oilon®

OPERATION AND MAINTENANCE MANUAL

Marine burners

30880641GB

Burners : RP-300 M RP-300 M-II RP-400 M RP-400 M-I RP-500 M
RP-600 M

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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 intented to guide operation and maintenace 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.

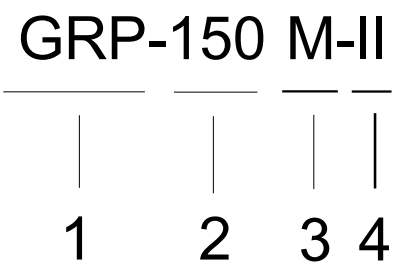
Symbols used are :

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

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



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 M - burners are fully automatic modulating burners
BURNER APPLICATIONS	Most heating appliances such as hot water boilers, steam boilers, air heaters and thermo fluid boilers
APPLICABLE FUEL	• 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	3 mm²/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 300 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 nozzle should be between 14 and 16 mm²/s (cSt)
LIGHT FUEL OIL ATOMIZING VISCOSITY	3 to 12 mm²/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 300 M : SPF10R46 RP 300 M II : SPF10R46 RP 400 M : SPF10R56 RP 400 M I : SPF10R56 RP 500 M : SPF10R56 RP 600 M : SPF20R38
NUMBER OF NOZZLES	1
NOZZLE CONTROL	Nozzle valve piston opens the nozzle. The nozzle valve is controlled with a solenoid valve.
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 m³ 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!	• 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.

 DANGER!	• 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.

! Note	• 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.

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 the 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 regularely.

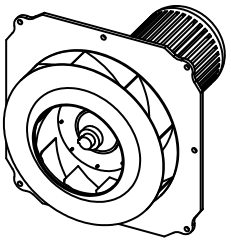
- Make sure the burner room combustion air gap (air in-let hole) is open.
- Make sure the shut-off valves on pressure gauges are shut.
- Make sure tightness of the pipeworks, safety appliances of the boiler system, pipeworks, and the burner are checked regularly according to rules and regulations of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

	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.

2. Burner operation

2.1. Burner operation modulating (M) burners

2.1.1 Combustion air



Burner device has been provided with a fan that is tailored to produce high and steady 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 feeded according to the amount of fuel combusted.

2.1.2 Pre-ventilation, purging and ignition

Before ignition burner runs through 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 valve 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 valve (NC) is closed and solenoid valves (NO) and main solenoid valves (NC) are open. During this time oil does not flow through the control circuit, but only to the nozzle valve of the utilisation circuit.

After the end of the purging period servomotor turns to the position of ignition load and solenoid valve (NC) opens and solenoid valve (NO) closes. The oil pressure begins to take effect on the nozzle control circuit. Oil flows from the nozzle. Spark between the ignition electrodes ignites oil spraying from the nozzle.

2.1.3 Atomizing

During burner operation the capacity controller drives the servomotor, which drives the oil regulator and air dampers between partial load and full load according to the capacity demand.

If the burner shuts down, solenoid valve (NC) and main solenoid valves close, solenoid valve (NO) opens. Oil pressure is released from nozzle valve. Nozzle valve springback closes the needle valve in the nozzle and closes the oil flow in the nozzle.

The oil quantity to be burnt (= burner capacity) is regulated by means of the oil regulator by throttling the oil return flow. At partial load the oil regulator is open and at full load closed.

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.

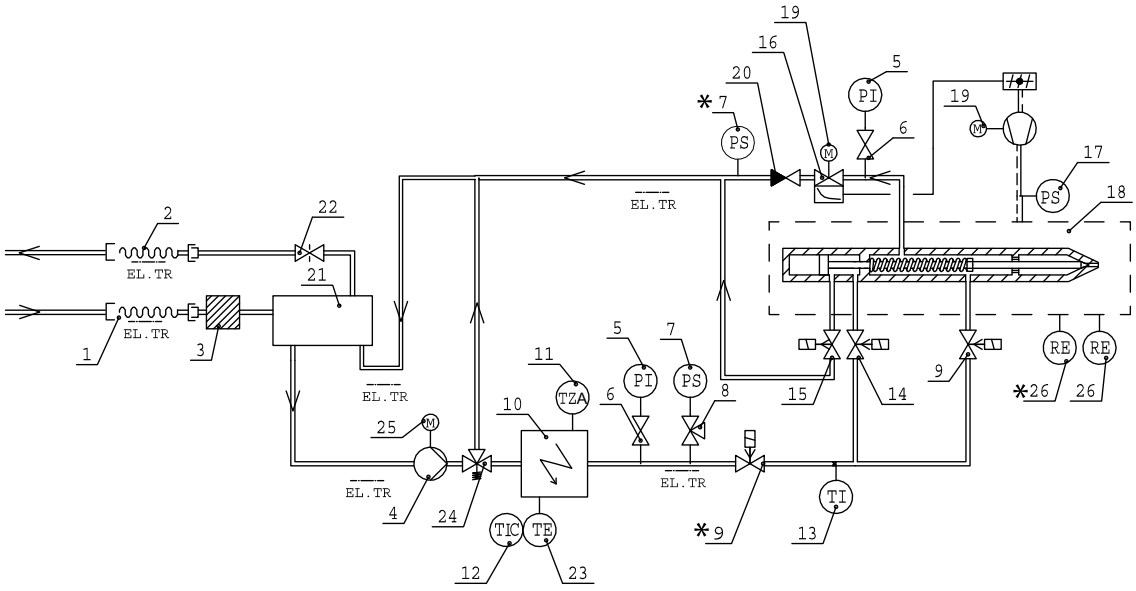
Atomizing pressure is provided by the burner oil pump.

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

The nozzle is controlled by the the control circuit pressure (open-close).

For safety reason there is a throttle plug in the control flow line fitted to the connection of solenoid valve (NC), with an aperture of Ø 1,5 mm. This plug reduces the strong control flow, which is directed onto the spring-loaded piston.

2.1.4 PI-diagram



1. Oil to burner hose
2. Oil from burner hose
3. Oil filter
4. Oil pump
5. Pressure gauge
6. Closing valve [NC]
7. Pressure switch
8. Three way valve
9. Main solenoid valves [NC]
10. Preheater
11. Preheater limit thermostat
12. Temperature controller
13. Temperature indicator
14. Solenoid valve [NC]
15. Solenoid valve [NO]
16. Oil regulator
17. Pressure switch
18. Nozzle valve

19. Servo motor
20. Non-return valve
21. De-aerator
22. Drilled ball valve [NC]
23. Temperature sensor
24. Pressure regulator valve
25. Oil pump motor
26. Flame detector

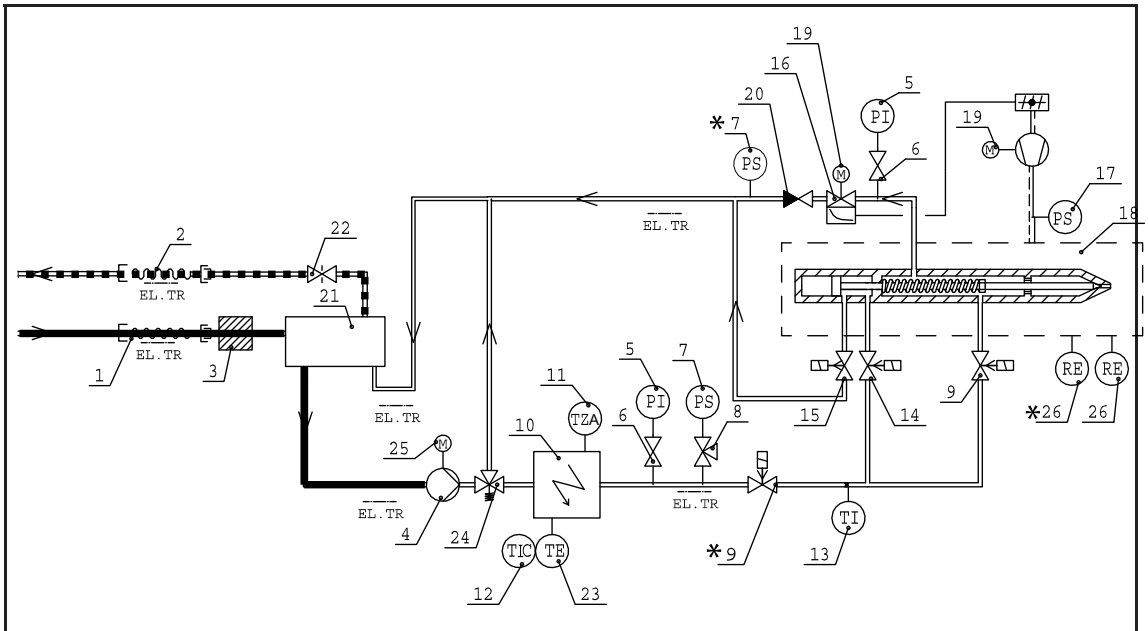
NC = default postion closed NO = default position open

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

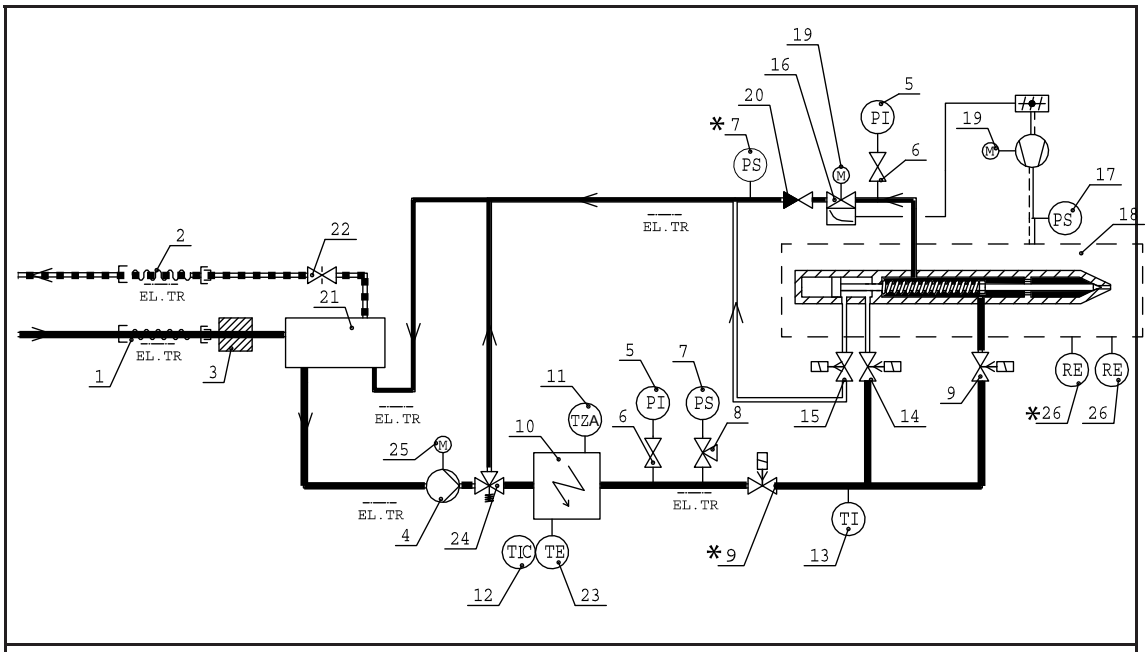
! Note	The burner has to be connected to the oil circulation system according to the oil supply diagram.

2.2. Oil circulation in the burner

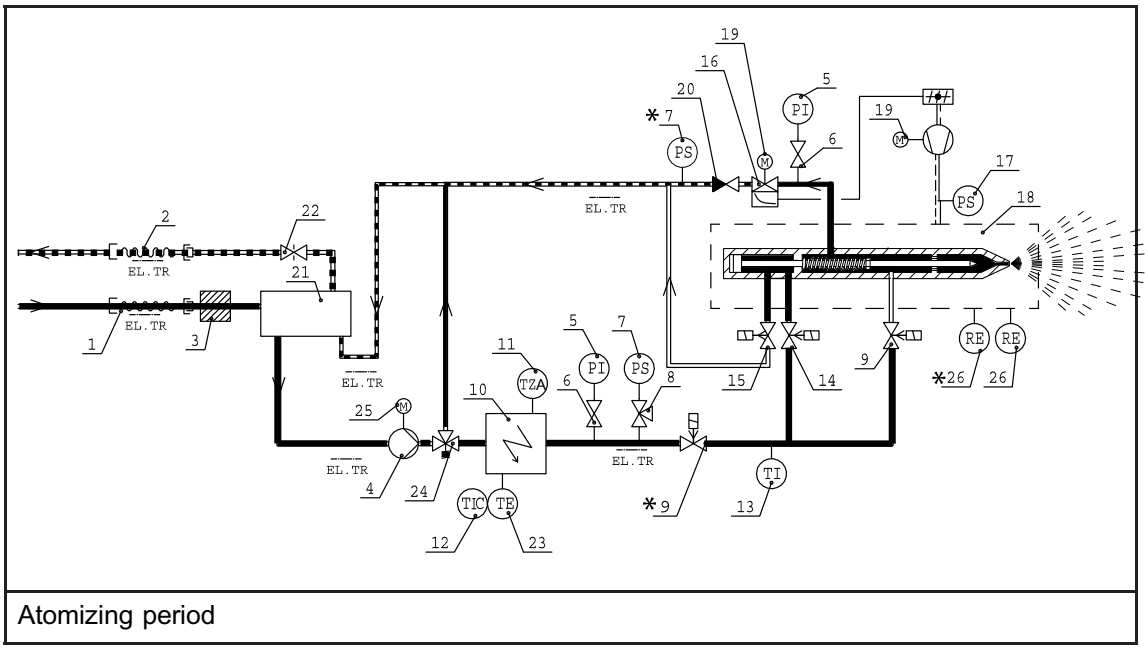
2.2.1 Oil circulation periods on a modulating burner (M)



