

## Light oil burner

Progressive two stage or modulating operation

CODE	MODEL	TYPE
20034452	RL 300/E	34452X



<b>1</b>	<b>Information and general instructions</b>	<b>3</b>
1.1	Information about the instruction manual	3
1.1.1	Introduction	3
1.1.2	General dangers	3
1.1.3	Safety precautions	3
1.1.4	Danger: live components	3
1.2	Guarantee and responsibility	4
1.2.1	Owner's responsibility	4
<b>2</b>	<b>Safety and prevention</b>	<b>5</b>
2.1	Introduction	5
2.2	Personnel training	5
<b>3</b>	<b>Technical description of the burner</b>	<b>6</b>
3.1	Technical data	6
3.2	Burner models designation	6
3.3	Burner dimensions	7
3.4	Packaging - weight - Approximate measurements	7
3.5	Standard equipment	7
3.6	Firing rate	8
3.6.1	Modulation ratio	8
3.7	Test boiler	8
3.8	Burner description	9
3.8.1	Panel board description	10
3.9	Control box for the air/fuel ratio (LMV51...)	11
3.10	Actuators	16
<b>4</b>	<b>Installation</b>	<b>17</b>
4.1	Notes on safety for the installation	17
4.2	Handling	17
4.3	Preliminary checks	17
4.4	Operation position	17
4.5	Preparing the boiler	18
4.5.1	Boring the boiler plate	18
4.5.2	Blast tube length	18
4.6	Securing the burner to the boiler	18
4.7	Accessibility to the interior of the combustion head	18
4.8	Nozzles	19
4.8.1	Recommended nozzle	19
4.8.2	Choice of nozzle	19
4.8.3	Nozzle installation	19
4.9	Electrode and ignition pilot positioning	19
4.10	Pilot gas train line	20
4.11	Combustion head setting	20
4.12	Light oil supply	21
4.12.1	Double-pipe circuit	21
4.12.2	The loop circuit	21
4.12.3	Hydraulic connections	21
4.12.4	Hydraulic system layout	22
4.12.5	Pressure variator	22
4.13	Pump	23
4.13.1	Technical data	23
4.13.2	Pump priming	23
4.14	Electrical wiring	24

4.14.1	Notes on safety for the electrical wiring . . . . .	24
4.15	Thermal relay calibration . . . . .	25
4.15.1	Electro-mechanical thermal relay . . . . .	25
4.15.2	Electronic thermal relay . . . . .	25
<b>5</b>	<b>Start-up, calibration and operation of the burner . . . . .</b>	<b>26</b>
5.1	Notes on safety for the first start-up. . . . .	26
5.2	Adjustments before first firing . . . . .	26
5.3	Burner firing . . . . .	26
5.4	Air/fuel control and power modulation system . . . . .	27
5.4.1	Combustion air adjustment . . . . .	27
5.4.2	Air gate adjustment for maximum output. . . . .	27
5.5	Rotation of fan motor . . . . .	27
5.6	Pressure switches calibration . . . . .	28
5.6.1	Air pressure switch . . . . .	28
5.6.2	Low oil pressure switch . . . . .	28
5.7	Final checks (with the burner working) . . . . .	28
<b>6</b>	<b>Maintenance . . . . .</b>	<b>29</b>
6.1	Notes on safety for the maintenance . . . . .	29
6.2	Maintenance programme. . . . .	29
6.2.1	Maintenance frequency . . . . .	29
6.2.2	Checking and cleaning . . . . .	29
6.2.3	Opening the burner . . . . .	30
6.2.4	Closing the burner . . . . .	30
<b>A</b>	<b>Appendix - Spare parts . . . . .</b>	<b>31</b>
<b>B</b>	<b>Appendix - Electrical panel layout . . . . .</b>	<b>34</b>
<b>C</b>	<b>Appendix - Burner start up report. . . . .</b>	<b>47</b>

**1 Information and general instructions**

**1.1 Information about the instruction manual**

**1.1.1 Introduction**

The instruction manual supplied with the burner:

- is an integral and essential part of the product and must not be separated from it; it must therefore be kept carefully for any necessary consultation and must accompany the burner even if it is transferred to another owner or user, or to another system. If the manual is lost or damaged, another copy must be requested from the Technical Assistance Service of the area;
- is designed for use by qualified personnel;
- offers important indications and instructions relating to the installation safety, start-up, use and maintenance of the burner.

**Symbols used in the manual**

In some parts of the manual you will see triangular DANGER signs. Pay great attention to these, as they indicate a situation of potential danger.

**1.1.2 General dangers**

The **dangers** can be of **3 levels**, as indicated below.



Maximum danger level!  
This symbol indicates operations which, if not carried out correctly, **cause** serious injury, death or long-term health risks.



This symbol indicates operations which, if not carried out correctly, **may cause** serious injury, death or long-term health risks.



This symbol indicates operations which, if not carried out correctly, **may cause** damage to the machine and/or injury to people.

**1.1.3 Safety precautions**

Good safety practices must be used when working on burner equipment. The potential energy in the electrical supply, fuel and related equipment must be handled with extreme care to prevent equipment failures, injuries and potential death.



If you smell gas, open window, extinguish any open flames, stay away from electrical switches, evacuate the building and immediately call the gas company.

If this equipment is not installed, operated, operated and maintained in accordance with the manufacturers instructions, this product could expose you to substances in fuel or from fuel combustion which can cause death or serious illness.

Improper servicing of this equipment may create a potential hazard to equipment and operators.

**Servicing must be done by a fully trained and qualified personnel.**

**1.1.4 Danger: live components**



This symbol indicates operations which, if not carried out correctly, lead to electric shocks with lethal consequences.

Other symbols



**ENVIRONMENTAL PROTECTION**

This symbol gives indications for the use of the machine with respect for the environment.

- This symbol indicates a list.

**Abbreviations used**

Ch.	Chapter
Fig.	Figure
Pag.	Page
Sec.	Section
Tab.	Table

**Delivery of the system and the instruction manual**

When the system is delivered, it is important that:

- The instruction manual is supplied to the user by the system manufacturer, with the recommendation to keep it in the room where the heat generator is to be installed.
- The instruction manual shows:
  - the serial number of the burner;

.....

- the address and telephone number of the nearest Assistance Centre;

.....  
 .....  
 .....

- The system supplier carefully informs the user about:
  - the use of the system,
  - any further tests that may be necessary before the system is started up,
  - maintenance and the need to have the system checked at least once a year by the manufacturer or another specialised technician.

To ensure a periodic check, the manufacturer recommends the drawing up of a Maintenance Contract.

## 1.2 Guarantee and responsibility

The manufacturer guarantees its new products from the installation date, in accordance with the regulations in force and/or the sales contract. At the moment of the first start-up, check that the burner is integral and complete.



Failure to observe the information given in this manual, operating negligence, incorrect installation and the carrying out of non authorised modifications will result in the annulment by the manufacturer of the guarantee that it supplies with the burner.

In particular, the rights to the guarantee and the responsibility will no longer be valid, in the event of damage to things or injury to people, if such damage/injury was due to any of the following causes:

- incorrect installation, start-up, use and maintenance of the burner;
- improper, incorrect or unreasonable use of the burner;
- intervention of unqualified personnel;
- carrying out of non authorised modifications on the equipment;
- use of the burner with safety devices that are faulty, incorrectly applied and/or not working;
- installation of untested supplementary components on the burner;
- powering of the burner with unsuitable fuels;
- faults in the fuel power supply system;
- use of the burner even following an error and/or an irregularity;
- repairs and/or overhauls incorrectly carried out;
- modification of the combustion chamber with inserts that prevent the regular development of the flame, as structurally established;
- insufficient and inappropriate surveillance and care of those burner components most subject to wear and tear;
- use of non-original components, including spare parts, kits, accessories and optionals;
- force majeure.

**the manufacturer furthermore declines any and every responsibility for the failure to observe the contents of this manual.**

### 1.2.1 Owner's responsibility

Please pay attention to the Safety Warnings contained within this instruction manual. Keep this manual for your records and provide it to your qualified service agency for use in professionally setting up and maintaining your burner.

Your burner will provide years of efficient operation if it is professionally installed and maintained by a qualified service technician. If at any time the burner does not appear to be operating properly, immediately contact your qualified service agency for consultation.

We recommend annual inspection/service of your gas heating system by a qualified service agency.

Failure to follow these instructions, misuse, or incorrect adjustment of the burner could lead to equipment malfunction and result in asphyxiation, explosion or fire.



If you smell gas:

- Do not touch any electrical items.
- Open all windows.
- Close all gas supply valves.
- Contact your local gas authority immediately.
- Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.
- Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.
- Refer to this manual for instructional or additional information.
- Consult a certified installer, service representative or the gas supplier for further assistance.
- Burner shall be installed in accordance with manufacturers requirements as outlined in this manual, local codes and authorities having jurisdiction.

## 2

## Safety and prevention

**2.1 Introduction**

The burners have been designed and built in compliance with current regulations and directives, applying the known technical rules of safety and envisaging all the potential danger situations.

It is necessary, however, to bear in mind that the imprudent and clumsy use of the equipment may lead to situations of death risk for the user or third parties, as well as the damaging of the burner or other items. Inattention, thoughtlessness and excessive confidence often cause accidents; the same applies to tiredness and sleepiness.

It is a good idea to remember the following:

- The burner must only be used as expressly described. Any other use should be considered improper and therefore dangerous. In particular:
  - it can be applied to boilers operating with water, steam, diathermic oil, and to other users expressly named by the

manufacturer;

the type and pressure of the fuel, the voltage and frequency of the electrical power supply, the minimum and maximum deliveries for which the burner has been regulated, the pressurisation of the combustion chamber, the dimensions of the combustion chamber and the room temperature must all be within the values indicated in the instruction manual.

- Modification of the burner to alter its performance and destinations is not allowed.
- The burner must be used in exemplary technical safety conditions. Any disturbances that could compromise safety must be quickly eliminated.
- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- Only those parts envisaged by the manufacturer can be replaced.

**2.2 Personnel training**

The user is the person, body or company that has acquired the machine and intends to use it for the specific purpose. He is responsible for the machine and for the training of the people working around it.

The user:

- Undertakes to entrust the machine exclusively to suitably trained and qualified personnel.
- Must take all the measures necessary to prevent unauthorised people gaining access to the machine.
- Undertakes to inform his personnel in a suitable way about the application and observance of the safety instructions. With that aim, he undertakes to ensure that everyone knows the use and safety instructions for his own duties.
- Must inform the manufacturer if faults or malfunctioning of the accident prevention systems are noticed, along with any presumed danger situation.

- Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.
- Personnel must follow all the danger and caution indications shown on the machine.
- Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.
- Personnel are obliged to inform their superiors of every problem or dangerous situation that may arise.
- The assembly of parts of other makes, or any modifications, can alter the characteristics of the machine and hence compromise operating safety. The manufacturer therefore declines any and all responsibility for any damage that may be caused by the use of non-original parts.

### 3 Technical description of the burner

#### 3.1 Technical data

Model		RL 300/E	
Output <sup>(1)</sup>	Min - Max	MBtu/hr	2272 - 13824
Delivery <sup>(1)</sup>		GPH	16 - 99
Fuel		Oil no. 2	
Operation		Progressive two-stage or modulating	
Nozzles	number	1	
Standard applications		Boilers: water, steam, diathermic oil	
Ambient temperatur	°F	32 - 104 (0 - 40° C)	
Combustion air temperature	°F max	140 (60° C)	
Electrical supply	Ph/V/Hz	3/575/60	
Fan motor	rpm	3500	
	V	333/575	
	HP	7.6	
	A	15.8 - 8.7	
Pump motor	rpm	3470	
	V	575	
	HP	2	
	A	2.2	
Ignition transformer	V1 - V2	120V - 1 x 7 kV	
	I1 - I2	1.6 A - 23 mA	
Pump	delivery at 290 PSI (GPH)	218	
	pressure range (PSI)	100 - 580	
	fuel temperatur (°F max)	284 (140°C)	
Electrical power consumption	HP	11.9	
Electrical protection		NEMA 1	
Noise levels <sup>(2)</sup>	dba	80	

**Tab. A**

<sup>(1)</sup> Reference conditions: Ambient temperature 68° C - Barometric pressure 394 "WC - Altitude 329 ft- Fuel GCV.

<sup>(2)</sup> Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.

#### 3.2 Burner models designation

Model	Electrical supply	Starting	Code
RL 300/E	TC 3/575/60	Direct	20034452

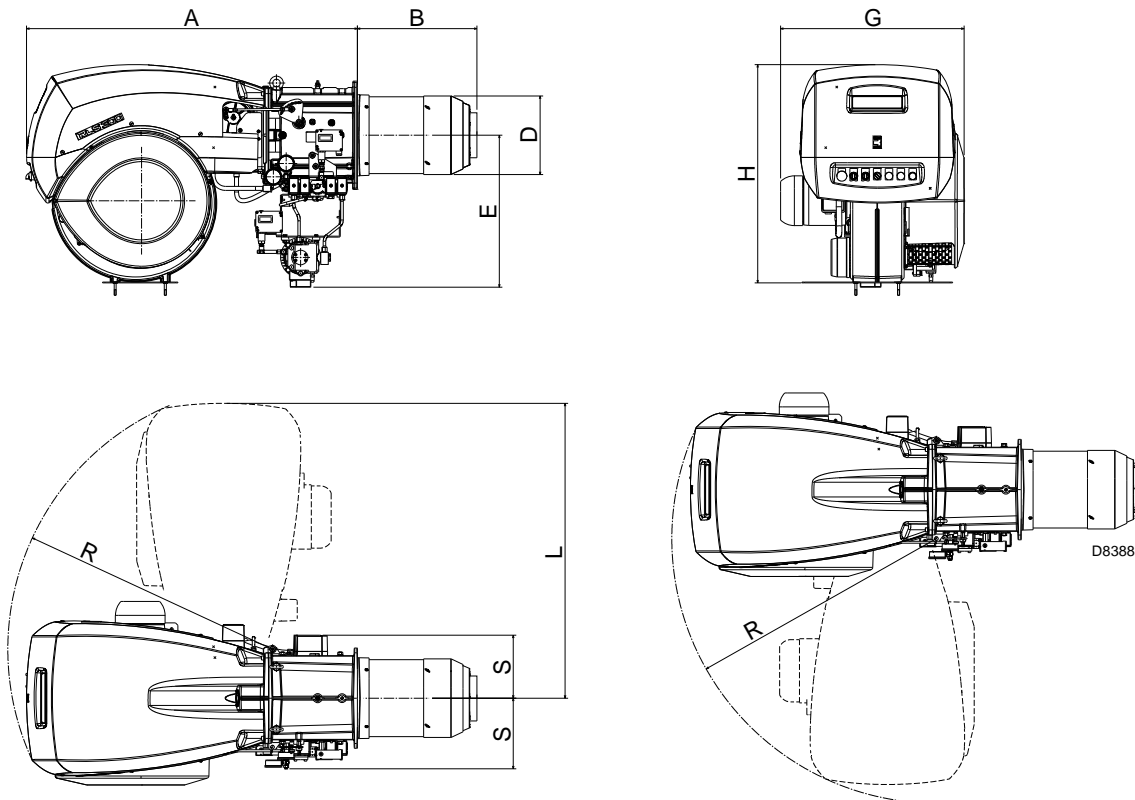


**3.3 Burner dimensions**

The maximum dimensions of the burner are given in Fig. 1.

Bear in mind that inspection of the combustion head requires the burner to be opened by rotating the rear part on the hinge.

The overall dimensions of the burner when open are indicated by L and R.



**Fig. 1**

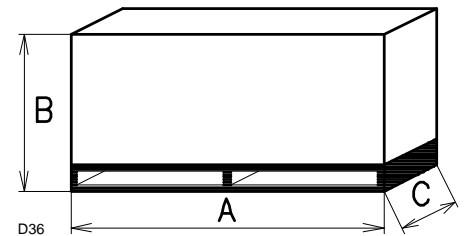
mm	A	B	D	E	G	H	L	R	S
RL 300/E	52 3/16"	20 1/2"	12 5/16"	23 5/32"	28 11/32"	34 9/64"	14 1/32"	41 17/32"	12 19/32"

**Tab. B**

**3.4 Packaging - weight - Approximate measurements**

The burners stands on a wooden base which can be lifted by fork-lifts. Outer dimensions of packaging are indicated in Fig. 2.

The weight of the burner complete with packaging is indicated in Tab. C.



**Fig. 2**

inch	A	B	C	lbs
RL 300/E	77 11/64"	37 1/64"	38 3/16"	496

**Tab. C**

**3.5 Standard equipment**

- 1 - Thermal insulation screen
- 4 - Screws to secure the burner flange to the boiler: M 18 x 70
- 2 - Spacers (see Fig. 18, page 20)
- 1 - Instruction booklet and spare parts list

**3.6 Firing rate**

**MAXIMUM OUTPUT** must be selected in the hatched area of the diagram (Fig. 3).

**MINIMUM OUTPUT** must not be lower than the minimum limit shown in the diagram:

RL 300/E = 2272 MBtu/h



The firing rate area values have been obtained considering a surrounding temperature of 68 °F, and an atmospheric pressure of 394 "WC (approx. 329 ft above sea level) and with the combustion head adjusted as shown on page 20.

**3.6.1 Modulation ratio**

The modulation ratio, determined using test boilers, is 4 : 1.

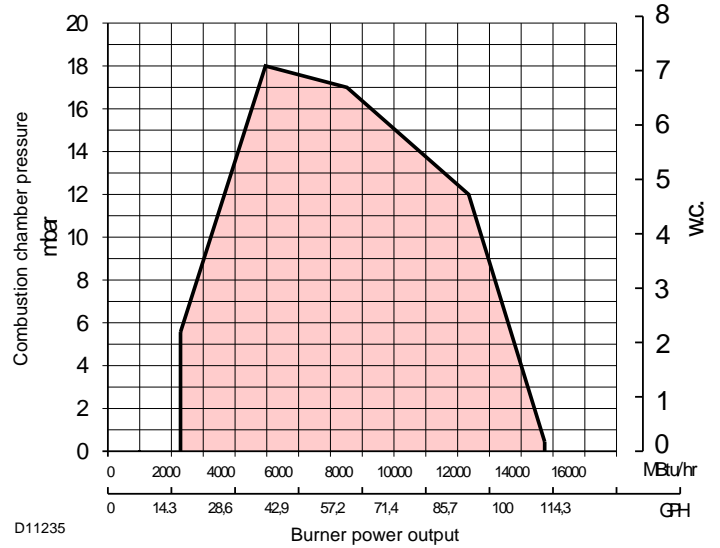


Fig. 3

**3.7 Test boiler**

The firing rates were set in relation to special test boilers.

