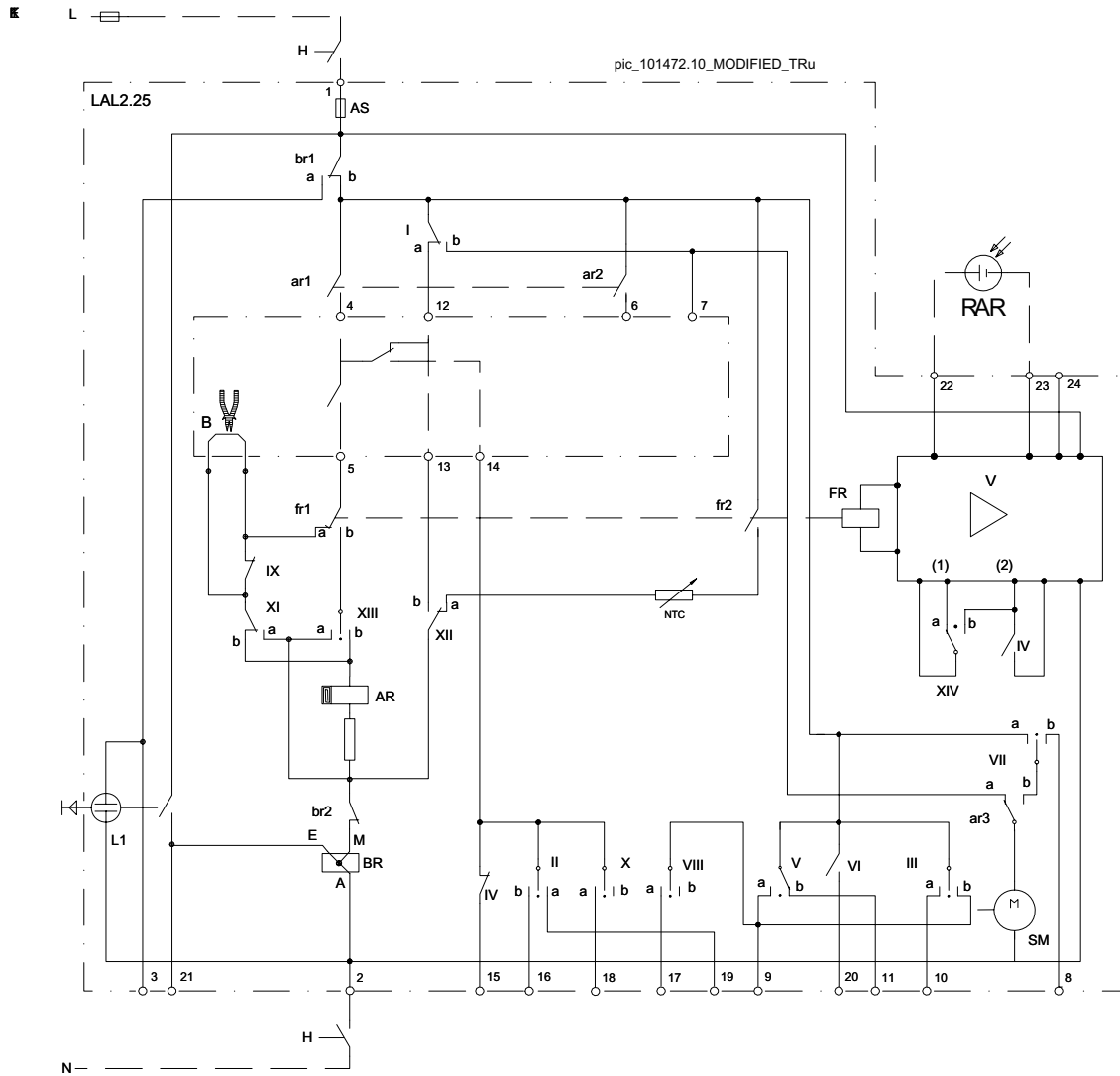
6.2. Control unit technical Data

6.2.1 Technical data (LAL 1.25 and 2.25)

Mains voltage	230 VAC -15 / +10%
Mains frequency	50 – 6%...60 Hz +6%
Power consumption	3,5 VA
Fuse, built-in	T6,3H250V, IEC 127
Fuse, external	max 10 A
Electromagnetic compatibility EMC	89/336
Permissible inlet current to terminal 1	5 A continuous; instantaneous max. 20 A
Permissible load of control terminals	4 A continuous; instantaneous max. 20 A, in total max 5 A
Required switching capacity of switching devices	1 A between terminals 4 and 5
Degree of protection	IP 40
Permissible ambient temperature	-20...+60 °C

6.3. Control unit LAL 2.25

6.3.1 Internal Circuitry LAL2.25



6.3.2 Diagram legend LAL 2.25

AR	Main relay (load relay) with contacts "ar"
AS	Control unit fuse
B	Wire link (on the plug section of the control unit) *)
BR	Lockout relay with contacts "br"
EK	Lockout reset button
FR	Flame relay with contacts "fr"
H	Main switch

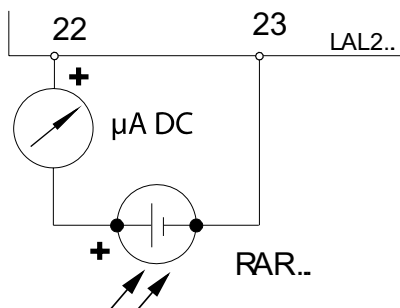
L	Lockout warning lamp
RAR	Flame detector
SM	Motor of sequence switch
V	Flame signal amplifier
NTC	NTC-thermistor

*) The wire link B has been cut away at the factory. This allows an automatic repetition of start-up sequence, if the flame extinguishes during burner operation. If the wire link B has not been cut away, lockout occurs, if the flame is extinguished during burner operation.

6.4. Flame Detector

6.4.1 Technical data

TYPE	RAR...
Min. required detector current with 230 VAC	6,5 μ A
Max. permissible detector current without flame	—
Max. possible detector current	25 μ A
Instrument's +pole to terminal	22
Cable run to detector in the same cable as control lines	not perm.
Cable run to detector with a separate cable in cable duct	RAR7: 30 m
Shielded cable (insulated shielding)	RAR8: 100 m
Shielding to terminal	—





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