Shutdown period



Purging period

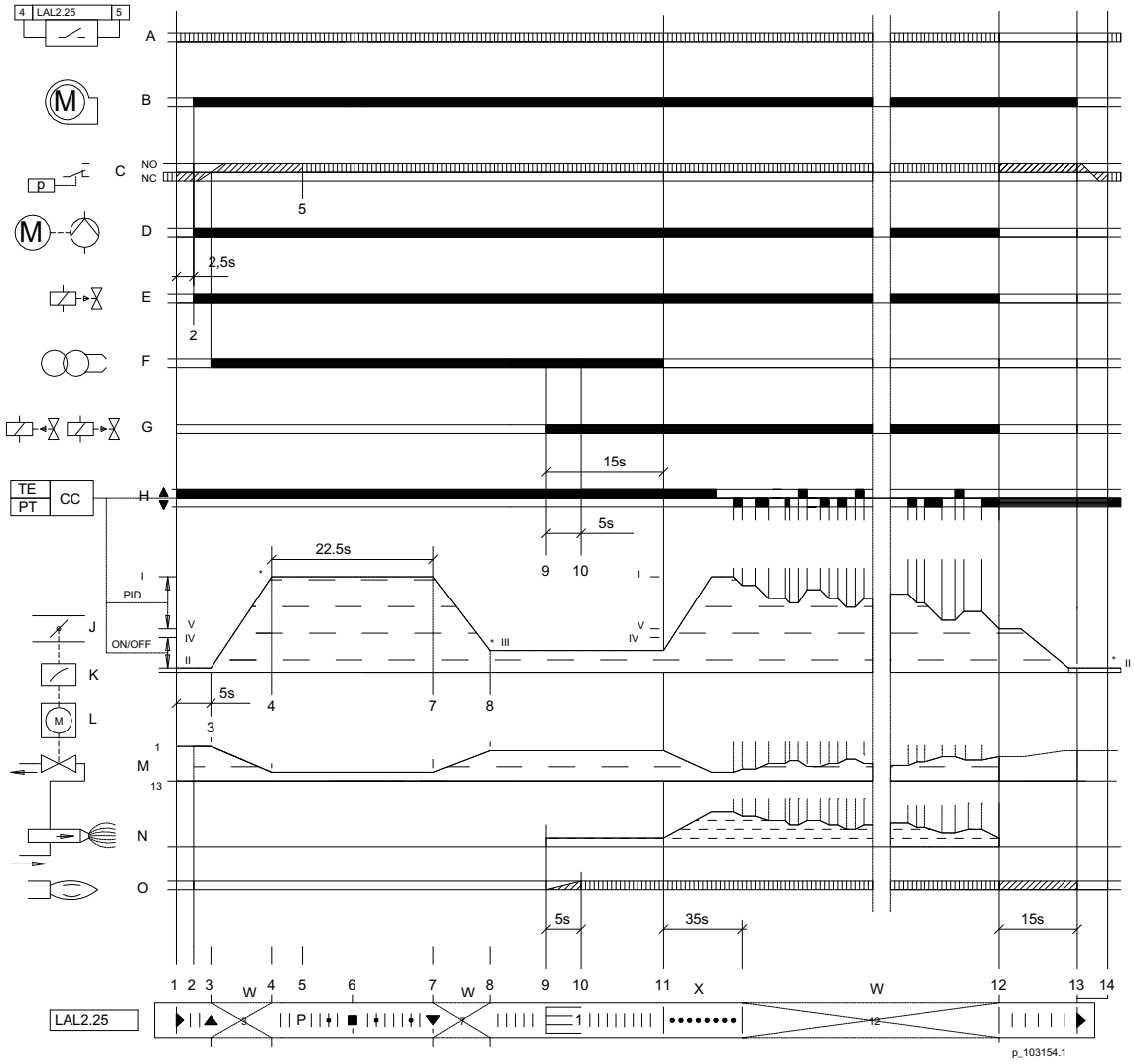


Atomizing period

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

2.3. Sequence program, fuel oil

2.3.1 Time Sequence Diagram LAL.2.25



Required input signals to control unit	Control signals	Permissible input signals to control unit

2.3.2 Time sequence diagram legend

A	Control loop
B	Fan
C	Differential air pressure switch
D	Oil pump
E	Main solenoid valve, NC
F	Ignition transformer
G	Control circuit solenoid valves, NC and NO
H	Capacity controller
J	Air dampers
K	Adjustable cam disc, air
L	Servomotor
M	Oil regulator
N	Nozzle valve
O	Flame signal
W	Sequence switch stopped
X	Sequence switch idle steps
*	Required start signal to control unit terminal 8

2.3.3 Adjustable switching points on the cam switches of the servomotor

I	switching point of full load
II	switching point of the ”closed” position after controlled shutdown
III	switching point of ignition load
IV	switching point of partial load before change over to modulating area
V	switching point of partial load at the low limit of the modulating area (V-I)
VI	free
VII	free

2.4. Automated functions in a modulating burner, oil fuel

2.4.1 Sequence point 1. Prerequisites for start-up

- Failures and interlocks are reset
- Limit switch on burner flange is closed
- Control unit is reset (lockout indicator at symbol ◂)
- Control switch in position 2, 3, 4 or 5 (A) *M*
- Contact of burner switch-on/switch-off level in capacity controller is closed or it is by-passed with manual operation position 3, 4 or 5 of control switch (A)
- Contact of boiler thermostat or pressurestat closed
- Preheater control switch in position 1 (heating ON)
- Required start signal from the limit switch of the switching point II in the servomotor to terminal 8 in the control unit
- oil temperature > min. or temperature controller (min.) by-passed (light fuel oil)
- Contact C/NC of differential air pressure switch is closed (differential air pressure < min.)
- Contacts of the low oil pressure switch connected to the control circuit are closed
- External contacts connected to the control circuit are closed
- Start signal at terminal 12 in control unit.

2.4.2 Sequence point 1.1. Start-up (lockout indicator of the control unit is at symbol ◂)

- Control loop closes
- Control program (sequence switch) of control unit starts.
- Checking of the flame detection circuit is in process

2.4.3 Sequence point 2

- Fan motor starts
- Oil pump motor starts
- Main oil valve opens and purging of nozzle valve with warm oil begins.
- After the differential air pressure switch has changed over its contact to position C/NO pre-ignition begins (differential air pressure > min.).

2.4.4 Sequence point 3. Lockout indicator of the control unit is at symbol ▲

- Servomotor runs to switching point I (air dampers are open)
- Sequence switch does not operate during the running time.

2.4.5 Sequence point 4. Servomotor has run to switching point I (Air smapers are open)

- Start signal from the limit switch of switching point I to terminal 8 in control unit. Otherwise the start-up program interrupts and the control unit remains (symbol ▲) waiting for start signal (no failure).
- Pre-purge (22,5 s) with nominal air quantity begins.

2.4.6 Sequence point 5. Lockout indicator of the control unit is at symbol P

- Differential air pressure switch has to have changed its contact over to position C/NO.

2.4.7 Sequence point 6. Lockout indicator of the control unit is at symbol ■

- Control of flame supervision circuit completed

2.4.8 Sequence point 7. Lockout indicator of the control unit is at symbol ▼

- Pre-purge (22,5 s) completed
- Servomotor runs to switching point III (ignition load)
- Sequence switch is stopped during the running time.

2.4.9 Sequence point 8. Servomotor has run to switching point III (ignition load)

- Required start signal from the limit switch of switching point III to terminal 8 in control unit. Otherwise the start-up program interrupts and the control unit remains (symbol ▼) waiting for start signal (no failure).

2.4.10 Sequence point 9. Safety time (5 s) begins

- Contact of return oil pressure switch (max.) must have been closed (C/NC)
- in control circuit of nozzle valve solenoid valve NC opens and solenoid valve NO closes
- Oil pressure is released to control circuit of the nozzle valve. Nozzle valve needle moves back and opens the nozzle valve.
- Fuel atomizing from the nozzle begins with pressure set for ignition phase.
- Oil spraying through the nozzle is ignited by the electric arc

2.4.11 Sequence point 10. Ohjelmareleen ohjelmaosoitin on symbolin 1 kohdalla

- Safety time ends (5s)
- Flame burns at set ignition load.

2.4.12 Sequence point 11. Lockout indicator of the control unit is at symbol | (operating)

- Ignition stops (electric arc)
- Sequence switch stops for the running time
- Control signal from terminal 20 on the control unit for the running time
- Servomotor runs to switching point IV (< V) before switching over to modulating area (between switching points V and I
- When the load is high and the burner is turned on all the time, capacity controller (PID, 3-step control) adjust the burner capacity on the modulating area (I - V) to correspond to the load. With signal ”increase” or ”decrease” from the capacity controller or from the control switch in manual operation, the servomotor of air dampers and oil regulator is regulated to the direction ”open” or ”closed” according to the capacity demand.

- Burner operates thus supervised by control unit and controlled by capacity controller according to set controller parameters and functions (see documentation of controller)
- Burner shuts down when the load is small and the process value exceeds the burner switch-off level set on the controller or controlled by the boiler thermostat/ pressurestat. In manual operation the burner shuts down controlled by the boiler thermostat/ pressurestat only.
- If the oil temperature rises above the set limit on the preheater limit thermostat- the burner shuts down. (thermostat lockup)
- stop and restart if the flame signal is lost during operation (wire link B has been cut away from the from the plug section of the control unit)
- Stop and restart if the return oil pressure rises too high

Wire link B has been cut away at the factory.

2.4.13 Sequence point 12. Controlled shuttdown (control loop opens)

- Sequence switch starts and begins to program the permissible post-purge time (15 s)
- Oil pump motor stops
- Main oil valve closes
- Solenoid valve NC closes and NO opens in the control circuit
- Nozzle valve closes when the oil pressure in the control circuit disappears
- Flame extinguishes
- With control signal from terminals 10 and 11 of the control unit servomotor runs to switching point II (air dampers to position ”closed” and oil regulator to position ”open”).

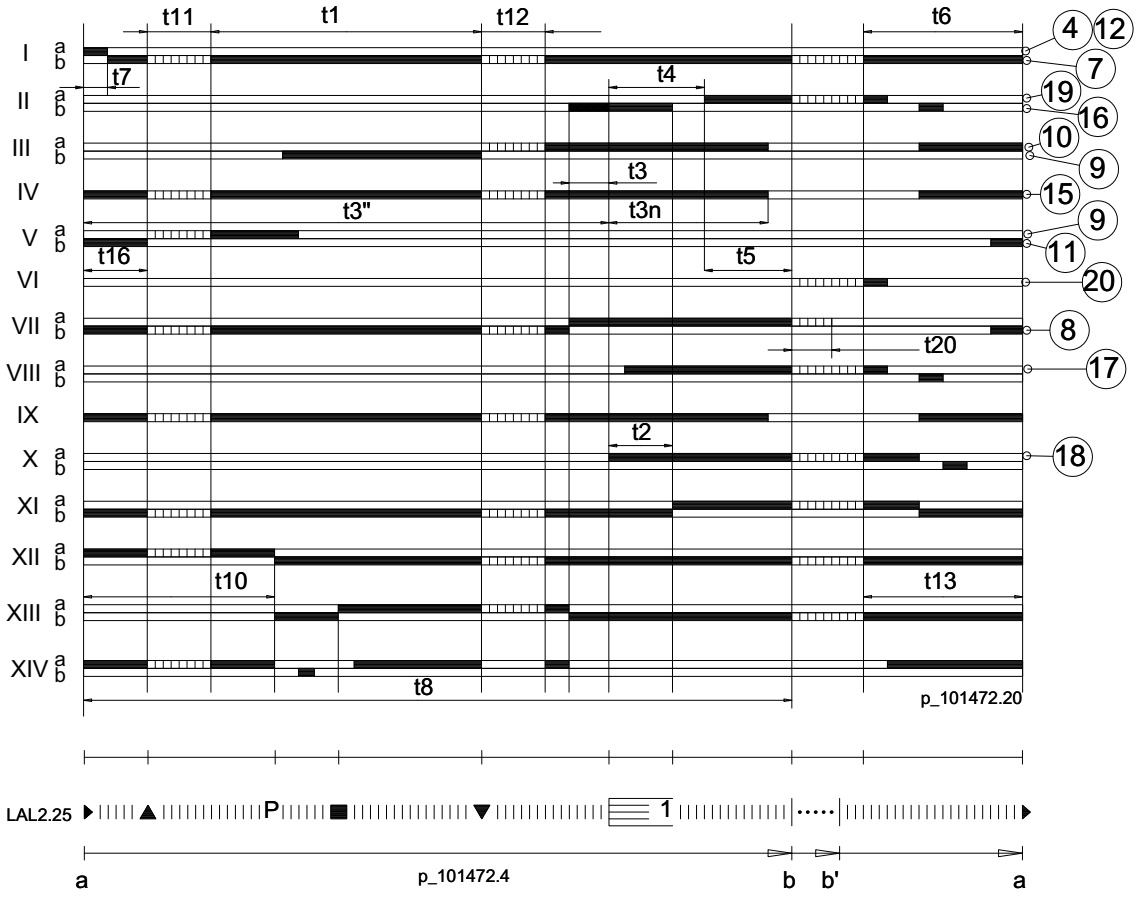
2.4.14 Sequence point 13. Lockout indicator of the control unit is at symbol ◄

- Permissible after-burn time (15 s) ends
- Flame simulation tests initiate in control unit.
- Sequence switch stops
- Fan motor stops

Re-start possible, if the prerequisites for start-up are fulfilled (see Sequence point 1.)

2.5. Control Program of the Sequence Switch

2.5.1 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

2.5.2 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 %.

2.6. Control Program under Fault Conditions and Lockout Indication

2.6.1 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.

2.6.2 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!

