User Manuel

LAL 1.25

Siemens

Oil Burner Controls

English

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Oil burner controls

-For oil atomizing burners of medium to large capacity
-For multistage or modulating burners in intermittent operation
-With or without air pressure supervision for checked air damper control
-Flame supervision
– with photoresistive detector QRB
– or blue-flame detector QRC1
– or silicon photocell detector RAR9
- Suitable for use with air heaters (WLE)
The LAL and this Data Sheet are intended for OEMs which integrate the oil burner controls in their products!

Warning notes

To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!
Do not open, interfere with or modify the unit!
-All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
-Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals
-Each time work has been carried out (mounting, installation, service work, etc.),
check to ensure that wiring is in an orderly state and make the safety checks as described in «Commissioning notes»
- Press the lockout reset button only manually (applying a force of no more than 10 N), without using any tools or pointed objects
-Do not press the lockout reset button on the unit or the remote reset button (input 21) for more than 10 seconds since this will damage the lockout relay in the unit
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage
-For safety reasons – self-test of the flame supervision circuit, etc. – at least one controlled shutdown must take place every 24 hours

Mounting notes

-Ensure that the relevant safety regulations are complied with
- Connect the earthing lug inside the terminal base to burner ground using a screw with a lockwasher

Note!
In applications involving air heaters (WLE), or in the case of oil burners with a maximum throughput of >30 kW/h, removing wire link B is not permitted.

Installation notes

Always run high-voltage ignition cables separately, with the greatest possible distance to the unit and to other cables
-Live and neutral conductors must not be mixed up
-Install switches, fuses, earthing, etc., in compliance with local regulations
- Make certain that the maximum permissible current rating of the connection terminals will not be exceeded
- The insulation on internal wiring which is subjected to the mains voltage must withstand the electrical stress occurring during correct use

Electrical connection of the flame detector

It is important to achieve practically disturbance- and loss-free signal transmission:
-Never run the detector cable together with other cables
– Line capacitance reduces the magnitude of the flame signal
– Use a separate cable
-Observe the permissible cable lengths (refer to «Technical data»)

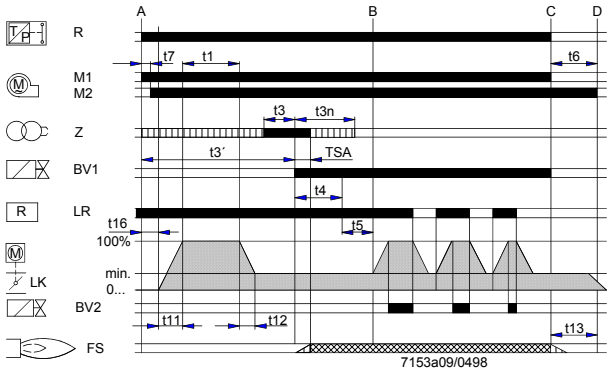
Commissioning notes

When commissioning the plant or when doing maintenance work, make the following safety checks:
Safety check to be carried out
"Anticipated response"
a) Burner startup with flame detector darkened
"Lockout at the end of safety time (TSA)"
b) Burner startup with flame detector exposed to extraneous light
"Lockout after 40 seconds at the latest"
c) With wire strap «B»: "imulation of loss of flame during operation. For that purpose, darken the flame detector during operation and maintain that state
"Lockout"
d) Without wire strap «B»: Simulation of loss of flame during operation. For that purpose, darken the flame detector during operation and maintain that state
"Repetition followed by lockout at the end of «TSA»"
e) Burner startup with response of air pressure switch
"Prevention of startup/lockout during prepurge time"
f) Burner operation with simulated air pressure failure
"Immediate lockout"
Engineering notes
- Install switches, fuses, earthing, etc., in compliance with local regulations
-Connect valves and other plant components as specified in the burner manufacturer's documentation
1. Connect safety limit thermostats (manual reset) in the line (e.g. «SB»)
2 .Remote reset
When connecting lockout reset button «EK2» between terminals 21 and
- terminal 3: For remote reset only
- terminal 1: For remote reset and remote emergency shutdown
3. With LAL1…: Required switching capacity of
- switching devices connected between terminals 4 and 5 (refer to «Technical data»)
With LAL2 / LAL3: Required switching capacity of
- switching devices connected between terminal 12 and «LP» (refer to «Technical data»)
- «LP» (refer to «Technical data»)
4. When using series connection, the control contacts of other devices contained in the burner plant must be connected as follows:
- to terminal 4 or 5 contacts that must be closed from startup to controlled shutdown otherwise no startup or shutdown

