GB

Dual fuel light oil/gas burner

Modulating operation

CE

CODE	MODEL
20166921	RLS 120/E FGR

20168262 (2) - 09/2019

Translation of the original instructions

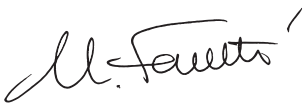
1 Declarations

Declaration of conformity in accordance with ISO / IEC 17050-1		
Manufacturer:	RIELLO S.p.A.	
Address:	Via Pilade Riello, 7 37045 Legnago (VR)	
Product:	Dual fuel light oil / gas burner	
Model:	RLS 120/E FGR	
These products are in compliance with the following Technical Standards:		
EN 676		
EN 267		
EN 12100		
and according to the European Directives:		
MD	2006/42/EC	Machine Directive
LVD	2014/35/UE	Low Voltage Directive
EMC	2014/30/UE	Electromagnetic Compatibility

Quality is ensured by means of an ISO 9001:2015 certified quality and management system.

Legnago, 21.04.2018

General Manager
RIELLO S.p.A. - Burners Department
Eng. U. Ferretti



Research and Development Director
RIELLO S.p.A. - Burners Department
Eng. F. Comencini

2 Information and general warnings

2.1 Information about the instruction manual

2.1.1 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 Centre 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.

2.1.2 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.

2.1.3 Other symbols

DANGER: LIVE COMPONENTS

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

DANGER: FLAMMABLE MATERIAL

This symbol indicates the presence of flammable materials.

DANGER: BURNING

This symbol indicates the risks of burns due to high temperatures.

DANGER: CRUSHING OF LIMBS

This symbol indicates the presence of moving parts: danger of crushing of limbs.

WARNING: MOVING PARTS

This symbol indicates that you must keep limbs away from moving mechanical parts; danger of crushing.

DANGER: EXPLOSION

This symbol signals places where an explosive atmosphere may be present. An explosive atmosphere is defined as a mixture - under atmospheric conditions - of air and flammable substances in the form of gases, vapours, mist or dust in which, after ignition has occurred, combustion spreads to the entire unburned mixture.

PERSONAL PROTECTION EQUIPMENT

These symbols indicate the equipment that must be worn and kept by the operator for protection against threats against safety and/or health while at work.

OBLIGATION TO ASSEMBLE THE COVER AND ALL THE SAFETY AND PROTECTION DEVICES

This symbol signals the obligation to reassemble the cover and all the safety and protection devices of the burner after any maintenance, cleaning or checking operations.

ENVIRONMENTAL PROTECTION

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

IMPORTANT INFORMATION

This symbol indicates important information that you must bear in mind.

➤ This symbol indicates a list.

Abbreviations used

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

2.1.4 Delivery of the system and the instruction manual

When the system is delivered, it is important that:

➤ The instruction manual is delivered 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 must carefully inform the user about:
– the use of the system;
– any further tests that may be required before activating the system;
– maintenance, and the need to have the system checked at least once a year by a representative of the manufacturer or another specialised technician.
To ensure a periodic check, the manufacturer recommends the drawing up of a Maintenance Contract.

2.2 Guarantee and responsibility

The manufacturer guarantees its new products from the date of installation, 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.

WARNING

Failure to observe the information given in this manual, operating negligence, incorrect installation and 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 unauthorised modifications on the appliance;
➤ 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 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 structurally established flame;
➤ insufficient and inappropriate surveillance and care of those burner components most likely to be 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.

3 Safety and prevention

3.1 Background

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.

Namely:

it can be applied to boilers operating with water, steam, diathermic oil, and to other uses 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 ambient 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.


WARNING

The manufacturer guarantees safety and proper functioning only if all burner components are intact and positioned correctly.

3.2 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;

➤ 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.

➤ Personnel must observe 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 must 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 every responsibility for any damage that may be caused by the use of non-original parts.

In addition:

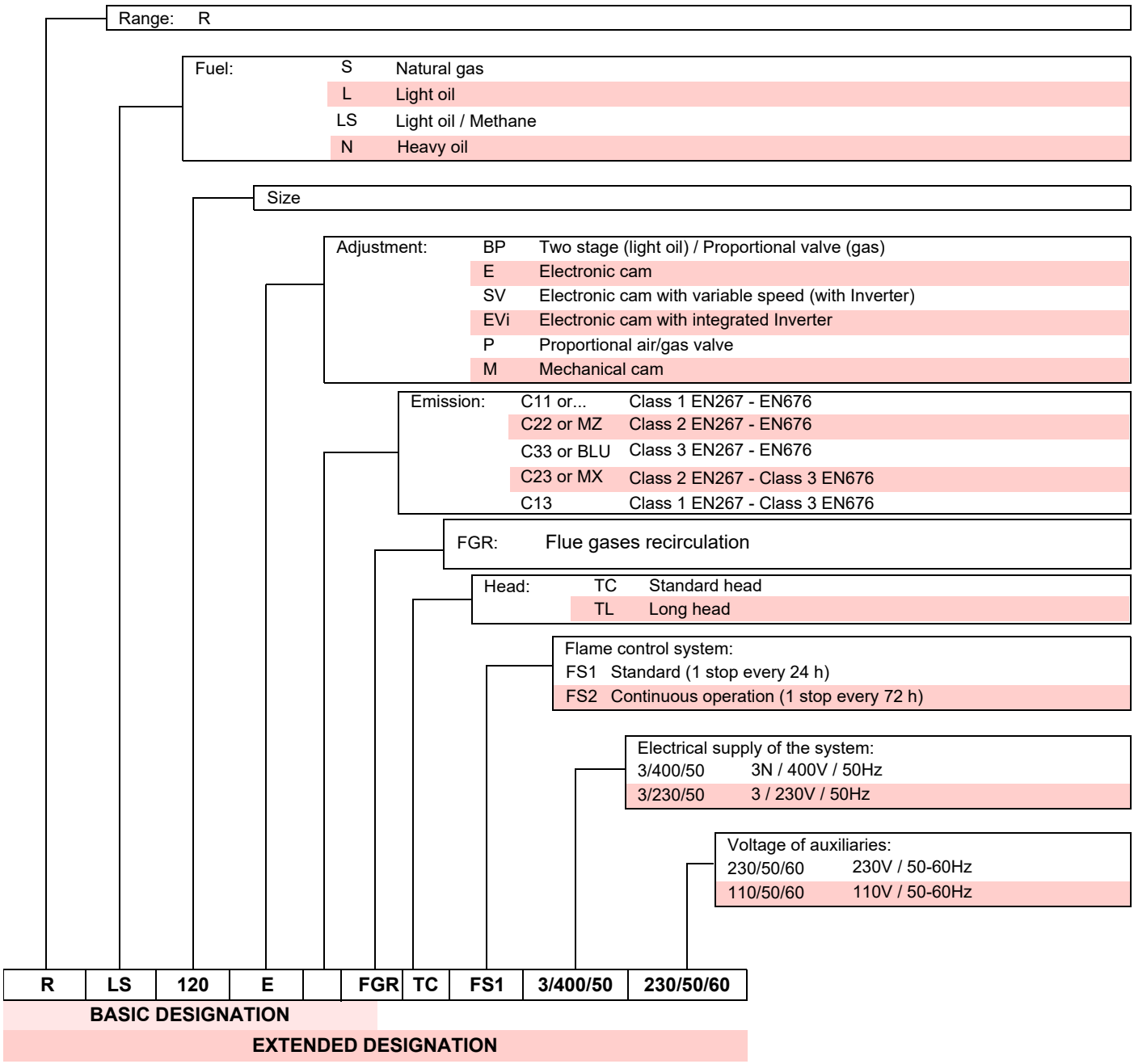
➤ must take all the measures necessary to prevent unauthorised people gaining access to the machine;

➤ the user 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.

4 Technical description of the burner

4.1 Burner designation



4.2 Models available

Designation		Voltage	Start-up	Code
RLS 120/E FGR FS1	TC	3/400/50	Direct	20166921

Tab. A

4.3 Burner categories - Countries of destination

Country of destination	Gas category
SE - FI - AT - GR - DK - ES - GB - IT - IE - PT - IS - CH - NO	I_{2H}
DE	I_{2ELL}
NL	I_{2L} - I_{2E} - I_2 (43.46 - 45.3 MJ/m^3 (0°C))
FR	I_{2Er}
BE	$I_{2E(R)B}$
LU - PL	I_{2E}

Tab. B

4.4 Technical data

Model			**RLS 120/E FGR FS1**
Power (1) Delivery (1)	min - max	kW kg/h	300/600 - 1200 25/50 - 101
Fuels			Light oil, max. viscosity at 20 °C: 6 mm^2/s (1.5°E - 6 cSt) Natural gas: G20 (methane gas)
Operation			– Intermittent (min. 1 stop in 24 hours) – Oil / Gas: modulating with kit
Nozzles		number	1
Standard applications			Boilers: water, steam, diathermic oil
Room temperature		°C	0 - 40
Combustion air temperature		°C max	60
Pump	output (at 12 bar) pressure range fuel temperature	kg/h bar °C max	230 10 - 21 90
Noise levels (2)	Sound pressure Sound power	dB (A)	85 96
Weight		kg	100

Tab. C

(1) Reference conditions: Ambient temperature 20°C - Gas temperature 15°C - Barometric pressure 1,013 mbar - Altitude 0 m a.s.l.
(2) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum output. The sound power is measured with the “Free Field” method, as per EN 15036, and according to an accurate “Accuracy: Category 3” measurement, as described in EN ISO 3746.

WARNING

To reduce the NOx of the nitric oxides in the event of an FGR system, the maximum burner output obtained chases based on the specific application and within the limits agreed upon with the Riello Technical Office.

4.5 Electrical data

Model		RLS 120/E FGR FS1
Main electrical supply		3~ 400V - 50Hz +/-10%
Auxiliary circuit electrical supply		1N ~ 230V - 50Hz
Fan motor	rpm V Hz W A	2890 380/415 50 2200 4.5
Pump motor	rpm V Hz W A	2700 230 50 550 3.6
Ignition transformer	V1 - V2 I1 - I2	230 V - 2 x 5 kV 1.9 A - 35 mA
Max. Absorbed electric power main electrical supply – light oil – gas	W	 2550 2550
Max. Absorbed electric power auxiliary circuit electrical supply – light oil – gas	W	 500 1300
Protection level		IP 44

Tab. D

4.6 Maximum 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 and the rear part drawn back on the slide bars.

The dimensions of the open burner are indicated by position I.

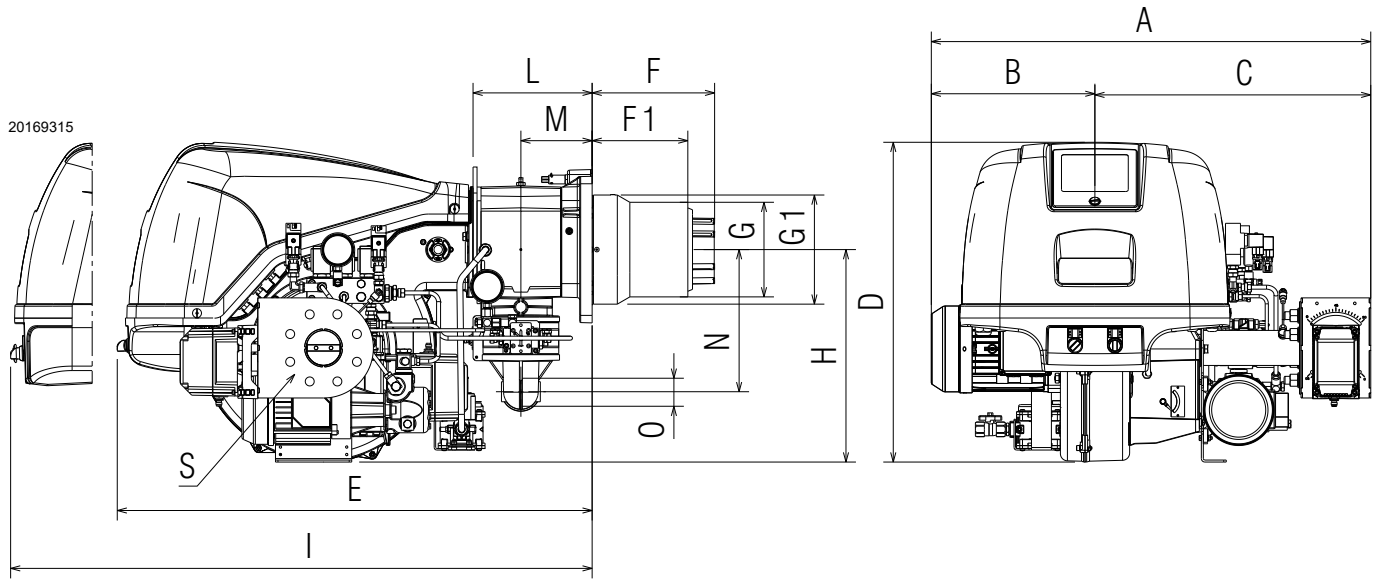


Fig. 1

mm	A	B	C	D	E	F*	F1*	G	G1	H	I*	L	M	N	O	S
RLS 120/E FGR	886	330	556	640	950	245	192	189	218	425	1482	239	143	284	2”	DN65

Tab. E

(*) Blast tube: short-long

4.7 Firing rate

The **maximum output** should be chosen within area A)(Fig. 2) of the diagram.

The **minimum output** must not be lower than the minimum limit of the diagram.

WARNING

The firing rate was obtained at an ambient temperature of 20°C and an atmospheric pressure of 1000 mbar (approx. 100 m above sea level), and with the combustion head adjusted as shown on page 22.

WARNING

For the operation inside the area B)(Fig. 2) remove the gas nozzle as shown (“**Removing the nozzles**” on page 22).

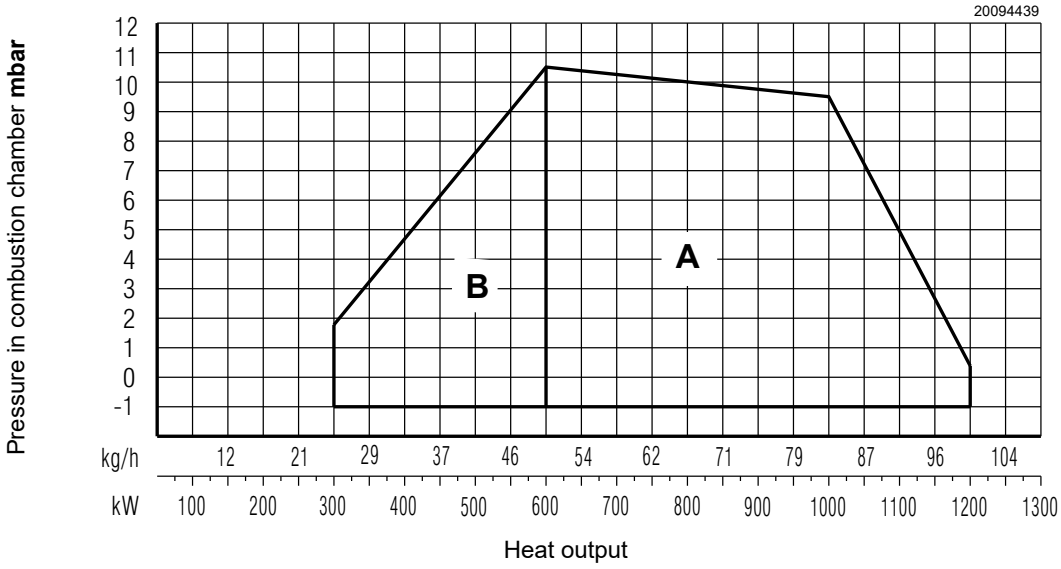


Fig. 2

4.8 Test boiler

The firing rates were established in special test boilers, according to EN 676 regulations.

In Fig. 3 you can see the diameter and length of the test combustion chamber.

Example:
Output 756 kW (650 Mcal/h): diameter 60 cm, length 2 m.

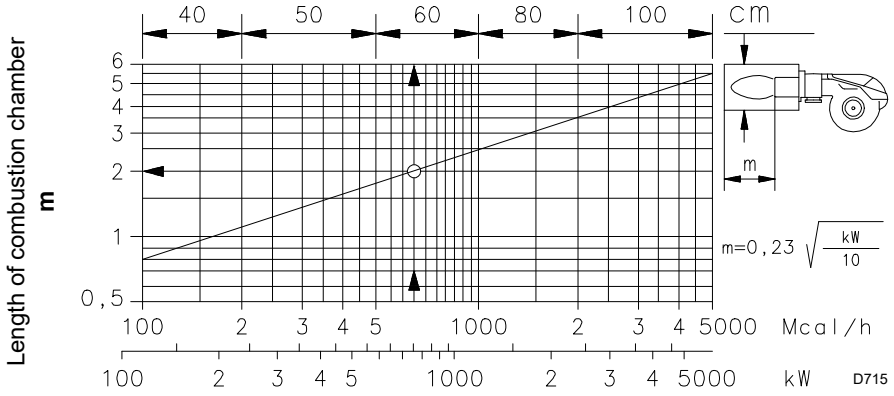


Fig. 3

4.9 Commercial boilers

The burner is suitable for operating on both flame inversion boilers (*), as well as on boilers with a combustion chamber with run-off from the bottom (three flue passes) on which the best results for low NO_x emissions are obtained.

The boiler front door maximum thickness must not exceed 250 mm (Fig. 4).

The coupling is ensured when the boiler is EC type-approved; for boilers or ovens with combustion chambers of very different dimensions compared to those shown in the diagram of (Fig. 3) preliminary checks are recommended.

(*) For flame inversion boilers, a kit is available to reduce the CO, if necessary.