Fig. 4 indicates the diameter and length of the test combustion chamber.

**Example:**

Output 18.500 MBtu/hr - diameter 39.4 inch - length 16.5 ft.

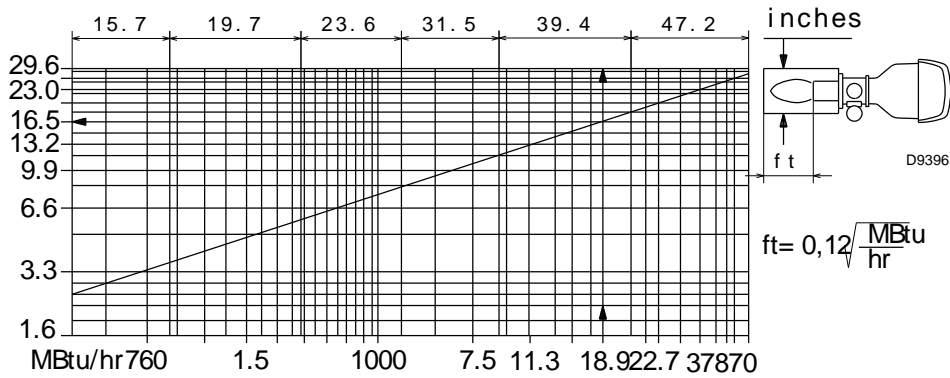


Fig. 4

3.8 Burner description

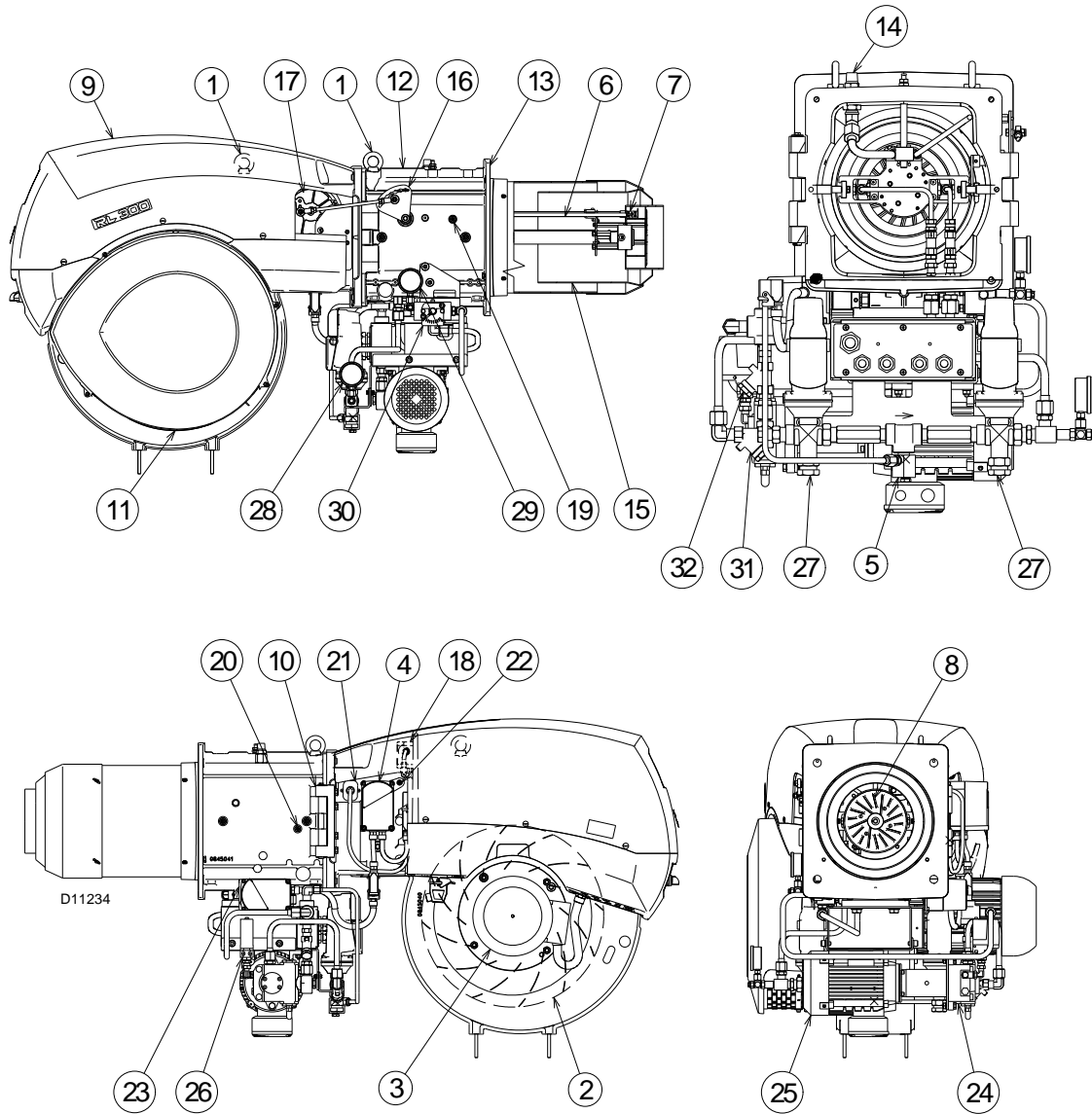


Fig. 5

- |  |                                   |
|--|-----------------------------------|
| 1 Lifting eyebolts   | 21 QRI cell                       |
| 2 Fan  | 22 Air pressure test point "+"    |
| 3 Fan motor  | 23 Oil modulator valve servomotor |
| 4 Air gate valve servomotor                                | 24 Pump                           |
| 5 Security relief valve                                    | 25 Pump motor                     |
| 6 Combustion head  | 26 Minimum oil pressure switch    |
| 7 Ignition pilot   | 27 Oil shutoff valve              |
| 8 Flame stability disk                                     | 28 Nozzle delivery pressure gauge |
| 9 Electric panel board - cover                             | 29 Nozzle return pressure gauge   |
| 10 Hinge for opening burner                                | 30 Oil modulator                  |
| 11 Air inlet to fan  | 31 Strainer                       |
| 12 Manifold  | 32 Check valve                    |
| 13 Thermal insulation screen for securing burner to boiler |                                   |
| 14 Ignition pilot attachment                               |                                   |
| 15 Shutter   |                                   |
| 16 Lever for movement of combustion head                   |                                   |
| 17 Gears for movement of air damper                        |                                   |
| 18 Air pressure switch (differential operating type)       |                                   |
| 19 Air pressure test point                                 |                                   |
| 20 Air pressure test point "-"                             |                                   |



The burner can be opened either on the right or left sides.  
When the burner is closed, the hinge can be re-positioned on the opposite side.

### 3.8.1 Panel board description

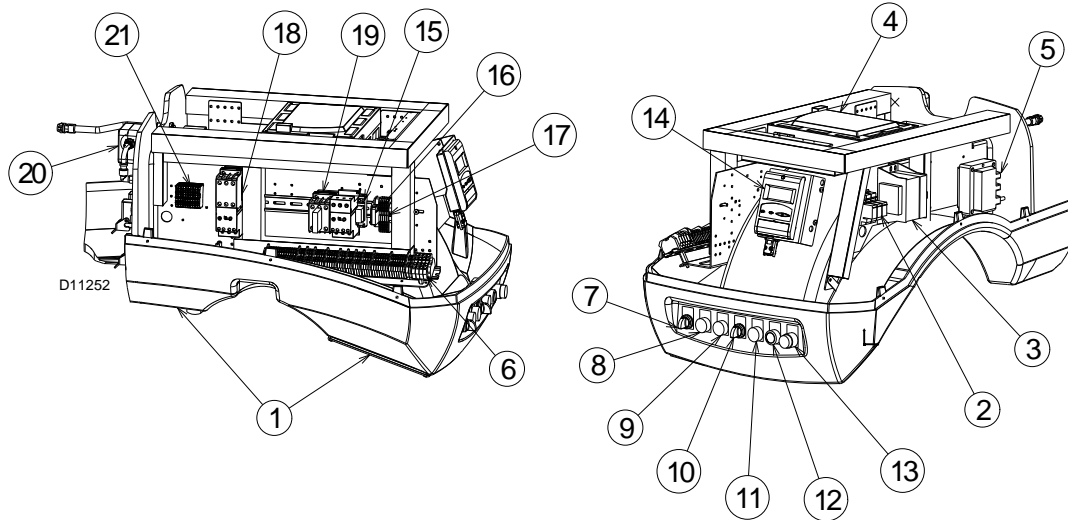


Fig. 6

- 1 Entry for power cables, external leads and kit
- 2 Relay outlet - clean contacts
- 3 Electronic cam transformer
- 4 Electronic cam setting device
- 5 Ignition transformer
- 6 Main supply terminal strip
- 7 Selector "OFF - ON"
- 8 Signal light for power ON
- 9 Signal light for call for heat
- 10 Selector "LOCAL - REMOTE"
- 11 Signal light for main fuel
- 12 Button for alarm silence
- 13 Signal light for burner failure and lock-out reset button
- 14 AZL display
- 15 Relay
- 16 Fuse
- 17 Auxiliary terminal strip
- 18 Pump motor contactor and thermal cut-out
- 19 Fan motor contactor and thermal cut-out
- 20 Air pressure switch

Two types of burner failure may occur:

- **Control box lock-out:**  
if on the AZL display 14)(Fig. 6) shows lock-out and the reset button 13) lights up, it indicates that the burner is in lock-out. To reset, press the pushbutton 13).
- **Motors trip:**  
release by pressing the push button on thermal.

**3.9 Control box for the air/fuel ratio (LMV51...)**

**Warning notes**



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

**The LMV51... is a safety device! Do not open, interfere with or modify the unit.**

**The manufacturer will not assume responsibility for any damage resulting from unauthorized interference!**

**Risk of explosion!  
Incorrect configuration can lead to excessive fuel supply which might cause an explosion!  
Operators must be aware that incorrect settings made on the AZL5... display and operating unit and incorrect settings of the fuel and / or air actuator positions can lead to dangerous burner operating conditions.**

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
- Before making any wiring changes in the connection area of the LMV5..., 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.
- Protection against electrical shock hazard on the LMV5... and on all connected electrical components must be ensured through appropriate mounting.
- Each time work has been carried out (mounting, installation and service work, etc.), check to ensure that wiring is in an orderly state, that the parameters have been correctly set and make the safety checks.
- 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.
- In programming mode, the position check of actuators and VSD (checking electronic fuel / air ratio control) is different from the check during automatic operation. Like in automatic operation, the actuators are still jointly driven to their required positions. If an actuator does not reach the required position, corrections are made until that position is reached. However, in contrast to automatic operation, there are no time limits to these corrective actions. The other actuators maintain their positions until all actuators have reached the positions currently required. This is essential for setting fuel / air ratio control. This means that during the time the fuel / air ratio curves are programmed, the person making the plant settings must continuously monitor the quality of the combustion process (e.g. by means of a flue gas analyzer). Also, if combustion levels are poor, or in the event of dangerous situations, the commissioning engineer must take appropriate action (e.g. switching off manually).

To ensure the safety and reliability of the LMV5... system, the following points must also be observed:

- Condensation and ingress of humidity must be avoided. Should such conditions occur, make sure that the unit will be completely dry before switching on again!
- Static charges must be avoided since they can damage the unit's electronic components when touched.



D9301

**Fig. 7**

**Mechanical design**

The LMV5... is a microprocessor-based burner management system with matching system components for the control and supervision of forced draft burners of medium to large capacity.

The following components are integrated in the basic unit of the LMV5...:

- Burner control with gas valve proving system
- Electronic fuel / air ratio control with a maximum of 4 (LMV51...) or 6 (LMV52...) actuators
- Optional PID temperature / pressure controller (load controller)
- Optional VSD module

**Installation notes**

- Ensure that the electrical wiring inside the boiler is in compliance with national and local safety regulations.
- Do not mix up live and neutral conductors.
- Make certain that strain relief of the connected cables is in compliance with the relevant standards (e.g. as per DIN EN 60730 and DIN EN 60 335).
- Ensure that spliced wires cannot get into contact with neighboring terminals. Use adequate ferrules.
- Always run high-voltage ignition cables separately while observing the greatest possible distance to the unit and to other cables
- The burner manufacturer must protect unused AC 230 V terminals with dummy plugs (refer to sections Suppliers of other accessory items).
- When wiring the unit, ensure that AC 230 V mains voltage cables are run strictly separate from extra low-voltage cables to warrant protection against electrical shock hazard.

### Electrical connection of ionization probe and flame detector

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cables together with other cables:
  - Line capacitance reduces the magnitude of the flame signal.
  - Use a separate cable.

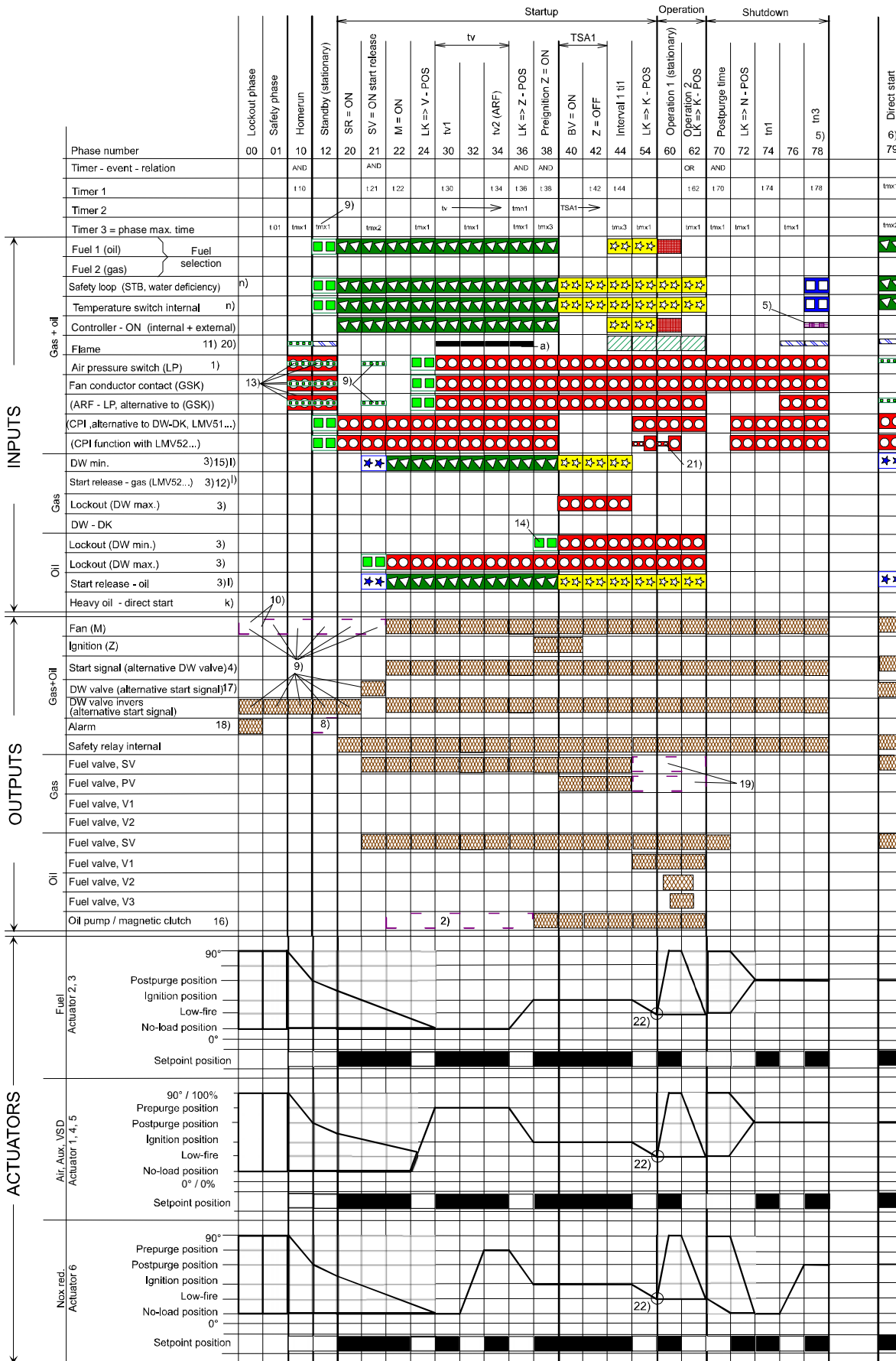
- Observe the permissible cable lengths.
- The ionization probe is not protected against electrical shock hazard. The mainspowered ionization probe must be protected against accidental contact.
- **Locate the ignition electrode and the ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electrical overloads).**

### Technical data

LMV51... basic unit	Mains voltage	AC 120 V -15 % / +10 %
	Mains frequency	50 / 60 Hz $\pm 6$ %
	Power consumption	< 30 W (typically)
	Safety class	I, with parts according to II and III to DIN EN 60730-1
Terminal loading 'Inputs'	Unit fuse F1 (internally)	6.3 AT
	Perm. mains primary fuse (externally)	Max. 16 AT
	Undervoltage	
	• Safety shutdown from operating position at mains voltage	< AC 96 V
	• Restart on rise in mains voltage	> AC 100 V
	Oil pump / magnetic clutch (nominal voltage)	
• Nominal current	1.6A	
• Power factor	$\cos\varphi > 0.4$	
Terminal loading 'Outputs'	Air pressure switch test valve (nominal voltage)	
	• Nominal current	0.5A
	• Power factor	$\cos\varphi > 0.4$
	<b>Total contact loading:</b>	
• Mains voltage	AC 120 V -15 % / +10 %	
• Input current of unit (safety loop) total load on contacts resulting from:	Max. 5 A	
- Fan motor contactor		
- Ignition transformer		
- Valve		
- Oil pump / magnetic clutch		
<b>Single contact loading:</b>		
Fan motor contactor (nominal voltage)		
• Nominal current	1A	
• Power factor	$\cos\varphi > 0.4$	
Alarm output (nominal voltage)		
• Nominal current	1 A	
• Power factor	$\cos\varphi > 0.4$	
Ignition transformer (nominal voltage)		
• Nominal current	1.6 A	
• Power factor	$\cos\varphi > 0.2$	
Fuel valve gas (nominal voltage)		
• Nominal current	1.6 A	
• Power factor	$\cos\varphi > 0.4$	
Fuel valve oil (nominal voltage)		
• Nominal current	1.6 A	
• Power factor	$\cos\varphi > 0.4$	
Cable lengths	Main line	Max. 100 m (100 pF/m)
Environmental conditions	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range	-20...+60 °C
	Humidity	< 95 % r.h.