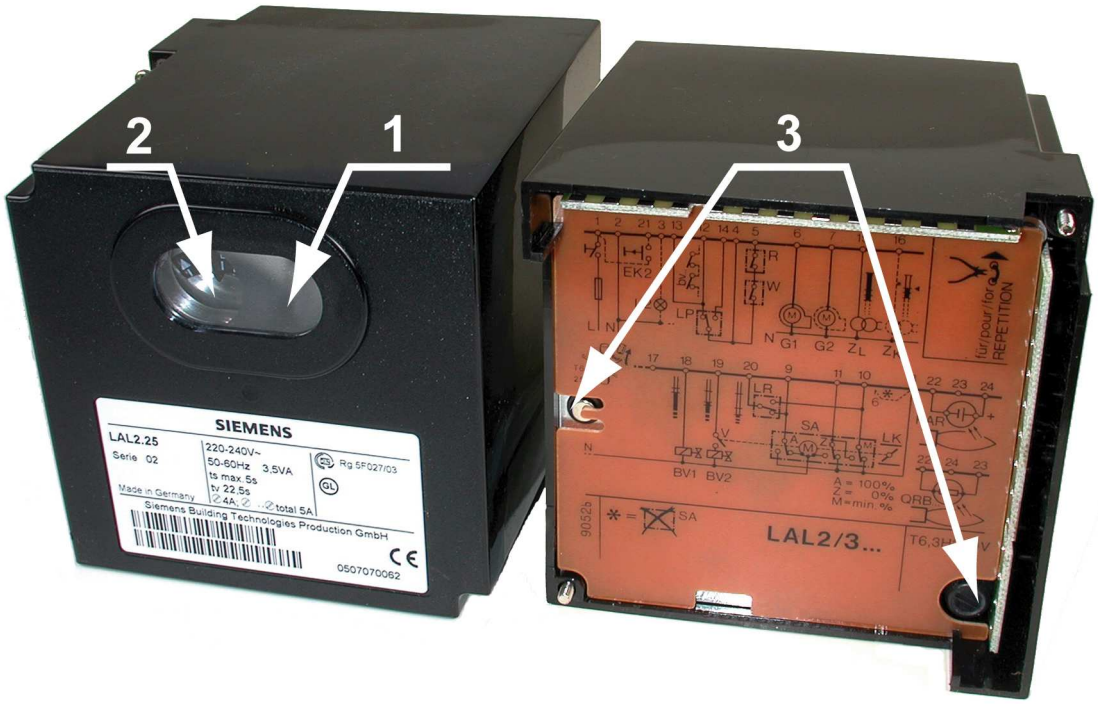
1	Lockout	Flame signal has not been received during safety time.	Every flame signal failure after safety time sequence leads to a lockout
1	Lockout	Return line pressure switch (max) triggering stops fuel injection.	Pressure switch is optional component. May not be included to delivery.
|	Lockout	The 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	

2.6.3 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.

2.6.4 Control unit LAL 2.25



1. Reset button
2. Program indicator
3. Fuses

CAUTION	• 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

2.7. Additional heating

2.7.1 Description

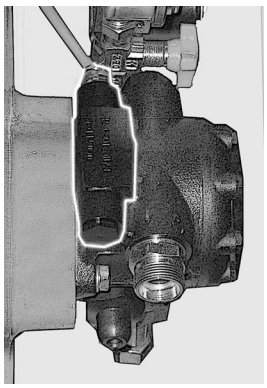
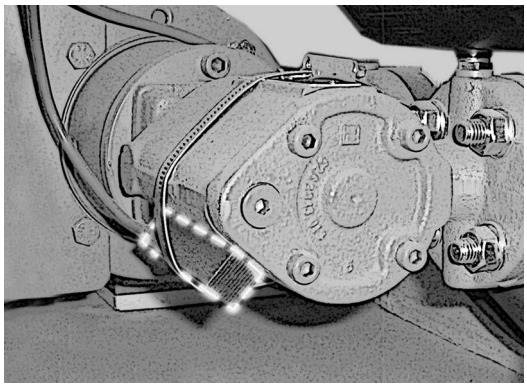
Additional heating keeps the burner ready for use. Additional heater devices ensure oil fluency by keeping oil viscosity adequately low.

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.

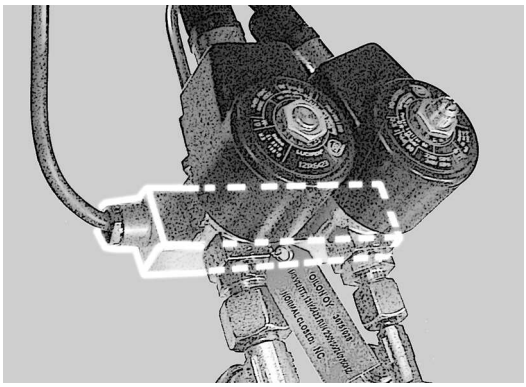
If the oil viscosity is too high :

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

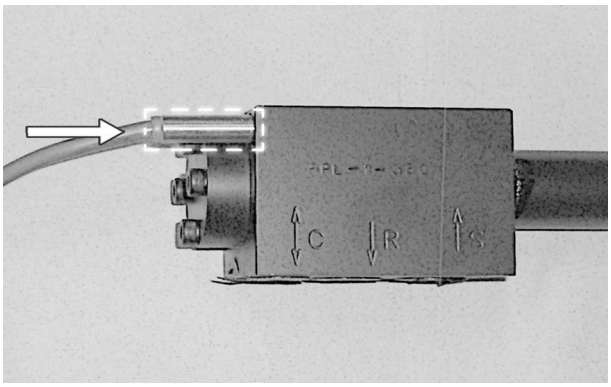
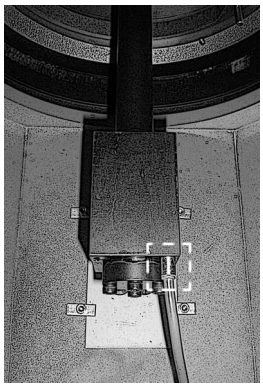
2.7.2 Heating cartridges on pumps

	Pump Suntec
	Pump SPF

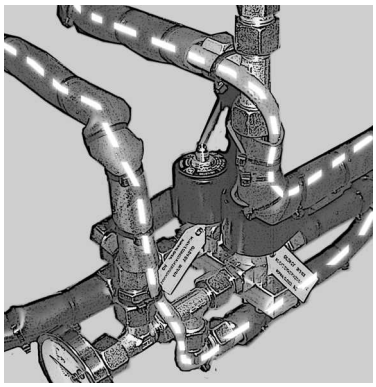
2.7.3 Heating cartridges on solenoid valves

	Solenoid valves

2.7.4 Heating cartridges on nozzle valve

	Press the cartridge in to the opening.
	Top view of the nozzle valve

2.7.5 Heating the pipes and hoses with heating cables

	The heating cables must run in direct contact with the pipe surface. Loose cable does not conduct heat into the pipings.

2.7.6 Technical data

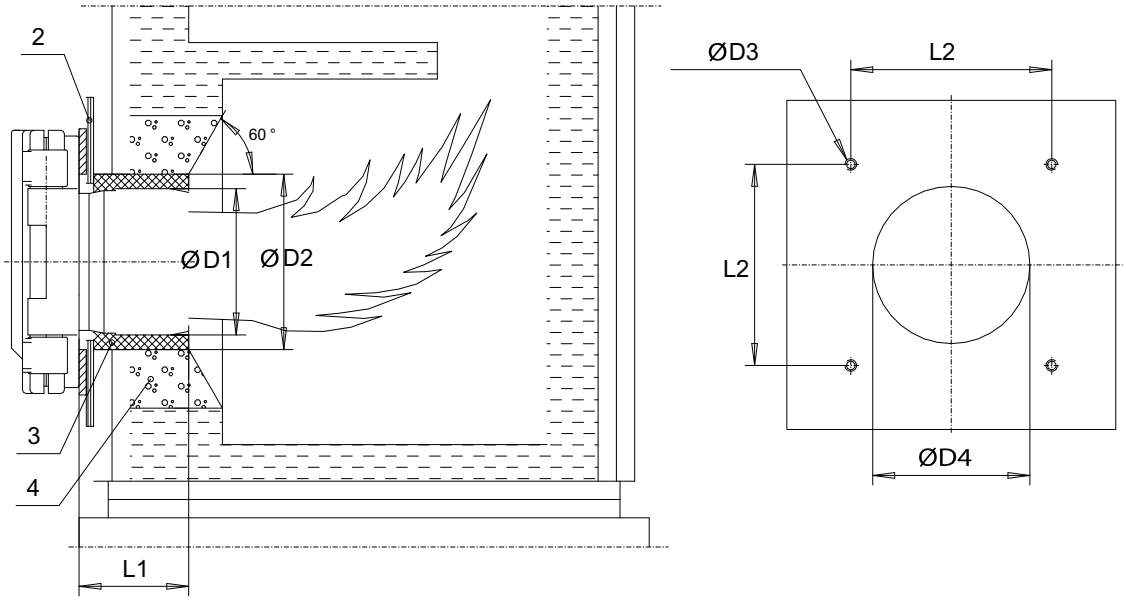
Heating cartridge capacity	40 W/230 V
Heating cartridge dimensions	10 x 50 mm
Heating cartridge electric cable	2500 mm
Heating cable	Self adjusting - capasity decreases as the pipe temperature rises.
Heating cable capacity	230 V 45 W/m in +10 C°

	Heating cartridge case may be hot

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
RP300M	300	340	M20	320	200	365
RP300M-II	300	340	M20	320	200	365
RP400M	300	340	M20	370	255	365
RP400M-I	340	380	M20	370	270	365
RP500M	340	380	M20	370	270	365
RP600M	370	410	M20	395	290	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.

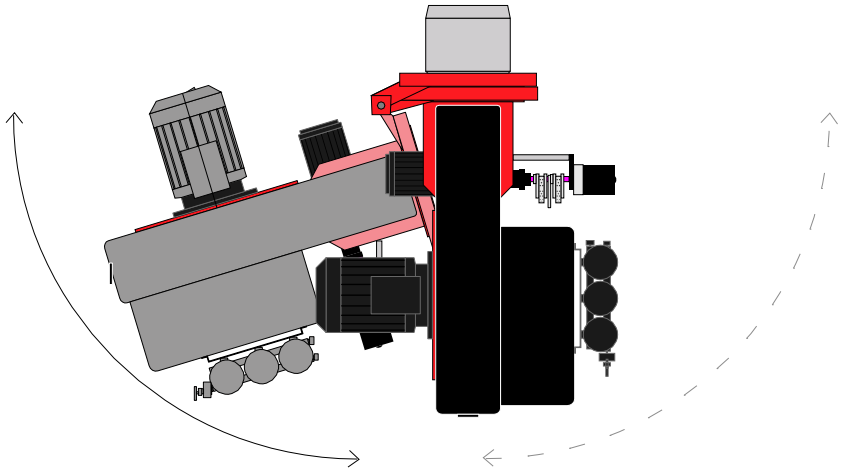
Remove the transportation bracket after the burner is attached to the boiler

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

CAUTION	The burner must be installed firmly. Vibrations may damage burner or its components.

3.2. Burner hinges

3.2.1 Standard composition

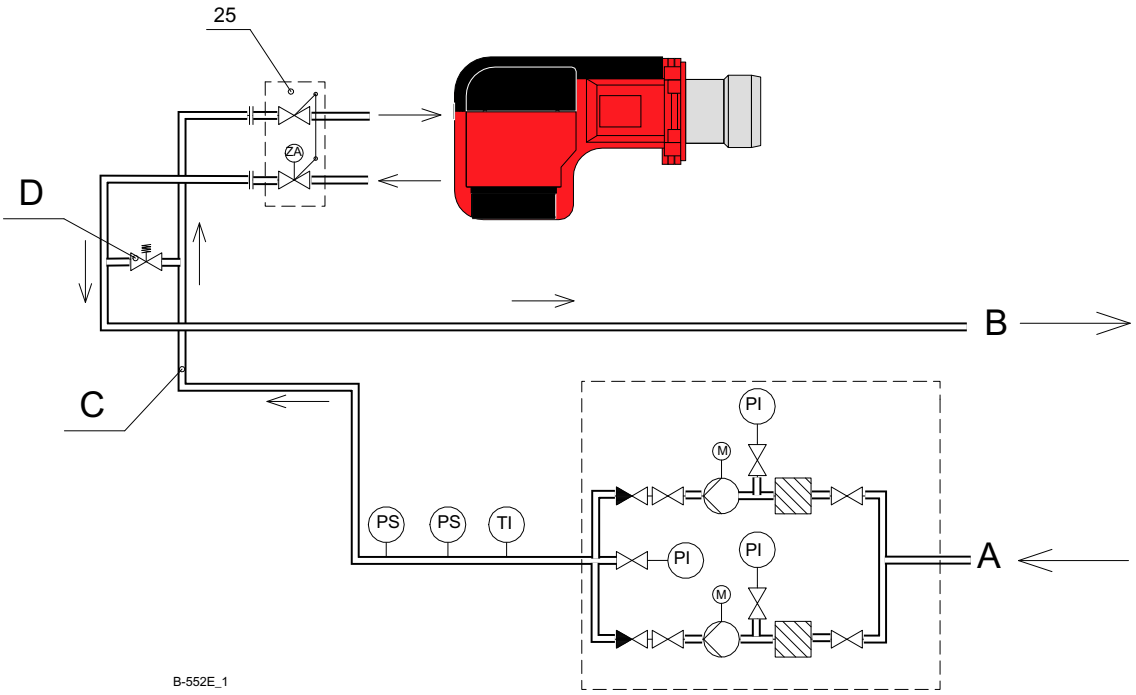


Defaulty burner swings to the left. Right side hinging is delivered on request only.

CAUTION	Switch off the electric power from your burner before burner swing-out.