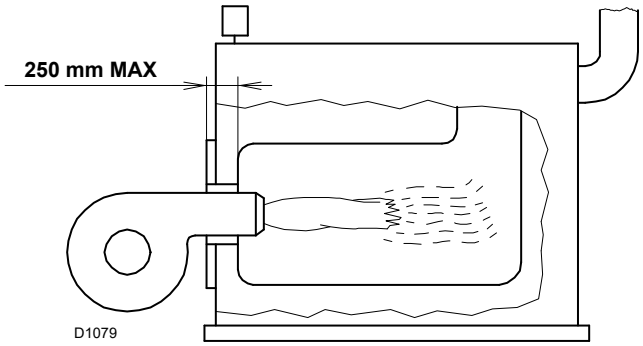


Fig. 4

4.10 Burner equipment

Flange for gas train . . . . . No. 1
Slide bar extensions (TL version) . . . . . No. 4
Gasket for flange . . . . . No. 1
M10x40 screws to fix the gas flange . . . . . No. 4
Thermal insulation screen . . . . . No. 1
Screws M12x35 to fix the burner flange to the boiler . . . . . No. 4
Flexible hoses . . . . . No. 2
Fittings for hoses . . . . . No. 2
Gaskets . . . . . No. 2
Spare parts list . . . . . No. 1
Instruction booklet . . . . . No. 1

4.11 Burner description

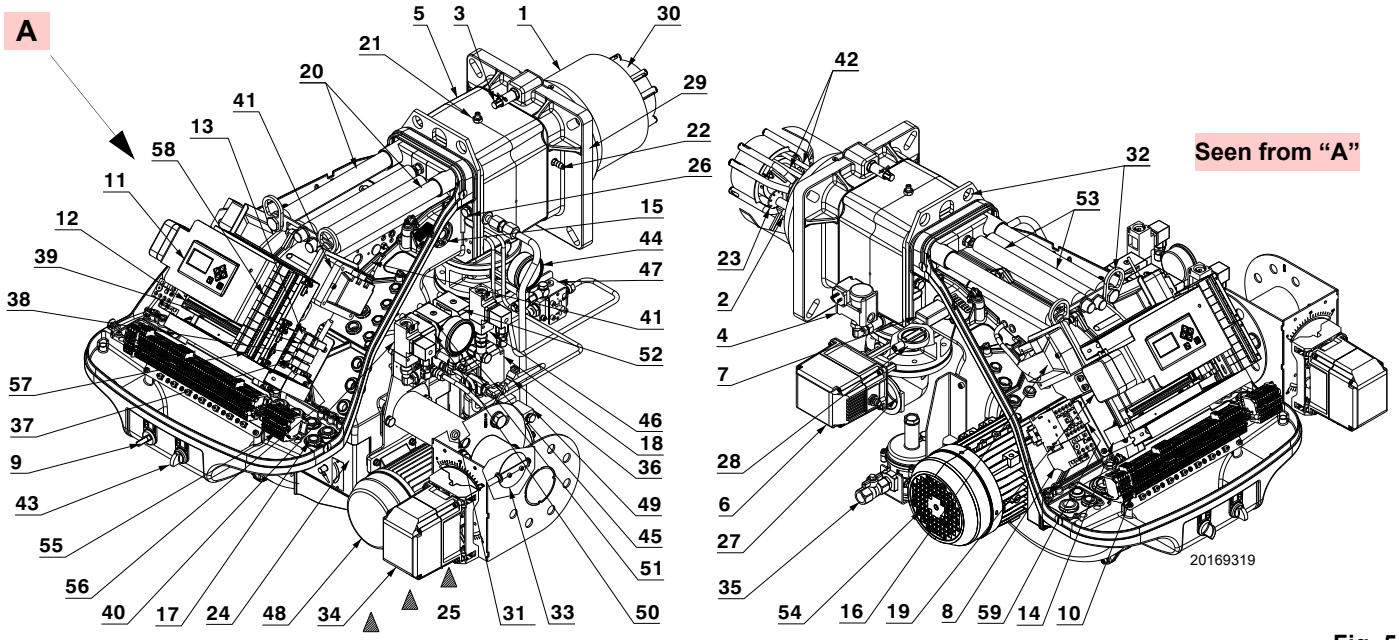


Fig. 5

1 Combustion head
2 Ignition electrode for pilot
3 Screw for combustion head adjustment
4 Maximum gas pressure switch
5 Pipe coupling
6 Gas servomotor
7 Flame sensor
8 Motor contact maker and thermal relay with reset button
9 “OFF/ON” (0-1) selector
10 Terminal board for electrical wiring
11 Operator panel with LCD display
12 Control box for checking flame and air/fuel ratio
13 K5 relay
14 Suppressor
15 Flame inspection window
16 GAS ignition transformer
17 Cable grommets for electrical wiring (to be carried out by the installer)
18 Air servomotor
19 Air pressure switch (differential type)
20 Guides for opening the burner and inspecting the combustion head
21 Gas pressure test point and head fixing screw
22 Air pressure socket
23 Pilot
24 Air damper
25 Fan air inlet
26 Screws to secure fan to pipe coupling
27 Gas input pipe
28 Gas butterfly valve
29 Boiler fixing flange
30 Flame stability disc
31 Connector G1/4
32 Lifting rings
33 Flue gas recirculation butterfly valve
34 Flue gas recirculation servomotor
35 Pilot gas train
36 Flue gas temperature probe
37 K1 relay
38 K2 relay
39 K3 relay
40 Minimum oil pressure switch
41 OIL ignition transformer
42 OIL ignition electrodes
43 “OIL-EXT-GAS” selector
44 Nozzle return pressure gauge
45 Nozzle delivery pressure gauge
46 Maximum oil pressure switch
47 Oil modulator
48 Pump motor
49 Pump
50 Safety valve
51 Operation valve
52 Return valve (VR)
53 Guides extensions
54 Fan motor
55 Auxiliary terminal board
56 Auxiliary circuit fuse
57 LCM100 module
58 DFM300 module
59 Pump motor relay (KMP)

4.12 Control box for controlling the air/fuel ratio (BT340)

Warning

WARNING

To avoid accidents, material and/or environmental damage, observe the following instructions!

The control box is a safety device! Avoid opening or modifying it, or forcing its operation. Riello S.p.A. cannot assume any responsibility for damage resulting from unauthorised interventions!

Risk of explosion!

An incorrect configuration can provoke fuel overcharging, with the consequential risk of explosion! The operators must be aware that the incorrect setting of the visualisation and operation control box, and of the positions of the fuel and/or air actuators, can cause dangerous conditions during burner operation.

For the safety and reliability of the control box, comply also with the following instructions.

- ➤ After commissioning and after each maintenance intervention, check the combustion gases values in the overall performance control!
- ➤ All activities (assembly, installation, assistance) should only be carried out by qualified specialist personnel
- ➤ Before carrying out work in the connection area, disconnect the power supply voltage of the system at all the poles. Secure it, then, from depression and make sure there is no voltage. if the system has not been deactivated there is a risk of an electrical shock.
- ➤ Ensure the BT340 is protected from electrical contact and all the electric components through the assembly. The cover should meet EN 60730 standards concerning the implementation, stability and protection.
- ➤ After carrying out all the activities (assembly, installation, assistance etc.) check the wiring and the parametrisation making sure they are in a good state.
- ➤ If the appliances fall or are jolted, do not restart them. The safety functions might be compromised even without any noticeable damage on the outside.
- ➤ When programming the configuration curves, the regulator constantly checks the quality of the system's combustion (for example using a station for analysing the combustion gases). If the combustion values are unsatisfactory or in the event of dangerous conditions, the regulator adopts suitable measures, like for example manually disarming the system.
- ➤ These instructions describe numerous possible applications and should be used as guidelines. Please always check and corroborate the fact the system is operating correctly by means of functional tests on the test bench when the system is operating! Comply with the additional instructions to ensure the BT340 is safe and reliable.
- ➤ Avoid the penetration of dew and humidity. If necessary, before starting the system, make sure it is dry!
- ➤ Avoid static charges. On contact they destroy the appliance's electrical components.

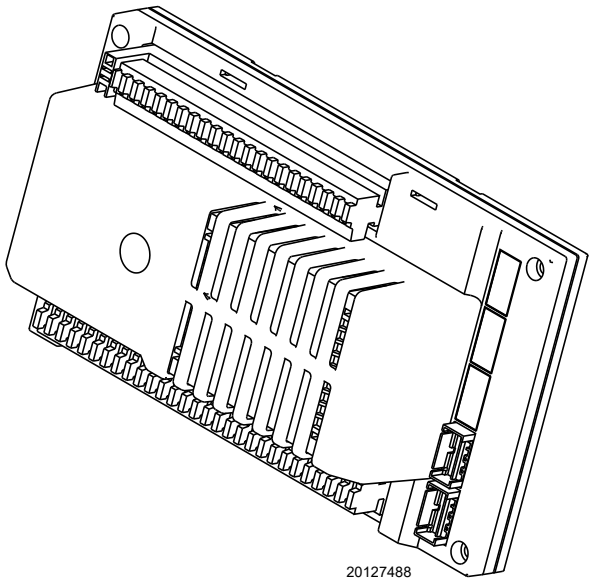


Fig. 6

Technical data

Model	BT340
Electrical power	230 V +10/-15 % 50-60 Hz
Input power	max. 30 VA
Cable length - control load - external reset button - fuel valve - other lines	 Max. 20 m Max. 20 m Max. 10 m Max. 20 m
Weight	1 kg
Environmental operating conditions:	
- climatic condition - mechanical condition - temperature interval	Class 3K5 (DIN EN 60721-3) Class 3M5 (DIN EN 60721-3) -20...+60 °C (dew not allowed)
Electrical safety	IP40 (housing) IP20 (terminals)

Tab. F

4.13 Operation sequence of the burner (GAS operation)

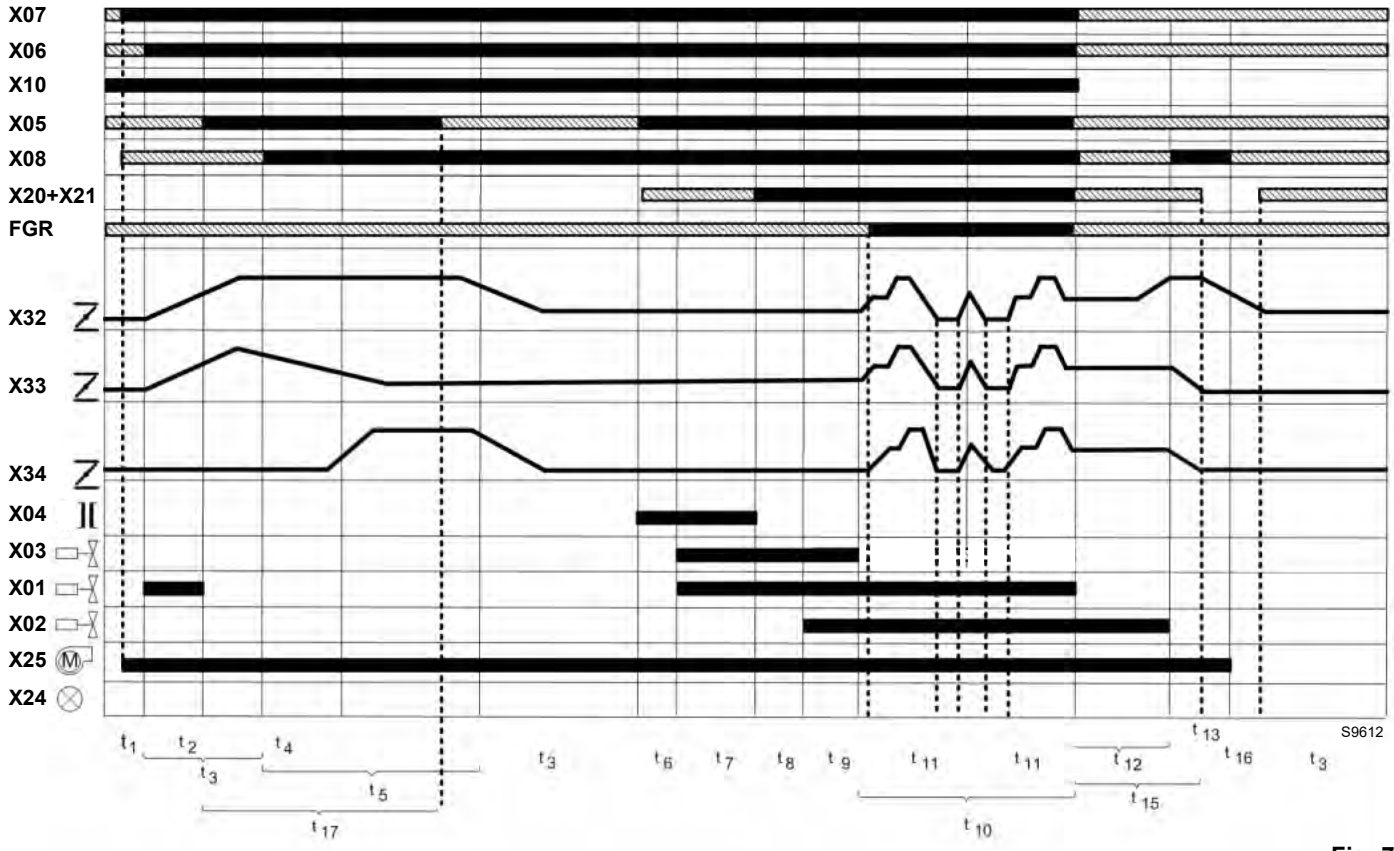


Fig. 7

Key to layout (Fig. 7)

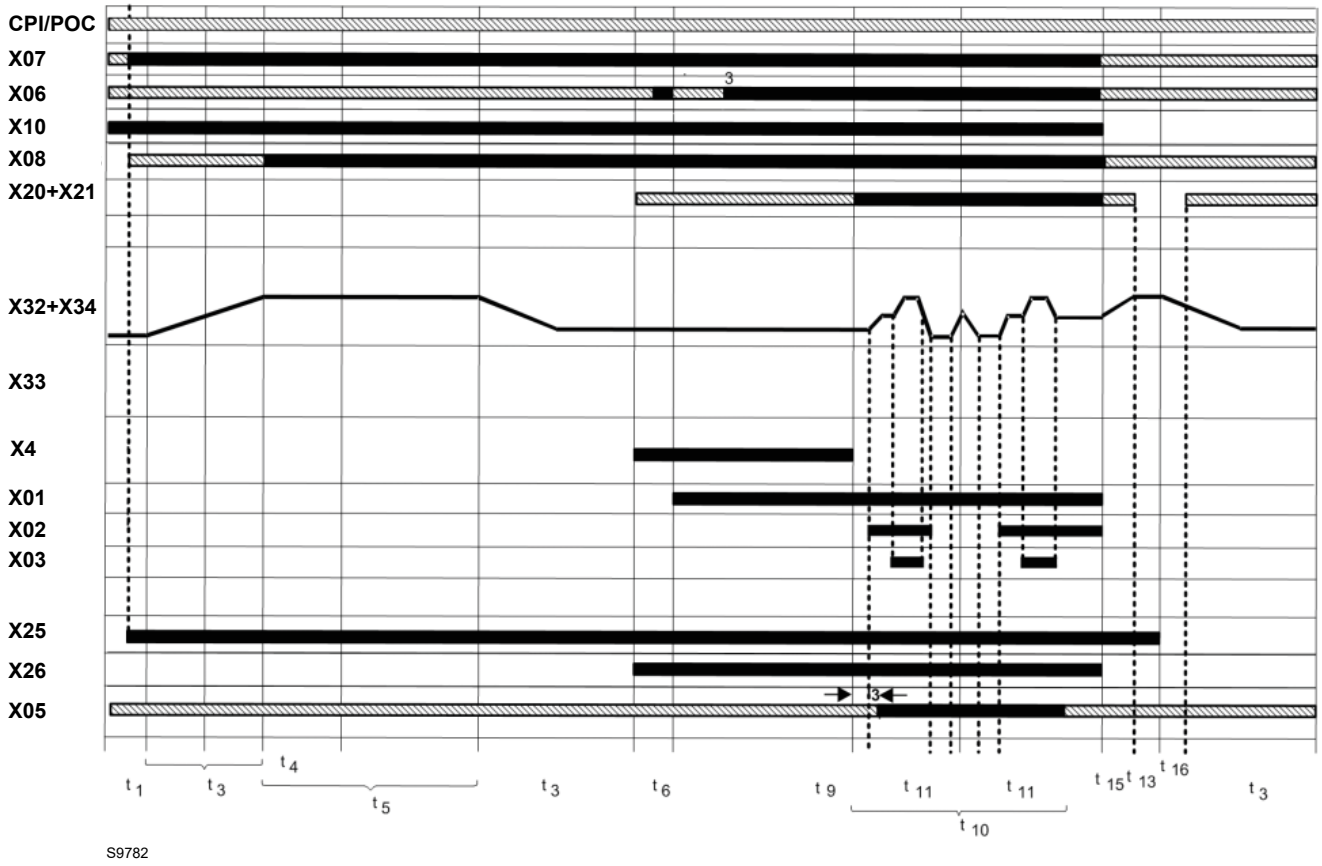
▨	Any position	
t1	Safety circuits enabling standby time (boiler and fuel)	
t2	Gas valve opening time (with valve leak detection control device active)	2.4 s
t3	Servomotor opening time	30/60 s
t4	FGR servomotor activation time	0 - t5
t5	Pre-purging time	adjustable
t6	Pre-ignition time	adjustable
t7	Flame ignition safety time	3s
t8	Flame stabilisation time	adjustable
t9’	2nd stage safety time	3s
t10	Modulation phase	
t11	Adjustment time	
t12	Gas valve opening time (with valve leak detection control device active)	3s
t13	Post-purging time	adjustable
t15	post-combustion time	adjustable
t16	Flame switching off control time	5 s
t17	Gas valve control time (with valve leak detection control device active)	30s

Tab. G

Key to layout (Fig. 7)

FGR	FGR enabling
X01	Gas valve 1
X02	Gas valve 2
X03	Pilot valve
X04	Ignition transformer
X05	Gas pressure > min.
X06	Gas safety circuit
X07	Boiler safety circuit
X08	Air pressure switch
X10	Burner on
X20+X21	Flame signal
X24	Lockout
X25	Fan on
X32	Air servomotor
X33	Fuel servomotor
X34	FGR servomotor

4.14 Operation sequence of the burner (LIGHT OIL operation)



CPI= Closed Position Indicator
POC= Proof Of Closure
(3) Oil irrelevance time P323, has an effect on the oil safety chain and on the minimum oil pressure when the air valve is opened.

Fig. 8

Key to layout (Fig. 8)

▨	Any position	
t1	Safety circuits enabling standby time (boiler and fuel)	
t2	Gas valve opening time (with valve leak detection control device active)	2.4 s
t3	Servomotor opening time	30/60 s
t4	FGR servomotor activation time	0 - t5
t5	Pre-purging time	adjustable
t6	Pre-ignition time	adjustable
t7	Flame ignition safety time	3s
t8	Flame stabilisation time	adjustable
t9’	2nd stage safety time	3s
t10	Modulation phase	
t11	Adjustment time	
t12	Gas valve opening time (with valve leak detection control device active)	3s
t13	Post-purging time	adjustable
t15	post-combustion time	adjustable
t16	Flame switching off control time	5 s
t17	Gas valve control time (with valve leak detection control device active)	30s

Tab. H

Key to layout (Fig. 8)

X01	Oil valve 1st level
X02	Oil valve 2nd level
X03	Oil valve 3rd level
X04	Ignition transformer
X05	Oil pressure > min.
X06	Oil safety circuit
X07	Boiler safety circuit
X08	Air pressure switch
X10	Burner on
X20+X21	Flame signal
X25	Fan on
X26	Oil pump
X32+X34	Air servomotor
X34	Servomotor

4.15 Servomotor (662R5...)

Warning

WARNING

To avoid accidents, material or environmental damage, observe the following instructions!
Do not open, modify or force the actuators.

- ➤ All interventions (assembly and installation operations, assistance, etc.) must be carried out by qualified personnel.
- ➤ Before modifying the wiring of the servomotor in the connection area, fully disconnect the burner control device from the power supply (omnipolar separation).
- ➤ To avoid the risk of electrocution, protect the connection terminals in a suitable manner and correctly fix the cover.
- ➤ After every intervention (assembly and installation operations, assistance, etc.), ensure the wiring is in order, then make the safety checks.
- ➤ Falls and collisions can negatively affect the safety functions. In this case, the servomotor must not be operated, even if it displays no evident damage.