Tab. D

## Operation sequence of the burner



S8319

7550f44e/1208

Fig. 8

### Legend to the sequence diagrams:

Depending on the parameter, valve proving takes place:  
between phase 62 and phase 70 or/and  
between phase 30 and phase 32.

#### Signal ON Signal OFF Next phase



01  $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$

Parameter direct start  
Checking with controller on  
Deviation  $\rightarrow$  10  
No Rep. decrement



10



70

Without VP70 with VP80



62



Stop, up to Ph – max. time  $\rightarrow$  01



Stop, up to Ph – max. time  $\rightarrow$  10



01  $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$



01  $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$



0-3 s.

01  $\begin{cases} \rightarrow 00, \text{Rep} = 0 \\ \rightarrow 12, \text{Rep} > 0 \end{cases}$



Param.  $\begin{cases} \rightarrow 79 \\ \rightarrow 10 \end{cases}$



Input: don't care



Output: OFF

Output: ON

### Assignment of times:

t0	Postpurge lockout position
t01	Max. time safety phase
t10	Min. time home run
t21	Min. time start release
t22	Fan runup time t30 Prepurge time part 1
t34	Prepurge time part 3
t36	Min. ON time oil pump
t38	Preignition time gas / oil
t42	Preignition time OFF
t44	Interval 1 gas / oil
t62	Max. time low-fire
t70	Afterburn time
t74	Postpurge time 1 gas / oil (tn1)
t78	Postpurge time 3 gas / oil (tn3)
t80	Valve proving evacuate time
t81	Leakage test time atmospheric pressure
t82	Leakage test filling test
t83	Leakage test time gas pressure
tmn1	Min. time extraneous light test (5 s.) after skip over of pre-purge
tmx1	Max. damper running time
tmx2	Max. time startup release
tmx3	Max. time circulation heavy oil
tn	Postpurge time
TSA1	Safety time 1
TSA2	Safety time 2
tv	Prepurge time gas / oil

Tab. E



## Legend to the sequence diagrams:

- 1) Parameter: With / without pressure switch
- 2) Parameter: Short / long preignition time for oil only Short / long oil pump – ON – time
- 3) Delayed shutdown within TSA1 + TSA2
- 4) Parameter: Output as startup signal / pressure switch relief valve
- 5) Parameter: Normal / direct startup  
 Normal startup → sequential phase = 10  
 Direct startup → sequential phase = 79  
 (when R = ON)
- 6) Sequential phase = 24
- 7) Only with valve proving during startup
- 8) Parameter: With / without alarm on prevention of startup
- 9) Parameter: With continuous purging the shown output signals are inverted
- 10) Fan controlled as before  
 Running time when LOCK OUT = T\_FanLockout LF
- 11) Parameter: With / without extraneous light test in STANDBY
- 12) With valve proving during startup phase 10
- 13) Parameter: Normal / continuous purging  
 Normal purging: Checking for off in 10, stop to Ph-max time → 01  
 Continuous purging: Checking for on in 10 and 12, Stop up to phase-max time → 01
- 14) Parameter: "OilPressureMin", "akt\_from\_ts" → no check before TSA1 (LO, HO) or TSA2 (LOgp, HOgp)
- 15) Parameter: "GasPressureMin", "deakt\_xOGP" → pressure switch-min can be deactivated for oil programs with gas pilot
- 16) Parameter: "OilPumpCoupling", "direct\_coupl" → shutoff valve oil has to be connected to output "Oil pump / magnetic clutch".  
 Output is active when fan is on and for another 15 s after fan is switched off
- 17) Parameter: "Start / pressure switch valve", "PS\_Reli\_Inv" → Output pressure switch valve will be logically inverted
- 18) Parameter: "Alarm act / deact", "deactivated" → The alarm output can temporarily be deactivated (for current error only)
- 19) Parameter: Only with LMV51...: Continuous pilot gas / oil: Activated → Pilot valve is also activated in operation
- 20) Parameter: Only with LMV51...: Extraneous light, pilot phase, operating phase gas / oil → Separate flame supervision possible
- 21) Parameter: Only with LMV51...: pressure switch valve proving / CPI or StartReleaseGas → Parameter-dependent ON / OFF test  
 CPI Gas: OFF test for gas trains only  
 CPI Oil: OFF test for oil trains only  
 CPI Gas+Oil: OFF test for gas and oil trains
- 22) Parameter: After LMV51... software version 04.50 and AZL5... software version 04.40, dependent on parameter *StartPktOperation*



Permissible positioning range



In Standby: actuator can travel within the permissible positioning range, but is always driven to the home position. Must be in the home position before changing the phase.

0°	Position as supplied (0°)
90°	Actuator fully open (90°)
AGR	Fuel gas recirculation
CPI	Closed position indication
DP	Pressure tester
PS-VP	Pressure switch – valve proving
FCC	Fan contactor contact
LF	Air damper
APS	Air pressure switch
N	Postpurging
SR	Safety relay
SLT	Safety limit thermostat
TL	Temperature limiter

## Repetition counter:

- k) Heavy oil
- l) Restricted startup behavior
- n) Restricted safety loop

**3.10 Actuators**

**Warning notes**



**To avoid injury to persons, damage to property or the environment, the following warning notes should be observed!**

**Do not open, interfere with or modify the actuators!**

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff.
- Before making any wiring changes in the connection area of the actuator, completely isolate the burner control from the mains supply (all-polar disconnection).
- Ensure protection against electric shock hazard by providing adequate protection for the connection terminals and by securing the housing cover.
- Check to ensure that wiring is in an orderly state.
- 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.



**The housing cover may only be removed for short periods of time for wiring or when making the addressing.**

**It must be made certain that dust or dirt will not get inside the actuator while such work is carried out.**

**Use**

The actuators (Fig. 9) are used to drive and position the air damper and the gas butterfly valve, without mechanical leverages but via the interposition of an elastic coupling.

When used in connection with burner controls or electronic fuel / air ratio control, the associated controlling elements are controlled depending on burner output.

**Installation notes**

- Always run the high-voltage ignition cables separate from the unit and other cables while observing the greatest possible distance.
- To ensure protection against electric shock hazard, make certain that the AC 230 V section of the actuator is strictly segregated from the functional low-voltage section.
- The holding torque is reduced when the actuator's power supply is switched off.



**When servicing or replacing the actuators, take care not to invert the connectors.**



**Fig. 9**

**Technical data**

Model	SQM45.295A9	SQM48.497A9
Operating voltage	AC 2 x 12 V via bus cable from the basic unit or via a separate transformer	
Safety class	Extra low-voltage with safe isolation from mains voltage	
Power consumption	9...15 VA	
Degree of protection	To EN 60 529, IP 54, provided adequate cable entries are used	
On time	50 %, max. 3 min. continuously	
Electrical connections	RAST3.5 terminals	
Direction of rotation (when facing the shaft)	- Standard: counterclockwise - Reverse: clockwise	
Running time (min.) for 90°	10 s.	30s.
Holding torque (max.)	1.5 Nm	20 Nm
Nominal torque (max.)	3 Nm	20 Nm
Weight	approx. 1 kg	approx. 1.6 kg
Environmental conditions:		
Operation	DIN EN 60721-3-1	
Climatic conditions	class 1K3	
Mechanical conditions	class 1M2	
Temperature range	-20...+60 °C	
Humidity	< 95 % r.h.	

**Tab. F**

**4 Installation**

**4.1 Notes on safety for the installation**

After carefully cleaning all around the area where the burner will be installed, and arranging the correct lighting of the environment, proceed with the installation operations.



All the installation, maintenance and disassembly operations must be carried out with the electricity supply disconnected.



The installation of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.

**4.2 Handling**

The packaging of the burner includes a wooden platform, so it is possible to move the burner (still packaged) with a transpallet truck or fork lift truck.



The handling operations for the burner can be highly dangerous if not carried out with the greatest attention: keep any unauthorised people at a distance; check the integrity and suitability of the available means of handling.

Check also that the area in which you are working is empty and that there is an adequate escape area (i.e. a free, safe area to which you can quickly move if the burner should fall).

During the handling, keep the load at not more than 20-25 cm from the ground.



After positioning the burner near the installation point, correctly dispose of all residual packaging, separating the various types of material.

Before proceeding with the installation operations, carefully clean all around the area where the burner will be installed.

**4.3 Preliminary checks**

**Checking the consignment**



After removing all the packaging, check the integrity of the contents. In the event of doubt, do not use the burner; contact the supplier.



The packaging elements (wooden cage or cardboard box, nails, clips, plastic bags, etc.) must not be abandoned as they are potential sources of danger and pollution; they should be collected and disposed of in the appropriate places.

**4.4 Operation position**

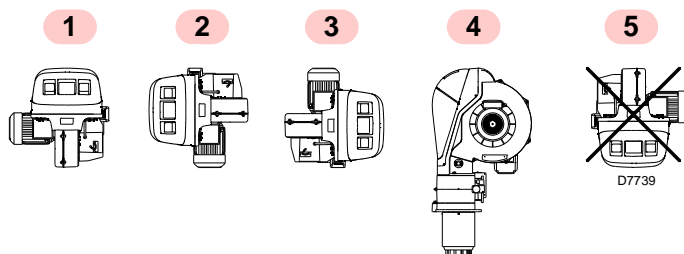
The burner is designed to operate only in the positions **1, 2, 3 and 4**.

Installation **1** is preferable, as it is the only one that allows the maintenance operations as described in this manual.

Installations **2, 3 and 4** permit operation but make maintenance and inspection of the combustion head more difficult.

Any other position could compromise the correct operation of the appliance.

Installation **5** is prohibited for safety reasons.



**Fig. 10**

### 4.5 Preparing the boiler

#### 4.5.1 Boring the boiler plate

Drill the combustion chamber locking plate as shown in Fig. 11. The position of the threaded holes can be marked using the thermal screen supplied with the burner.

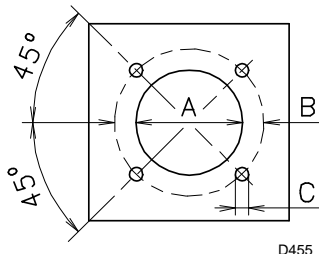


Fig. 11

mm	A	B	C
RL 300/E	13 <sup>25</sup> / <sub>32</sub> "	17 <sup>51</sup> / <sub>64</sub> "	45/ <sub>64</sub> "

Tab. G

#### 4.5.2 Blast tube length

The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, and in any case it must be greater than the thickness of the boiler door complete with its fettling.

For boilers with front flue passes 1)(Fig. 12) or flame inversion chambers, protective fettling in refractory material 5) must be inserted between the boiler fettling 2) and the blast tube 4).

This protective fettling must not compromise the extraction of the blast tube.

For boilers having a water-cooled front the refractory fettling 2)-5)(Fig. 12) is not required unless it is expressly requested by the boiler manufacturer.

### 4.6 Securing the burner to the boiler

Prepare an adequate system of hoisting by hooking onto the rings 3)(Fig. 12).

- Slip the thermal protection (standard equipment) onto the blast tube 4).
- Place entire burner on the boiler hole (arranged previously, see Fig. 11), and fasten with the screws given as standard equipment.



The coupling of the burner-boiler must be air-tight.

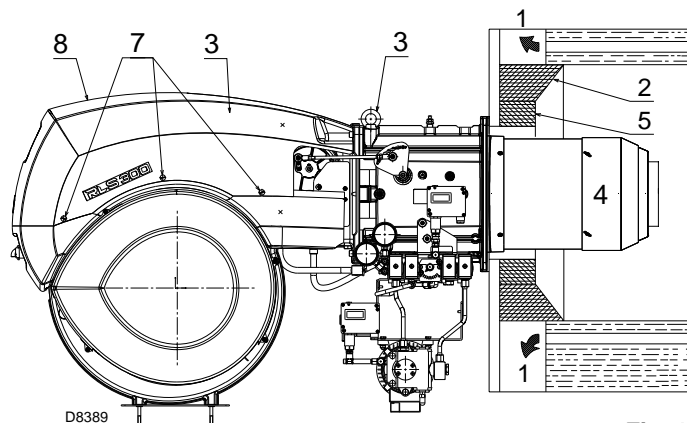


Fig. 12

### 4.7 Accessibility to the interior of the combustion head

Proceed as follows:

- open burner at hinge (Fig. 13) after removing the 4 screws 1).
- Disconnect the wires 2) from the electrodes.
- Disconnect the oil pipes by unscrewing the two connectors 3).
- While unscrewing, some fuel may leak out.
- Unscrew the under part of the elbow 4) until it comes free of its slot.
- Extract the internal part 5) of the combustion head.

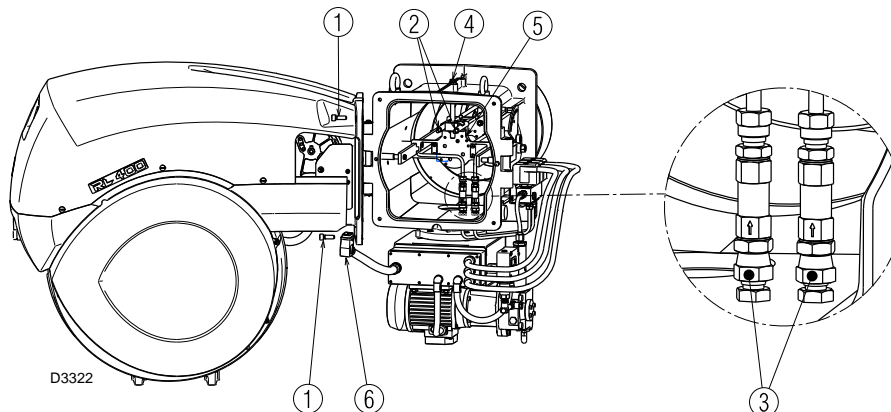


Fig. 13

**4.8 Nozzles**

The burner complies with the emission requirements of the EN 267 standard.

In order to guarantee that emissions do not vary, recommended and/or alternative nozzles specified by the manufacturer in the Instruction and warning booklet should be used.



It is advisable to replace nozzles every year during regular maintenance operations.



The use of nozzles other than those specified by the manufacturer and inadequate regular maintenance may result into emission limits non-conforming to the values set forth by the regulations in force, and in extremely serious cases, into potential hazards to people and objects.

The manufacturing company shall not be liable for any such damage arising from nonobservance of the requirements contained in this manual.

**4.8.1 Recommended nozzle**

- BERGONZO, type B5;
- FLUIDICS, type N1 or W2.

Intermediate flow rates may be obtained by choosing the nozzle with a nominal flow rate slightly higher than that actually required.

**Complete range of nozzles:**

Bergonzo B5 60° - 150 - 200 - 225 - 250 - 275 - 300 - 325 - 350 - 375 - 400 - 425.

We normally recommend 60° angles of pulverisation.

**4.8.2 Choice of nozzle**

Nozzles with or without fuel shutoff needle can be fitted on the nozzle holder.

To set the delivery range within which the nozzle must work, nozzle return line fuel pressure must be adjusted according to the Tab. H.

**Ugello CMB 60° B5**

kg/h	Delivery pressure	Return pressure	kg/h	GPH	
150	21	13	51	15.8	Low fire
	21	19	106	32.9	High fire
200	22	8.5	67	20.8	Low fire
	22	17.5	150	46.6	High fire
300	20	7	100	31.1	Low fire
	20	17.5	257	79.9	High fire
375	20	6.5	148	46	Low fire
	20	15.5	305	94.8	High fire
425	20	7.5	68	21.1	Low fire
	20	17.5	365	113.4	High fire

**Tab. H**

**4.8.3 Nozzle installation**

Fit the nozzle with the box spanner, fitting the spanner through the central hole in the flame stability disk (Fig. 14).

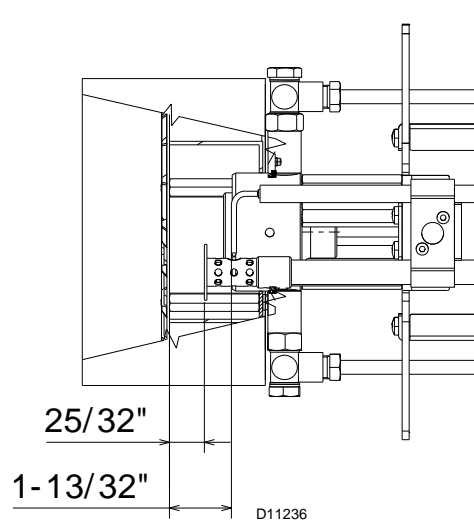


- Do not use any sealing products such as gaskets, sealing compound, or tape.
- Be careful to avoid damaging the nozzle sealing seat.
- The nozzles must be screwed into place tightly but not to the maximum torque value provided by the wrench.

**4.9 Electrode and ignition pilot positioning**



Make sure that the electrode and the ignition pilot are positioned as shown in Fig. 14.



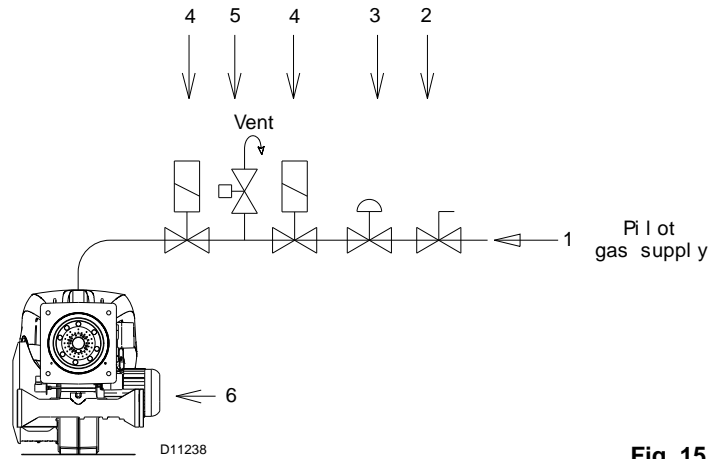
**Fig. 14**

**4.10 Pilot gas train line**

It must be type-approved according to required standards and is supplied separately from the burner.

Key (Fig. 15)

- 1 Gas input pipe for pilot
- 2 Manual valve
- 3 Pilot regulator
- 4 Safety shut-off valve
- 5 NO vent valve
- 6 Burner



**Fig. 15**

**4.11 Combustion head setting**

In addition to varying air flow depending on the output requested, the air gate valve servomotor 4)(Fig. 5, page 9) - by means of a lifting assembly - varies the setting of the combustion head.

This system allows an optimal setting even at a minimum firing rate.

For the same servomotor rotation, combustion head opening can be varied by moving the tie rod onto holes 1-2-3 (Fig. 17).