3.3. Examplery 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 x quantity of oil to be burned kg/h + 150 kg/h

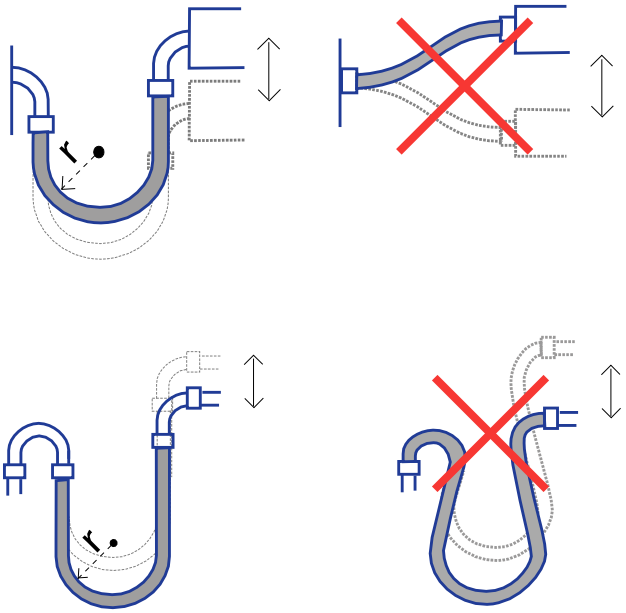
Example

If	Then
burner capacity is 200kg/h	throughput must be 1,2 x 200 kg/h + 150 kg/h = 390 kg/h

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

3.4. Installing hoses

3.4.1 Avoid torsion stress on hoses

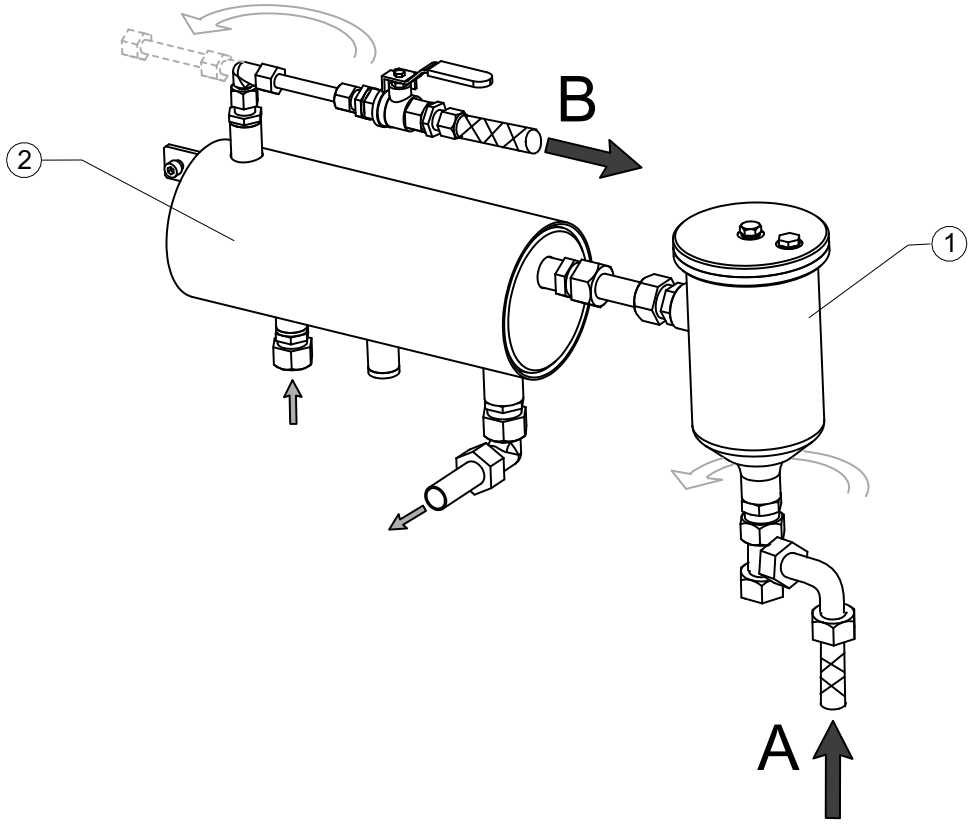
Leave neutral hose ends long enough	
Use rigid pipe pends when necessary	

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. De-aerator and oil filter

3.5.1 Installation



A = Oil to burner

B = Oil to tank

1. Oil filter

2. De-aerator

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

 DANGER!	Keep the boiler doors closed during ignition and operation.

4.1.1 Prepatory 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

 CAUTION	Prior to first start-up the oil pump must be vented. The pump must not operate without oil. See chapter ”Oil Pump".

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 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 nozzle.
11. Check the cam positions on air damper servomotor.
12. Switch the burner ON to minimum capacity.
13. Check the atomizing pressure is correct.
14. Check the return pressure for ignition phase.

15. Use an oil flow meter to check minimum capacity. (Minimum capacity preadjusted at the factory)
16. increase capacity step-by-step by adjusting the screws.
17. Use a gas analyzer to adjust optimum values for the combustion.
18. Use an oil flow meter to check maximum capacity. (Maximum capacity preadjusted at the factory)
19. Test the safety equipments on the burner.

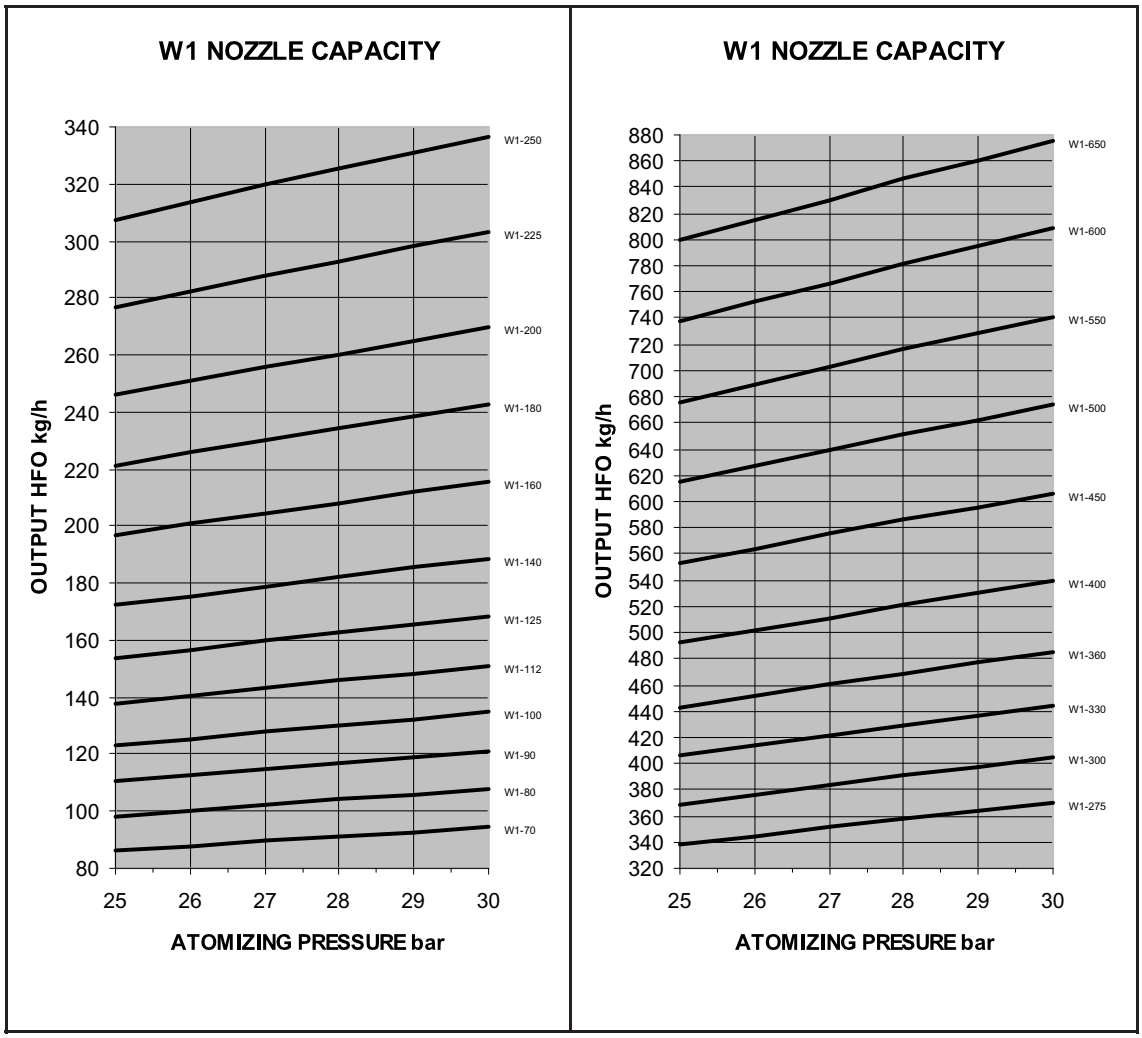
 DANGER !	Never use a naked flame while checking the burner or the boiler. Never store any inflammable material in the boiler room.

 DANGER !	Wear hearing protectors, if there is noise in the boiler room.

4.2. Nozzle capacity charts

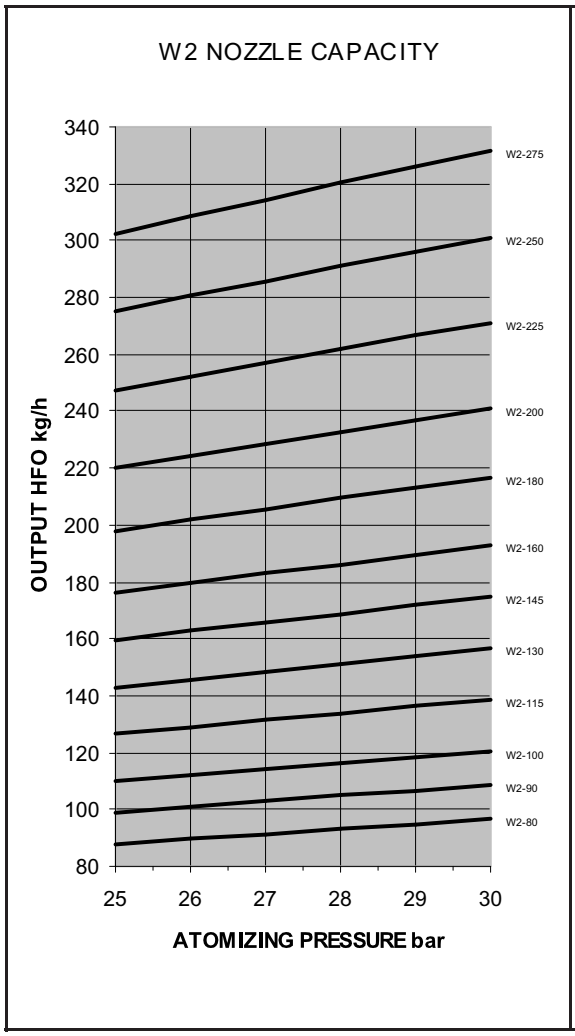
4.2.1 Nozzle capacity charts Fluidics 12 W1

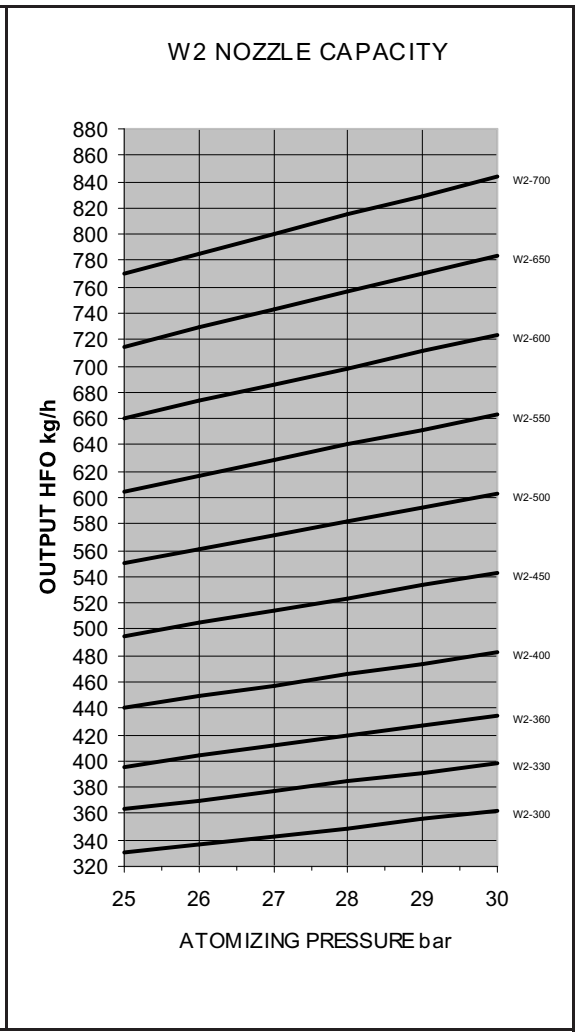
Charts applicable when atomizing viscosity15 mm²/s (cSt)



4.2.2 Nozzle capacity charts Fluidics 12 W2

Charts applicable when atomizing viscosity15 mm²/s (cSt)





FOR EXAMPLE

Oil viscosity	Atomizing temperature
180 mm2/s at 50 °C	110...115 °C
380 mm2/s at 50 °C	125...130 °C
700 mm2/s at 50 °C	135...140 °C

4.2.3 Fuel consumption by boiler capacity

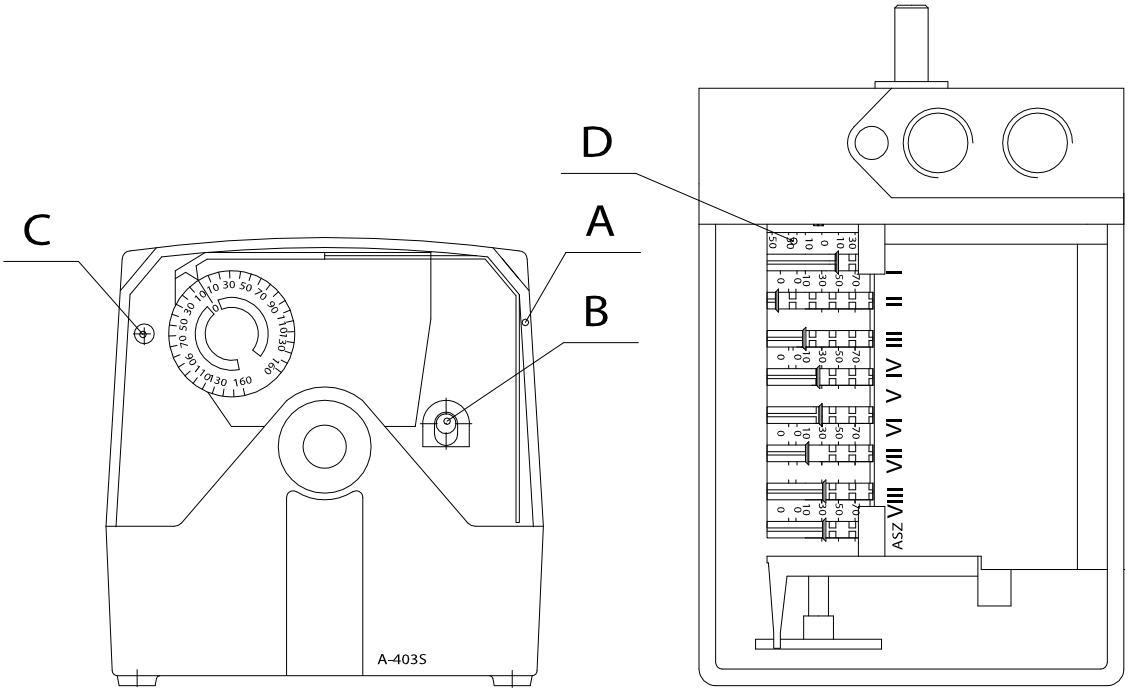
q = P/μ *Q	P = boiler capacity kW μ = boiler efficiency, 0,80-0,95 Q =heat value, kWh/kg q = fuel demand, kg/h (Note! all nozzles)

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.