WARNING

Assembly notes

The connection between the actuator command shaft and the control element must be rigid, without any mechanical play.

Installation notes

- ➤ The static torque is reduced when the electrical supply of the actuator is switched off.

WARNING

During the maintenance or replacement of the actuators, be careful not to invert the connectors.

WARNING

Condensation, the formation of ice and the entry of water are prohibited!

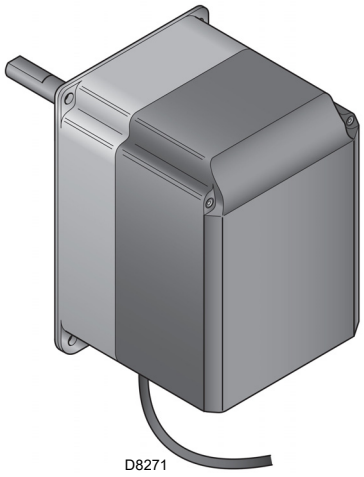


Fig. 9

Technical data

Model	662R5...
Adjustment time	5 sec / 90°
Rotation direction from 0° towards 90°	left - view from motor shaft
Rated torque (max.)	3 Nm
Static torque (max.)	3 Nm
Weight	approx. 1.4 kg
Type of protection	IP54 according to DIN EN 60529-1
Environmental operating conditions:	
- climatic condition - mechanical condition - temperature interval	Class 3K5 (DIN EN 60721-3) Class 3M5 (DIN EN 60721-3) -20...+60 °C (dew not allowed)
Electrical safety	Protection class 2 according to DIN EN 60730

Tab. I

4.16 Calibration of the thermal relay

The thermal relay serves to avoid damage to the motor due to an excessive absorption increase or if a phase is missing.

For calibration 2), see the table in the wiring diagram.

To reset, in case of an intervention of the thermal relay, press the "RESET" button 1) of Fig. 10. The red “TEST” button 3) opens the NC (95-96) contact and stops the motor.

CAUTION

The automatic reset (Position “A” button 1) can be dangerous. This operation is not anticipated in the burner's operation, leave it always on “H”. **Therefore do not position the “RESET” button 1) on “A”.**

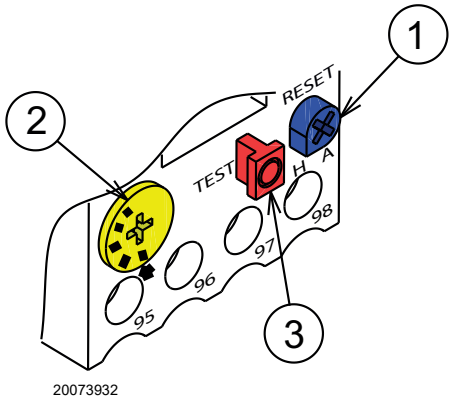


Fig. 10

5 Installation

5.1 Notes on safety for the installation

After carefully cleaning all around the area where the burner is to be installed, and arranging for the environment to be illuminated correctly, proceed with the installation operations.

DANGER

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

WARNING

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.

DANGER

Combustion air inside the boiler must be free from hazardous mixes (e.g.: chloride, fluoride, halogen); if present, it is highly recommended to carry out cleaning and maintenance more frequently.

5.2 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.

WARNING

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 suitableness 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).
When 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.

CAUTION

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

5.3 Preliminary checks

Checking the consignment

CAUTION

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.

Checking the characteristics of the burner

Check the identification label of the burner, showing:
- ➤ the model (**A**) and type of burner (**B**);
- ➤ the year of manufacture, in cryptographic form (**C**);
- ➤ the serial number (**D**);
- ➤ the data for electrical supply and the protection level (**E**);
- ➤ the absorbed electrical power (**F**);
- ➤ the types of gas used and the relative supply pressures (**G**);
- ➤ the data of the burner's minimum and maximum output possibilities (**H**) (see Firing rate)
  Warning. The output of the burner must be within the boiler's firing rate;
- ➤ the category of the appliance/countries of destination (**I**).

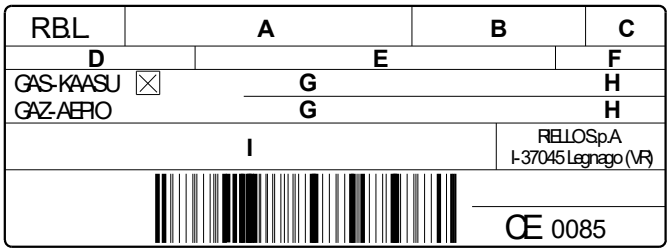


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Fig. 11

WARNING

A burner label that has been tampered with, removed or is missing, along with anything else that prevents the definite identification of the burner makes any installation or maintenance work difficult.

5.4 Operating position

WARNING

- The burner is designed to operate only in positions **1**, **2**, **3** and **4** (Fig. 12).
- 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.

DANGER

- Any other position could compromise the correct operation of the appliance.
- Installation **5** is prohibited for safety reasons.

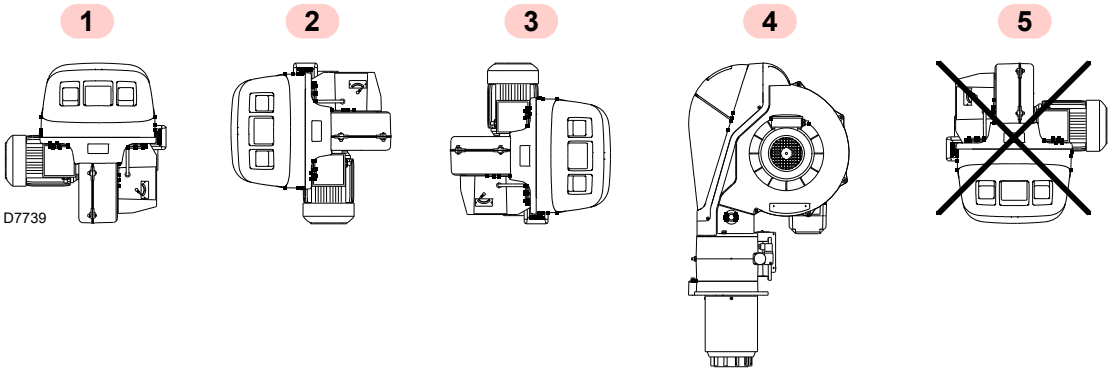


Fig. 12

5.5 Preparing the boiler

5.5.1 Boring the boiler plate

Pierce the closing plate of the combustion chamber, as in Fig. 13.

The position of the threaded holes can be marked using the thermal insulation screen supplied with the burner.

5.5.2 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.

The available lengths L are those indicated in the table below.

Blast tube (mm)	Short
RLS 120/E FGR	245

Tab. J

For boilers with a front flue gas passes 13)(Fig. 15 on page 19) or flame inversion chamber, a protection device in refractory material 11) must be inserted between the boiler fettling 12) and the blast tube 10).

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

For boilers with a water-cooled frontal, a refractory lining is not necessary 11)-12) unless expressly requested by the boiler manufacturer.

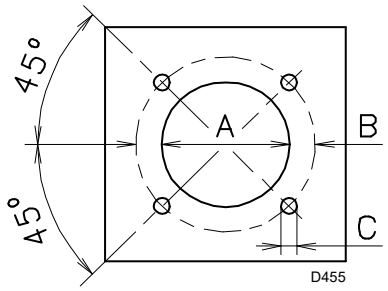


Fig. 13

mm	A	B	C
RLS 120/E FGR	230	325-368	M 16

Tab. K

5.6 Positioning electrode and pilot

WARNING

Before fixing the burner to the boiler, check the correct positioning of the electrodes and pilot as indicated Fig. 25.

The following is required to perform the check:
- ➤ remove the screw 1)(Fig. 15);
- ➤ extract the inner part 2) of the head, and adjust them.

WARNING

Observe the dimensions shown in Fig. 25.

5.6.1 Electrodes adjustment

WARNING

Position the electrodes according to the dimensions shown in Fig. 15.

5.6.2 Pilot operation parameters

WARNING

For the correct operation of the burner, gas pressure at the pilot must be between 15 and 30 mbar and the air damper must have an opening angle between 0° and 15°.

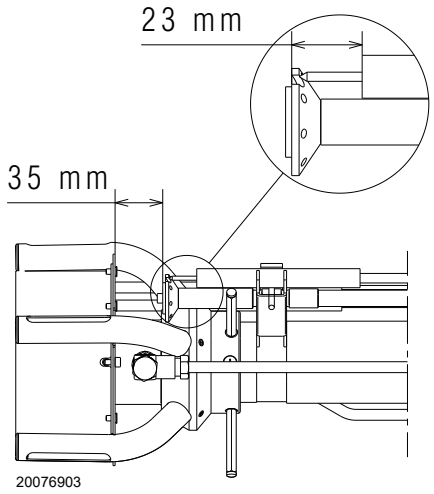


Fig. 14

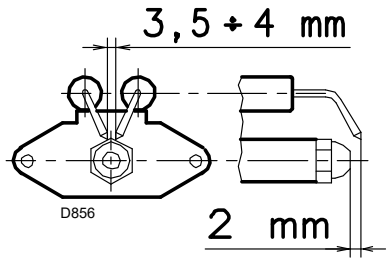


Fig. 15

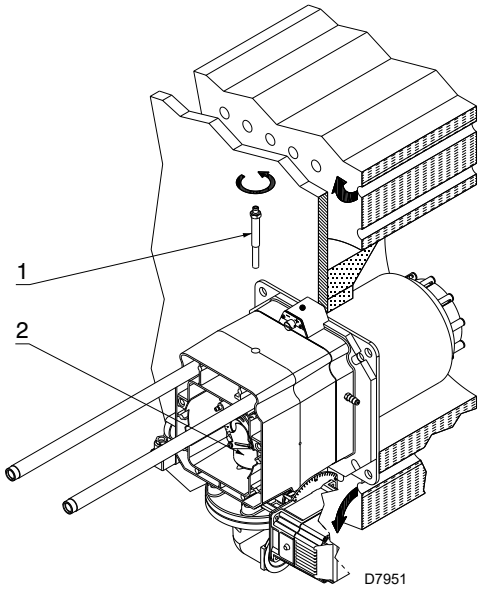


Fig. 16

5.7 Securing the burner to the boiler

Provide an adequate lifting system of the burner.

Separate the combustion head from the rest of the burner, as in Fig. 17; proceed as follows:

- ➤ loosen the 4 screws 3) and remove the cover 1);
- ➤ remove the screws 2) from the two guides 5);
- ➤ disconnect the socket from the maximum gas pressure switch;
- ➤ disconnect the pilot tube 6) and the hoses 7);
- ➤ remove the two screws 4);
- ➤ pull back the burner on the guides 5) by about 100 mm;
- ➤ disconnect the electrode leads, then unthread the burner completely from the guides;
- ➤ fix the flange 9) to the boiler plate, interposing the insulating gasket 8) supplied;
- ➤ use the 4 screws supplied, with a tightening torque of 35 - 40 Nm, after protecting their thread with anti-seize products.

WARNING

The seal between burner and boiler must be air-tight; after the start-up, check there is no leakage of flue gases into the external environment.

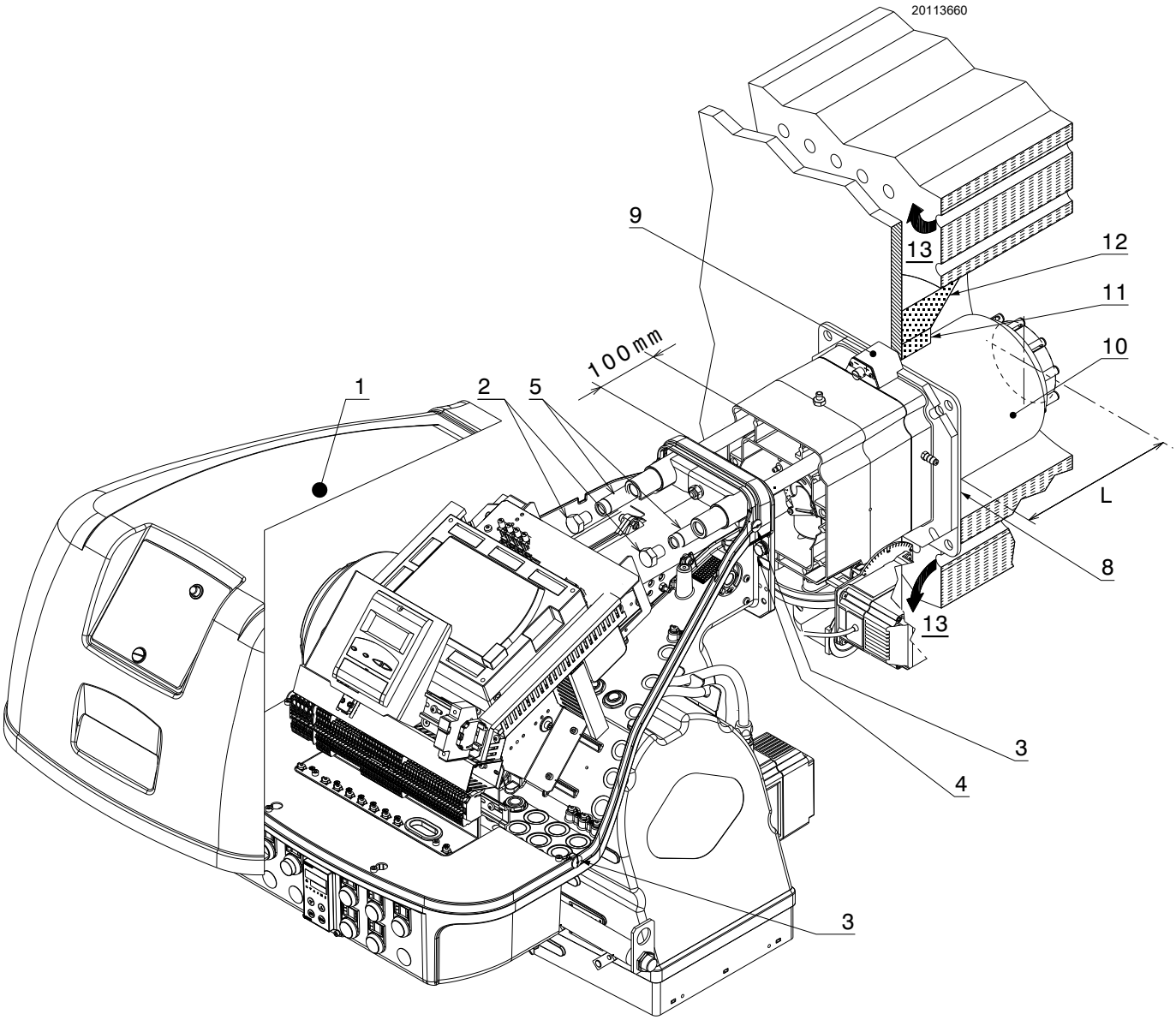


Fig. 17

5.8 Nozzle

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 Riello in the Instruction and warning booklet should be used.

WARNING

It is advisable to replace the nozzle once a year during periodical maintenance.

CAUTION

The use of nozzles other than those specified by Riello S.p.A. 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 non-observance of the requirements contained in this manual.

5.8.1 Recommended nozzles

– Bergonzo type A3 - angle 45°
– Bergonzo type A4 - angle 45°

If you want an output somewhere between the two values shown in the diagram (Fig. 18), select a nozzle with a higher flow rate.

The reduction in the flow rate is obtained with the pressure variator.

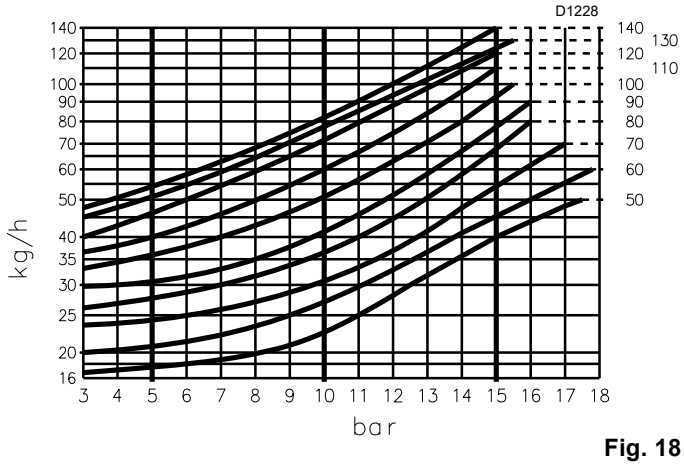


Fig. 18

5.8.2 Nozzle installation

➤ Remove the screw 1)(Fig. 19) and the internal part 2);
➤ remove the nozzle 1)(Fig. 20) using a wheel spanner;
➤ install the nozzle 1)(Fig. 20);
➤ fix it with the spanner through the central hole of the flame stability disk or loosen the screws 1)(Fig. 21);
➤ remove the disk 2) and replace the nozzle with the spanner 3)(Fig. 21).

WARNING

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

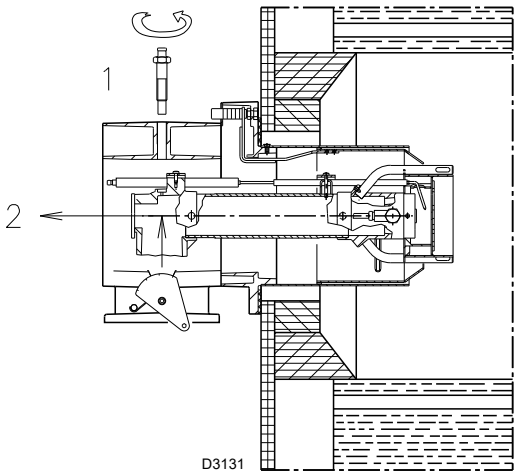


Fig. 19

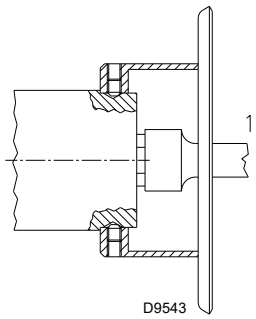


Fig. 20

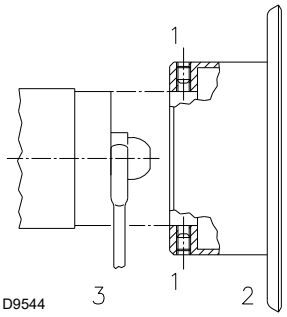


Fig. 21

5.8.3 Removing the nozzles

Necessary for the operation within area B) of the Fig. 2 on page 10.

- ➤ extract the internal part of the combustion head as described in paragraph "**Nozzle installation**" on page 21;
- ➤ unscrew screws 1)(Fig. 22) and nuts 2);
- ➤ extract the restrictor 3);
- ➤ unscrew the nozzles 4) at the front of the head;
- ➤ replace the restrictor 3).