The choice of the hole (1-2-3) to be used is decided on the basis of diagram (Fig. 16) against the required maximum output.

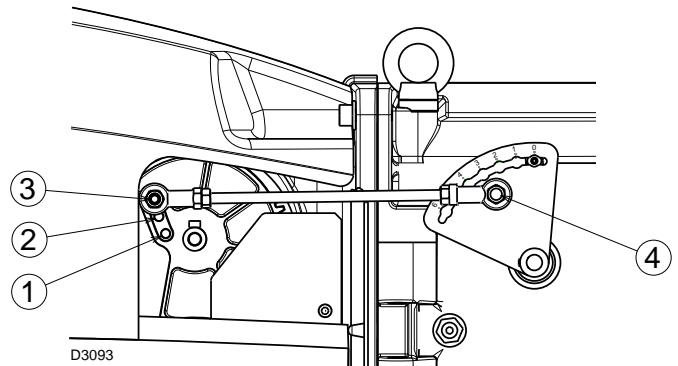
Setting is pre-arranged in the plant for the maximum run (hole 3).

When dealing with boilers featuring a strong back pressure, if air delivery is insufficient even with the damper fully open, you can use a different setting to that illustrated in diagram (Fig. 16) - do this by moving the tie rod onto the next highest hole numerically speaking, thus increasing the combustion head's opening and hence air delivery.

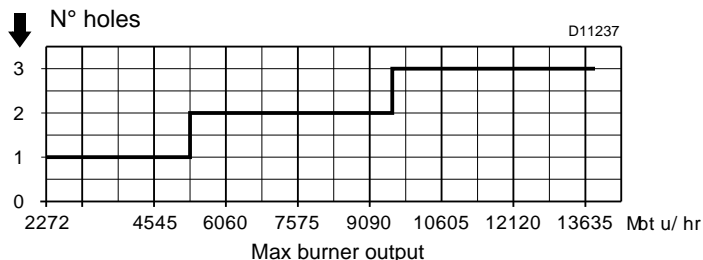
If combustion requirements require you to move spacer 1)(Fig. 18) onto the 1<sup>st</sup> or 2<sup>nd</sup> hole of the gear and, at the same time, the hinge is on the right, you need to fit the spacers 4)(Fig. 18) supplied with the burner.

Proceed as follows (Fig. 18):

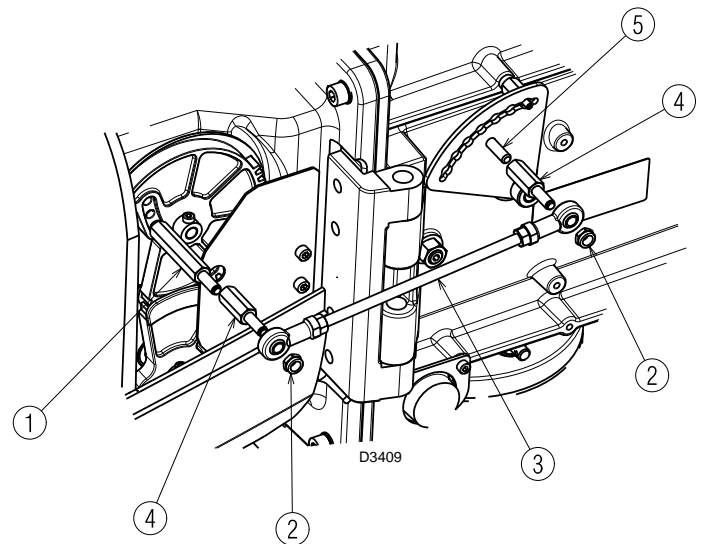
- first unscrew nuts 2), remove tie rod 3), unscrew spacer 1) and position it on the hole you want,
- screw the spacers 4) onto spacer 1) and screw 5) respectively,
- once done, refit the tie rod and nuts.



**Fig. 17**



**Fig. 16**



**Fig. 18**

**4.12 Light oil supply**

**4.12.1 Double-pipe circuit**

The burner is equipped with a self-priming pump which is capable of feeding itself within the limits listed in the Tab. I.

**The tank higher than the burner A**

The distance "P" must not exceed 33 ft in order to avoid subjecting the pump's seal to excessive strain; the distance "V" must not exceed 13 ft in order to permit pump self-priming even when the tank is almost completely empty.

**The tank lower than the burner B**

Pump depression values higher than 7 PSI must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.

It is good practice to ensure that the return and suction lines enter the burner from the same height; in this way it will be more improbable that the suction line fails to prime or stops priming.

**4.12.2 The loop circuit**

A loop circuit consists of a loop of piping departing from and returning to the tank with an auxiliary pump that circulates the fuel under pressure.

A branch connection from the loop goes to feed the burner.

This circuit is extremely useful whenever the burner pump does not succeed in self-priming because the tank distance and/or height difference are higher than the values listed in the Tab. I.

**4.12.3 Hydraulic connections**

The pumps are equipped with a by-pass that connects return line and suction line. The pumps are installed on the burner with the by-pass closed by screw 3(Fig. 20).

It is therefore necessary to connect both hoses to the pump.

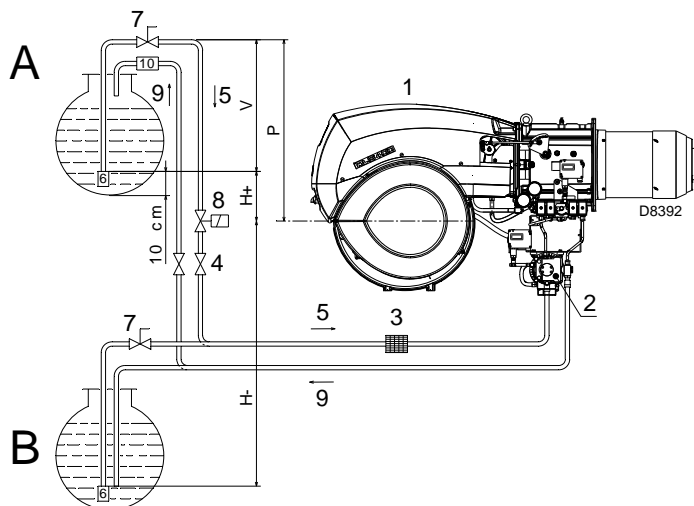


Fig. 19

Key (Fig. 19)

- H Pump/Foot valve height difference
- L Piping length
- ∅ Inside pipe diameter
- 1 Burner
- 2 Pump
- 3 Filter
- 4 Manual on/off valve
- 5 Suction line
- 6 Foot valve
- 7 Rapid closing manual valve remote controlled (only Italy)
- 8 On/off solenoid valve (only Italy)
- 9 Return line
- 10 Check valve (only Italy)

+/- H (ft)	L (ft)	
	∅ 1/2"	∅ 5/8"
+ 13	197	263
+ 10	164	230
+ 6.6	132	197
+ 4.8	115	181
+ 3.3	99	164
+ 1.6	82	148
0	66	132
- 1.6	59	115
- 3.3	49	99
- 4.8	43	82
- 6.6	33	66
- 10	16	33
- 13	-	20

Tab. I



**WARNING**

The pump will break immediately if it is run with the return line closed and the by-pass screw inserted.

- Remove the plugs from the suction and return connections of the pump.
- Insert the hose connections with the supplied seals into the connections and screw them down.



**CAUTION**

Take care that the hoses are not stretched or twisted during installation.

- Install the hoses where they cannot be stepped on or come into contact with hot surfaces of the boiler and where they do not hamper the opening of the burner.
- Now connect the other end of the hoses to the suction and return lines by using the supplied nipples.

### 4.12.4 Hydraulic system layout

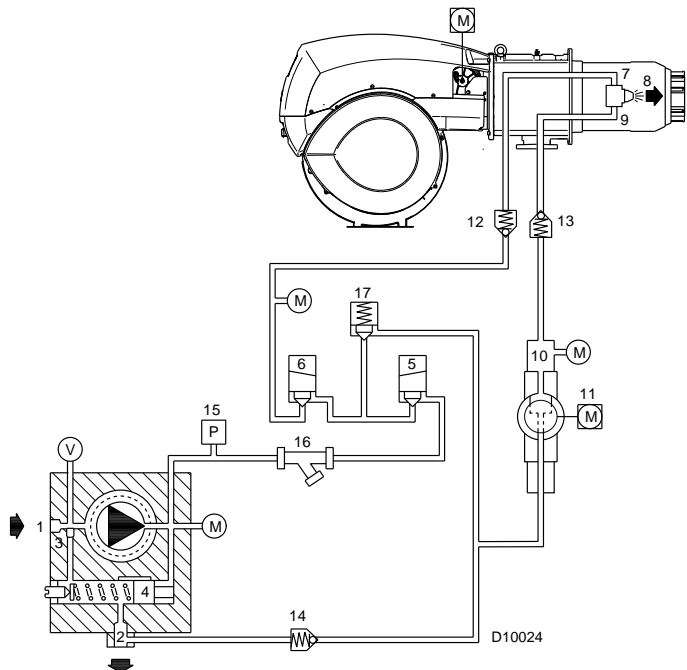


Fig. 20

#### Key (Fig. 20)

- 1 Pump suction
- 2 Pump and nozzle return
- 3 By-pass screw in pump
- 4 Pump pressure governor
- 5 Safety valve
- 6 Safety valve
- 7 Nozzle delivery
- 8 Nozzle without interception pin
- 9 Nozzle return
- 10 Pressure variator on nozzle return
- 11 Servomotor for pressure variator
- 12 Check valve (no dripping function)
- 13 Check valve (no dripping function)
- 14 Check valve
- 15 Pressure switch on pump delivery
- 16 Strainer
- 17 Security relief valve
- M Pressure gauge
- V Vacuumeter

### OPERATION

**Pre-purging phase** of closed valves 5), 6), 13) and 14).

**Firing phase and operation** of opened valves 5), 6), 13) and 14).

**Halt:** All the valves closed.

### 4.12.5 Pressure variator

The pressure variator (Fig. 21) integrated into the valve unit of the oil circuit makes it possible to vary the pressure on return of the nozzle depending on the flow rate required.

Governing of the pressure on return is obtained with the variation of a section by rotating the servomotor 23)(Fig. 5, page 9).

- Pressure governor at 0° (maximum opening) = minimum pressure on nozzle return.
- Pressure governor at 90° (minimum opening) = maximum pressure on nozzle return.

The servomotor is operated by the electronic cam 4)(Fig. 6, page 10); by means of this device it is possible to set different curves for oil. The air gate valve servomotor 4)(Fig. 5, page 9) may be operated in the same way.

In regulating with oil, setting is made depending on the type of nozzle used and on the modulation required. Under the conditions of minimum firing rate, 20° rotation may be sufficient.

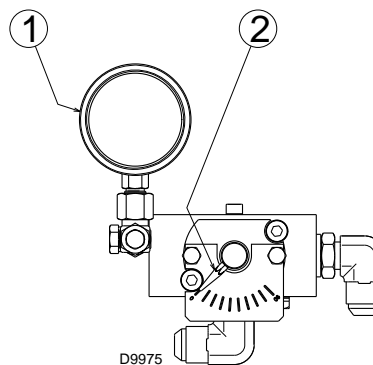


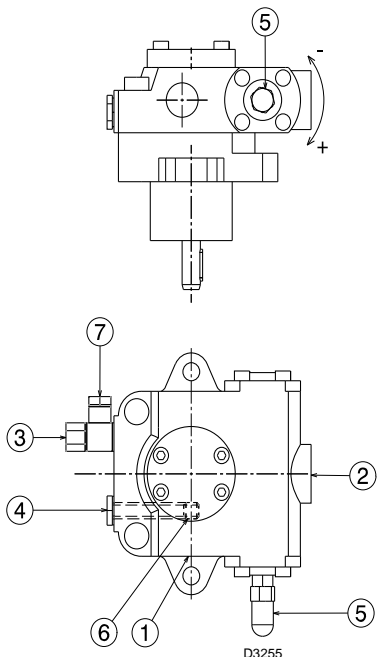
Fig. 21

#### Key (Fig. 21)

- 1 Nozzle pressure gauge
- 2 Position indicator (0 - 90) of pressure variator



4.13 Pump



Key (Fig. 22)

- |   |                            |        |
|---|----------------------------|--------|
| 1 | Suction                    | G 1/2" |
| 2 | Return                     | G 1/2" |
| 3 | Pressure switch attachment | G 1/4" |
| 4 | Vacuum meter attachment    | G 1/4" |
| 5 | Pressure adjustment screw  |        |
| 6 | Screw for by-pass          |        |
| 7 | Pressure gauge attachment  | G 1/4" |

4.13.1 Technical data

**Suntec TA3**

Min. delivery rate at 290 PSI pressure	GPH	218
Delivery pressure range	PSI	100 - 580
Max. suction depression	PSI	7
Viscosity range	cSt	4 - 800
Max. oil temperature	°F	284
Max. suction and return pressure	PSI	73
Pressure calibration in the factory	PSI	290

Tab. J

4.13.2 Pump priming



**Before starting the burner, make sure that the tank return line is not clogged.**

**Obstructions in the line could cause the sealing organ located on the pump shaft to break.**

- For self-priming to take place, the screw 4)(Fig. 22) of the pump must be loosened in order to bleed off the air contained in the suction line.
- Start the burner by closing the remote controls. Check the fan wheel rotation direction as soon as the burner starts.
- The pump is primed when oil comes out of screw 4)(Fig. 22). Stop the burner and screw screw 4) in.

The time required for this operation depends upon the diameter and length of the suction tubing.

If the pump fails to prime at the first starting of the burner and the burner locks out, wait approx. 15 seconds, reset the burner, and then repeat the starting operation as often as required.

After 5 or 6 starting operations allow 2 or 3 minutes for the transformer to cool.

Do not illuminate the QRI cell or the burner will lock out; the burner should lock out anyway about 10 seconds after it starts.



The a.m. operation is possible because the pump is already full of fuel when it leaves the factory.

If the pump has been drained, fill it with fuel through the opening on the vacuum meter 4)(Fig. 22) prior to starting; otherwise, the pump will seize.

Whenever the length of the suction piping exceeds 66-98 ft, the supply line must be filled using a separate pump

### 4.14 Electrical wiring

#### 4.14.1 Notes on safety for the electrical wiring



- The electrical wiring must be carried out with the electrical supply disconnected.
- Electrical wiring must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination. Refer to the wiring diagrams.
- The manufacturer declines all responsibility for modifications or connections different from those shown in the wiring diagrams.
- Do not invert the neutral with the phase in the electrical supply line. Any inversion would cause a lockout due to firing failure.
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- The burners have been set for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to perform checks of its own start-up efficiency. Normally the boiler's thermostat/pressure switch ensures the stopping of the burner.  
If this is not the case, it is necessary to apply in series with IN a timer switch that turns off the burner at least once every twenty-four hours. Refer to the wiring diagrams.
- The electrical safety of the device is obtained only when it is correctly connected to an efficient earthing system, made according to current standards. It is necessary to check this fundamental safety requirement. In the event of doubt, have the electrical system checked by qualified personnel.
- The electrical system must be suitable for the maximum input power of the device, as indicated on the label and in the manual, checking in particular that the section of the cables is suitable for the input power of the device.
- For the main power supply of the device from the electricity mains:
  - do not use adapters, multiple sockets or extensions;
  - use an omnipolar switch, as indicated by the current safety standards.
- Do not touch the device with wet or damp body parts and/or in bare feet.
- Do not pull the electric cables.

Before carrying out any maintenance, cleaning or checking operations:



disconnect the electrical supply from the burner by means of the main system switch;



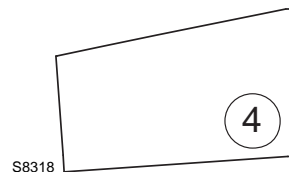
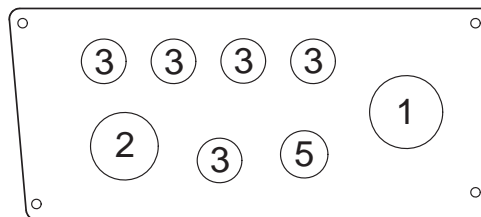
isolate the fuel supply.

If the hood is still present, remove it and proceed with the electrical wiring according to the layouts shown in Appendix.

All the cables to be connected to the burner are fed through the grommets. See Fig. 23.

The use of the cable grommets can take various forms. By way of example we indicate the following mode:

- 1 Three phase power supply
- 2 Fan motor
- 3 Triggering / Safety device
- 4 Available
- 5 Single phase power supply



S8318

Fig. 23

**4.15 Thermal relay calibration**

Depending on the burner type, there are two different thermal relays:

- Electro-mechanical thermal relay (used for single phase motors)
- Electronic thermal relay (used for three phase motors)

**4.15.1 Electro-mechanical thermal relay**

The electro-mechanical thermal relay (Fig. 24) is used to avoid damage to the motor owing to a strong increase in absorption or the lack of a phase.

For the calibration, refer to the table given in electrical layout. If the minimum value of the scale of the thermal relay is greater than the rating absorption of the motor, protection is still ensured.

This arises when the power supply of the motor is 400V.

- To reset, in the case of an intervention of the thermal relay, press the button "RESET" (Fig. 24).
- The button "STOP" (Fig. 24) opens the NC (95-96) contact and stops the motor.

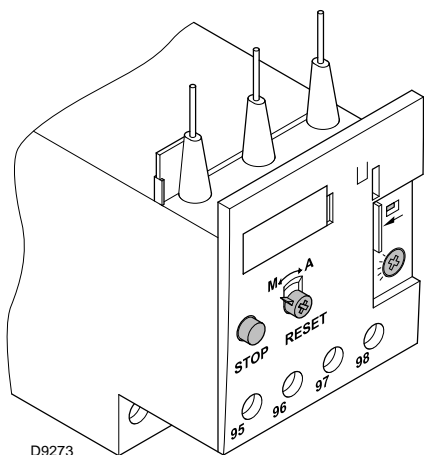


Fig. 24

- To test the thermal relay, insert a screwdriver in the window "TEST" (Fig. 25) and move it in the sense of the arrow (towards right).