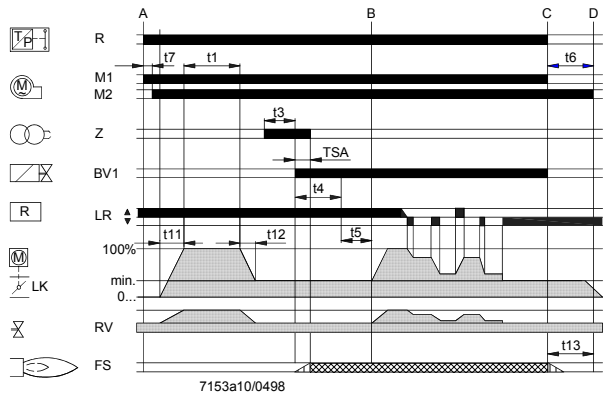
- to terminal 12 (not with LAL1) - contacts that must only be closed on startup otherwise no startup
- to terminal 14 (not with LAL1) - contacts that must be closed no later than at the beginning of short preignition or long preignition and that must remain closed until controlled shutdown occurs
-otherwise lockout
5. Maximum current draw, refer to «Technical data»
6. «Z» connected to terminal 15 short and long preignition
- For use in applications with short preignition, the oil supply must be equipped with two shutoff valves connected in series.
Observe the following:
EN 298:2012, Section 7.101.3.3 Prepurge time for oil burner control systems and the corresponding application standards.
7. Connection of «BVx» to terminal 20, refer to «Connection examples»
8. When using burners without air damper, or with an air damper not controlled and monitored by the LAL…, terminal 8 must be connected to terminal 6
9. Wire link «B» clearly marked on the underside of the LAL…
When wire link «B» is fitted, the LAL initiates lockout if loss of flame occurs during operation. For repetition of the startup sequence, wire link «B» on the plug-in section of the LAL must be cut away. Just cutting is not permitted!
Note!
In applications involving air heaters (WLE), or in the case of oil burners with a maximum throughput of >30 kW/h, removing wire link B is not permitted.
10. For the permissible lengths and laying of detector cables, refer to «Flame supervision»

Function

2-stage expanding flame burner



Modulating expanding flame burner



Legend

BV...	Fuel valve
FS	Flame signal amplifier
LK	Air damper
LR	Load controller
M...	Fan or burner motor
R	Control thermostat or pressurestat
RV	Modulating fuel valve
Z	Ignition transformer
A	Start command by «R»
B	Operating position of burner
B-C	Burner operation
C	Controlled shutdown
C-D	Sequence switch travels to start position «A», postpurging
D-A	End of control sequence
t1	Prepurge time with air damper open
t3	Preignition time
t4	Interval fuel valve 1 (BV1) - fuel valve 2 (BV2) or fuel valve 1 (BV1) - load controller (LR)
t5	Interval between voltage at terminal 19 and terminal 20
t6	Postpurge time
t7	Interval between start command and power at terminal 7
t11	Air damper running time to the OPEN position
t12	Air damper running time to the low-fire position
t13	Permissible afterburn time
TSA	Ignition safety time

General

The following features of the LAL afford a high level of safety:

- Detector and flame simulation test are restarted on completion of the afterburn time «t13». Open or not fully closed fuel valves immediately initiate lockout at the end of afterburn time «t13». The test ends on completion of the prepurge time «t1» of the next startup sequence
- The correct functioning of the flame supervision circuit is automatically checked during each burner startup sequence
- The control contacts for the release of fuel are checked to ensure they have not welded postpurge time «t6»
- A built-in unit fuse protects the control contacts against overloads

Control of the burner

- Burner operation with or without postpurge
- Fan motors with a current draw of up to 4 A can be connected directly → starting current max. 20 A (for max. 20 ms)
- Separate control outputs for
  – preignition from start command
  – postignition until shortly before the burner startup sequence is completed
  – short preignition with postignition up to the end of «TSA»
- Separate control outputs for the actuator's positioning directions «OPEN», «CLOSE» and «MIN»
- Checked air damper operation to ensure prepurging with the nominal air volume
- Checked positions:
  - «CLOSED» or «MIN» on startup → low-fire position
  - «OPEN» at the beginning of prepurging
  - «MIN» on completion of prepurging
  If the actuator does not drive the air damper to the required position, the burner startup sequence will be stopped
- 2 control outputs for the release of the second and third output stage or for load control
- When load control is enabled, the control outputs for the actuator will be galvanically separated from the burner control's control section
- Connection facilities for
  – remote lockout warning device
  – remote reset
  – remote emergency shutdown
- In addition, with LAL2 / LAL3:
  – possibility of air pressure supervision with functional test of the air pressure monitor on startup
  – possibility of semiautomatic burner startup

Flame supervision

- Flame detector and flame simulation test are made automatically during burner off times and the prepurge time «t1»
- If loss of flame occurs during operation, the burner control will initiate lockout
- If automatic repetition of the startup sequence is required, the clearly marked wire link on the plug-in section of the LAL must be cut away → start repetition

Preconditions for burner startup

- Burner control is not in the lockout position
- Sequence switch is in its start position
  → with LAL1, voltage is present at terminals 4 and 11
  → with LAL2 / LAL3, voltage is present at terminals 11 and 12
- Air damper is closed
- End switch «z» for the «CLOSED» position must feed power from terminal 11 to terminal 8
- Contact of the limit thermostat or pressure switch «W» and the contacts of any other switching devices in the control loop between terminals 4 and 5 must be closed → e.g. a control contact for the oil preheaters temperature

With the exception of LAL1 Normally closed contact of the air pressure switch must be closed → «LP» test.