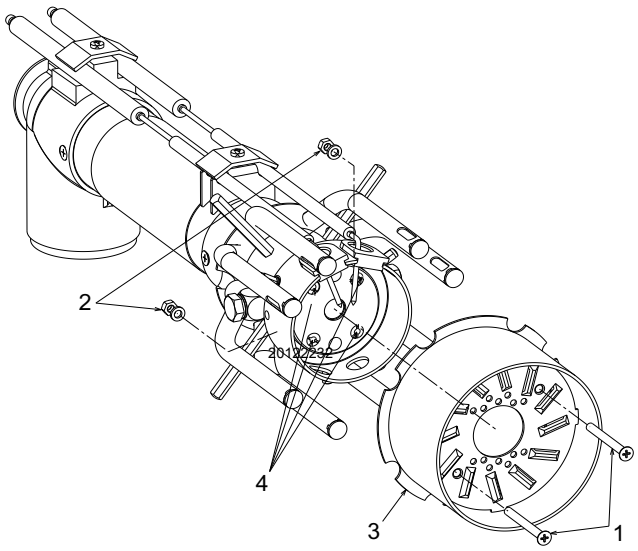


Fig. 22

5.9 Combustion head adjustment

The adjustment of the combustion head depends only on the maximum output of the burner.

Turn the screw 5)(Fig. 23) until the notch indicated by the diagram (Fig. 24) corresponds with the front part of the flange 6).

WARNING

To facilitate the adjustment, loosen the screw 1)(Fig. 19), adjust, then block.

Example:

Burner maximum output = 900 kW.
From the diagram (Fig. 24) it shows that for this output, the adjustment of the combustion head is carried out on the notch 3 (Fig. 23).

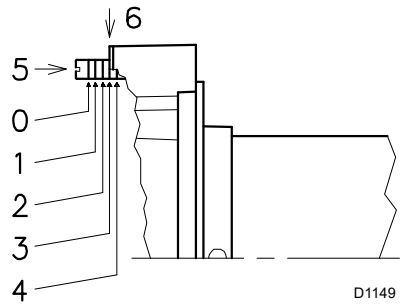


Fig. 23

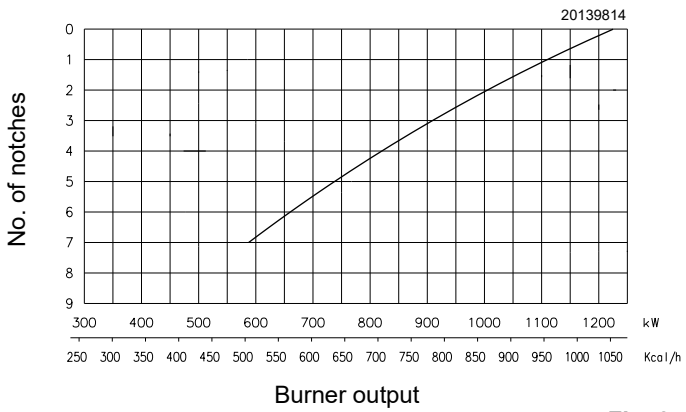


Fig. 24

5.10 Electrodes adjustment

WARNING

Position the electrodes according to the dimensions shown in Fig. 25.

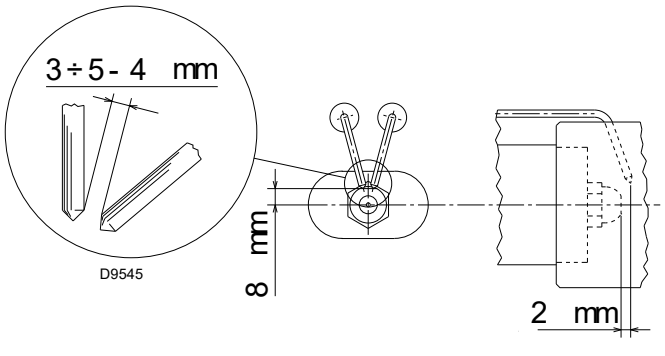


Fig. 25

5.11 Flue gases recirculation piping system

– Normally the pipe would be connected to the flue stack as shown in Fig. 26, forming an angle of 45° facing the flow of the flue gases and with the centre of the angle located at the centre of the flue. The pipe can be connected to the flue gas chamber, but should anyway be kept at the same angle of 45° facing the flow of the flue gases and with the centre of the angle at the centre of the flow.
– The pipe should be prepared so that the number of elbows is reduced to a minimum and the normal expansion and contraction of the piping is ensured.
Long piping can excessively dilate and place a very heavy load on the connection points, causing the components to break eventually.
The arrangement should take into account misalignments that allow the necessary movement of the piping without the exercise of undue force on the burner or the flue.
– The expansion and contraction of the pipe can be managed using two relatively long pipes next to each other at 90°.
A small movement of the angle between these two pipes will provide the space necessary for absorbing the expansion and the contraction. The ends of the flue gases recirculation pipes should be fixed securely to allow it to work correctly and avoid the application of high load on the burner or on the flue.
– A channel for draining the condensate should be provided upstream of the flue gases recirculation control valve and the relative shut-off valve (if being used). There should be condensate drain valves and a collection space (drain channels volumes) sufficient enough to prevent the condensate flowing through the control valves and inside the fan.
If there is a lot of condensate it might be necessary to have a drain channel on the bottom of the casing to remove it all.
– Establish whether reduction joints are needed to connect the flue gases recirculation control valve and the relative shut-off valve.
– The pipe should be adequately supported in order to manage its weight and to control its thermal expansion and contraction. It might be necessary to fix the supports to ensure the flue gases recirculation pipe is stable.

CAUTION

Uncontrolled accumulation of condensate could cause an untimely malfunction of the control valves, the fan and the motor.

Suitable means should be provided for removing the condensate from the system.

Cold starting will generate a great deal of condensate.

– The flue gases recirculation pipe is generally composed of a Schedule 40 pipe since it can easily be found and is inexpensive.
For this application it is possible to use a Schedule 20 pipe.
– The pipe components should be welded airtight, flanged or screwed together to ensure it is airtight.
Any leaks of air in the pipe will prevent the system from operating correctly. You only need to check the seals, without checking for any leaks.

WARNING

The pipe and fittings need to be suitably insulated to prevent accidental scalding.

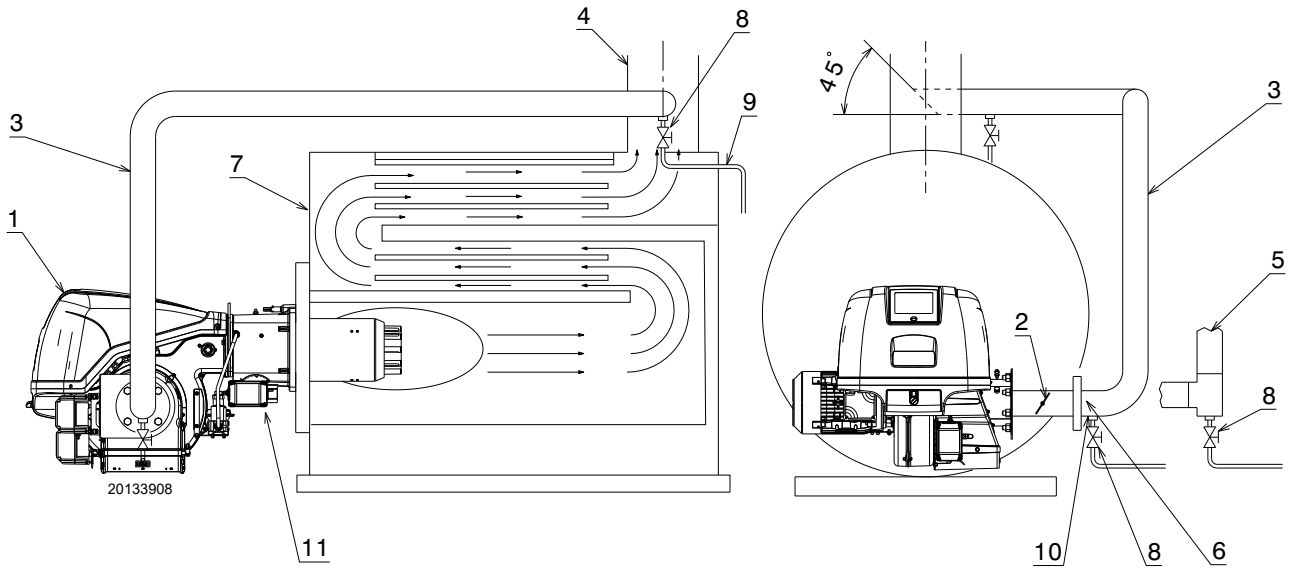


Fig. 26

Key to layout (Fig. 26)
1 Burner
2 Induced flue gases recirculating modulating damper
3 Flue gases recirculating pipe
4 Boiler flue
5 Alternative "T" configuration
6 Flue gases pressure test point upstream of damper 2)
7 Boiler
8 Discharge valve (manual ball valve, stainless steel)
9 Discharge line
10 Condensate syphon
11 Main gas feeding input

WARNING

The FGR system is only provided for gas operation.

5.11.1 Flue gas recirculation line sizing

The Tab. L can be helpful to correctly size the FGR pipes taking flue gases from boiler stack base up to the burner intake port.

NOTE:
The typical recirculation percentage is between 10% and 15%.
A low recirculation percentage might cause a high Nox level.
A high recirculation percentage might cause flame instability and a CO level higher than normal.

5.11.2 Calculating the percentage of recirculated flue gas

As a general rule, recirculated flue gas quantity must be adjusted so as to recirculate the smallest quantity necessary to obtain the required NOx rate.

Adjustment is carried out through the throttle valve located on FGR pipe. It is necessary to consider that too high a quantity of recirculated flue gas could lead to flame instability and excessively high CO rate.

To calculate the % of recirculated flue gas, use the formula below: % IFGR= ($CO_{2\ R}$)/($CO_{2\ f}$) x 100.

Where:
– ($CO_{2\ R}$) is the percentage of CO_2 measured at the burner coupling
– ($CO_{2\ f}$) is the percentage of CO_2 measured at the stack

Burner output kW	Flue gas pressure at test point 6)(Fig. 26) - mbar
350	-0.8
400	-1.1
450	-1.3
500	-1.6
550	-1.8
600	-2.1
650	-2.4
700	-2.6
750	-2.9
810	-3.2

Tab. L

5.12 Closing the burner

Once the combustion head adjustment is completed:
➤ reassemble the burner on the guides 3) at about 100 mm from the pipe coupling 4) - burner in the position shown in Fig. 27;
➤ insert the electrode cables and then slide the burner up to the pipe coupling;
➤ connect the socket of the maximum gas pressure switch;
➤ connect the connector of the fuel servomotor;
➤ replace screws 2) and lifting rings on the two slide bars 3);
➤ connect the light oil pipes by screwing in the two fittings 16);
➤ connect the gas train pipe 15);
➤ fix the burner to the pipe coupling with the screws 4).

WARNING

When fitting the burner on the two slide bars, it is advisable to gently draw out the high voltage cable and the flame detection probe cable until they are slightly stretched.

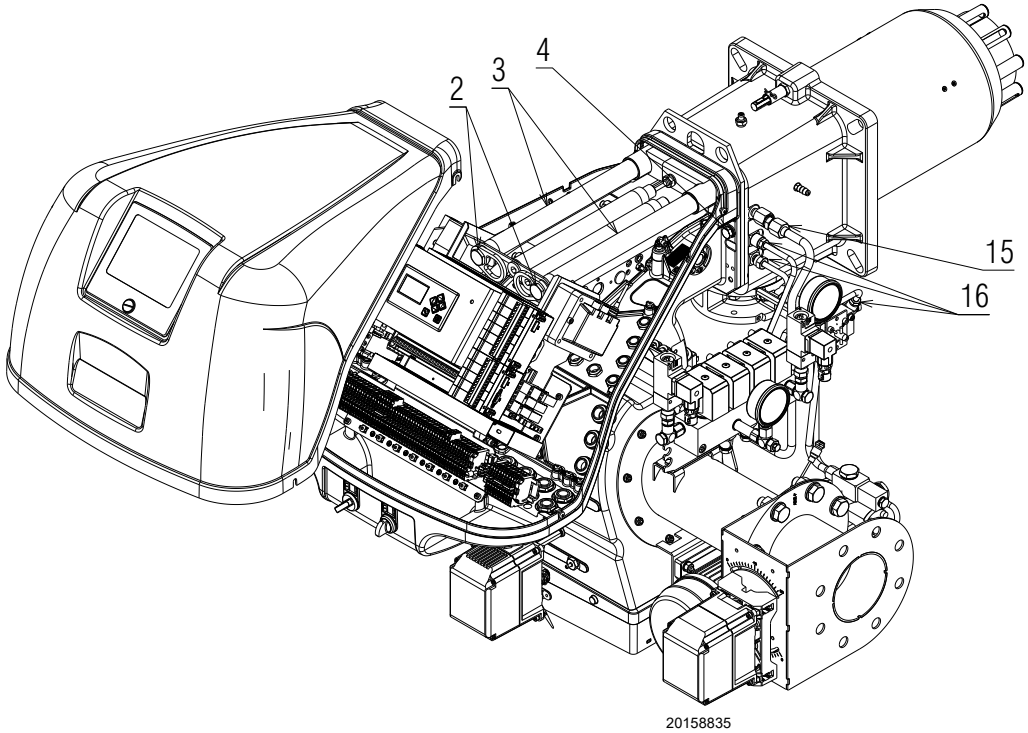


Fig. 27

5.13 Light oil supply

Explosion danger due to fuel leaks in the presence of a flammable source.

Precautions: avoid knocking, attrition, sparks and heat.

Make sure that the fuel interception tap is closed before performing any operation on the burner.

WARNING

The fuel supply line must be installed by qualified personnel, in compliance with current standards and laws.

5.13.1 Double-pipe circuit

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

Tank higher than burner A (Fig. 28)

Distance "P" must not exceed 10 meters in order to avoid straining the pump's seal; distance "V" must not exceed 4 meters in order to allow pump self-priming even when the tank is almost empty.

Tank lower than burner B (Fig. 28)

Pump depression values higher than 0.45 bar (35 cm Hg) 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 less probable that the suction line fails to prime or stops priming.

5.13.2 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 feeds 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 Tab. M.

5.13.3 Hydraulic connections

The pumps are equipped with a by-pass that connects return line with suction line.

They are installed on the burner with the by-pass closed by screw 6)().

It is necessary to connect both flexible hoses to the pump (Fig. 29). The pump will break down 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.

WARNING

Follow the instructions below:

- ➤ Tighten the flexible hoses with the supplied gaskets.
- ➤ Take care that the hoses are not stretched or twisted during installation.
- ➤ Place the pipes so that they are not crushed or are in contact with hot parts of the boiler and so it is possible to open the burner.
- ➤ Finally, connect the other end of the flexible hoses to the suction and return pipes.

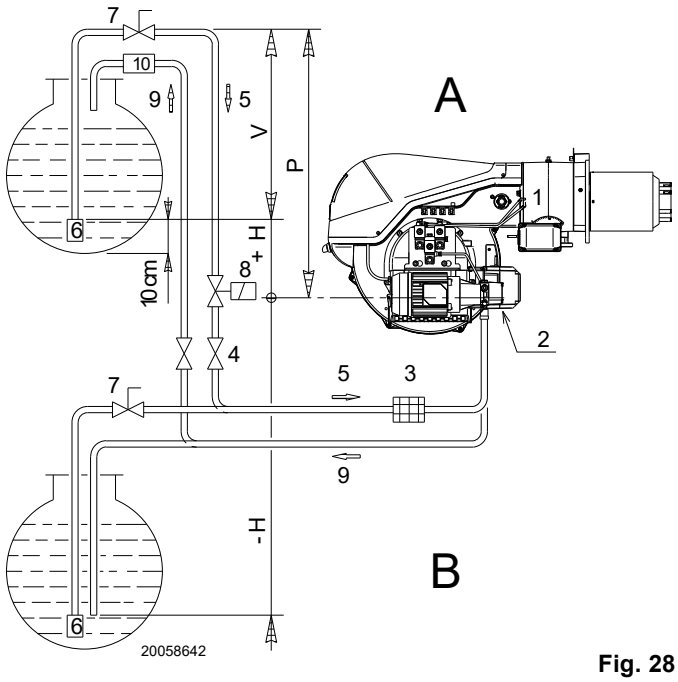


Fig. 28

Key to layout (Fig. 28)

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

+/- H	L [m]		
m	Ø 12 mm	Ø 14 mm	Ø 16 mm
+ 4	71	138	150
+ 3	62	122	150
+ 2	53	106	150
+ 1	44	90	150
+ 0.5	40	82	150
0	36	74	137
- 0.5	32	66	123
- 1	28	58	109
- 2	19	42	81
- 3	10	26	53
- 4	-	10	25

Tab. M

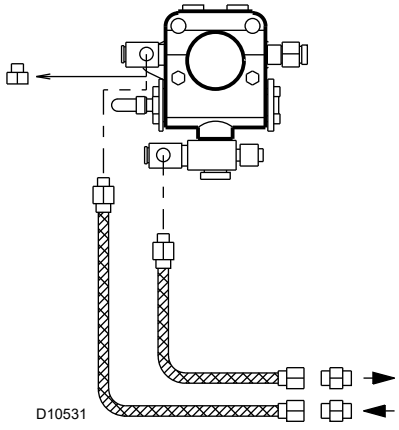


Fig. 29

5.13.4 Hydraulic circuit diagram

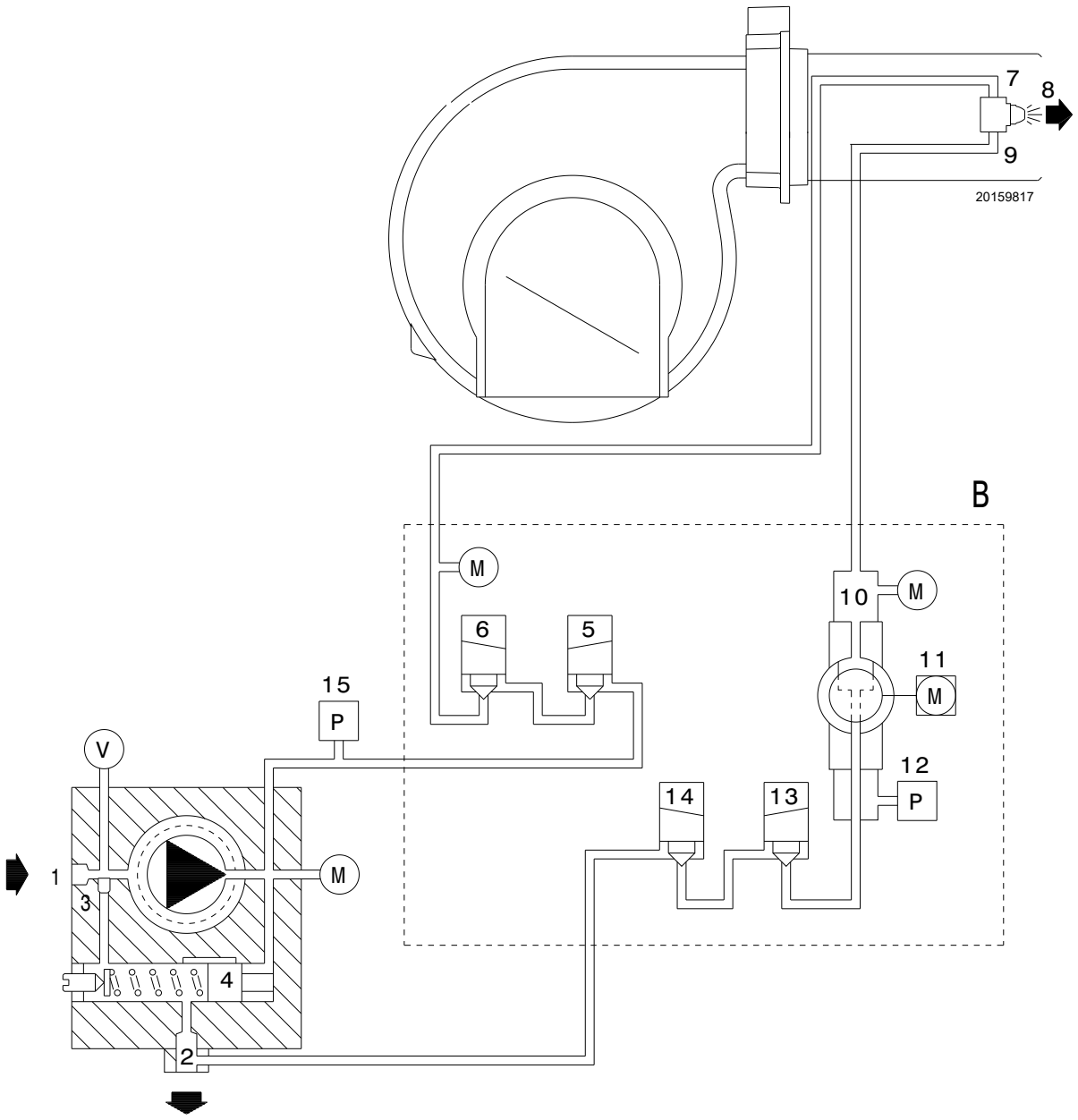


Fig. 30

Key (Fig. 30)

1 Pump suction
2 Pump return line and nozzle return line
3 Pump by-pass screw
4 Pump pressure regulator
5 Safety valve
6 Safety valve
7 Nozzle delivery line
8 Nozzle without interception rod
9 Nozzle return line
10 Pressure variator on nozzle return line
11 Pressure variator servomotor
12 Pressure switch on nozzle return line
13 Safety valve on nozzle return line
14 Safety valve on nozzle return line
15 Pressure switch on pump delivery line
B Oil valve group and pressure variator
M Pressure gauges
V Vacuometer connection

OPERATION

Pre-purging phase:
valves 5), 6), 13) and 14) closed.
Ignition and operation phase:
valves 5), 6), 13) and 14) open.
Stop: All valves closed.