**Automatic resetting can be dangerous.**

**This action is not provided for the burner operation.**

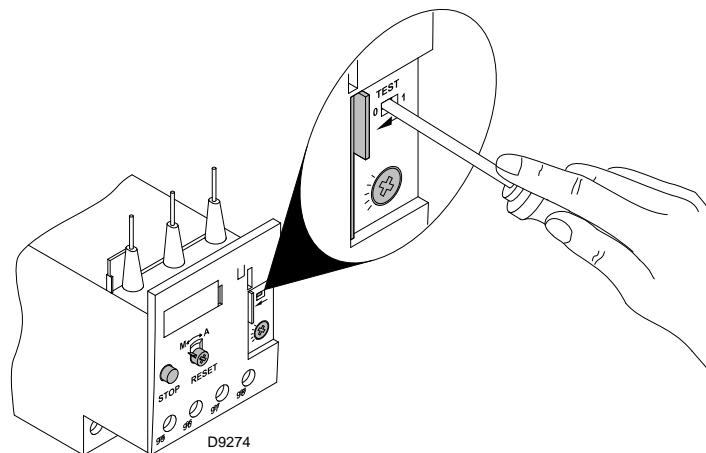


Fig. 25

**4.15.2 Electronic thermal relay**

- To reset, in the case of an intervention of the thermal relay, press the button "RESET" (Fig. 26).

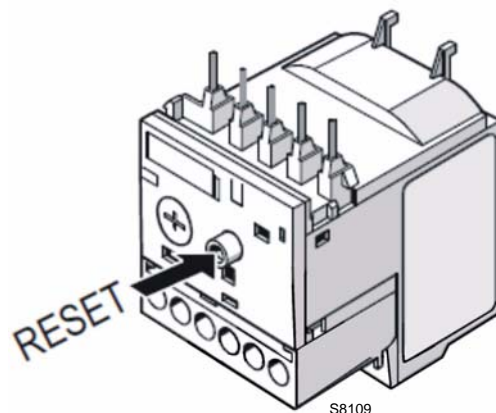


Fig. 26

There are two different solution to test the electronic thermal relay:

- **Device test (Fig. 27)**  
Push slowly the button in the window with a little screwdriver.

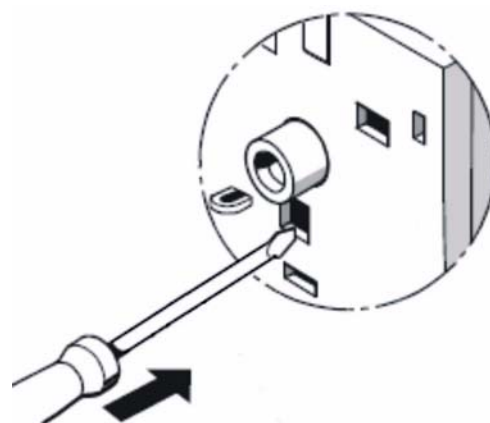


Fig. 27

- **Contact test NC (95-96) and NO (97-98)(Fig. 28)**  
Insert in the window a little screwdriver and move it in the sense of the arrow.

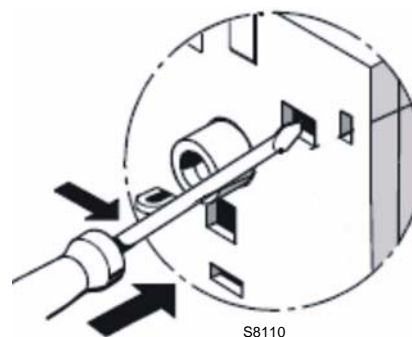


Fig. 28

## 5

## Start-up, calibration and operation of the burner

## 5.1 Notes on safety for the first start-up



The first start-up of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.



Check the correct working of the adjustment, command and safety devices.

## 5.2 Adjustments before first firing

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet.

Adjust successively:

- Combustion head
- Nozzles
- Pump pressure

**Combustion head**

The adjustment of the combustion head already carried out (page 20) need not be altered unless the delivery of the burner is changed.

**Nozzles**

See "Nozzles" on page 19.

**Pump pressure**

20 bar: this is the pressure calibrated in the factory which is usually sufficient for most purposes. In order to adjust pump pressure, use the screw 5)(Fig. 22, page 23).

## 5.3 Burner firing

Set the selector to "ON" position (Fig. 29).

Close the thermostats/pressure switches and set the selector to "LOCAL" position (Fig. 29).



Make sure that the lamps or testers connected to the solenoids, or indicator lights on the solenoids themselves, show that no voltage is present.

If voltage is present, stop the burner **immediately** and check the electrical wiring.



**For the start-up procedure and the parameters calibration, refer to the specific instruction manual of the LMV51... electronic cam supplied with the burner.**

Having completed the checks indicated in the previous heading, the burner should fire.

If the motor starts but the flame does not appear and the control box goes into lock-out, reset and wait for a new firing attempt.

The ignition of the burner is always using the pilot ignition; if firing is still not achieved, it may be that gas is not reaching the combustion head within the safety time period. In this case increase gas firing delivery.

Happened this operation, the oil burner active devices and retires gas operation; if firing is still not achieved, it may be that oil is not reaching the combustion head within the safety time period. In this case increase oil firing delivery.

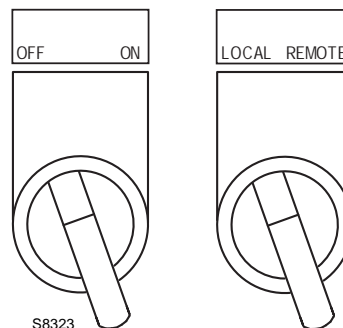


Fig. 29

During the first firing, there is a momentary lowering of the fuel pressure caused by the filling of the nozzle tubing. This lowering of the fuel pressure can cause the burner to lock-out and can sometimes give rise to pulsations.

Once the following adjustments have been made, the firing of the burner must generate a noise similar to the noise generated during operation.

**5.4 Air/fuel control and power modulation system**

The air/fuel and power modulation system installed on burner series provides, a set of integrated functions ensuring top level energy and operational performance from the burner, both for single and grouped burners (e.g. boiler with a double combustion chamber or several generators in parallel).

The system includes the following basic functions:

- air and fuels are supplied in correct quantities by positioning the valves by direct servo-control, thus avoiding the possibility of play typical of systems used for traditional modulating burners, in which settings are obtained by levers and a mechanical cam;
- burner power is modulated according to the load required by the system, while boiler pressure or temperature is maintained at set operating values;

Further interfaces and computer communication functions for remote control or integration in centrally supervised systems are available according to the system's configuration.

**NOTE**

The first start-up and all further operations concerning internal settings of the control system or expansion of basic functions, are accessed with a password and are reserved for technical service personnel specifically trained for internal programming of the instrument and for the specific application obtained with this burner.

The first start-up and curve synchronization manual is supplied with the burner.

The complete manual for checking and setting all parameters will be provided on application.

**5.4.1 Combustion air adjustment**

Fuel/combustion air must be synchronized with the relevant servomotors (air and oil) by storing a setting curve by means of the electronic cam.

To reduce pressure loss and to have a wider adjustment range, it is best to set the servomotor to the maximum output used, as near to maximum opening (90°) as possible.

On the butterfly valve, the fuel's partial setting adjustment based on required output, with the servomotor fully open, is made by turning the pressure adjustment screw 5)(Fig. 22, page 23).

**5.5 Rotation of fan motor**

After turning the power on to the burner, check the motor rotation. If the phase sequence is not correct, the burner does not fire.

**5.4.2 Air gate adjustment for maximum output**

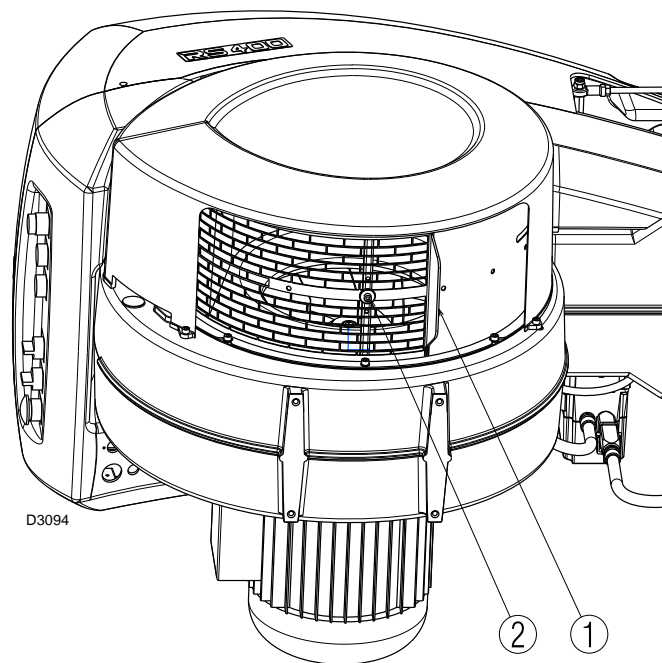
Set the servomotor to maximum opening (near 90°) so that the air butterfly valves are fully open.

Loosen screw 2)(Fig. 30) under the burner's intake and close grille 1) progressively until you achieve the required output.

The only time reducing intake to a partial setting is not necessary is when the burner is working at the top of the operating range.



We recommend you achieve the maximum output required manually, and adjust intake to the partial setting, define gas pressure and adjust the combustion head before completing the setting and storing the fuel/combustion air synchronization curves.



**Fig. 30**

**5.6 Pressure switches calibration**

**5.6.1 Air pressure switch**

Adjust the air pressure switch after having performed all other burner adjustments with the air pressure switch set to the start of the scale (Fig. 31).

With the burner operating at min. output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.

Then turn the dial anti-clockwise by about 20% of the set point and repeat burner starting to ensure it is correct.

If the burner locks out again, turn the dial anti-clockwise a little bit more.



**Fig. 31**



As a rule, the air pressure switch must prevent the air pressure from lowering below 80% of the adjustment value as well as preventing the CO in the fumes from exceeding 1% (10,000 ppm).

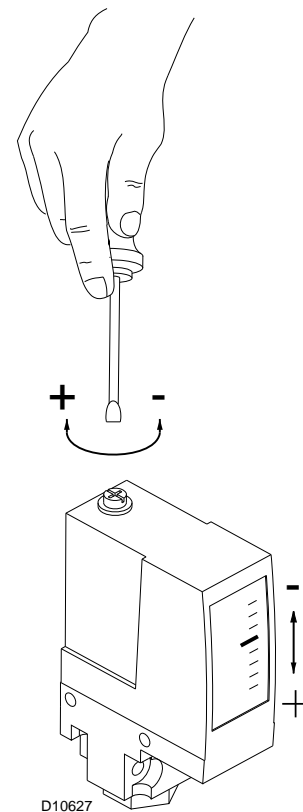
To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 1%.

**5.6.2 Low oil pressure switch**

The low oil pressure switch (Fig. 32) is factory set to 261 PSI.

If the oil pressure goes down this value in the delivery piping, the pressure switch stops the burner.

Burner starts again automatically if the pressure goes above 261 PSI (18 bar) after burner start up.



**Fig. 32**

**5.7 Final checks (with the burner working)**

<ul style="list-style-type: none"> <li>➤ Open the control limit operation</li> <li>➤ Open the high limit operation</li> </ul>	➡	The burner must stop
<ul style="list-style-type: none"> <li>➤ Rotate the air pressure switch knob to the maximum end of scale position</li> </ul>	➡	The burner must stop in lockout
<ul style="list-style-type: none"> <li>➤ Switch off the burner and disconnect the voltage</li> <li>➤ Disconnect the minimum gas pressure switch</li> <li>➤ Rotate the low oil pressure switch at the maximum of the scale</li> </ul>	➡	The burner must not start
<ul style="list-style-type: none"> <li>➤ Disconnect the QRI sensor</li> </ul>	➡	The burner must stop in lockout due to firing failure

## 6

## Maintenance

## 6.1 Notes on safety for the maintenance

The periodic maintenance is essential for the good operation, safety, yield and duration of the burner.

It allows you to reduce consumption and polluting emissions and to keep the product in a reliable state over time.



The maintenance interventions and the calibration of the burner must only be carried out by qualified, authorised personnel, in accordance with the contents of this manual and in compliance with the standards and regulations of current laws.

Before carrying out any maintenance, cleaning or checking operations:



Disconnect the electricity supply from the burner by means of the main switch of the system.



Close the fuel interception tap.

## 6.2 Maintenance programme

## 6.2.1 Maintenance frequency

The combustion system should be checked at least once a year by a representative of the manufacturer or another specialised technician.

## 6.2.2 Checking and cleaning

**Combustion**

The optimum calibration of the burner requires an analysis of the flue gases. Significant differences with respect to the previous measurements indicate the points where more care should be exercised during maintenance.

**Combustion head**

Open the burner and make sure that all components of the combustion head are in good condition, not deformed by the high temperatures, free of impurities from the surroundings and correctly positioned.

**Fan**

Check to make sure that no dust has accumulated inside the fan or on its blades, as this condition will cause a reduction in the air flow rate and provoke polluting combustion.

**Boiler**

Clean the boiler as indicated in its accompanying instructions in order to maintain all the original combustion characteristics intact, especially the flue gas temperature and combustion chamber pressure.

**Filters**

Check the filtering baskets on line and at nozzle present in the system.

Clean or replace if necessary.

If rust or other impurities are observed inside the pump, use a separate pump to lift any water and other impurities that may have deposited on the bottom of the tank.

**Nozzles**

It is advisable to replace nozzles every year during regular maintenance operations.

Do not clean the nozzle openings; do not even open them.

**Flexible hoses**

Check to make sure that the flexible hoses are still in good condition.

**Power to photocell QRI (Fig. 33)**

Min value for a good work: 3.5 Vdc (AZL display flame approx. 50%).

If the value is lower, it can depend on:

- photocell positioned incorrectly;
- low current (lower than 187 V)
- bad regulation of the burner.

To measure power, use a voltmeter with a 10 Vdc scale, connected as illustrated on Fig. 33.

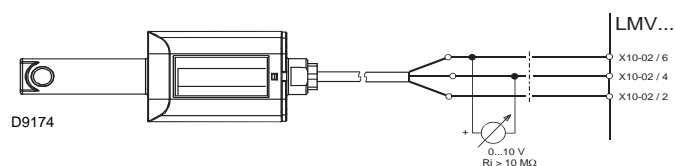


Fig. 33

**Fuel tank**

Approximately every 5 years, or whenever necessary, suck any water or other impurities present on the bottom of the tank using a separate pump.

**Combustion**

In case the combustion values found at the beginning of the intervention do not respect the standards in force or, in any case, do not correspond to a proper combustion, contact the Technical Assistant and have him carry out the necessary adjustments.

**6.2.3 Opening the burner**



Disconnect the electrical supply from the burner.

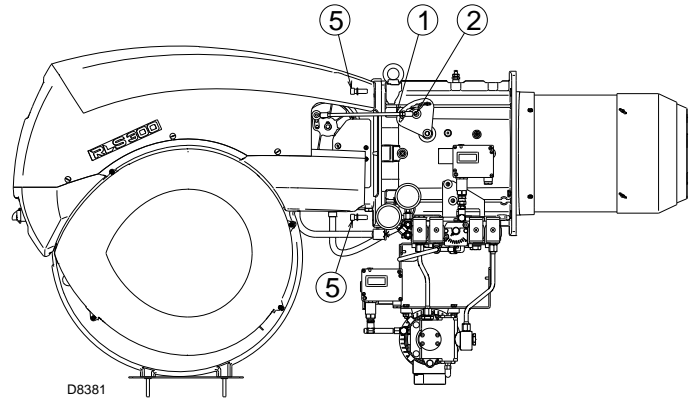
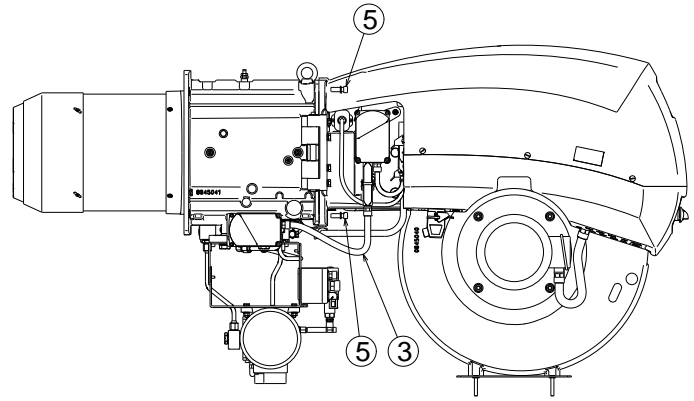
- Remove the tie rod 1)(Fig. 34) of the head movement lever, loosening nut 2).
- Disconnect the oil servomotor test point 3).
- Remove screws 5).

At this point it is possible to open the burner at the hinge.

**6.2.4 Closing the burner**

- Close the burner at the hinge.
- Apply screw 5).
- Connect the oil servomotor test point 3).
- Apply the tire rod 1) of the head movement lever, loosening nut 2).

Connect the electrical supply from the burner.