DESCRIPTION OF OPERATION WITH LIGHT OIL

The cyclic relay control box carries out the ignition programme by starting up the fan motor and thus the pump in order to effect the pre-ventilation and light oil pre-circulation phases.
The pressure of the air supplied by the fan must be sufficient to let the relative pressure switch come into operation; on the contrary the control box stops in block position. Oil from the pump reaches the atomizer unit and is obliged to circulate within it because the passage leading to the outward and return nozzles are closed.
This closure is carried out by "closing pins" applied to the ends of the rods. These "pins" are pressed against by strong which are situated at the apposite ends of the rods. The oil circulates, comes out of the atomizer unit return and arrives at the return pressure regulator. It passes through this and reaches the pump return and from there it is discharged back into the return.
Oil circulation, as described above, should be carried out at a pressure value slightly higher (by some bar) than the minimum pressure at which the return pressure regulator has been set (10 † 12 bar). Duration of the pre-ventilation and oil precirculation phase is not 22,5 seconds, as foreseen by the control box, because it is effected when the air shutter is in an open position. The pre-ventilation and pre-circulation time is calculated by summing together the times of the following manoeuvres: the modulation motors opening stroke + pre-ventilation time foreseen by the control box + modulation motors closing stroke until ignition air position Subsequently, the control box continues carrying out the ignition programme by connecting the ignition transformer which, in turn, feeds the electrodes with high voltage. High voltage between the electrodes primes the electric spark for ignition of the fuel/air mixture. 2,5 seconds after the ignition spark appears, the control box carries voltage to the magnet which, by means of appropriate levers, moves backwards the two rods which intercept the flow (outward and return) of light oil to the nozzle. This moving backwards of the rods also determines a closing of the passage (by-pass) inside the atomizer unit.
Consequently, the pump pressure is taken to the normal value of about 20 † 22 bar.
Deviation of the two rods from the closing seat, now permits the fuel to enter the nozzle at the pressure at which the pump has been regulated at (20 † 22 bar), and comes out of the nozzle adequately atomized. The return pressure, which determines delivery to the furnace, is regulated by the return pressure regulator. The value of the ignition flow rate (minimum delivery) should be about 10 † 12 bar. The atomized light oil which comes out of the nozzle is mixed with air supplied by the fan and is then ignited by the spark of the electrodes. Flame presence is detected by the photoresistance. The programme proceeds and, after 5 seconds, surpasses the "shut down" position, disconnects the ignition transformer, and then connects the modulation circuit. The modulation motor commands an increase in the delivery of fuel and combustion air at the same time. The increase in fuel delivery is determined by a disk with a varied profile which, by rotating, can determine a greater compression of the return pressure regulator spring and thus an increase in the pressure itself.
When the return pressure increases, there is also a corresponding increase in fuel delivery.
There should also be an adequate increase in combustion air to meet the increase in fuel delivery. Adjustment can be carried out at first regulation by operating the screws which vary the profile of the command disc of the combustion air regulator.
Fuel and combustion air delivery both increase at the same time until they reach maximum value (light oil pressure at the return pressure regulator is equal to about 18 † 20 bar if the pressure at the pump is at the value of 20 † 22 bar).
Fuel and combustion air delivery keeps its maximum value until the temperature of the boiler (pressure if we have a steam boiler) approaches the set value on the thermostat (or pressure switch) of the second stage which determines the return of the delivery regulation servomotor (fuel/air) in the apposite direction to the previous movement thus gradually reducing the delivery of the gas oil and of its combustion air to a minimum value.
If even with a minimum fuel and combustion air delivery a maximum temperature is reached (pressure if we have a steam boiler), at the set value the thermostat (pressure switch if we have a steam boiler) determines the complete stop of the burner. When the temperature lowers (pressure if we have a steam boiler) below the value causing the activation of the stopping device, the burner starts up again as described above.
Under regular working conditions, the 2nd stage thermostat (or pressure switch) detects any variation, in the boiler load and automatically requires the adjustment of the gas oil delivery and of its combustion air to the delivery regulation servomotors (fuel/air). Thus the delivery regulation system (fuel/air) reaches a balance position corresponding to a fuel delivery and to its combustion air delivery equal to the heat amount required by the boiler.