WARNING

The above-mentioned 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 vacuometer 4)(Fig. 30) prior to starting; otherwise, the pump will seize.

Whenever the length of the suction piping exceeds 20-30 meters, the supply line must be filled using a separate pump.

5.13.5 Pump

Technical data

Pump	J7C
Min. delivery rate at 20 bar pressure	195 kg/h
Delivery pressure range	10 - 21 bar
Max. suction depression	0.45 bar
Viscosity range	2.8 - 200 cSt
Max. light oil temperature	90 °C
Max. suction and return pressure	1.5 bar
Pressure calibration in the factory	20 bar
Filter mesh width	0.175 mm

Tab. N

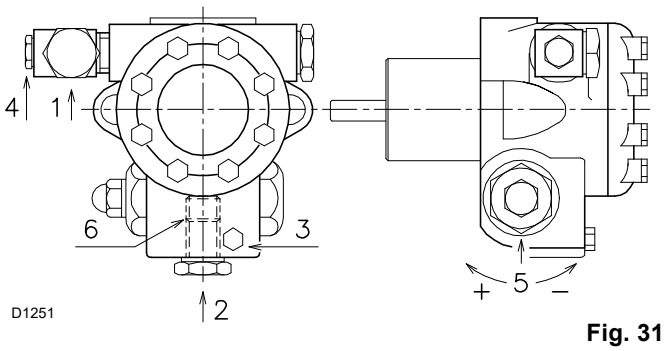


Fig. 31

1 Suction line G 1/2”
2 Return line G 1/2”
3 Gauge connection G 1/8”
4 Vacuometer connection G 1/8”
5 Pressure adjuster
6 By-pass screws

5.13.6 Priming pump

WARNING

- ➤ 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.
- ➤ Make sure that the valves on the suction line are open and that there is fuel in the tank.

In order for self-priming to take place, the screw 3)(Fig. 31) of the pump must be loosened in order to bleed off the air contained in the suction line.

- ➤ Select the fuel by positioning the selector (Fig. 31) to “OIL”.
- ➤ Start the burner closing the remote control, with the selector 9)(Fig. 5 on page 12) set to "ON".
- ➤ The pump can be considered to be primed when the light oil starts coming out of the screw 3)(Fig. 31).
- ➤ Stop the burner: position the selector 9)(Fig. 5 on page 12) in the “OFF” position and tighten the screws 3) of the pump.

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.
And so on.

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

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

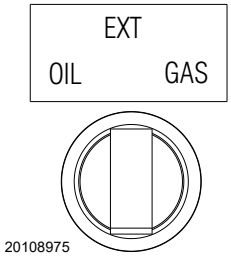


Fig. 32

WARNING

The above-mentioned 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 prior to starting; otherwise, the pump will seize.

Whenever the length of the suction piping exceeds 20-30 meters, the supply line must be filled using a separate pump.

5.13.7 Pump motor rotation

WARNING

Check that the rotation takes place in an anticlockwise direction, as shown in Fig. 33.

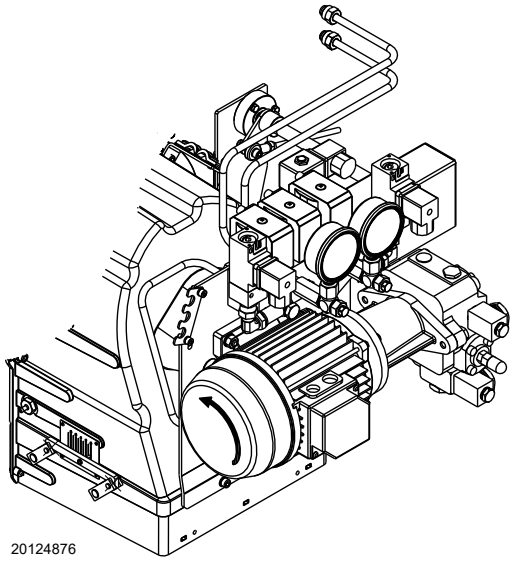


Fig. 33

5.14 Gas supply

Explosion danger due to fuel leaks in the presence of a flammable source.

Precautions: avoid knocking, attrition, sparks and heat.

Make sure that the fuel interception tap is closed before performing any operation on the burner.

The fuel supply line must be installed by qualified personnel, in compliance with current standards and laws.

5.14.1 Gas feeding line

Key (Fig. 34 - Fig. 35 - Fig. 36 - Fig. 37)

1 Gas input pipe
2 Manual valve
3 Vibration damping joint
4 Pressure gauge with push-button cock
5 Filter
6A Includes:
- filter
- safety valve
- pressure adjuster
- working valve

6C Includes:
- safety valve
- working valve

6D Includes:
- safety valve
- working valve

7 Minimum gas pressure switch
8 Leak detection control, provided as an accessory or integrated, based on the gas train code. In compliance with the EN 676 standard, gas valve leak detection control devices are compulsory for burners with maximum outputs over 1,200 kW.
9 Gasket, for "flanged" versions only
10 Pressure adjuster
11 Train-Burner adaptor, supplied separately
P2 Upstream pressure of valves/adjuster
P3 Upstream pressure of the filter
L Gas train, supplied separately
L1 The responsibility of the installer

MB

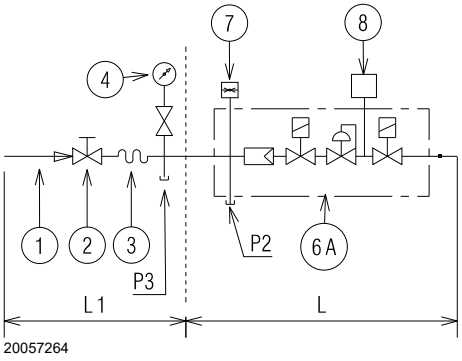


Fig. 34

MBC

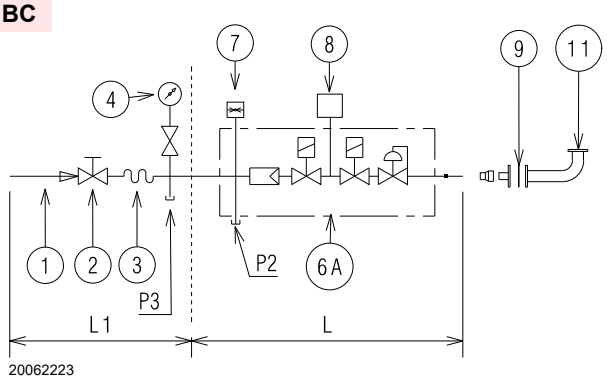


Fig. 35

DMV

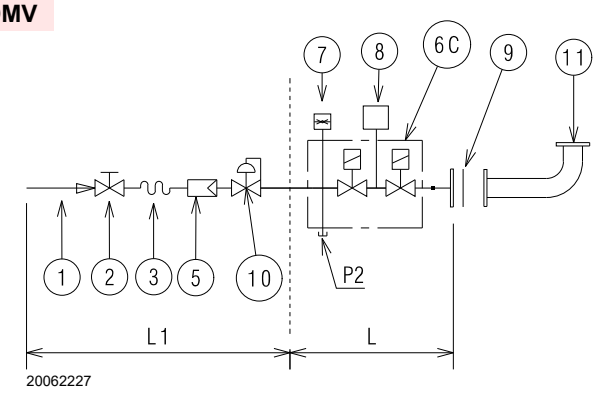


Fig. 36

CB

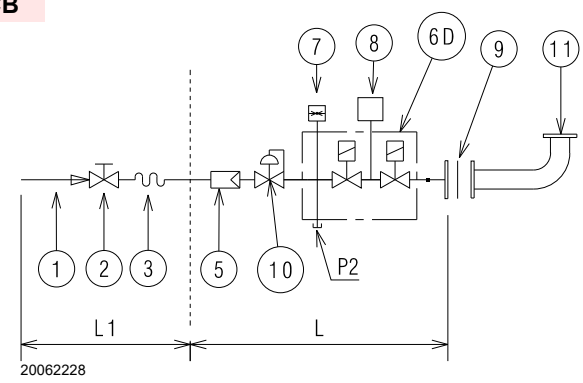


Fig. 37

5.14.2 Gas pressure

Indicates the pressure drop of the combustion head and the gas butterfly valve depending on the operating output of the burner.

The values shown the table refer to:
– natural gas G 20 NCV 10 kWh/Nm^3 (8.6 Mcal/Nm^3)
– natural gas G 25 NCV 8.6 kWh/Nm^3 (7.4 Mcal/Nm^3)

Column 1

Combustion head pressure drop.
Gas pressure measured at test point 1)(Fig. 38), with:
- combustion chamber at 0 mbar;
- gas butterfly valve fully opened (90°) as in Fig. 38;
- combustion head set as on page 22.

Column 2

Pressure loss at gas butterfly valve 2)(Fig. 38) with maximum opening: 90°.

kW	**1** Δp (mbar)		**2** Δp (mbar)	
	G20	G25	G20	G25
290	1.7	2.4	0.6	0.8
394	2.5	3.5	0.6	0.8
498	3.5	4.9	0.7	1.0
601	4.8	6.7	0.8	1.1
705	6.4	9.0	0.9	1.3
809	8.2	11.5	1.1	1.5
913	10.4	14.6	1.2	1.7
1016	12.8	17.9	1.4	2.0
1120	15.5	21.7	1.6	2.2
1224	18.5	25.9	1.8	2.5

Tab. O

The heat output and gas pressure data in the head refer to operation with gas butterfly valve fully open (90°).

To calculate the approximate output at which the burner operates:
– subtract the pressure in combustion chamber from the gas pressure measured at test point 1)(Fig. 38).
– Find, in related to the burner concerned, the pressure value closest to the result of the subtraction.
– Read off the corresponding output on the left.

Example with G 20 natural gas:
Maximum output operation
Gas pressure at test point 1)(Fig. 38) = 13.4 mbar
Pressure in combustion chamber = 3.0 mbar
13.4 - 3.0 = 10.4 mbar

A pressure of 10.4 mbar, (column 1, corresponds in to an output of 913 kW.

This value serves as a rough guide; the effective output must be measured at the gas meter.

To calculate the required gas pressure at test point 1)(Fig. 38), set the maximum modulating output required from the burner operation:
– find the nearest output value in for the burner in question.
– Read, on the right (column 1), the pressure at the test point 1)(Fig. 38).
– Add this value to the estimated pressure in combustion chamber.

Example with G 20 natural gas:
Operation at maximum modulating output
Gas pressure at an output of 913 kW = 10.4 mbar
Pressure in combustion chamber = 3.0 mbar
10.4 + 3.0 = 13.4 mbar
pressure required at test point 1)(Fig. 38).

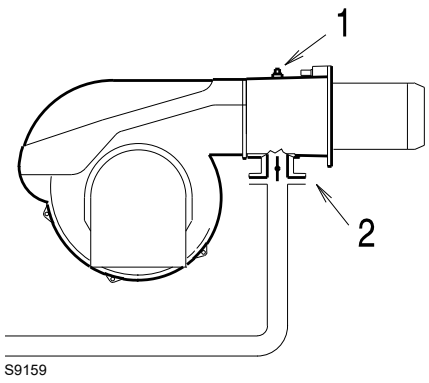


Fig. 38

5.15 Electrical connections

Notes on safety for the electrical wiring

DANGER

- The electrical wiring must be carried out with the electrical supply disconnected.
- Electrical wiring must be made in accordance with the regulations currently in force in the country of destination and by qualified personnel. Refer to the wiring diagrams.
- The manufacturer declines all responsibility for modifications or connections different from those shown in the wiring diagrams
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- The burner has been type-approved for intermittent use.
  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, burner stopping is guaranteed by the boiler's thermostat/pressure switch.
- If this is not the case, a time switch should be fitted in series to IN to provide for burner stopping at least once every 24 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. Do not use the gas tubes as an earthing system for electrical devices.
- The electrical system must be suitable for the maximum power absorption of the device, as indicated on the label and in the manual, checking in particular that the section of the cables is suitable for that level of power absorption.
- For the main power supply of the device from the electricity mains:
  - do not use adapters, multiple sockets or extensions;
  - use a multiple pole switch with at least a 3 mm gap between the contacts (overvoltage category III), as envisaged by the present 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:

DANGER

Disconnect the burner's electrical supply using the main system switch.

DANGER

Turn off the fuel interception tap.

DANGER

Avoid condensate, ice and water leaks from forming.

If the cover is still present, remove it and proceed with the electrical wiring according to the wiring diagrams.

Use flexible cables in compliance with the EN 60 335-1 standard.

5.15.1 Supply cables and external connections passage

All the cables to be connected to the burner should be passed through cable grommets, as shown in Fig. 39.

NOTE:

for details of external connections, refer to the wiring diagrams included in this booklet.

To select the fuel from the outside, provide a switching system with a contact capable of opening the TL circuit on every rotation of the selector.

After carrying out maintenance, cleaning or checking operations, reassemble the cover and all the safety and protection devices of the burner.

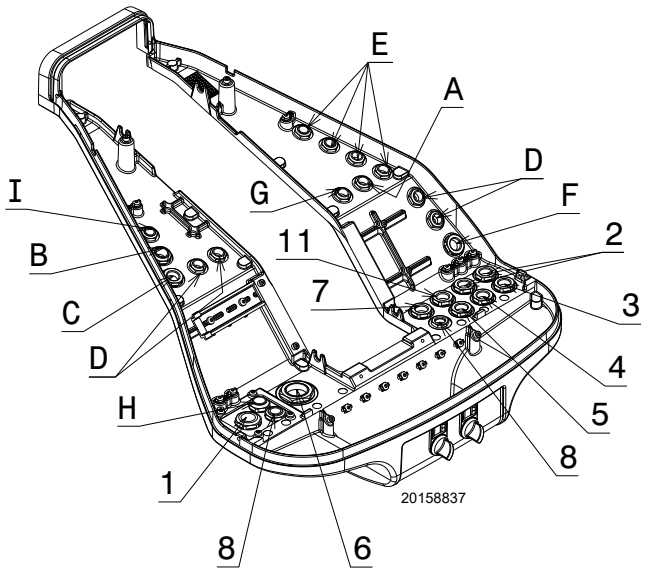


Fig. 39

Key to layout (Fig. 39)

1 Three-phase power supply
2 Consents/Safety
3 Minimum gas pressure switch
4 Gas valves seal control kit
5 Gas train
6 Single-phase power supply
7 Flue gas temperature probe
8 Available

A Air servomotor
B Maximum gas pressure switch
C gas servomotor
D Oil pressure switch
E Oil valves
F Pump motor
G FGR servomotor
H Fan motor
I Flame sensor

6 Start-up, calibration and operation of the burner

6.1 Notes on safety for the first start-up

WARNING

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.

WARNING

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

WARNING

Before igniting the burner, see the paragraph "Safety test - with gas feeding closed" on page 37.

6.2 Adjustments prior to ignition (light oil)

WARNING

It is recommended to adjust first the light oil burner and then the gas burner.

Carry out the fuel change with burner off.

Optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet and interventions on the following points.

6.2.1 Nozzle

See information in paragraph "**Nozzle**" on page 21.

6.2.2 Combustion head

The adjustment of the combustion head already carried out on page 22 does not require any modifications unless the burner output is changed.

6.2.3 Pump pressure

In order to change the pump pressure, use the screw 5)(Fig. 31 on page 27).

6.2.4 Fan damper

For the initial ignition, leave the factory setting for the 1st and 2nd stages.

6.3 Operations before start-up (gas)

- ➤ Ensure that the gas supply company has carried out the supply line vent operations, eliminating air or inert gases from the piping.
- ➤ Slowly open the manual valves situated upstream from the gas train.
- ➤ Adjust the minimum gas pressure switch to the start of the scale.
- ➤ Adjust the maximum gas pressure switch to the end of the scale.
- ➤ Adjust the air pressure switch to the start of the scale.
- ➤ Adjust the pressure switch for the valve leak detection control device (PVP kit), if present, according to the instructions supplied with the kit itself.
- ➤ Check the gas supply pressure by connecting a pressure gauge to the pressure test point 1)(Fig. 40) of the minimum gas pressure switch: it must be lower than the maximum allowed pressure of the gas train, as shown on the characteristics label.

DANGER

Excessive gas pressure can damage the components of the gas train and lead to a risk of explosion.

- ➤ Bleed the air from the piping of the gas train, connecting a plastic tube to the pressure test point 1)(Fig. 40) of the minimum gas pressure switch.
  Take the vent tube outside the building so you can notice the smell of gas.
- ➤ Connect two lamps or testers to the two gas line solenoids to check the exact moment in which voltage is supplied.
  This operation is unnecessary if each of the two solenoid valves is equipped with a pilot light that signals voltage passing through.