4.3. Adjusting combustion air

4.3.1 Servomotor SQM 50. cam switches

The diagram shows the basic positions of the cam discs.



Cam switches (limit switches) are set at the factory during testing as follows:

II	burner shutdown
III	ignition load
IV	load, when changing over from ignition load to partial load
V	partial load, when changing over from full load to partial load
I	full load

- A - adjusting key (under cover)
- B - release lever
- C - adjusted at the factory, DO NOT RELEASE THE SWITCH!
- D - scale indicates only the turning angle of servomotor shaft

- With the release lever B the cam shaft can be disengaged. This makes it possible to turn the cam discs manually.

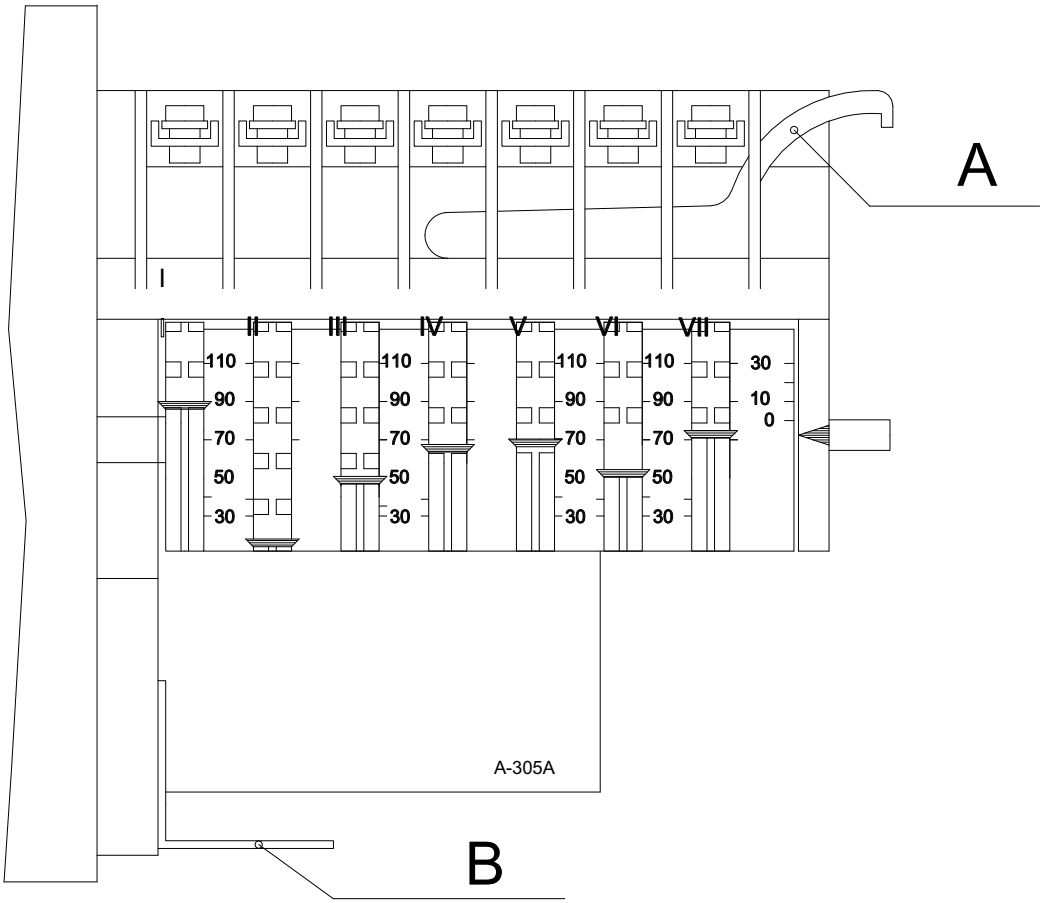
! Note	Difference between switches IV and V must be approx. 3 - 5° The black scale is in use. Cam switches VI, VII, and VIII are free ASZ (potentiometer) in use when necessary

! Note	Do a flue gas analyzis to verify adjustments

	Do not release the switch C. Change in position of cam discs will damage servomotor and change burner adjustments.

4.4. Adjusting combustion air

4.4.1 Cam switch position in principle SQM 10.-motor



4.4.2 Cam switch function in a modulating burner

Cam switches (limit switches) are set at the factory during testing as follows:

II	Air dampers closed (approx. 0°). With gas fuel shutdown, ignition capacity and part capacity
III	Ignition capacity (approx. 30°)
IV	Part capacity, when switching between part capacity levels (approx. 40°)
V	Part capacity, when switching from full capacity to part capacity (approx. 45°)
I	Full capacity (approx. 130°)

- A = adjusting key
- B = release switch

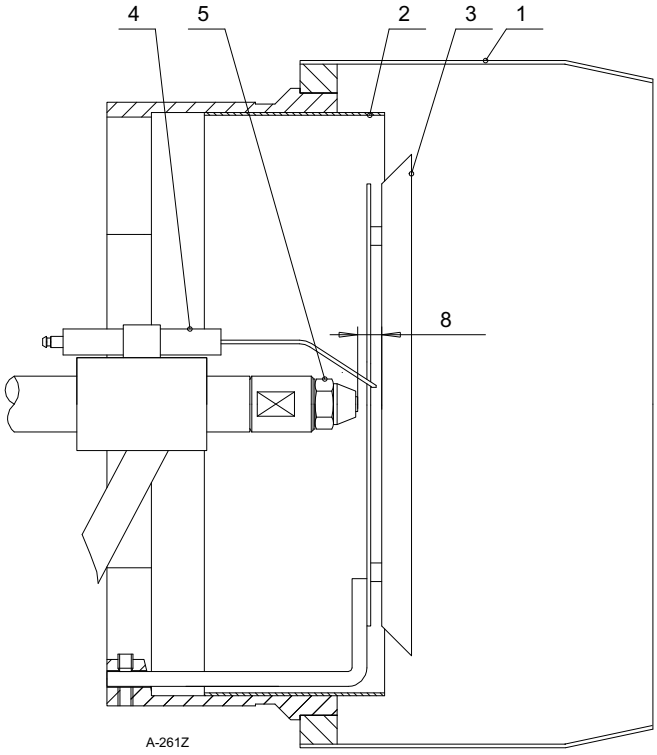
Release switch B enables manual setting of the adjusting mechanism

Difference between IV and V must be approx. 3-5°. Cam switches VI and VII are not in use.

! Note	Do a flue gas analyzis to verify adjustments

4.5. Adjusting pressure drop in combustion head

4.5.1 Combustion head components



1. Combustion head extension
2. Adjustment ring
3. Diffuser disc
4. Ignition electrode
5. Nozzle

4.5.2 Effect of the adjustmen 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 fort 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 igniton 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 adjusment ring is too rear with a lesser load	there is not enough pressure drop	deficcient combustio (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

4.5.3 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.

4.5.4 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 analysator.
2. Set the combustion air levels within the operation range of the servomotor

Guideline values

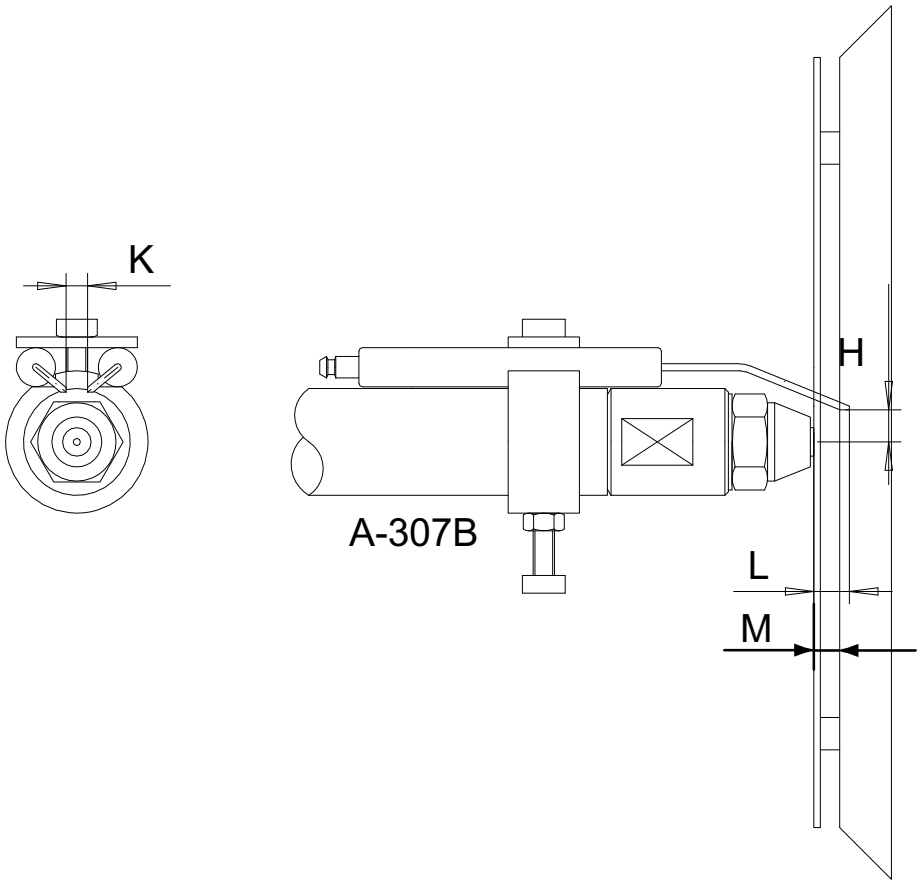
CAPACITY	FUEL	O_2-LEVEL %
Ignition, minimum- and part power	Heavy fuel oil	4,5 - 6
Full power	Heavy fuel oil	3 - 4,5
Ignition, minimum- and part power	Light fuel oil	3,5 - 4,5
Full power	Light fuel oil	3 - 4

4.6. Setting the burner head

4.6.1 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

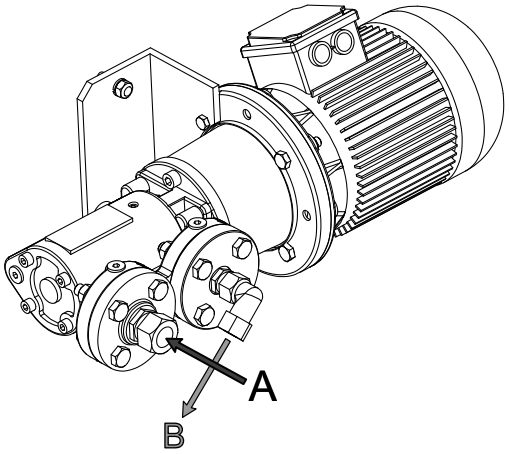
4.6.2 Measures



H	9 mm
K	3 mm
L	10 mm
M	8 mm

4.7. Oil pump and pressure regulating valve

4.7.1 Oil pump connections



A - Oil to pump

B - Oil from pump

4.7.2 Pump values

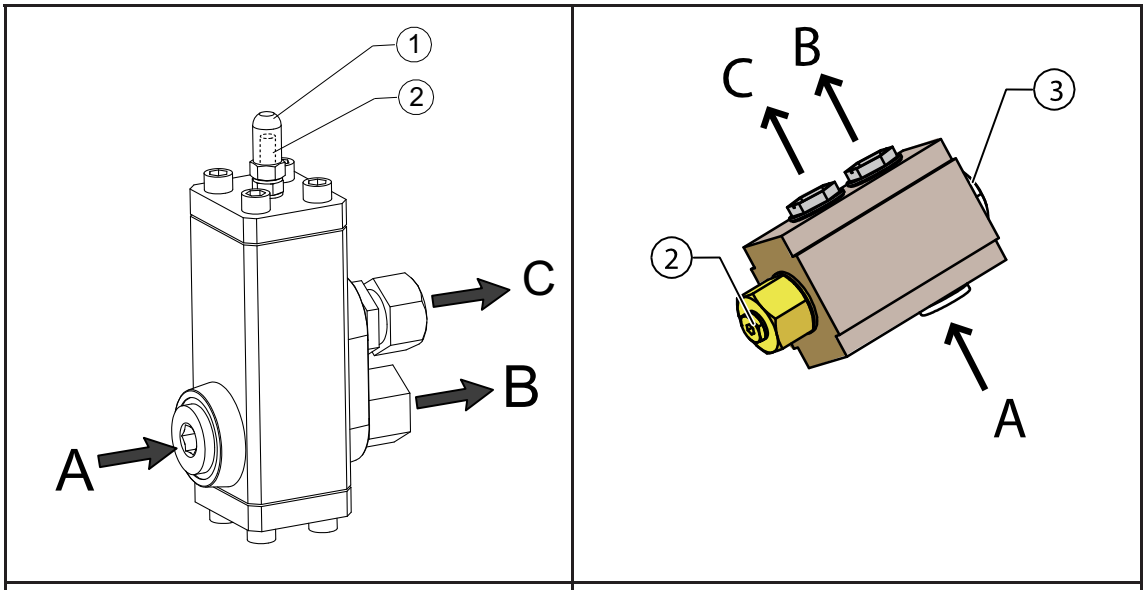
TECHNICAL DATA	PUMP SPF
Max. oil inlet pressure to burner	5 bar
Min. oil inlet pressure to burner	2.5 bar or higher depending on oil temperature at the pump. See illustration.
In-let oil temperature range: Heavy fuel oil	60 - 100 C°

- Note! 1 bar = 100 kPa.

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

4.7.3 Adjusting atomizing pressure

Adjust the thermal output of the burner by changing the size of the nozzle and adjusting the oil atomising pressure. Pump provides a constant pressure. Atomizing pressure is adjusted with separate pressure regulating valve.