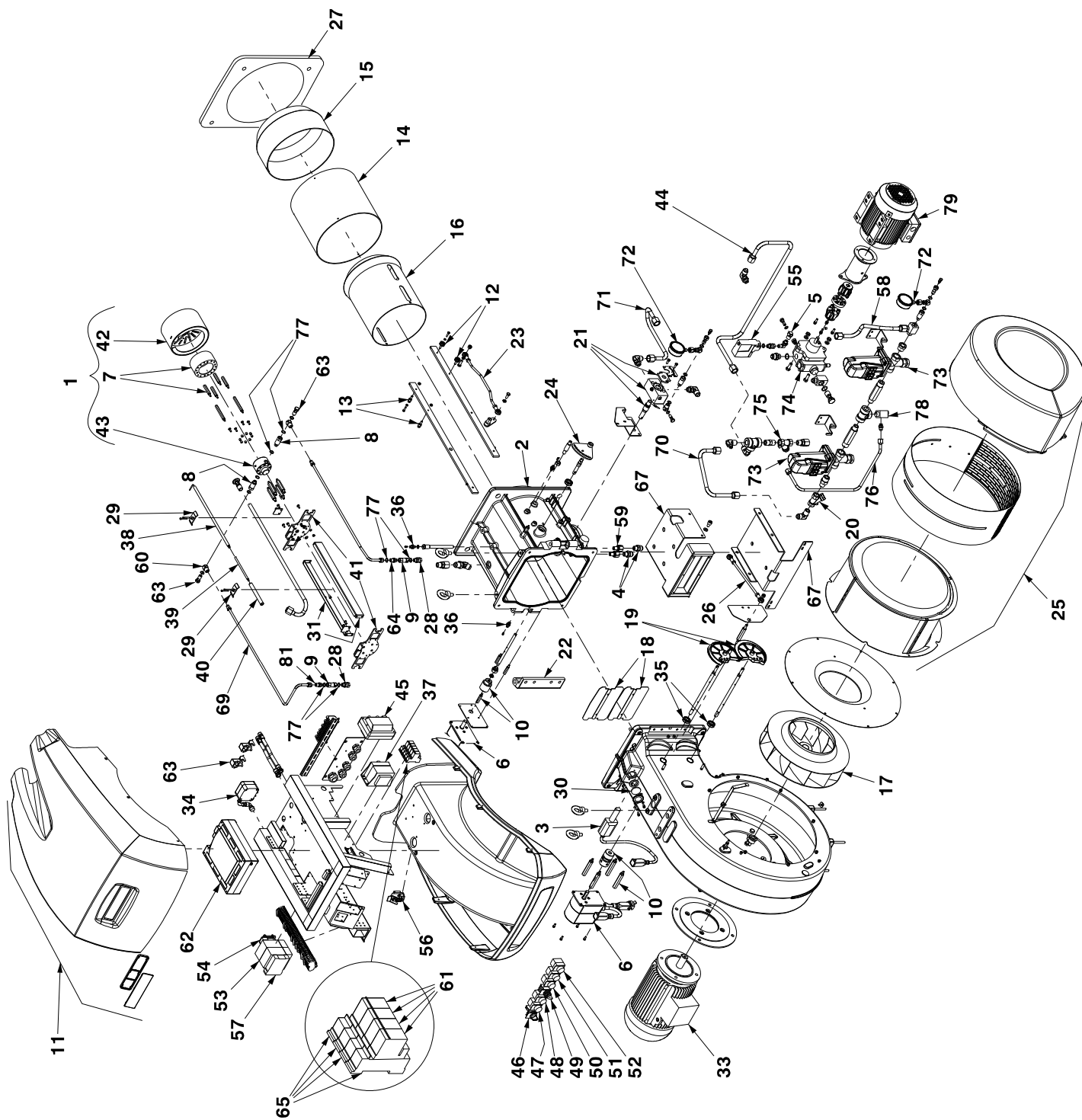


**Fig. 34**



**A**

**Appendix - Spare parts**



N.	CODE	DESCRIPTION	*
1	20041683	COMBUSTION HEAD ASSEMBLY	
2	20013114	MANIFOLD	
3	20006151	QRI CELL	A
4	20041659	CONNECTOR	C
5	3006896	CONNECTOR	C
6	3013304	AIR SERVOMOTOR	B
7	20041674	AIR DIFFUSER	A
8	3013460	CONNECTOR	C
9	3013461	VALVE NOT RETURN	B
10	3013307	JOINT	
11	20013115	COVER	
12	3013311	BAR	C
13	3013312	BAR	C
14	3013313	SLEEVE	
15	3013314	END CONE	B
16	3013508	SHUTTER	C
17	20006192	FAN	C
18	3013319	AIR DAMPER	
19	3013320	GEAR TRAIN	
20	20029233	FILTER	
21	20041353	MODULATOR	
22	3013323	HINGE	
23	3013324	INTERNAL TIE ROD	C
24	3013325	LEVER ASSEMBLY	
25	3013326	AIR INTAKE ASSEMBLY	
26	3013327	EXTERNAL TIE ROD	C
27	3013328	FLANGE GASKET	A
28	3013462	CONNECTOR	C
29	20041685	U BOLT	C
30	3008663	VIEWING PORT	C
31	3013509	TIE ROD	C
33	3014152	FAN MOTOR	C
34	3012948	AIR PRESSURE SWITCH	
35	3012795	BEARING	C
36	3005447	PRESSURE TEST POINT	C
37	3013284	AZL TRANSFORMER	B
38	3013106	ELECTRODE	A
39	3013128	HIGH VOLTAGE LEAD	A
40	20013160	INSULATOR	A
41	20041690	SUPPORT	
42	20041673	AIR DIFFUSER	A
43	3013549	NOZZLE HOLDER	C
44	20041364	TUBE	
45	3012956	TRANSFORMER	B
46	20027021	ON/OFF SWITCH	C
47	20027013	POWER ON LIGHT	C
48	20027014	CALL FOR HEAT LIGHT	C
49	20027422	LOCAL REMOTE SWITCH	A
50	20027013	MAIN FUEL LIGHT	A
51	20010962	ALARM SILENCE BUTTON	C
52	3013354	ALARM LIGHT RESET	A
53	20010966	RELAY	C
54	20027432	RELAY + CONTACTOR	C
55	3012384	OIL PRESSURE SWITCH	B
56	3013473	PLUG	
57	20013973	CONTACTOR	C
58	20041731	TUBE	
59	20041687	CONNECTOR	C
60	3012455	CONNECTOR	C
61	20010969	RELAY	C

N.	CODE	DESCRIPTION	*
62	3013282	CONTROL BOX	B
63	3003006	BAR	C
64	3006723	CONNECTOR	C
65	3012841	SOCKET	C
67	20041698	SUPPORT	
68	3013516	TUBE	
69	3013517	TUBE	
70	20041716	TUBE	
71	20041723	TUBE	
72	3006140	PRESSURE GAUGE	
73	20029212	VALVE	B
74	3006158	PUMP	C
75	20029257	VALVE	
76	20041730	TUBE	
77	3007079	SEAL	B
78	20029248	VALVE	
79	20041732	MOTOR	C

**\*****ADVISED PARTS**

A = Spare parts for minimum fittings

A+B = Spare parts for basic safety fittings

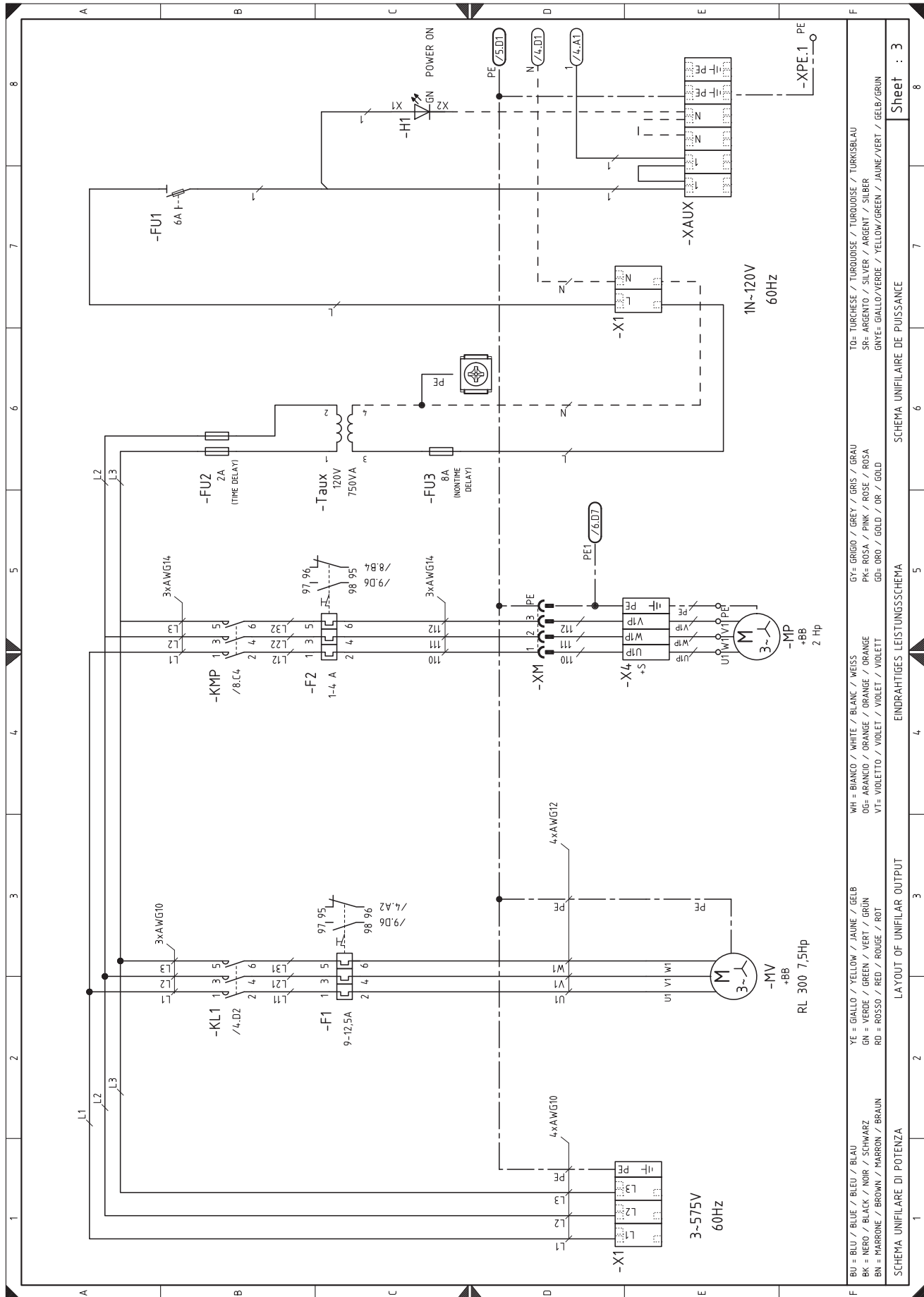
A+B+C = Spare parts for extended safety fittings

**B Appendix - Electrical panel layout**

<b>1</b>	<b>Index of layouts</b>
<b>2</b>	References layout
<b>3</b>	Layout of unifilar output
<b>4</b>	Operational layout
<b>5</b>	LMV51... operational layout
<b>6</b>	LMV51... operational layout
<b>7</b>	LMV51... operational layout
<b>8</b>	LMV51... operational layout
<b>9</b>	LMV51... operational layout
<b>10</b>	LMV51... operational layout
<b>11</b>	LMV51... operational layout
<b>12</b>	Electrical connections set by installer
<b>13</b>	Electrical connections set by installer

**2 Reference layout**



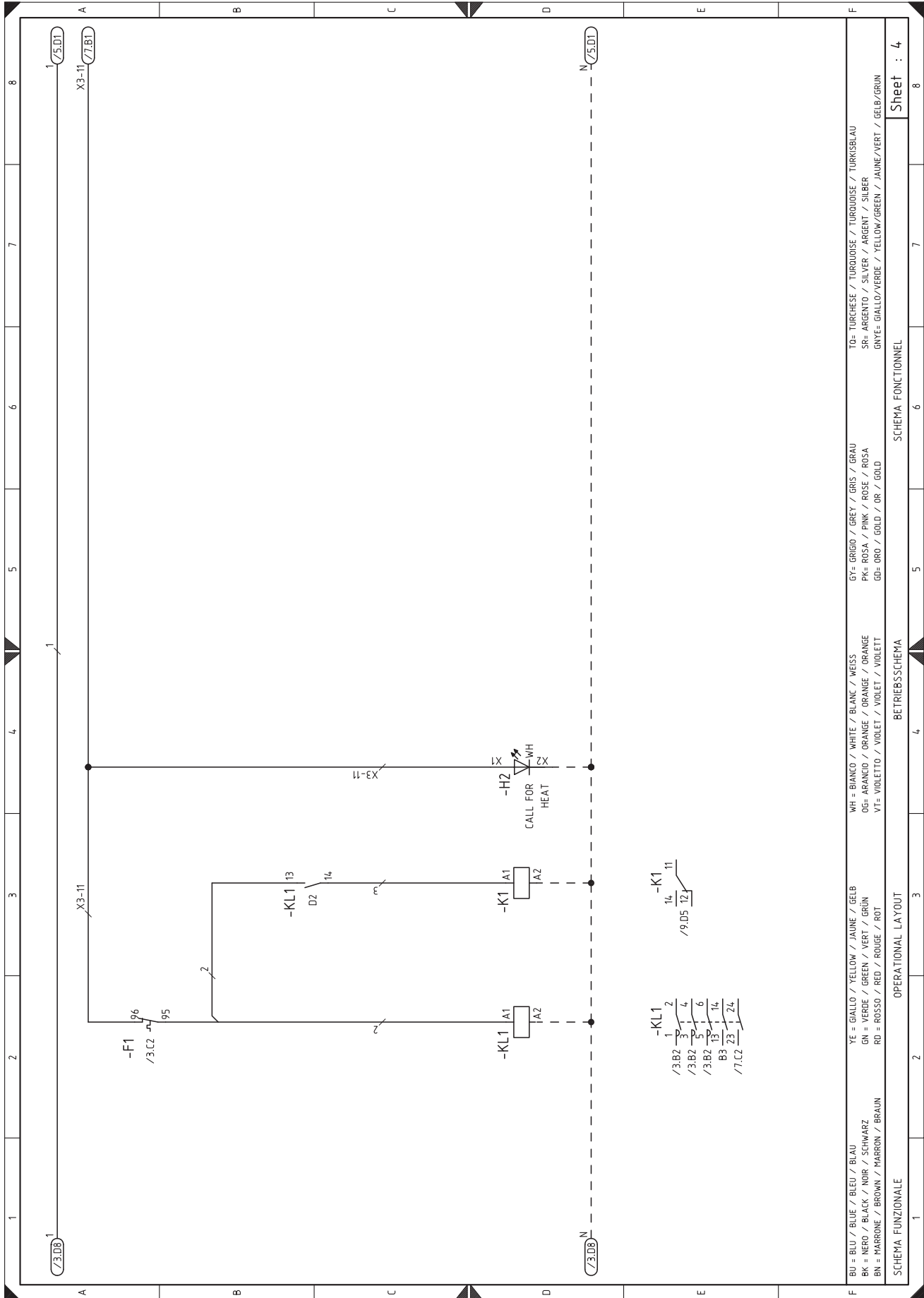


BU = BLU / BLUE / BLEU / BLAU	YE = GIALLO / YELLOW / JAUNE / GELB	WH = BIANCO / WHITE / BLANC / WEISS	GY = GRIGIO / GREY / GRIS / GRAU	TO = TURCHESE / TURKHOISE / TURKISBLAU
BK = NERO / BLACK / NOIR / SCHWARZ	GN = VERDE / GREEN / VERT / GRÜN	OG = ARANCIO / ORANGE / ORANGE / ORANGE	PK = ROSA / PINK / ROSE / ROSA	SR = ARGENTO / SILVER / ARGENT / SILBER
BN = MARRONE / BROWN / MARRON / BRAUN	RD = ROSSO / RED / ROUGE / ROT	VT = VIOLETTO / VIOLET / VIOLET / VIOLETT	GD = ORO / GOLD / OR / GOLD	GNVE = GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRÜN

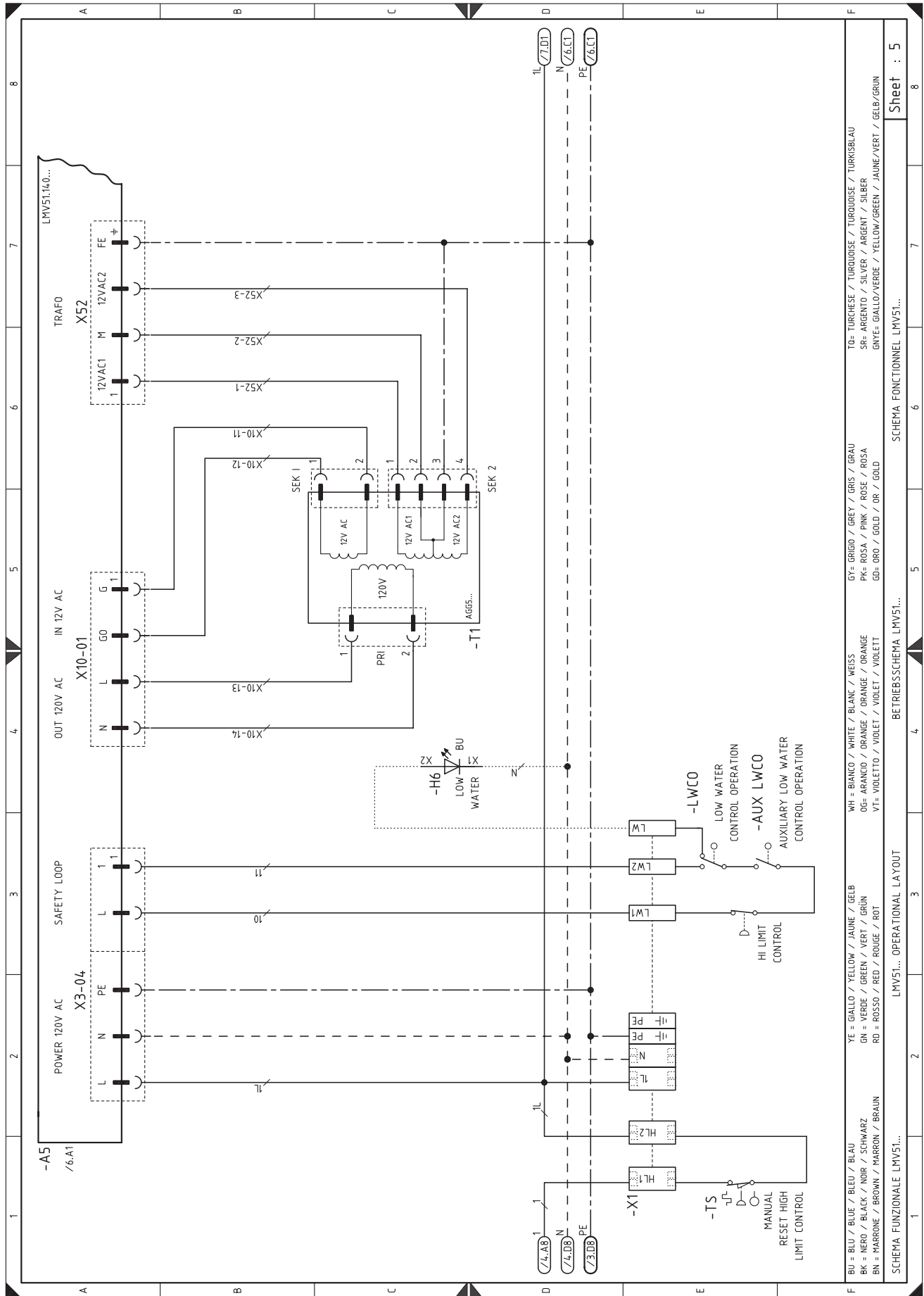
SCHEMA UNIFILARE DI POTENZA LAYOUT OF UNIFILAR OUTPUT

EINDRAHTIGES LEISTUNGSSCHEMA SCHEMA UNIFILAIRE DE PUISSANCE

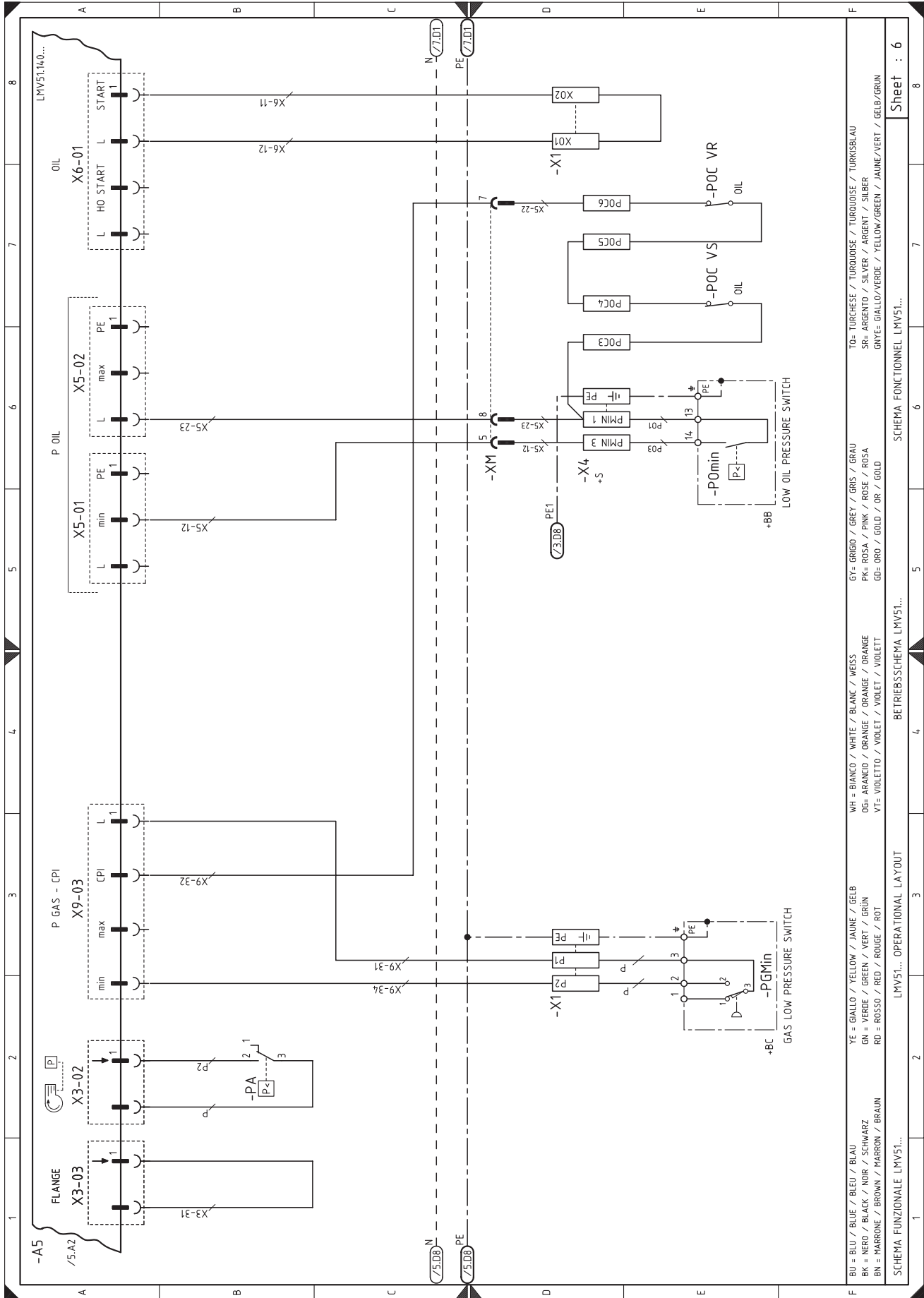
Sheet : 3



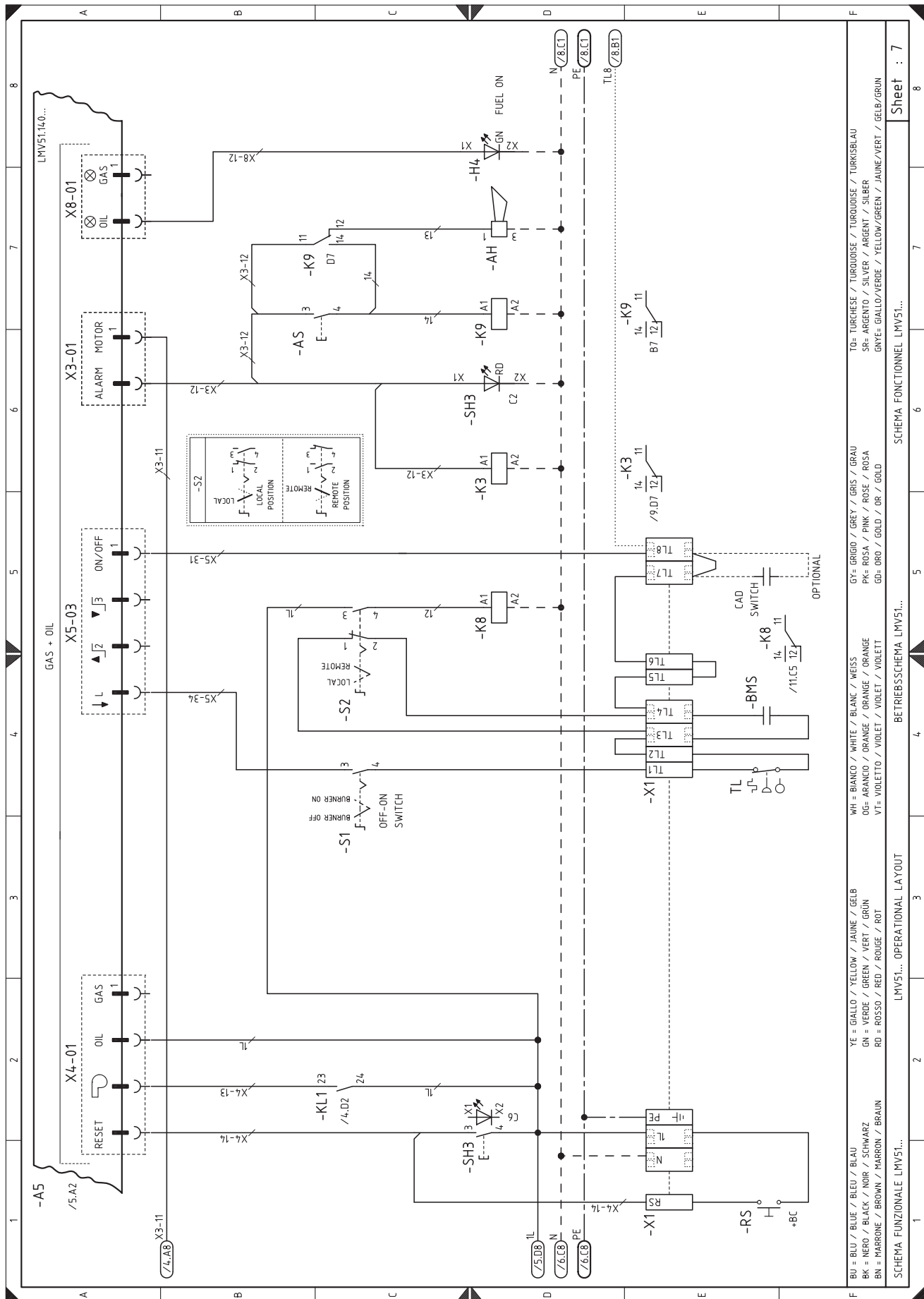
Sheet : 4



Sheet : 5

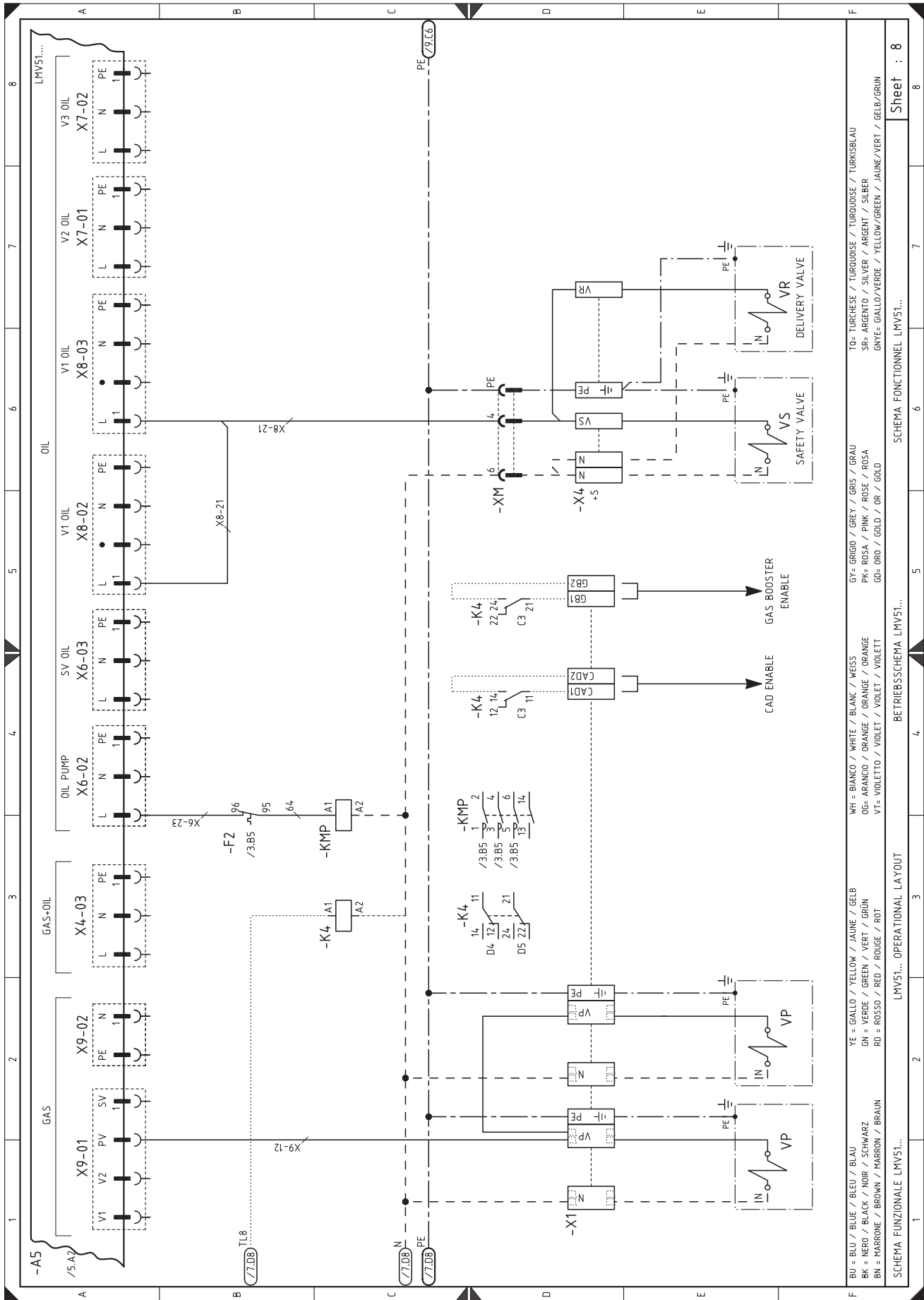




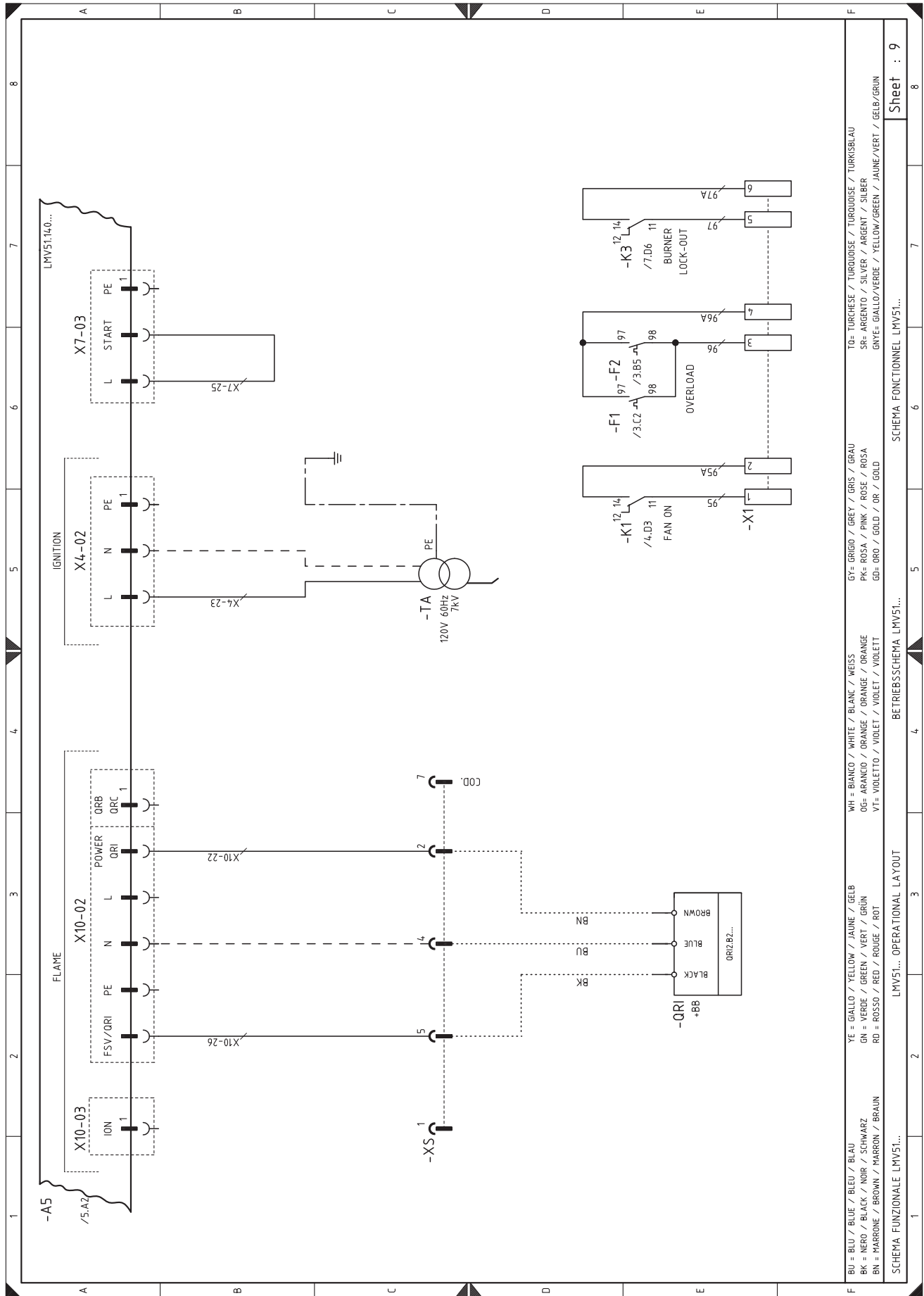


BU = BLU / BLUE / BLEU / BLAU  
 BK = NERO / BLACK / NOIR / SCHWARZ  
 BN = MARRONE / BROWN / MARRON / BRAUN  
 YE = GIALLO / YELLOW / JAUNE / GELB  
 GN = VERDE / GREEN / VERT / GRÜN  
 RD = ROSSO / RED / ROUGE / ROT  
 WH = BIANCO / WHITE / BLANC / WEISS  
 OG = ARANCIO / ORANGE / ORANGE / ORANGE  
 VT = VIOLETTO / VIOLET / VIOLET / VIOLETT  
 GY = GRIGIO / GREY / GRIS / GRAU  
 PK = ROSA / PINK / ROSE / ROSA  
 GD = ORO / GOLD / OR / GOLD  
 TO = TURCHESE / TURQUOISE / TURKISBLAU  
 SR = ARGENTO / SILVER / ARGENT / SILBER  
 GNYE = GALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRÜN

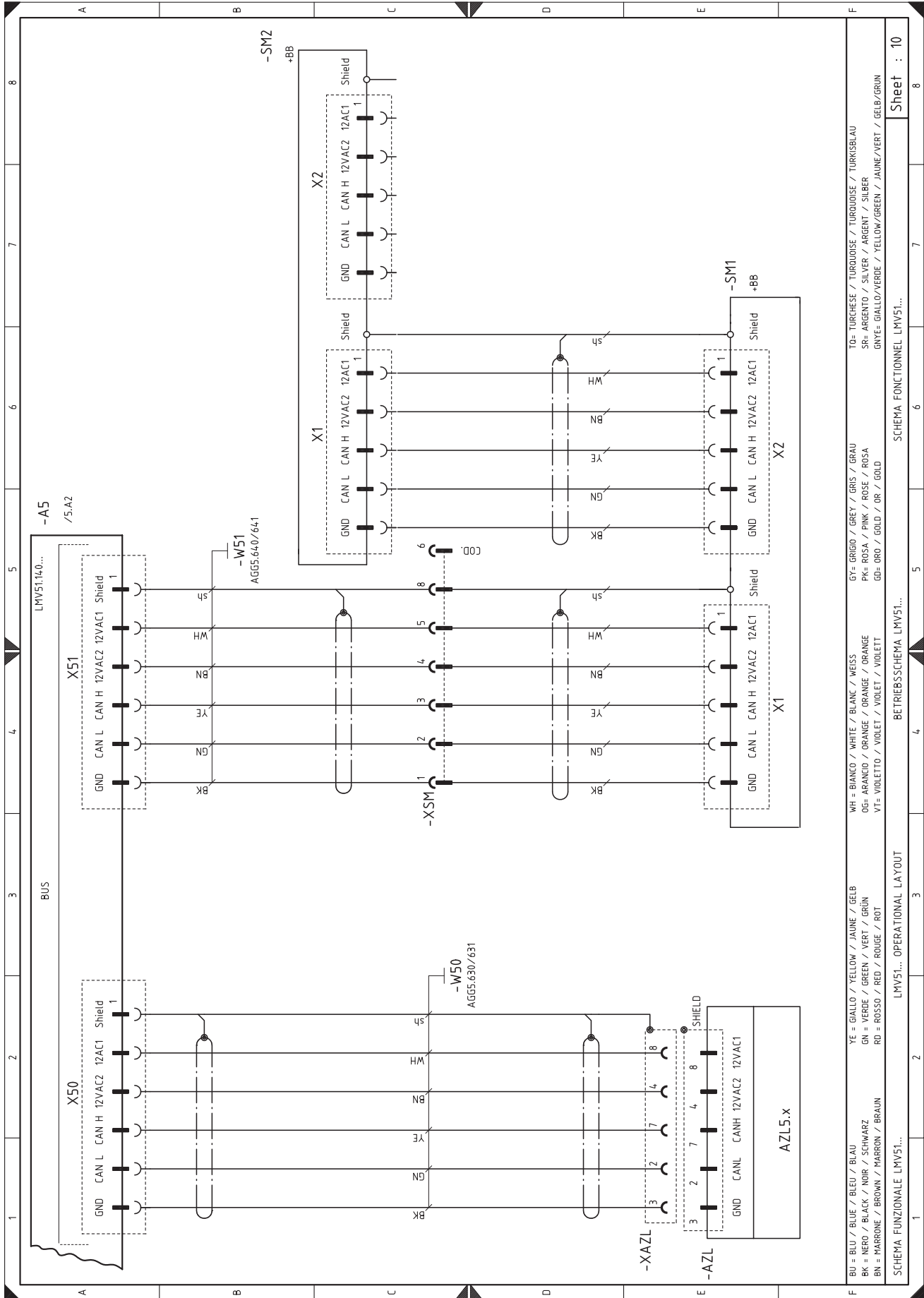
Sheet : 7



BU = BLU / BLEU / BLEU / BLEU  
 BK = NERO / BLACK / NOIR / SCHWARZ  
 BN = MARRONE / BROWN / MARRON / BRAUN  
 YE = GIALLO / YELLOW / JAUNE / GELB  
 GN = VERDE / GREEN / VERT / GRÜN  
 RD = ROSSO / RED / ROUGE / ROT  
 WH = BIANCO / WHITE / BLANK / WEISS  
 OG = ARANCIO / ORANGE / ORANGE / ORANGE  
 VI = VIOLETTO / VIOLET / VIOLET / VIOLETT  
 GR = GRIGIO / GREY / GRIS / GRAU  
 PK = ROSA / PINK / ROSE / ROSA  
 GD = ORO / GOLD / OR / GOLD  
 TO = TURCOISE / TURQUOISE / TURQUOISE / TURKISBLAU  
 SR = ARGENTO / SILVER / ARGENT / SILBER  
 GNVE = GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRÜN  
 SCHEMA FUNZIONALE LMV51...  
 LMV51... OPERATIONAL LAYOUT  
 BETRIEBSSCHEMA LMV51...  
 SCHEMA FONCTIONNEL LMV51...