WARNING

Before starting up the burner, it is good practice to adjust the gas train so that ignition takes place in conditions of maximum safety, i.e. with gas delivery at the minimum.

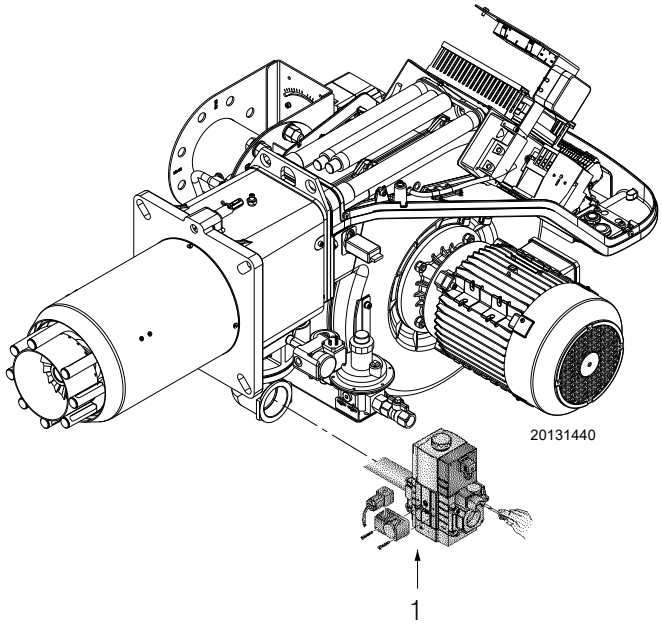


Fig. 40

6.4 Burner start-up

➤ Feed electricity to the burner via the disconnecting switch on the boiler panel.
➤ Close the thermostats/pressure switches and set the selector 9)(Fig. 5 on page 12) to “**ON**”.
➤ Put the switch 44 (Fig. 5 on page 12) to **“OIL”** for light oil operation and **“GAS”** for gas operation.

As the burner is not fitted with a phase sequence control device, the motor rotation may be incorrect.

As soon as the burner starts up, go in front of the cooling fan of the fan motor and check it is rotating anticlockwise. See Fig. 41.

If this is not the case:
– put the selector 9)(Fig. 5 on page 12) on “**OFF**” and wait for the control box to carry out the switching off phase;
– disconnect the burner from the electrical supply;
– invert the phases on the three-phase power supply.

Make sure that the lights or testers connected to the solenoids, or the pilot lights on the solenoids themselves, indicate that no voltage is present.

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

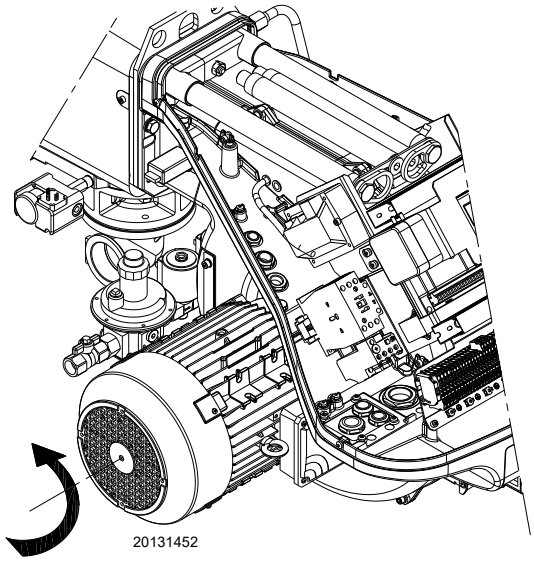


Fig. 41

6.5 Change of fuel

There are two change of fuel options:
1 with the “OIL-EXT-GAS” selector 20)(Fig. 5 on page 12);
2 with a remote selector connected to the main terminal board, positioning the “OIL-EXT-GAS” selector on “EXT” the remote fuel selection function is active.
In this position, if there is not already a remote selector present, the burner starts for gas operation.

6.6 Burner adjustment

6.6.1 Gas/air delivery adjustment

- ➤ Slightly move towards the maximum flow rate (butterfly valve fully open);
- ➤ adjust the maximum delivery required with the pressure stabiliser.
- ➤ Adjust the fuel parameters with the air servomotor and memorise the maximum combustion value;
- ➤ slowly complete the procedure, synchronising the combustion with the two servomotors and memorising the different adjustment values.

WARNING

For the start-up procedure and the adjustment of the parameters, see the specific manual of the electronic cam, supplied with the burner.

6.6.2 Light oil/air delivery adjustment

- ➤ Position the selector for selecting the light oil fuel.
- ➤ During the ignition phase, slightly move towards the oil servomotor, with an approximate adjustment of max. 90°.
- ➤ Adjust the maximum pressure on the return nozzle using the "nut and blocking nut".
- ➤ Adjust the fuel parameters with the air servomotor and memorise the maximum combustion value;
- ➤ slowly complete the procedure, synchronising the combustion with the two servomotors
- ➤ Memorise the different adjustment values.

6.7 Final calibration of the pressure switches

6.7.1 Air pressure switch

Adjust the air pressure switch after performing all other burner adjustments with the air pressure switch set to the start of the scale (Fig. 44).

With the burner operating at MIN output, insert a combustion analyser in the stack, slowly close the suction inlet of the fan (for example, with a piece of cardboard) until the CO value does not exceed 100 ppm.

Slowly turn the appropriate knob clockwise until the burner goes into lockout.

Read the value indicated by the upward arrow on the graduated scale (Fig. 44). Turn the knob clockwise again, until the value shown on the graduated scale corresponds with the arrow pointing downwards, and so recovering the hysteresis of the pressure switch (shown by the white mark on a blue background, between the two arrows).

Now check the correct start-up of the burner.

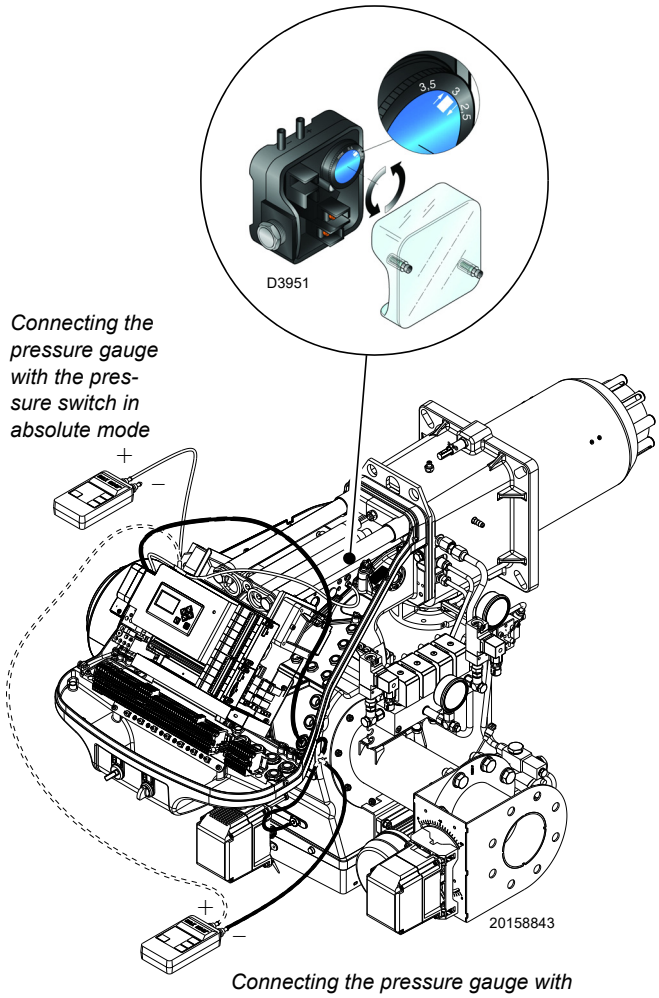
If the burner locks out again, turn the knob anti-clockwise a little bit more.

During these operations it may be useful to measure the air pressure with a pressure gauge.

The connection of the pressure gauge is shown in Fig. 44.

The standard configuration is that with the air pressure switch connected in absolute mode.
Note the presence of a “T” connection, not supplied.

In certain applications in strong depression situations, the connection of the pressure switch does not allow it to change over.
In this case it is necessary to connect the pressure switch in differential mode, applying a second tube between the air pressure switch and the fan suction line mouth.
In this case also, the pressure gauge must be connected in differential mode, as shown in Fig. 44.



Connecting the pressure gauge with the pressure switch in differential mode

Fig. 42

6.7.2 Maximum gas pressure switch

Adjust the maximum gas pressure switch after having performed all the other burner adjustments with the maximum gas pressure switch set at the end of the scale (Fig. 43).

With the burner operating at maximum output, lower the adjustment pressure by slowly turning the relative knob anticlockwise until the burner locks out.

Turn the knob clockwise by 0.2 kPa (2 mbar) and repeat the start-up of the burner.

If the burner locks out again, turn the knob clockwise again by 0.1 kPa (1 mbar).

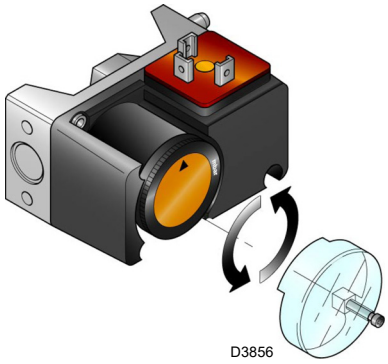


Fig. 43

6.7.3 Minimum gas pressure switch

Adjust the minimum gas pressure switch after performing all the other burner adjustments with the pressure switch set to the start of the scale (Fig. 44).

With the burner operating at maximum output, increase adjustment pressure by slowly turning the relative knob clockwise until the burner stops.

Then turn the knob anticlockwise by 0.2 kPa (2 mbar) and repeat burner start-up to ensure it is uniform.

If the burner locks out again, turn the knob anticlockwise again by 0.1 kPa (1 mbar).

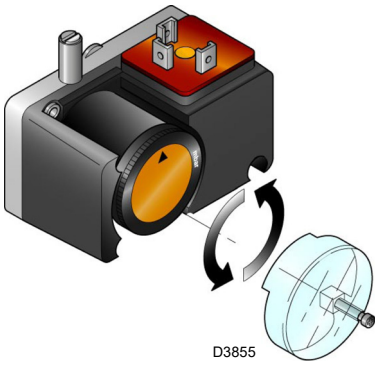


Fig. 44

WARNING

1 kPa = 10 mbar

6.7.4 PVP pressure switch kit

Adjust the pressure switch for the leak detection control (PVP kit) (Fig. 45) according to the instructions supplied with the kit.

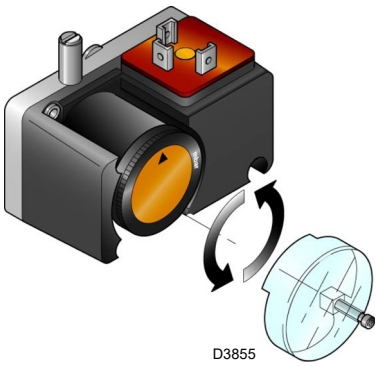


Fig. 45

6.7.5 Minimum oil pressure switch

The minimum oil pressure switch (Fig. 46) is calibrated in the factory at 18 bar. If the oil pressure falls below this value in the delivery line, the pressure switch stops the burner.

The burner restarts automatically if the pressure goes above 18 bar after the burner starts.

6.7.6 Maximum oil pressure switch

The maximum oil pressure switch (Fig. 46) is calibrated in the factory at 3 bar. If the oil pressure goes above this value in the return line, the pressure switch stops the burner.

The burner restarts automatically if the pressure drops below 3 bar, after the burner has stopped.

If a loop circuit with pressure “Px" feeds the burner, the pressure switch has to be adjusted to Px + 3 bar.

For the regulation see Fig. 46.

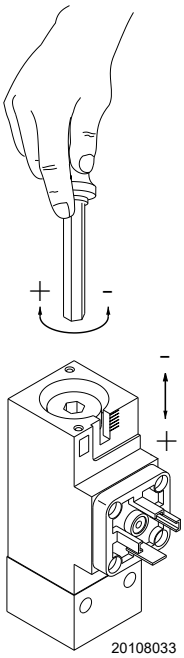


Fig. 46

6.8 Start-up the flue gases recirculation system

The flue gases recirculation function has the task of reducing the quantity of NOx contained in the combustion gases. To this end, a part of the combustion gases is put back into the combustion chamber, creating a drop in temperature.

The amount of recirculated flue gases is fixed using FGR servomotor (channel 3).

When adjusting you should keep in mind that the excessive amount of recirculated flue gases can cause the flame to rise above the burner head (flame stability limit).

NOTE:

Reduction of the burner's maximum output

The use of the flue gases recirculation function (FGR) or the input of the mass of flue gases into the feeding air pipe could reduce the maximum output of the burner.

This means that the maximum amount of combustion air that can be put in will be reduced.

Therefore it is necessary to reduce the amount of fuel for the high range operation to ensure the correct combustion values.

The control box supports the flue gases recirculation function (FGR) without temperature compensation.

With these operating principles, the positions of FGR servomotor can vary only between CLOSED (ignition position) and the positions on the combustion curves.

First configuration

Start-up of the system without influence of the flue gases recirculation.

Adjust the air/fuel ratio control system as if operating without flue gases recirculation.

Once the settings of the fuel/air ratio of the curves without flue gases recirculation, it is possible to pass to the settings of the FGR servomotor.

From the moment that this could influence the combustion settings, it might be necessary to adjust the servomotors position again.

FGR first configuration

The FGR position servomotor is kept in lighting position until an adjustable time and temperature is reached.

During operation, check the temperature of the flue gases recirculation (FGR). It should be 100-130°C to reduce the condensation in the burner or in the suction pipe.

FGR operation configuration

The FGR position servomotor is kept in lighting position until an delay time and an adjustable temperature is reached.

During the initial start-up of the flue gases recirculation (FGR), we recommend to verify the control box FGR delay time. Use a value between 5 and 15 minutes.

Check the FGR temperature sensor and make sure that the temperature of the flue gases reaches the value within the time set. If necessary, it is possible to adjust the FGR temperature of the control box with a different value.

– Factory setting time (default): 300s.
– Factory setting FGR temperature: 50°C

Check the air temperature when the flame sensor is fitted. If the temperature exceeds 50-60°, the flame sensor could get damaged.

When the burner is operating with flue gases recirculation it is possible that a high temperature is reached.

6.9 Steady state operation

Once the start-up cycle is completed, the servomotor command moves on to the thermostat/pressure switch TR that controls the pressure or the temperature in the boiler.

➤ If the temperature or the pressure is low the burner gradually increases the output up to the MAX.
➤ If the temperature or the pressure increases, the burner gradually lowers the output up to the MIN and so on.
➤ The burner stops when the heat request is less than the heat supplied by the burner at MIN output.
➤ The thermostat/pressure switch TL opens, the control box carries out the switching off phase.
➤ The air damper closes completely to reduce heat losses to a minimum.

6.10 Ignition failure

If the burner does not switch on, there is a lockout within 3s of the electrical supply reaching the gas valve. It may be that the gas does not arrive at the combustion head within the safety time of 3s. In this case increase gas ignition delivery. The arrival of gas to the pipe coupling is shown by the pressure gauge in Fig. 48.

In the event the burner stops, in order to prevent any damage to the installation, do not unblock the burner more than twice in a row.
If the burner locks out for a third time, contact the customer service.

In the event there are further lockouts or faults with the burner, the maintenance interventions 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.

6.11 Burner flame goes out during operation

If the flame accidentally goes out during operation, the control box carries out a recycle (i.e. it repeats the start-up phase once, and makes a further ignition attempt).
If the flame is still absent, the control box goes into lockout.

6.12 Stopping of the burner

The burner can be stopped by:
- ➤ intervening on the disconnecting switch of the electrical supply line, located on the boiler panel;
- ➤ positioning the selector "**OFF/ON**" (Fig. 5 on page 12) to "**OFF**".

6.13 Final checks (with burner operating)

➤ Open the thermostat/pressure switch TL ➤ Open the thermostat/pressure switch TS	⇨	The burner must stop
➤ Turn the gas maximum pressure switch knob to the minimum end of scale position ➤ Turn the air pressure switch to the maximum end of scale position ➤ Turn the oil maximum pressure switch knob to the minimum end of scale position	⇨	The burner must stop in lockout
➤ Turn off the burner and cut off the power ➤ Disconnect the minimum gas pressure switch connector ➤ Turn the oil minimum pressure switch knob to the maximum end of scale position	⇨	The burner must not start
➤ Obscure the flame sensor	⇨	the burner must stop in lockout due to flame loss

Tab. P

Make sure that the mechanical locking systems on the various adjustment devices are fully tightened.

7 Maintenance

7.1 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 burner's electrical supply using the main system switch.

Make sure that both electrical supplies have been disconnected.

Turn off the fuel interception tap.

Wait for the components in contact with heat sources to cool down completely.

7.2 Maintenance programme

7.2.1 Maintenance frequency

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

7.2.2 Safety test - with gas feeding closed

For its safe commissioning it is very important to make sure that the electrical wiring has been carried out correctly between the gas valves and the burner.

To this end, after checking that the connections have been made in conformity with the burner's wiring diagrams, a starting cycle should be carried out with the gas tap closed (dry test).

1 The manual gas valve should be closed with the locking/releasing device ("lock-out / tag out" procedure).
2 Make sure the limit electric contacts of the burner close.
3 Make sure the contact of the minimum gas pressure switch closes.
4 Proceed with an attempt to start up the burner.

The starting cycle should occur with the following phases:

– Starting the fan motor for pre-purging
– Carrying out the gas valve leak detection control, if applicable
– Completing the pre-purging
– Reaching the ignition point
– Power supply of the ignition transformer
– Power supply of the gas valves

Since the gas is closed, the burner will not be able to start and its control box will stop or go into a safety lockout.

The effective supplying of the gas valves can be checked with the insertion of a tester; some valves are fitted with light signals (or closure/opening position indicators) that are activated when the electrical supply arrives.

IF THE ELECTRICAL SUPPLY OF THE GAS VALVES OCCURS AT AN UNEXPECTED MOMENT, DO NOT OPEN THE MANUAL VALVE, DISCONNECT THE ELECTRICAL SUPPLY, CHECK THE WIRING; CORRECT THE ERRORS AND CARRY OUT THE ENTIRE TEST AGAIN.

7.2.3 Checking and cleaning

The operator must use the required equipment during maintenance.

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 the components of the combustion head are:
- undamaged;
- not deformed due to high temperature;
- free of ambient dirt or dust;
- free of rusted materials;
- adequately positioned.

Check the gas outlet holes for the ignition phase (in the distributor of the combustion head) are free of impurities or rust.

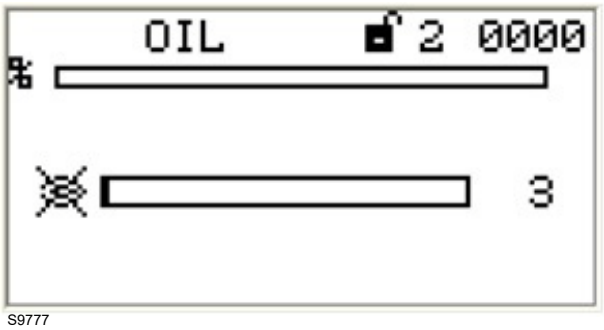
Burner
Clean the outside of the burner.