Regulator valve option 1	Regulator valve option 2

A - Oil from pump

B - Oil to nozzle

C - Return oil

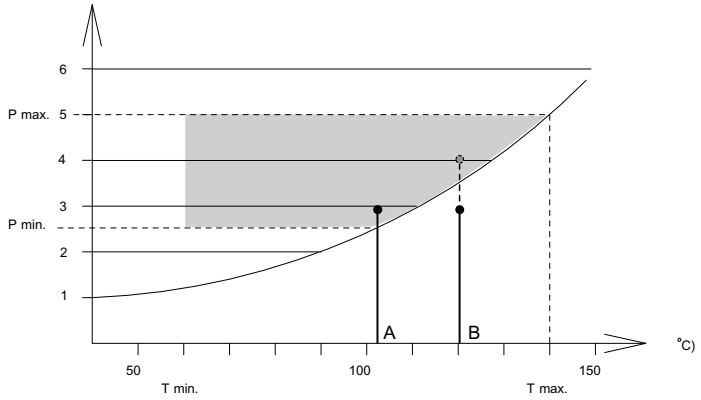
1. Protective cap
2. Pressure regulation
3. Pressure gauge connection

Atomizing pressure	Fuel
25 - 30 bar	Heavy fuel oil
20 - 25 bar	Light fuel oil

4.7.4 Adjusting 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.



Recommended operating zone illustrated in gray
Temperature curve = Oil temperature at the pump

Example A :

Oil temperature at the pump	In-let oil pressure to burner	Status
102 C°	2,9 bar	OK

Example B :

Oil temperature at the pump	In-let oil pressure to burner	Status
120 C°	2,9 bar	LOW PRESSURE ! Pressure must be lifted over 3,8 bar

4.8. Burning light fuel oil

Burner is suitable for temporary use of light fuel oil

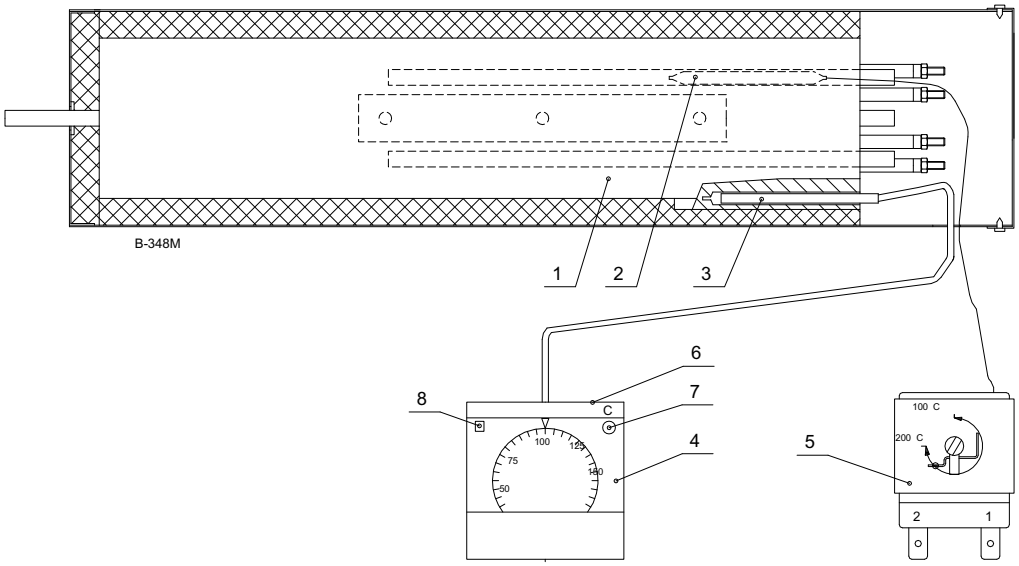
Pay attention to following:

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

CAUTION	Turn OFF preheater when using light fuel oil

4.9. Preheater

4.9.1 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!	The connectors in the control box are under voltage. The safety cover is allowed to be opened only by authorized staff.

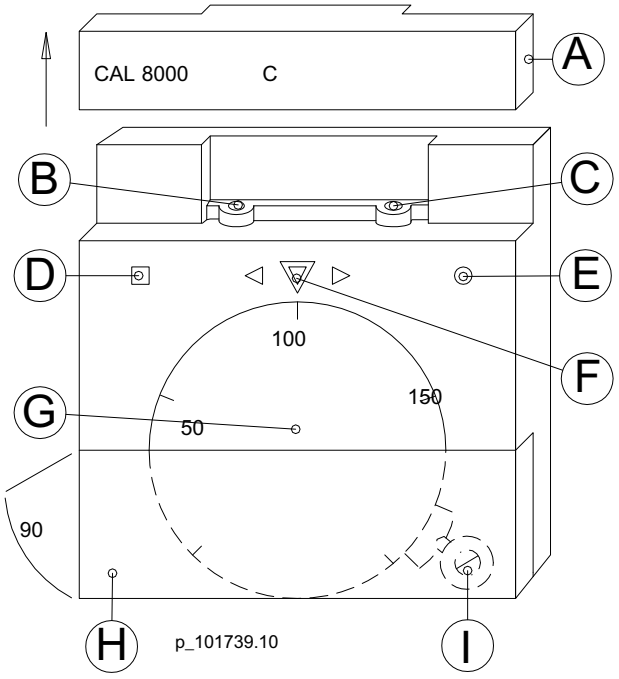
4.9.2 Temperature regulation

Oil atomizing temperature is adjusted with the controller.

Check the oil atomizing temperature on the thermometer.

4.10. Temperature Controller for Preheater

4.10.1 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.

4.10.2 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 ºC).

SIGNAL	MEANING
◁	more than 6 °C below set value
◁▽	6 - 2 °C below set value
▽	Set value ± 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.

4.11. Preheater limit thermostat settings

4.11.1 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.

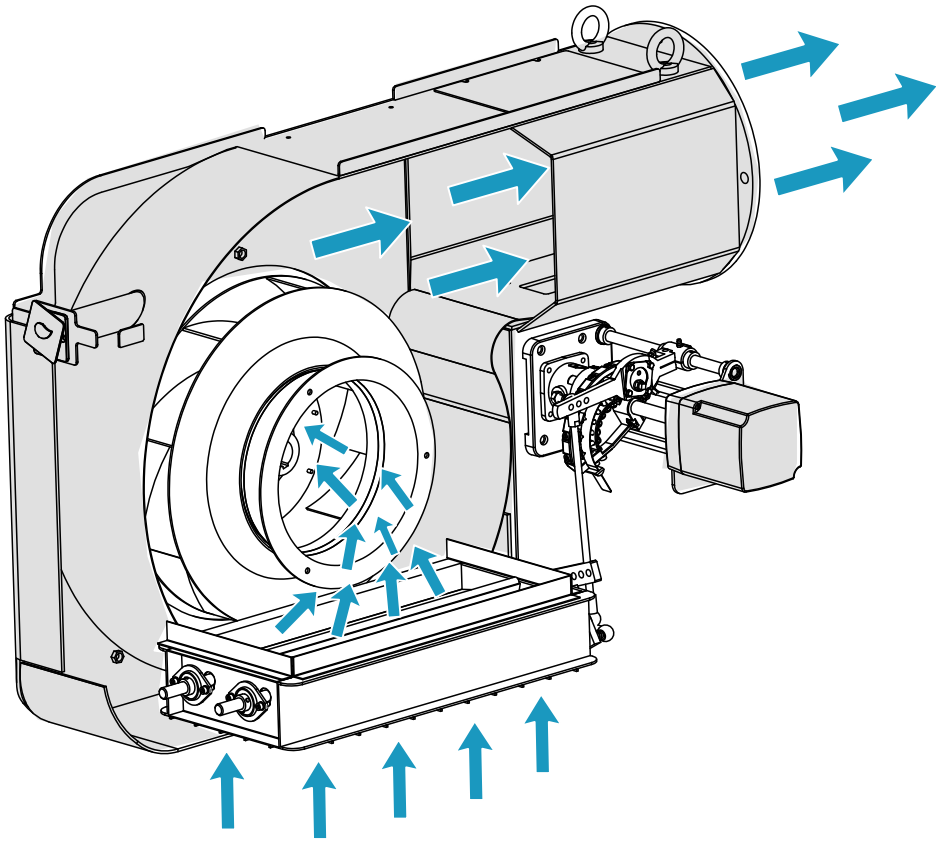
! Note	Do not open the sealed locking screw. Breaking the seal voids warranty

4.12. Compound regulator

The oil quantity to be burned is determined by nozzle size and oil pump pressure. The oil regulator controlled by the servomotor regulates the return oil flow according to the capacity demand.

At partial load the oil regulator is open so that the oil throughput in the valve is at maximum and return flow pressure and nozzle capacity are adequate.

At full load the oil regulator is closed whereupon the oil throughput is at minimum and the pressure at maximum. The air quantity is matched to the oil quantity to be burnt by means of the spring band on the adjustable cam disc (see ”Adjustable Cam Disc”).



The burner is preadjusted at the factory. Accurate adjustments to be made with a flow meter at site

! Note	Do a flue gas analyzis to verify adjustments

5. Maintenance

5.1. Burner maintenance

 DANGER!	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.

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.

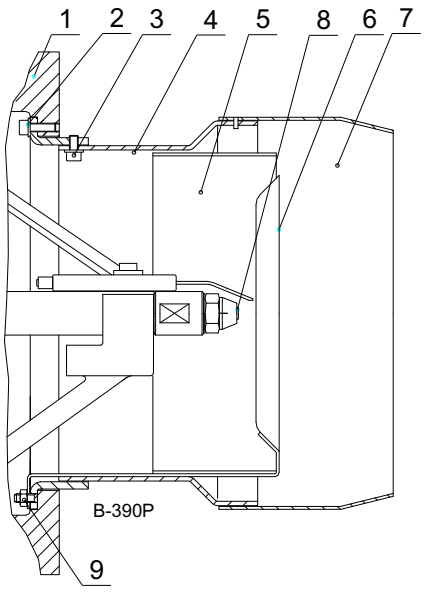
Correct installation and adjustments and regular maintenance ensure correct operation of the burner.

- 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

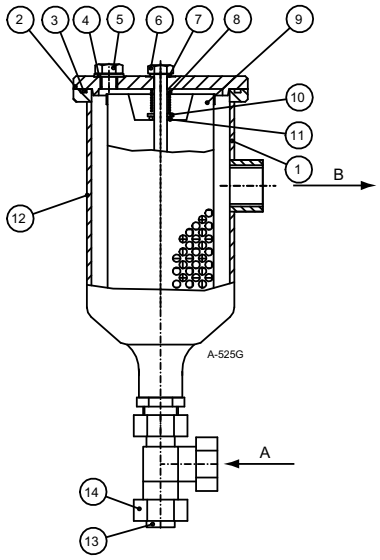


1. Burner body
2. Fixing screw of combustion head
3. Fixing screw of combustion head guide
4. Combustion head guide
5. Adjustment ring
6. Diffuser disc
7. Combustion head extension
8. Nozzle
9. Fixing bolt of diffuser disc

- Detach the burner from boiler or open boiler door.
- Detach fixing screws of combustion head guide.
- Detach fixing screws of adjustment ring.
- Pull out the adjustment ring.
- Detach fixing bolts of diffuser disc.
- Pull out the diffuser disc.
- Pull out the combustion head guide along with combustion head extension from the fire chambers side. The combustion head extension is fixed with rivets to combustion head guide.
- Reassemble in reverse order

5.3. Oil Filter

5.3.1 Oil Filter components



1. Mantle
2. Cover
3. O-ring
4. Gasket
5. Hexagon head plug
6. Hexagonal screw
7. Gasket
8. Spring
9. Filter element
10. Washer
11. O-ring
12. Label
13. Plug
14. Nut

A - Oil to filter
B - Oil to burner

5.3.2 Note!!

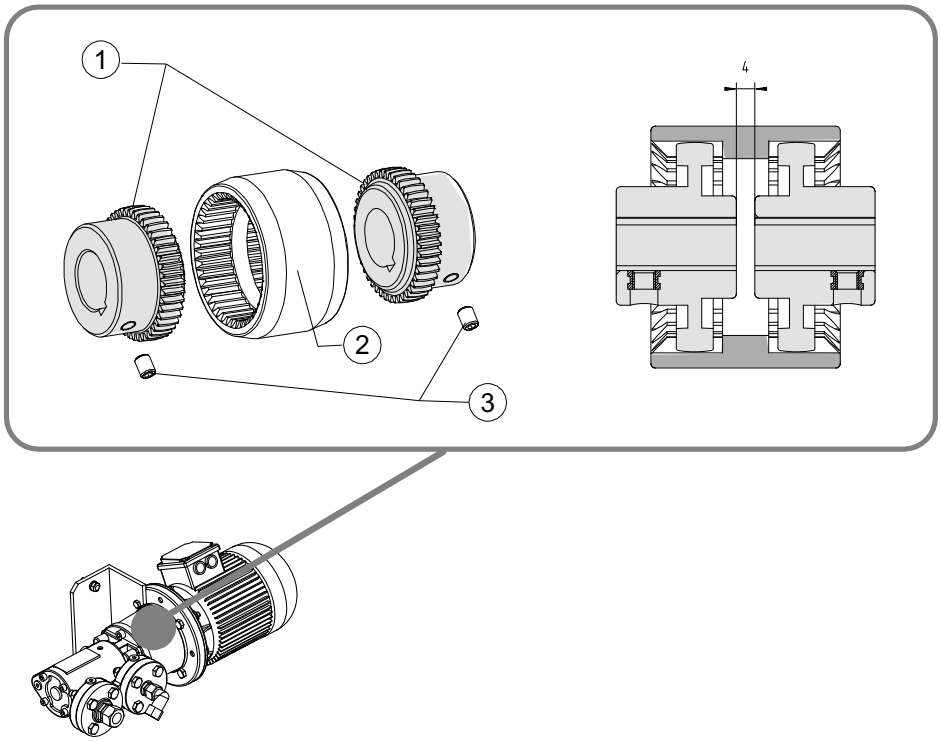
Before cleaning of the filter make sure, that oil does not flow to the filter.