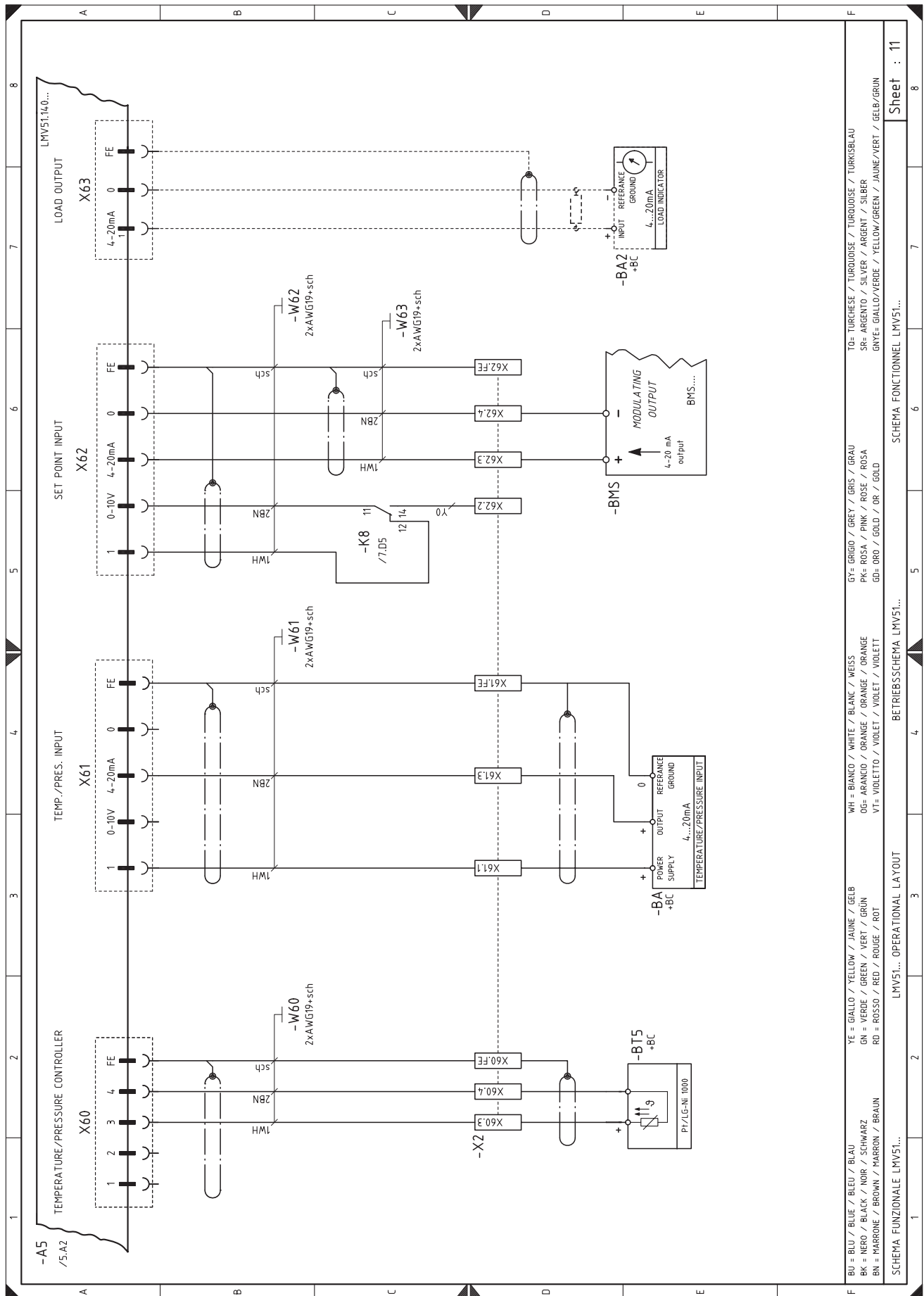


Sheet : 9



BU = BLU / BLUE / BLEU / BLAU	YE = GIALLO / YELLOW / JAUNE / GELB	WH = BIANCO / WHITE / BLANK / WEISS	GY = GRIGIO / GREY / GRIS / GRAU	TO = TURCHESE / TURQUOISE / TURKOISE / TURKISBLAU
BK = NERO / BLACK / NOIR / SCHWARZ	GN = VERDE / GREEN / VERT / GRÜN	OG = ARANCIO / ORANGE / ORANGE / ORANGE	PK = ROSA / PINK / ROSE / ROSA	SR = ARGENTO / SILVER / ARGENT / SILBER
BN = MARRONE / BROWN / MARRON / BRAUN	RD = ROSSO / RED / ROUGE / ROT	VI = VIOLETTA / VIOLET / VIOLET / VIOLETT	GD = ORO / GOLD / OR / GOLD	GNTE = GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRÜN
SCHEMA FUNZIONALE LMV51... OPERATIONAL LAYOUT				
SCHEMA FONCTIONNEL LMV51... BETRIEBSSCHEMA LMV51...				

Sheet : 10



TO= TURCHESE / TURQUOISE / TURKISBLAU  
 SR= ARGENTO / SILVER / ARGENT / SILBER  
 GNYE= GALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN

GY= GRIGIO / GREY / GRIS / GRAU  
 PK= ROSA / PINK / ROSE / ROSA  
 GD= ORO / GOLD / OR / GOLD

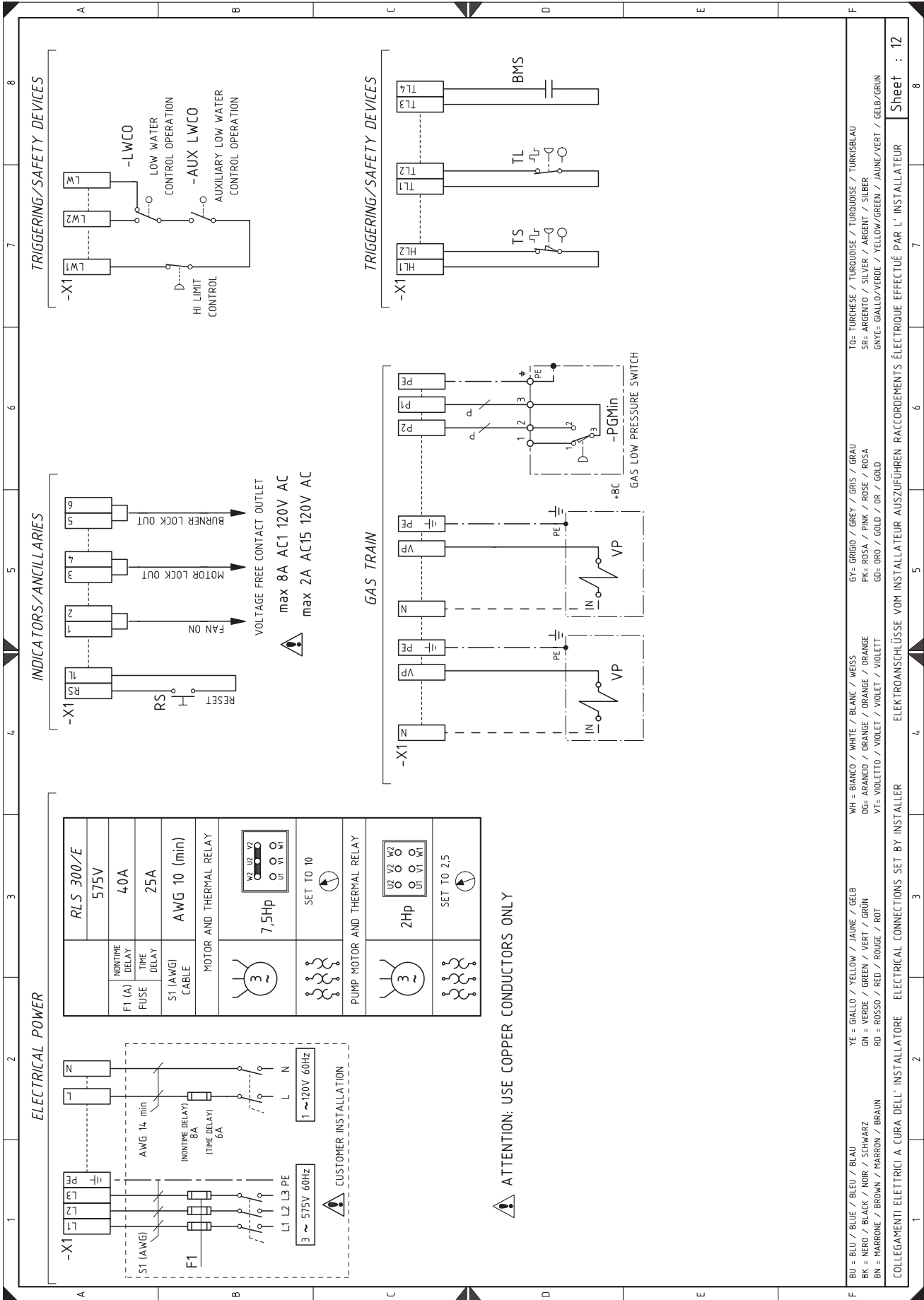
WH = BIANCO / WHITE / BLANC / WEISS  
 OG= ARANCIO / ORANGE / ORANGE / ORANGE  
 VT= VIOLETTA / VIOLET / VIOLET / VIOLETT

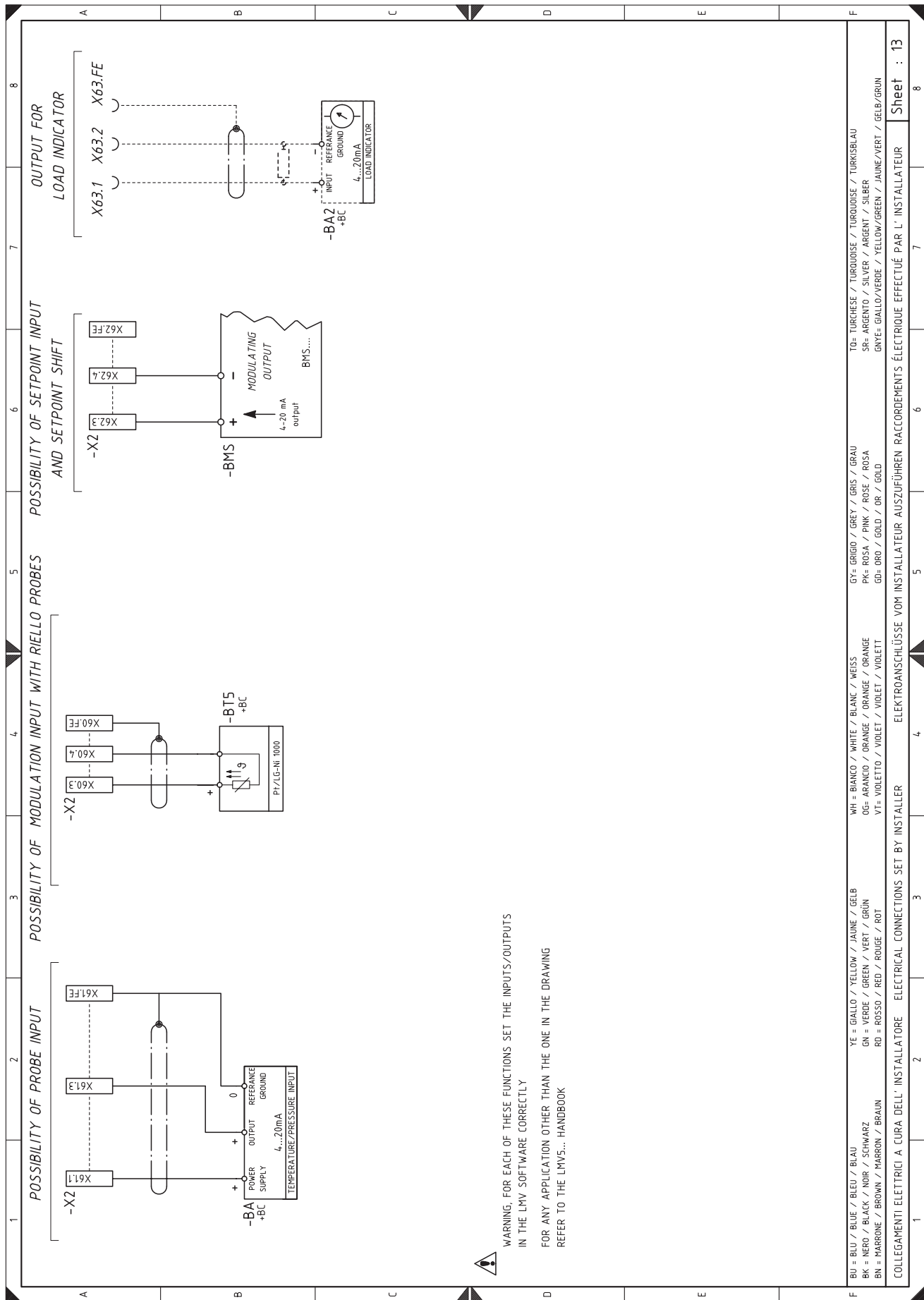
YE = GIALLO / YELLOW / JAUNE / GELB  
 GN = VERDE / GREEN / VERT / GRUN  
 RD = ROSSO / RED / ROUGE / ROT

BU = BLU / BLUE / BLEU / BLAU  
 BK = NERO / BLACK / NOIR / SCHWARZ  
 BN = MARRONE / BROWN / MARRON / BRAUN

PI/LG-NI 1000

SCHEMA FUNZIONALE LMV51...  
 SCHEMA FONCTIONNEL LMV51...  
 SCHEMA FUNKTIONNEL LMV51...





**⚠** WARNING, FOR EACH OF THESE FUNCTIONS SET THE INPUTS/OUTPUTS IN THE LMV SOFTWARE CORRECTLY  
 FOR ANY APPLICATION OTHER THAN THE ONE IN THE DRAWING REFER TO THE LMVS... HANDBOOK

BU = BLU / BLUE / BLEU / BLAU	YE = GIALLO / YELLOW / JAUNE / GELB	WH = BIANCO / WHITE / BLANC / WEISS	GY = GRIGIO / GREY / GRIS / GRAU	TO = TURCHESE / TURQUOISE / TURKOISE / TURKISBLAU
BK = NERO / BLACK / NOIR / SCHWARZ	GN = VERDE / GREEN / VERT / GRÜN	OG = ARANCIO / ORANGE / ORANGE / ORANGE	PK = ROSA / PINK / ROSE / ROSA	SR = ARGENTO / SILVER / ARGENT / SILBER
BN = MARRONE / BROWN / MARRON / BRAUN	RD = ROSSO / RED / ROUGE / ROT	VT = VIOLETTA / VIOLET / VIOLET / VIOLETT	GD = ORO / GOLD / OR / GOLD	GNVE = GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRÜN

**Key to electrical layout**

A5	-	Electronic cam
AZL	-	Display and operating unit
BA	-	Probe with current output
BA2	-	Load indicator
BMS	-	Remote set point
BT5	-	Thermocouple probe
F1	-	Fan motor thermal cut-out
F2	-	Pump motor thermal cut-out
FU1	-	Auxiliary fuse
H1	-	Signal light for power on
H2	-	Signal light for call to heat
H4	-	Signal light for fuel ON
KL1	-	Direct start and star/delta starter line contactor
KMP	-	Pump motor contactor
K1	-	Fan ON free contact relay
K3	-	Burner lock-out voltage free contact relay
LWCO	-	Low water control operation
MP	-	Pump motor
MV	-	Fan motor
PA	-	Air pressure switch
PE	-	Burner ground
PGmin	-	Min. gas pressure switch
POmin	-	Min. oil pressure switch
POC VR-	-	Light oil POC return valve
POC VS-	-	Light oil POC safety valve
QRI	-	Infrared sensor
RS	-	Remote lock-out reset button
S1	-	Switch for burner ON/OFF
S2	-	Switch for following operations: LOCAL/REMOTE
SH3	-	Burner reset button and lockout warning
SM1	-	Air servomotor
SM2	-	Servomotor
T1	-	Electronic cam transformer
TA	-	Ignition transformer
TL	-	Limit pressure switch/thermostat
TS	-	Safety pressure switch/thermostat
X1	-	Main supply terminal strip
X2	-	Controller input terminal strip
X4	-	Light oil assembly terminal block
XAUX	-	Auxiliary terminal strip
XAZL	-	Plug for on-board AZL
XM	-	Light oil assembly connector
XS	-	Flame detectors connector
XSM	-	Servomotor connector
VP	-	Pilot gas valve
VR	-	Light oil return valve
VS	-	Light oil safety valve