Fan
Check to make sure that no dust has accumulated inside the fan or on its impellers, 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.

Flame sensor
Clean the glass cover from any dust that may have accumulated.
To remove the sensor, pull it forcefully towards the outside; it is only pushed in.

Measuring the flame signal
The burner is fitted with a sensor to check that a flame is present.
The display (Fig. 47) will display the intensity of the flame signal.



S9777

Fig. 47

7.2.4 Safety components

The safety components should be replaced at the end of their life cycle indicated in the Tab. Q.

The specified life cycles do not refer to the warranty terms indicated in the delivery or payment conditions.

Safety component	Life cycle
Flame control	10 years or 250,000 operating cycles
Flame sensor	10 years or 250,000 operating cycles
Gas valves (solenoid)	10 years or 250,000 operating cycles
Pressure switches	10 years or 250,000 operating cycles
Pressure adjuster	15 years
Servomotor (electronic cam)	10 years or 250,000 operating cycles
Oil valve (solenoid)	10 years or 250,000 operating cycles
Oil regulator	10 years or 250,000 operating cycles
Pipes/ oil fittings (metallic)	10 years
hoses (if present)	5 years or 30,000 pressurised cycles
Fan impeller	10 years or 500,000 start-ups

Tab. Q

GAS OIL OPERATION

Pump
The depression must be less than 0.45 bar.
Unusual noise must not be evident during pump operation.
If the pressure is found to be unstable or if the pump runs noisily, the flexible hose must be detached from the line filter and the fuel must be sucked from a tank located near the burner.
This measure permits the cause of the anomaly to be traced to either the suction piping or the pump.
If the problem lies in the suction line, check the filter is clean and that air is not entering the piping.

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 once a year during periodical maintenance.
Do not clean the nozzle openings.

Hoses
Check that these are in good conditions.

Fuel tank
Approximately every 5 years, suck any water 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 Assistance Centre in order to carry out the necessary adjustments.

EN 267	Eccesso d'aria		
	Potenza max. $\lambda \leq 1,2$		Potenza min. $\lambda \leq 1,3$
CO_2 max. teorico 0 % O_2	Taratura CO_2 %		CO mg/kWh
	$\lambda = 1,2$	$\lambda = 1,3$	
15,2	12,6	11,5	≤ 100

Tab. R

GAS OPERATION

Gas leaks
Make sure that there are no gas leaks on the pipe between the gas meter and the burner.

Gas filter
Change the gas filter when it is dirty.

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 Assistance Centre in order to carry out the necessary adjustments.

EN 676		Eccesso d'aria		
		Potenza max. $\lambda \leq 1,2$		Potenza min. $\lambda \leq 1,3$
GAS	CO_2 max. teorico 0 % O_2	Taratura CO_2 %		CO mg/kWh
		$\lambda = 1,2$	$\lambda = 1,3$	
G 20	11,7	9,7	9,0	≤ 100
G 25	11,5	9,5	8,8	≤ 100
G 30	14,0	11,6	10,7	≤ 100
G 31	13,7	11,4	10,5	≤ 100

Tab. S

7.2.5 Checking the air and gas pressure on the combustion head

To carry out this operation it is necessary to use a pressure gauge to measure the air and gas pressure at the combustion head, as shown in Fig. 48.

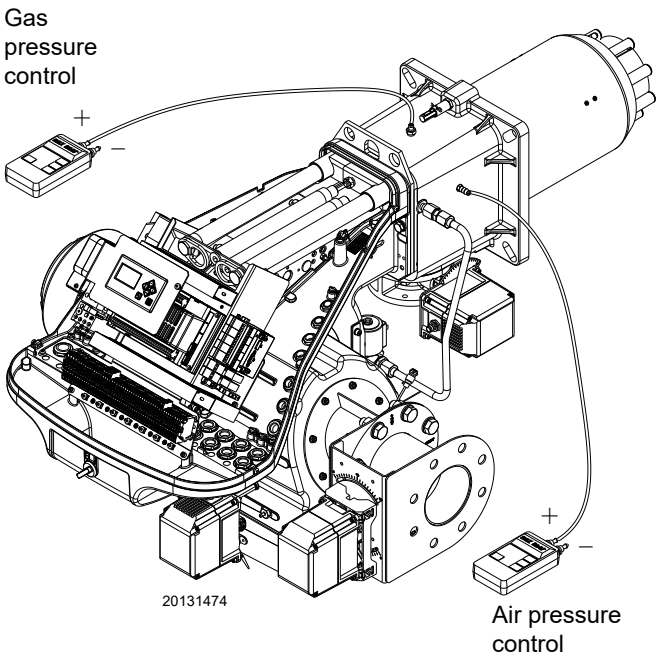


Fig. 48

7.3 Opening the burner

DANGER

Disconnect the burner's electrical supply using the main system switch.

Make sure that both electrical supplies have been disconnected.

DANGER

Turn off the fuel interception tap.

Wait for the components in contact with heat sources to cool down completely.

- ➤ Loosen the 4 screws 1)(Fig. 49) and remove the hood 2).
- ➤ Disconnect the light oil pipes using the fittings 3).
- ➤ Disconnect the pipe 4).
- ➤ Assemble the supplied extensions on the sliding bars 6).
- ➤ Fit the screws 10).
- ➤ Disconnect the socket from the maximum gas pressure switch.
- ➤ Disconnect the connector of the fuel servomotor.
- ➤ Remove the screws 7) and move the burner backwards by about 100 mm on the slide bars 6).
- ➤ Disconnect the electrode cables, then completely retract the burner.

At this point it is possible to extract the inner part 8) after having removed the screw 9).

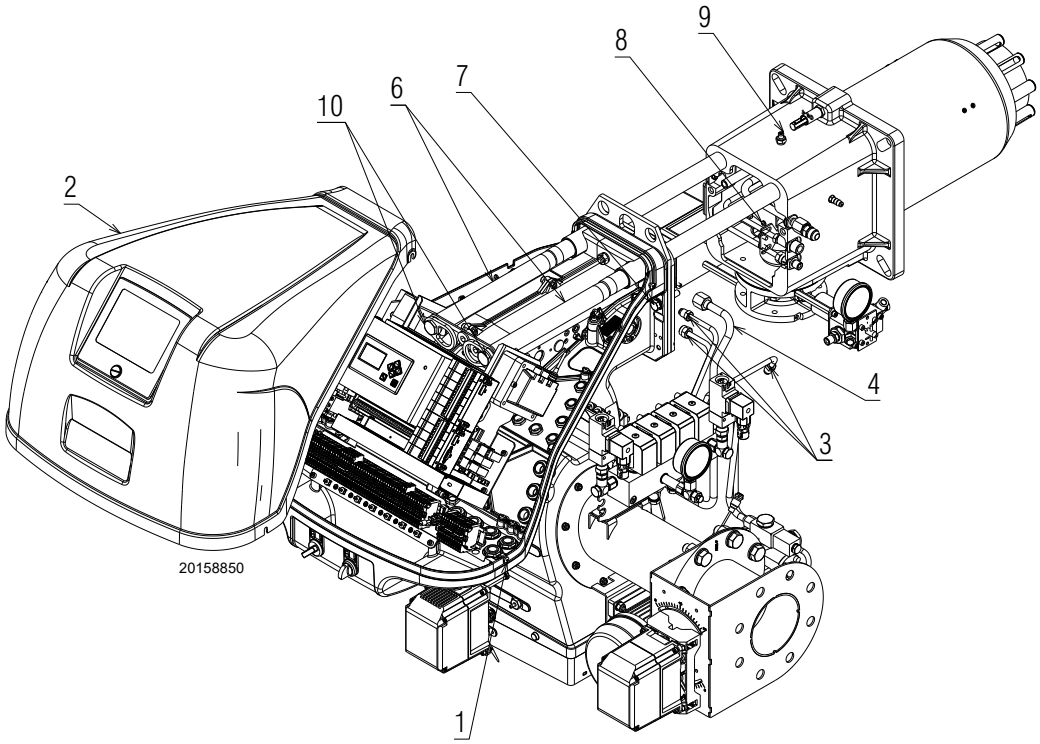


Fig. 49

7.4 Closing the burner

- ➤ Push the burner to approximately 100 mm from the pipe coupling.
- ➤ Disassemble the two extensions from the slide bars 6).
- ➤ Tighten the screws 10) on the slide bars of the burner.
- ➤ Reconnect the cables and slide in the burner until it comes to a stop.
- ➤ Connect the socket of the maximum gas pressure switch.
- ➤ Put back the screws 7) and connect the connector of the fuel servomotor carefully pull the electrode cables outwards until they are slightly taut.
- ➤ Connect the pipe 4).
- ➤ Connect the light oil pipes using the fittings.

After carrying out maintenance, cleaning or checking operations, reassemble the cover and all the safety and protection devices of the burner.

8 Faults - Possible causes - Solutions

If faults arise in ignition or operations, the burner performs a "safety stop", which is signalled by the red burner lockout LED.

The operator panel display shows the lockout code.

When the burner starts up again, the red LED goes out.

In the event the burner stops, in order to prevent any damage to the installation, do not unblock the burner more than twice in a row.

If the burner locks out for a third time, contact the customer service.

In the event there are further lockouts or faults with the burner, the maintenance interventions 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.

8.1 List of error codes

Error code	TRD P301=0 P328>0	EN67 P301=2 P328>0	Description	D1	D2
0	0	0	Unknown fault (internal error)		
1	0	3	Flame fault		
2	0	0	Parasite light detected		
3	0	3	General flame fault during ignition		
4	1	1	Flame failure during operation		
5	0	3	No flame signal during the first safety time		
6	0	3	Flame signal disappears during the stabilisation time		
7	0	3	No flame signal during the first safety time		
8	0	0	No flame signal at the end of the second safety time		
9	0	0	No flame signal during the first safety time		
10	0	0	No flame signal at the end of the first safety time		
11	0	0	Monitoring the parasite flame does not last for the required 5 seconds		
13	1	0	The flame signal appears during ignition (pilot burner)		
103	0	0	Various data invalid		
105	Unlimited	0	Data curve invalid or unavailable	Curve set / Fuel number	
106	0	0	Difference between the value of the parameters HP and UP.	Parameter No.	
			Possible cause of the error: You have loaded an abnormal data set (unprotected) and there has been an error during the data transfer. The data set has not been saved correctly.		
107	0	0	Configuration not valid; contact the After Sales Service		
120	1	1	Various operating modes on both controllers		
121	0	0	Out of range correction.	Channel	
141	0	0	Feedback speed variation too broad.	Channel	
			The set of parameters is based on an obsolete or invalid factory setting. Update the factory setting of the BT300.		
151	Unlimited	3	The recirculation damper is still OPEN 240 seconds after recirculation reset was switched off (OFF).	Channel	
170	0	0	LDR flame sensor short-circuit		
191	1	1	First monitoring band has been exceeded for too long: channel	Channel	
201	1	1	First monitoring band has had a short-circuit for too long: channel	Channel	
211	0	0	Second monitoring band has been exceeded for too long: channel	Channel	
221	0	0	Second monitoring band has had a short-circuit for too long: channel	Channel	

Error code	TRD P301=0 P328>0	EN67 P301=2 P328>0	Description	D1	D2
231	Unlimited	3	Fuel/air ration command blocked: Channel	Channel	
241	0	0	The actuator does not move, namely no position feedback.	Channel	Direction: P 2 = backward, forward
			If this indication appears, the monitoring of fault 271 is damaged.		
251	0	0	The actuator does not find the reference position	Channel	
			Direction: 0 backward 1 forward Check that the flap moves smoothly towards the reference position.		
261	Unlimited	3	The actuator provides an invalid position (too broad a difference with respect to the target position)	Channel	
271	Unlimited	3	The actuator feedback remains constant for too long, also after the movement of the actuator	Channel	
281	1	1	The feedback signal of at least 1 actuator is incorrect	Channel	
			To identify the rotation direction of the actuator, it sends double pulse signals, unaligned of 90 degrees. If fault 281 occurs, these signals are not correctly identified. Cause of the error: – kickback – actuator 0.8 Nm: clockwise external torque > 0.2 Nm – actuator 9 Nm: clockwise external torque > 1 Nm		
291	Optional	3	The actuator does not reach the final position because of a fuzzy detection.	Channel	
			The actuators are exchanged during the reconnection. The test for recognising this fault is described in the BT300 manual - print number DLT1201. At least one actuator does not reach its test position: – 2 actuators are exchanged – another problem is preventing the actuator from reaching its test position		
320	1	1	Broken or open cable on the firing rate input		
321	1	1	Broken or open cable on the feedback channel: channel number	Channel	
351	1	1	Fuel change not valid when the burner is operating		
352	Optional	3	Fuel signals combination not valid (no signal)		
353	Optional	3	Fuel signals combination not valid (various signals)		
360	0	0	The lack of air causes a shutdown due to a fault with the O_2 regulation.		
362	0	0	Shutdown die to a fault because of lack of burner maintenance		
363	1	1	The smallest O_2 value is adopted		
371	0	0	The output for the internal conditions is defective		
372	0	0	The difference of burner running values between the main processor and the watchdog one is too high		
381	0	0	The deviation between the main processor and the watchdog control is too high	Channel correction	
391	0	0	The curve set has changed during programming		
393	0	0	Emergency stop activated		
394	0	0	The burner ON/OFF signal on the user interface has unexpectedly stopped		
451	1	1	In the operating mode for ignition, not all the channels are in the ignition position	Channel	
600	0	0	Programming monitoring time(FAT) exceeded	Reference number	

Error code	TRD P301=0 P328>0	EN67 P301=2 P328>0	Description	D1	D2
601	0	0	Fault during the seal test: gas pressure still active		
602	0	0	Fault during the seal test: no gas pressure detected		
603	0	0	Request for manual vent of the gas line		
606	0	0	CPI/POC in unexpected state signal		
608	1 *1)	1 *1)	Invalid drop of the boiler's safety interlock chain		
609	1 *1)	1 *1)	Invalid drop of the gas safety interlock chain		
610	Optional *1)	3 *1)	Invalid drop of the oil safety interlock chain		
611	Optional	3	Gas pressure too low		
613	0	0	No air pressure signal		
617	1	1	Flame signal disappearance when operating		
624	Optional	3	Light oil pressure too low		
711	0	0	Modification of the operating mode not valid		
713	0	0	Signal combination not valid in BURNER OFF operating mode		
714	0	0	Signal combination not valid in BURNER READY operating mode		
715	0	0	Signal combination not valid in PRE-PURGING operating mode		
716	0	0	Signal combination not valid in FIRING POSITION operating mode		
717	0	0	Signal combination not valid in FIRING operating mode		
719	0	0	The fuel valves remain open too long without a flame		
720	0	0	Ignition transformer activated for too long		
721	0	0	The ignition valve remains open for too long		
722	0	0	The fuel valves open in maintenance mode		
723	0	0	The ignition process takes too long		
724	0	0	The gas valve opens with light oil		
725	0	0	The oil valves are open during the selection of the gas		
727	0	0	Main gas valve 1 opens unexpectedly		
728	0	0	All three gas valves remain open for too long		
729	0	0	The ignition process takes too long (without pilot burner)		
730	0	0	Maintenance mode without pilot burner		
731	0	0	The ignition valve opens without pilot burner		
732	0	0	Signals combination not valid on input terminals during operation		
734	0	0	Pre-purging time not respected		
739	0	0	Seal test: the main gas valve 2 opens for too long		
740	0	0	Seal test: leaks from the main gas valve 1		
741	0	0	Seal test: the main gas valve 1 opens for too long		
742	0	0	Seal test: leaks from the main gas valve 2		
743	0	0	Flame monitoring: the flame burns for too long after the shutdown		
745	0	0	Programming monitoring time exceeded		
746	0	0	Impossible to switch off the solenoid valve		
747	0	0	Seal test: Burner vent not allowed		
759	0	0	BT300 automatically exits the SETTING mode after 24 hours		
763	0	0	Different curve selection on main processor and watchdog processor		
764	1	1	CO control device - internal curve set fault	Curves set	
800	0	0	Parameter fault	Parameter No.	
801	0	0	The channel control mode of the main processor is not consistent with that of the watchdog (fatal error, no automatic restart possible)	Channel	
802	1	1	The integration of a channel inside the fuel/air ration control lasts too long (only an automatic restart is possible)	Channel	

Error code	TRD P301=0 P328>0	EN67 P301=2 P328>0	Description	D1	D2
803	0	0	The channel remains outside the 1st monitoring band for too long	Channel	
804	0	0	The channel mode of the air/fuel ratio control does not correspond to the type of activation	Channel	
805	0	0	The direct control channel moves to an invalid position, i.e. a channel that is not deactivated or controlled by the air/fuel ratio control	Channel + set point position	
806	0	0	Channel set-point of the main controller not possible	Channel + set point position + effective value + programming tolerance	
807	1	1	LSB message timeout (message no. = parameter)		
			Possible cause of the error: – connection between VSM/LCM GND and PE protective earth – speed modification confirmation too fast / VSM fault – LSB error (the red LED flashes or is constantly on)		
889	0	0	The interval between two remote fault resets is too short		
			EN 14459 only allows 4 remote fault resets every 15 minutes. The fault reset is monitored by remote control software, LAMTEC SYSTEM BUS and a field bus. The overcoming of the fault reset causes the H889 to stop and further remote fault resets are ignored. After a delay time it is possible to carry out another fault reset. The stopping of the H889 occurs when the fault reset is sent without good reason. A reset from the terminal is always possible. How to reset this fault: – wait 15 minutes and try again to reset the fault – cut off power to the BT300 for a moment, reconnect the power supply and then reset the fault.		
921	0	0	Relay actuator self-diagnostics: output fault at the oil valve		
922	0	0	Relay actuator self-diagnostics: output fault at the ignition transformer		
923	0	0	Relay actuator self-diagnostics: output fault at gas valve 1		
924	0	0	Relay actuator self-diagnostics: output fault at gas valve 2		
925	0	0	Relay actuator self-diagnostics: output fault at the ignition transformer		
928	0	0	Relay actuator self-diagnostics: output fault at terminal 41 for oil pump		
929	0	0	Relay actuator self-diagnostics: output fault at impeller		
985	0	0	VSM diagnostic error		
			Possible cause of the error: BurnerTronic waiting for VSM module, but there is an error in the exchange of diagnostic data with the module		
986	0	0	The dynamic field test recognises invalid feedback	Channel	Effective value
987	0	0	The change during operation in stages takes too long		
988	0	0	The fuel selection relay in the DFM is defective or feedback is from DFM is inconsistent		
989	0	0	Plausibility test of the actuator feedback in programmed curve failed		
990	Optional *1)	3	Power failure		

Error code	TRD P301=0 P328>0	EN67 P301=2 P328>0	Description	D1	D2
996	0	0	Secure parameter writing could not be completed. Device is blocked		
999			contact the After Sales Service		

Tab. T

*1) The system will not be restarted until the condition that generated the fault is eliminated (i.e. the drop of the safety interlock chain (SIC) or the power failure).