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. Oil pump coupling

5.4.1 Oil pump coupling components



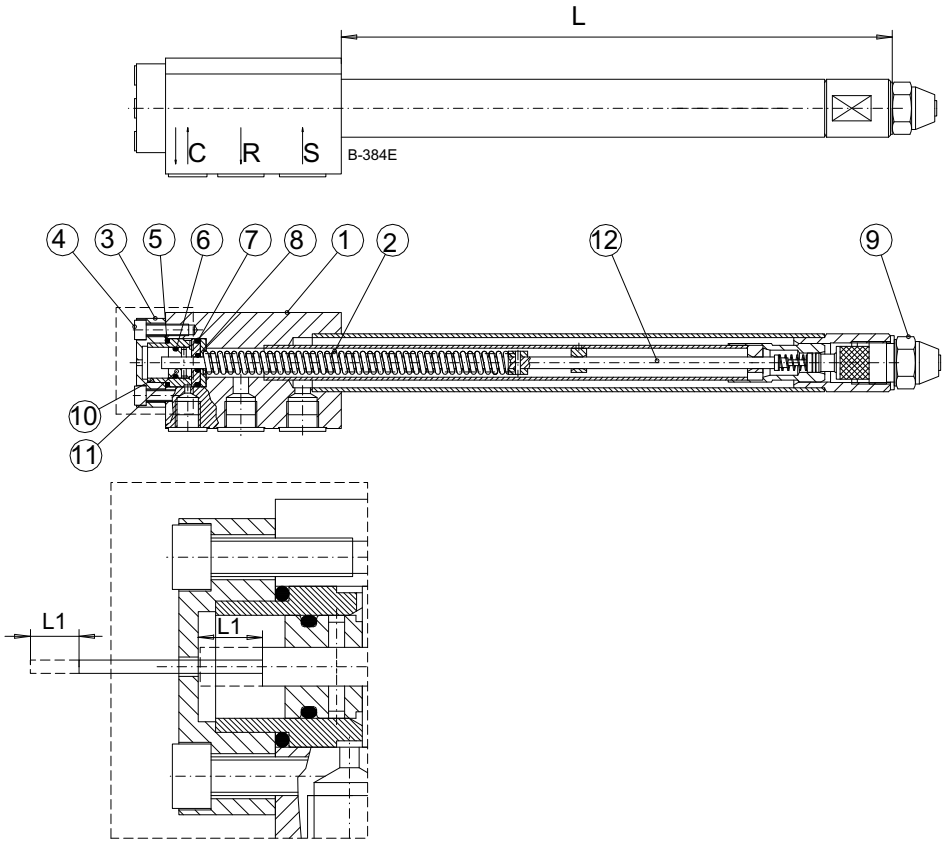
1. Hub
2. Sleeve
3. Set screw

Set a distance between the hubs. See image.

! Note	Check the correct assembly direction for hubs

5.5. Nozzle Valve RPL-1

5.5.1 RPL-1 Components



1. Body
2. Break spring
3. Rear cover
4. Hexagonal socket screw
5. O-ring for cover 18,72 x 2,62 Viton
6. O-ring for piston 12 x 2 Viton
7. O-ring for bottom plate 18,72 x 2,62 Viton
8. O-ring for spindle 6 x 2 Viton
9. Oil nozzle
10. Cylinder
11. Piston
12. Spindle

C	Control circuit
R	Return from nozzle
S	Outlet to nozzle
L	Nominal size of nozzle valve
L1	Nozzle open position (chacking the spindle movement)

5.5.2 RPL-1 Operation principle

The opening of the nozzle valve is controlled by solenoid valves and oil pressure. The force of the oil pressure on the piston must exceed the force of the spring. The pressure of the spring closes the nozzle valve, when the oil pressure stops having effect on the nozzle valve. The needle valve of the nozzle closes. The needle in the nozzle valve is complete withdrawn when the oil pressure in the control circuit is approx. 1800 kPa (approx. 18 bar).

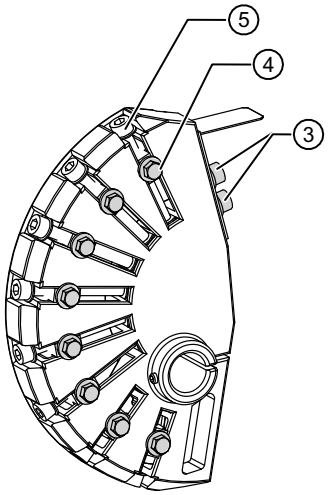
5.5.3 When to change nozzle

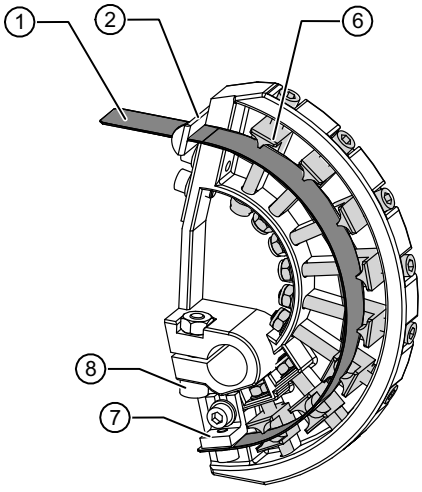
If the nozzle seems to be functioning improperly, you may clean the nozzle with diesel oil. If cleaning does not fix the problem, the properties of the nozzle have got worse and the nozzle has to be changed. The new nozzle has to be of same type as the original.

If there is an oil leak from the hole in the rear cover , change the nozzle or install a repair kit.

5.6. Adjusting cam

5.6.1 Adjusting cam components





1. Spring band

    1.1. Spring band guide
    1.2. Locking screws of spring band guide
    1.3. Adjusting guide locking screw
    1.4. Adjusting screw
    1.5. Adjusting guide
    1.6. Locking guide
    1.7. Axle lock (hexagon socket-head screw)

5.6.2 Adjusting cam function

The adjusting cam regulates the air flow into the burner relative to the quantity of atomized fuel.

Profile of the spring band sets the dampers positions at any point within the adjusting range. The profile of the band can be shaped with the adjusting guide and the adjusting screws.

The air dampers are connected to the adjusting cam with the adjusting lever. The adjusting lever moves according to the profile of the spring band. Combustion values have to be verified by doing a flue gas analysis with every adjusting cam indvidually.

5.6.3 Adjusting the spring band

Adjust the spring band by turning the adjusting screws

 CAUTION	The edges of the spring band are sharp. Unwary handling may cause slashes

5.6.4 Changing the spring band

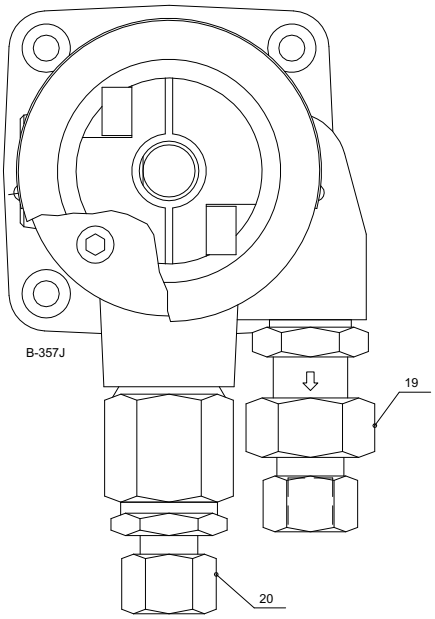
1. Remove the servomotor along with its locking plate from the compound-regulator.
2. Release the first adjusting lever from compound-regulator
3. Release the adjusting flange
4. Release the locking screw of the spring band and the spring band guide.
5. Replace the damaged spring band
6. Reassemble the components by following these instructions in reverse order

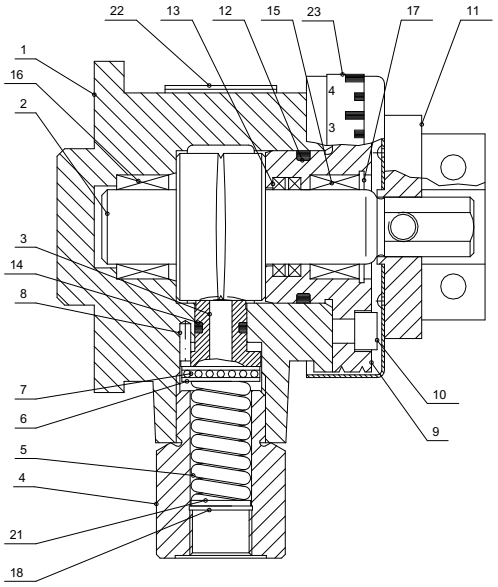
5.7. Oil regulator

5.7.1 Oil regulator function

A pointer indicates the turn angle of the servomotor shaft. At point 1 the dozing shaft is open. Return flow is at maximum and return pressure at minimum. At point 13 the dozing shaft is closed. Return flow is at minimum and return pressure is at maximum.

5.7.2 Oil regulator components





1. Body
2. Dosing shaft
3. Dosing nozzle
4. Nipple
5. Pressure spring
6. Thrust washer
7. Roller bearing
8. Spring cotter
9. Front flange
10. hexagonal socket screw
11. O-ring
12. X-ring
13. O-ring
14. Needle bearing
15. Needle bearing
16. Retainer ring
17. Retainer ring
18. Non-return valve
19. Coupling
20. Washer
21. Indicator
22. Scale

- B - Oil to valve
- C - Oil from valve

The pressure gauge on the regulator shows the return pressure. There is a number on the dosing shaft and on the indicator which shows the size of the groove on the shaft.

5.8. Trouble shooting

5.8.1 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 intackt 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.

5.8.2 Start failure

CONDITON	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	Faulty control unit	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 ◄	The control unit (connector 8) is not receiving required start signal from servomotor (limit switch II) 1. A break in control circuit 2. Faulty servomotor 3. Faulty control unit 4. Air dampers are stuck	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 ▲	Servomotor does not reach the position of full load of air dampers (limit switch I) 1. faulty servomotor 2. faulty limit switch in servomotor 3. Faulty control unit 4. jammed air dampers 5. incorrect setting on cam switch	1. Change the servomotor 2. Change the limit switch 3. Change control unit 4. Release the dampers, lubricate 5. Correct the settings
Burner motor starts, program remains at pre- purge period ▼.	Servomotor does not reach the position of ignition load of air dampers(limit switch III) 1. faulty servomotor 2. faulty limit switch in servomotor 3. Faulty control unit 4. jammed air dampers 5. incorrect setting on cam switch	1. Change the servomotor 2. Change the limit switch 3. Change control unit 4. Release the dampers, lubricate 5. Correct the settings

5.8.3 Motor failure

CONDITON	POSSIBLE CAUSE	ACTION
Burner motor does not start. Lockout occurs. Symbol **1**	1. Break in main circuit 2. Motor overload relay triggered 3. Fuse triggered 4. Faulty motor contactor 5. Faulty motor 6. Break in the motor control circuit 7. Faulty control unit 8. Return pressure too high (pressure switch triggered) 9. Faulty pressure switch max.	1. Repair break 2. Check relay trigger level , reset or change 3. reset or change fuse 4. change 5. change 6. Repair break 7. Change control unit 8. Examine, isolate fault 9. change the switch

5.8.4 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. Symbol**1**	1. Dirty or worn ignition electrodes, insulator cracked 2. Ignition electrodes too far apart 3. Ignition cable damaged 4. Faulty ignition transformer	1. Clean or change 2. Adjust according to instructions 3. Change the cables 4. Change the tarnsformer
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. Symbol**1**	1. Faulty control unit 2. Connection joint of ignition transformer is loose or damaged	1. Change control unit 2. Attach properly or change the joint

5.8.5 No flame establishment

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts, ignition is operational, after a short period of time a lockout occurs. Symbol **1**	1. Solenoid valve does not function 2. faulty coil on solenoid valve 3. damaged cable 4. faulty control unit	1. Change the valve 2. change the coil 3. Change the cable 4. Change the control unit
Nozzle valve does not open	1. nozzle needle does not open 2. Nozzle valve piston is stuck 3. Clogged throttle plug	1. Change the nozzle 2. Change the piston or the O-ring 3. Clean the plug
No spray from nozzle	Oil atomizing pressure is inadequate The nozzle O-ring is faultySuuttimen O-rengas on viallinen	See 'pump adjustments'. Cahnge the O-ring
Main solenoid valve does not open	1. Return oil pressure is too high 2. Faulty return oil pressure switch (max.)	1. Examine, isolate fault, repair 2. Change the pressure switch

5.8.6 Oil pump failure

CONDITION	POSSIBLE CAUSE	ACTION
Supplies no oil or atomizing pressure is too low	1. Dirty filter 2. Leaking suction line of transfer pump 3. Pump capacity decreased / pump is worn or faulty	1. Clean or change filter 2. Fix the leaks 3. Change the pump
Loud mechanical noise	1. Pump is cavitating / insufficent in-let pressure to the burner 2. In-let oil temperatur too low 3. In-let oil pipings connected incorrectly	1. Tighten joints, Clean the filter, check and adjust pressure 2. Raise in-let oil temperature 3. Check joints

5.8.7 Lock out after flame establishment

CONDITION	POSSIBLE CAUSE	ACTION
Flame forms. When burner runs to full load, flame extinguishes, shutdown occurs and then re-start (wire link B cut away from the plug section of the control unit).	1. Incorrect burner adjustment 2. Dirty filters 3. Clogged nozzle	1. Correct adjustments 2. Clean filters 3. Change the nozzle
Flame establishes. Shutdown occurs and then re-start.	Oil temperature is too low 1. oil preheater is faulty o 2. oil preheater's capacity is inadequate 3. incorrect setting on low limit of oil temperature	1. Repair or change the preheater 2. Check and adjust the inlet oil temperature

5.8.8 Oil flows into the combustion chamber

CONDITION	POSSIBLE CAUSE	ACTION
Oil flows into the combustion chamber during burning period	Nozzle valve and main oil valve or nozzle valve and non-return valve do not close properly	Clean, repair or replace
Oil leaks to the boiler during purging period	valves are leaking	Clean, repair or replace
Constant oil leak from the nozzle valve when the nozzle is closed	A leak in non-return valve or main solenoid valve	Change the valve

5.8.9 Flame monitoring fault (=lockout)

CONDITION	POSSIBLE CAUSE	ACTION
Burner motor starts, flame establishes, and then a lockout	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	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	1. Faulty flame detector 2. Faulty control unit 3. Incorrect flame signal due to extraneous light	1. Change the flame detector 2. Change control unit 3. Prevent extraneous light from reaching the flame detector
Lockout during shutdown Symbol ◂	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	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

5.8.10 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	1. Distance between diffuser disc and nozzle incorrect 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	1. Correct the adjustments 2. Correct the adjustments 3. Enhance air supply 4. Replace with an appropriate nozzle type of correct size 5. Change the nozzle

6. Technical data

6.1. Technical data

6.1.1 Burner technical data

Weight	RP-300 M : 380 kg RP-300 M-II : 390 kg RP-400 M : 525 kg RP-400 M-I : 540 kg RP-500 M : 540 kg RP-600 M : 545 kg
Capacity kW	RP-300 M : 790 - 3800 RP-300 M-II : 850 - 4500 RP-400 M : 960 - 3500 RP-400 M-I : 1300 -4700 RP-500 M : 1585 - 6060 RP-600 M : 1400 - 6750
Capacity kg/h	RP-300 M : 70 - 340 RP-300 M-II : 76 - 405 RP-400 M : 85 - 310 RP-400 M-I : 110 - 420 RP-500 M : 140 - 535 RP-600 M : 125 - 600
Control unit	LAL 2.25 / LOK16 / PLC
Oil pump	RP-300 M : SPF10R46 RP-300 M-II : SPF10R46 RP-400 M : SPF10R56 RP-400 M-I : SPF10R56 RP-500 M : SPF10R56 RP-600 M : SPF20R38
Oilhose connection (suction)	R 1"
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

Fan motor output kW	RP-300 M : 5,5 RP-300 M-II : 7,5 RP-400 M : 7,5 RP-400 M-I : 11 RP-500 M : 11 RP-600 M : 15
Fan motor current IN [A]	RP-300 M : 10,9 RP-300 M-II : 14,7 RP-400 M : 14,7 RP-400 M-I : 20,5 RP-500 M : 20,5 RP-600 M : 28,5
Fan motor efficiency [%]	RP-300 M : 84,5 RP-300 M-II : 85,1 RP-400 M : 85,1 RP-400 M-I : 90,8 RP-500 M : 90,8 RP-600 M : 88,1
Fan motor speed [r/min]	RP-300 M : 2830 RP-300 M-II : 2915 RP-400 M : 2915 RP-400 M-I : 2915 RP-500 M : 2915 RP-600 M : 2890

Pump motor output kW	RP-300 M : 1,5 RP-300 M-II : 1,5 RP-400 M : 2,2 RP-400 M-I : 2,2 RP-500 M : 2,2 RP-600 M : 2,2
Pump motor current IN [A]	RP-300 M : 3,4 RP-300 M-II : 3,4 RP-400 M : 4,6 RP-400 M-I : 4,6 RP-500 M : 4,6 RP-600 M : 4,6
Pump motor speed [rpm]	RP-300 M : 2850 RP-300 M-II : 2850 RP-400 M : 2860 RP-400 M-I : 2860 RP-500 M : 2860 RP-600 M : 2860
Pump motor efficiency [%]	RP-300 M : 79,7 RP-300 M-II : 79,7 RP-400 M : 81,8 RP-400 M-I : 81,8 RP-500 M : 81,8 RP-600 M : 81,8

Preheater capacity kW	RP-300 M : 12 RP-300 M-II : 12 RP-400 M : 18 RP-400 M-I : 18 RP-500 M : 18 RP-600 M : 24
Preheater current A	RP-300 M : 17,4 RP-300 M-II : 17,4 RP-400 M : 26,1 RP-400 M-I : 26,1 RP-500 M : 26,1 RP-600 M : 34,8

6.1.3 Suply voltage option 440 V 60 Hz

Fan motor output kW	RP-300 M : 6,4 RP-300 M-II : 8,6 RP-400 M : 8,6 RP-400 M-I : 14,5 RP-500 M : 14,5 RP-600 M : 17,5
Fan motor current IN [A]	RP-300 M : 10,8 RP-300 M-II : 14,6 RP-400 M : 14,6 RP-400 M-I : 24 RP-500 M : 24 RP-600 M : 27,5
Fan motor efficiency [%]	RP-300 M : 85,7 RP-300 M-II : 86,5 RP-400 M : 85,1 RP-400 M-I : 90,8 RP-500 M : 90,8 RP-600 M : 88,1
Fan motor speed [r/min]	RP-300 M : 3430 RP-300 M-II : 3430 RP-400 M : 3430 RP-400 M-I : 3485 RP-500 M : 3485 RP-600 M : 3485

Pump motor output kW	RP-300 M : 1,75 RP-300 M-II : 1,75 RP-400 M : 2,5 RP-400 M-I : 2,5 RP-500 M : 2,5 RP-600 M : 2,5
Pump motor current IN [A]	RP-300 M : 3,4 RP-300 M-II : 3,4 RP-400 M : 4,7 RP-400 M-I : 4,7 RP-500 M : 4,7 RP-600 M : 4,7
Pump motor speed [rpm]	RP-300 M : 3420 RP-300 M-II : 3420 RP-400 M : 3420 RP-400 M-I : 3420 RP-500 M : 3420 RP-600 M : 3420
Pump motor efficiency [%]	RP-300 M : 79,7 RP-300 M-II : 79,7 RP-400 M : 81,8 RP-400 M-I : 81,8 RP-500 M : 81,8 RP-600 M : 81,8

Preheater capacity kW	RP-300 M : 14,4 RP-300 M-II : 14,4 RP-400 M : 21,6 RP-400 M-I : 21,6 RP-500 M : 21,6 RP-600 M : 28,8
Preheater current A	RP-300 M : 19,2 RP-300 M-II : 19,2 RP-400 M : 28,8 RP-400 M-I : 28,8 RP-500 M : 28,8 RP-600 M : 38,4

6.1.4 Suply voltage option 690 V 50 Hz

Fan motor output kW	RP-300 M : 5,5 RP-300 M-II : 7,5 RP-400 M : 7,5 RP-400 M-I : 11 RP-500 M : 11 RP-600 M : 15
Fan motor current IN [A]	RP-300 M : 10,9 RP-300 M-II : 14,7 RP-400 M : 14,7 RP-400 M-I : 20,5 RP-500 M : 20,5 RP-600 M : 28,5
Fan motor efficiency [%]	RP-300 M : 84,5 RP-300 M-II : 85,1 RP-400 M : 85,1 RP-400 M-I : 90,8 RP-500 M : 90,8 RP-600 M : 88,1
Fan motor speed [r/min]	RP-300 M : 2830 RP-300 M-II : 2915 RP-400 M : 2915 RP-400 M-I : 2915 RP-500 M : 2915 RP-600 M : 2890

Pump motor output kW	RP-300 M : 1,5 RP-300 M-II : 1,5 RP-400 M : 2,2 RP-400 M-I : 2,2 RP-500 M : 2,2 RP-600 M : 2,2
Pump motor current IN [A]	RP-300 M : 1,9 RP-300 M-II : 1,9 RP-400 M : 2,5 RP-400 M-I : 2,5 RP-500 M : 2,5 RP-600 M : 2,5
Pump motor speed [rpm]	RP-300 M : 2870 RP-300 M-II : 2870 RP-400 M : 2885 RP-400 M-I : 2885 RP-500 M : 2885 RP-600 M : 2885
Pump motor efficiency [%]	RP-300 M : 80,1 RP-300 M-II : 80,1 RP-400 M : 83,6 RP-400 M-I : 83,6 RP-500 M : 83,6 RP-600 M : 83,6

Preheater capacity kW	RP-300 M : 12 RP-300 M-II : 12 RP-400 M : 18 RP-400 M-I : 18 RP-500 M : 18 RP-600 M : 24
Preheater current A	RP-300 M : 10 RP-300 M-II : 10 RP-400 M : 15 RP-400 M-I : 15 RP-500 M : 15 RP-600 M : 20

6.1.5 Suply voltage option 690 V 60 Hz

Fan motor output kW	RP-300 M : 6,4 RP-300 M-II : 8,6 RP-400 M : 8,6 RP-400 M-I : 14 RP-500 M : 14 RP-600 M : 17,5
Fan motor current IN [A]	RP-300 M : 7 RP-300 M-II : 9,1 RP-400 M : 9,1 RP-400 M-I : 16,9 RP-500 M : 16,9 RP-600 M : 20,2
Fan motor efficiency [%]	RP-300 M : 86,4 RP-300 M-II : 87,6 RP-400 M : 87,6 RP-400 M-I : 88,9 RP-500 M : 88,9 RP-600 M : 91,6
Fan motor speed [r/min]	RP-300 M : 3465 RP-300 M-II : 3455 RP-400 M : 3455 RP-400 M-I : 3513 RP-500 M : 3513 RP-600 M : 3513

Pump motor output kW	RP-300 M : 1,75 RP-300 M-II : 1,75 RP-400 M : 2,5 RP-400 M-I : 2,5 RP-500 M : 2,5 RP-600 M : 2,5
Pump motor current IN [A]	RP-300 M : 2,3 RP-300 M-II : 2,3 RP-400 M : 3,1 RP-400 M-I : 3,1 RP-500 M : 3,1 RP-600 M : 3,1
Pump motor speed [rpm]	RP-300 M : 3460 RP-300 M-II : 3460 RP-400 M : 3470 RP-400 M-I : 3470 RP-500 M : 3470 RP-600 M : 3470
Pump motor efficiency [%]	RP-300 M : 80,1 RP-300 M-II : 80,1 RP-400 M : 80,8 RP-400 M-I : 80,8 RP-500 M : 80,8 RP-600 M : 80,8

Preheater capacity kW	RP-300 M : 12 RP-300 M-II : 12 RP-400 M : 18 RP-400 M-I : 18 RP-500 M : 18 RP-600 M : 24
Preheater current A	RP-300 M : 10 RP-300 M-II : 10 RP-400 M : 15 RP-400 M-I : 15 RP-500 M : 15 RP-600 M : 20

6.2. Control unit technical Data

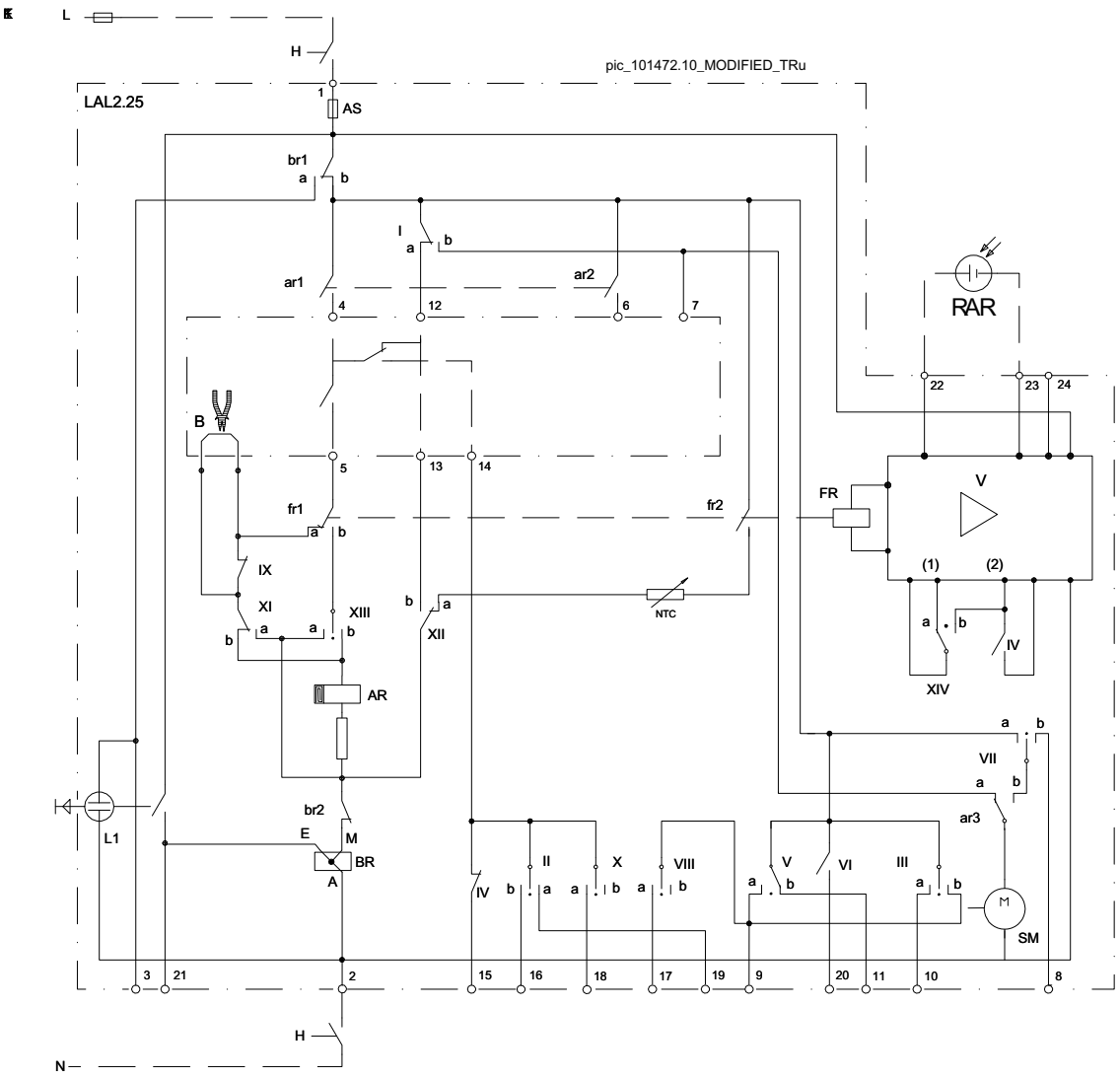
6.2.1 Technical data (LAL 1.25 and 2.25)

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

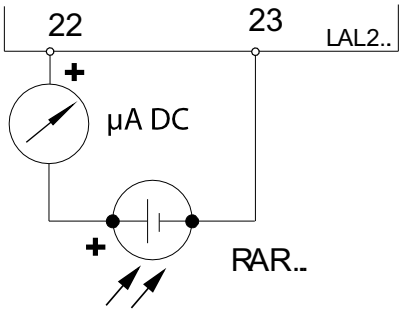
*) The wire link B has been cut away at the factory. This allows an automatic repetition of start-up sequence, if the flame extinguishes during burner operation. If the wire link B has not been cut away, lockout occurs, if the flame is extinguished during burner operation.

6.4. Flame Detector

6.4.1 Technical data

TYPE	RAR...
Min. required detector current with 230 VAC	6,5 µA
Max. permissible detector current without flame	—
Max. possible detector current	25 µA
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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