A Appendix - Accessories

Output power regulator kit for modulating operation

With the modulating operation, the burner continually adapts the power to the heat request, ensuring a high level of stability for the parameter controlled: temperature or pressure.

Parameter to be checked		Probe	
	Adjustment field	Type	Code
Temperature	- 100...+ 500°C	PT 100	3010110
Pressure	0...2.5 bar 0...16 bar	Output probe 4...20 mA	3010213 3010214

Software interface kit

Burner	Code
RLS 120/E FGR	20130843

O2 control kit - CO

Burner	Code
RLS 120/E FGR	20101753

O2 - CO high efficiency control kit

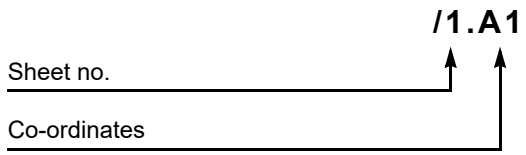
Burner	Code
RLS 120/E FGR	20125127

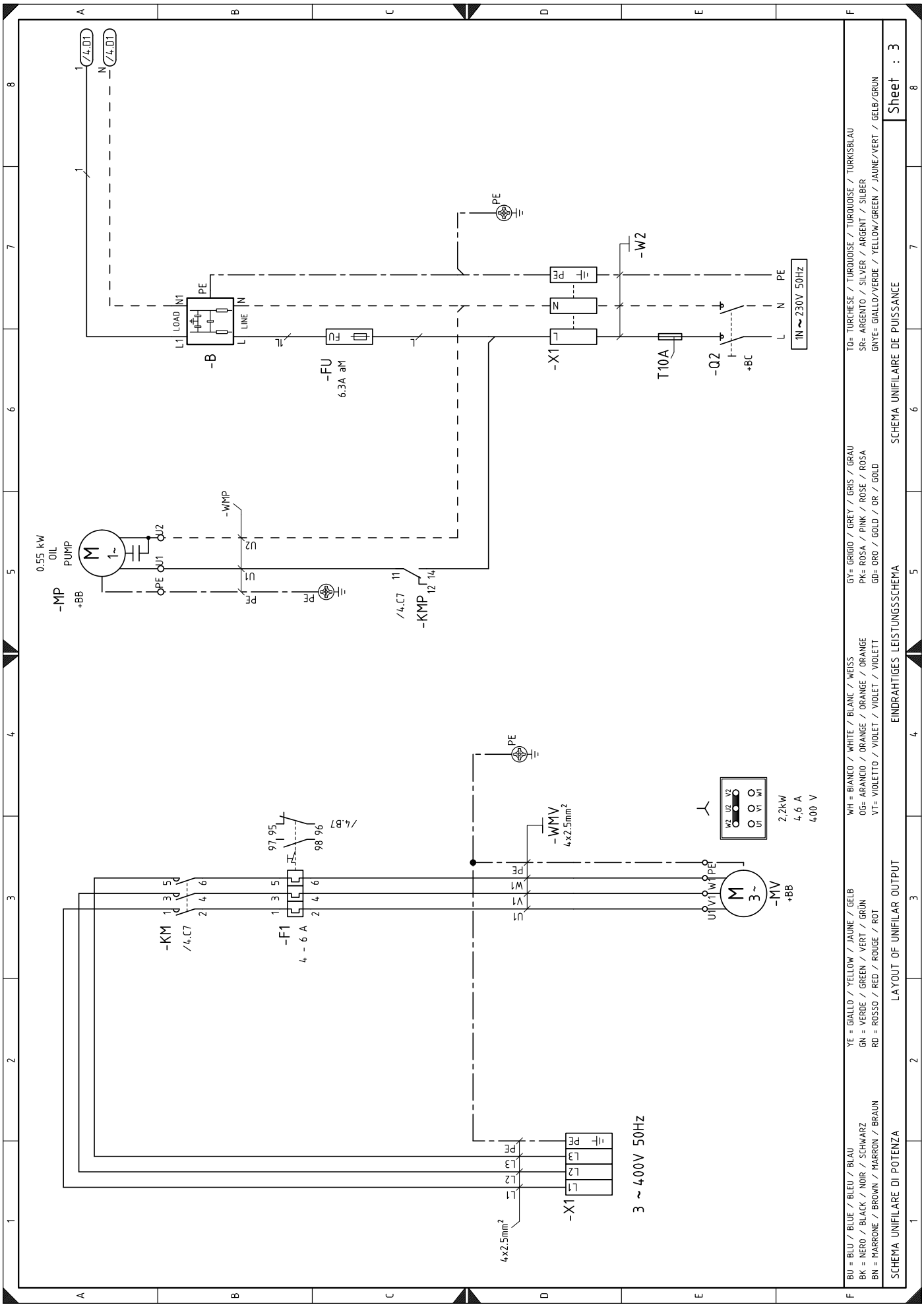
Gas trains in compliance with EN 676

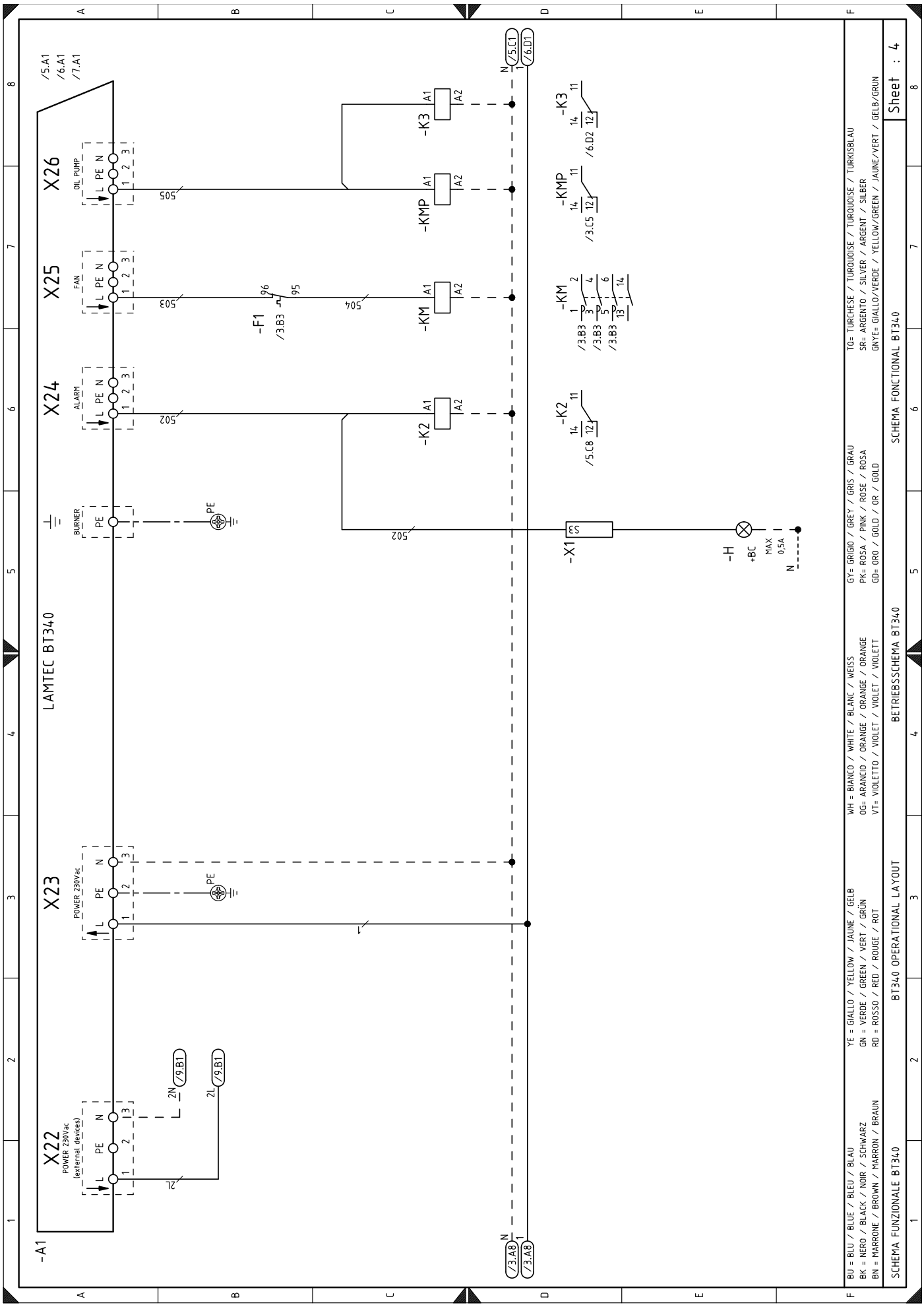
Please refer to manual.

B Appendix - Electrical panel layout

2 Indication of references




SCHEMA UNIFILARE DI POTENZA
LAYOUT OF UNIFILAR OUTPUT
EINDRAHTIGES LEISTUNGSSCHEMA
SCHEMA UNIFILAIRE DE PUISSANCE
Sheet : 3
-MP
0.55 kW
OIL
PUMP
+BB
-WMP
-B
-FU
6.3A aM
-X1
-W2
T10A
-Q2
+BC
1N ~ 230V 50Hz
-KMP
/4.C7
-KM
/4.C7
-F1
4 - 6 A
/4.87
-WMV
4x2.5mm²
-MV
+BB
2,2kW
4,6 A
400 V
3 ~ 400V 50Hz
4x2.5mm²
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
TQ= TURCHESE / TURQUOISE / TURQUOISE / TURKISBLAU
SR= ARGENTO / SILVER / ARGENT / SILBER
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN


LAMTEC BT340
-A1
X22
POWER 230Vac
(external devices)
X23
POWER 230Vac
X24
ALARM
X25
FAN
X26
OIL PUMP
BURNER
-K2
-K3
-KM
-KMP
-F1
-X1
-H
+BC
MAX
0,5A
SCHEMA FUNZIONALE BT340
BT340 OPERATIONAL LAYOUT
BETRIEBSSCHEMA BT340
SCHEMA FONCTIONAL BT340
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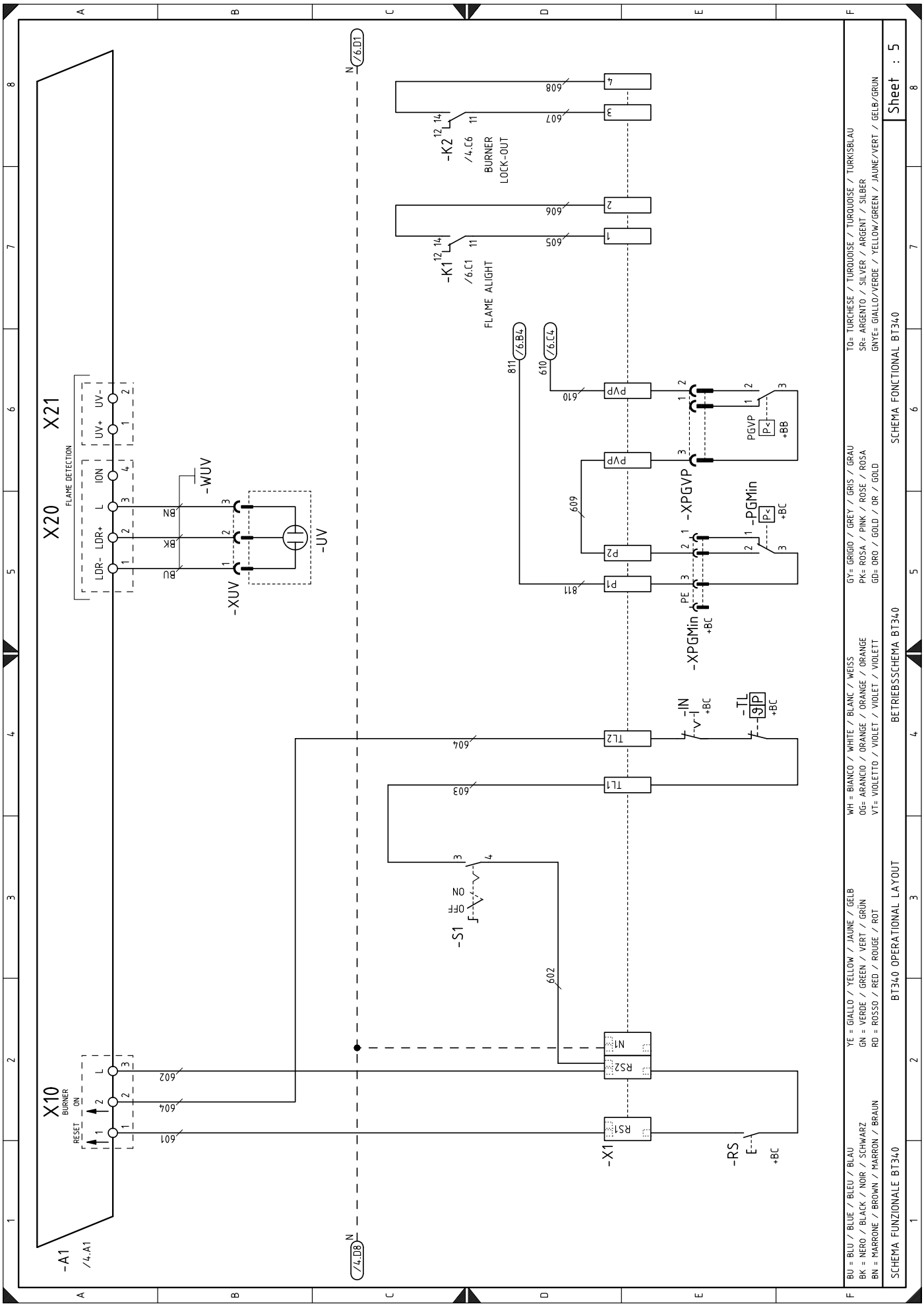
SR= ARGENTO / SILVER / ARGENT / SILBER
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN


X21
X20
FLAME DETECTION
LDR- LDR+ L ION UV+ UV-
X10
BURNER
RESET ON
-A1
/4.A1
-wUV
-UV
-XUV
-K2
/4.C6
BURNER
LOCK-OUT
-K1
/6.C1
FLAME ALIGHT
-XPGVP
-PGMin
-XPGMin
PGVP
-IN
-TL
-S1
ON
OFF
-X1
-RS
N1
RS2
RS1
TL2
TL1
PVP
P2
P1
PE
+BB
+BC
/6.D1
/4.D8
/6.B4
/6.C4
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GY= GRIGIO / GREY / GRIS / GRAU
PK= ROSA / PINK / ROSE / ROSA
GD= ORO / GOLD / OR / GOLD
TQ= TURCHESE / TURQUOISE / TURQUOISE / TURKISBLAU
SR= ARGENTO / SILVER / ARGENT / SILBER
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN
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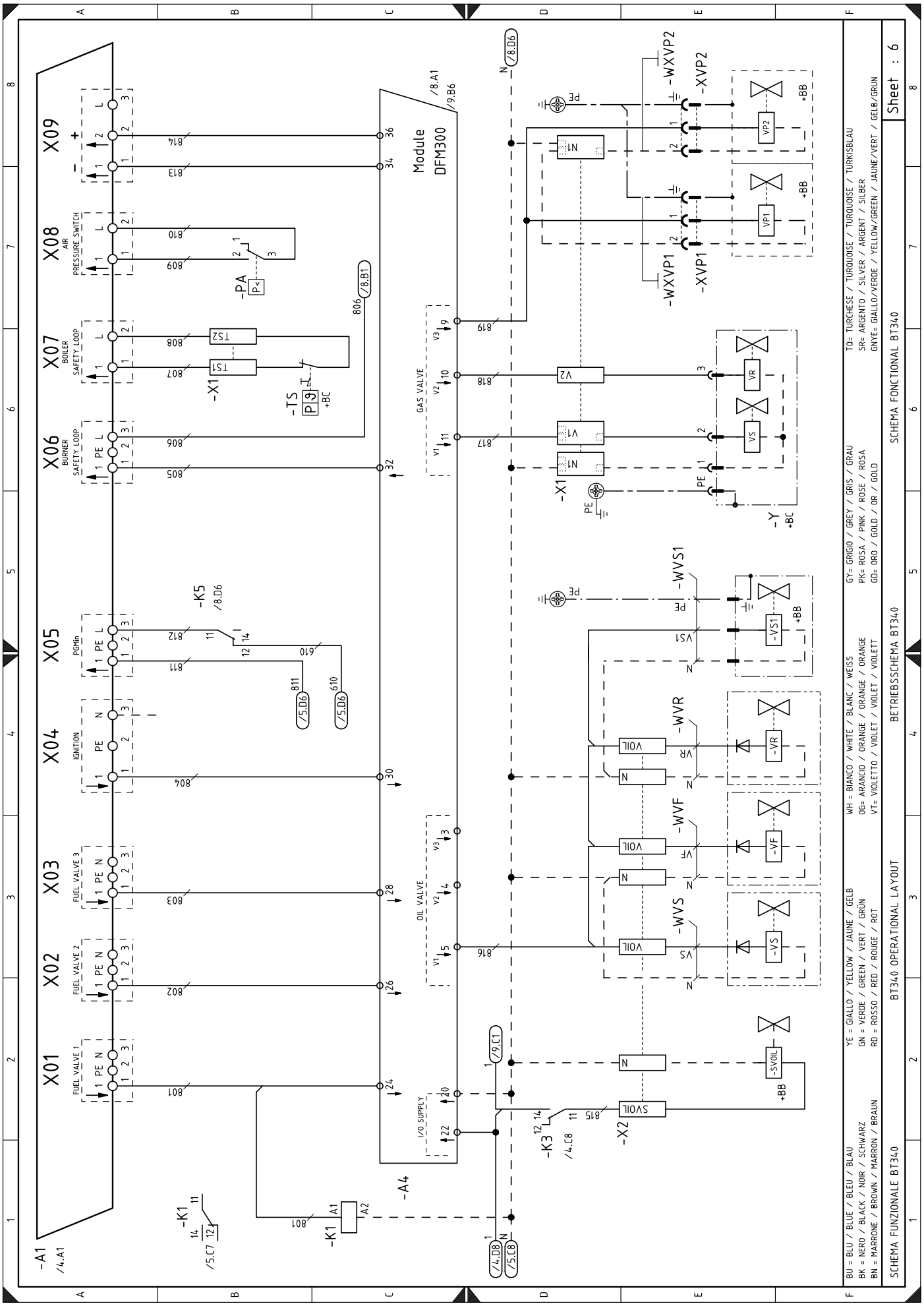
BT340 OPERATIONAL LAYOUT
BETRIEBSSCHEMA BT340
SCHEMA FONCTIONAL BT340
Sheet : 5


SCHEMA FUNZIONALE BT340
BT340 OPERATIONAL LAYOUT
BETRIEBSSCHEMA BT340
SCHEMA FONCTIONAL BT340
Sheet : 6
Module DFM300
-A1
-A4
-K1
-K3
-K5
-X1
-X2
-TS
-PA
-Y
-WXVP1
-WXVP2
-XVP1
-XVP2
-WVR
-WVF
-WVS
-WVS1
-SVOIL
GAS VALVE
OIL VALVE
I/O SUPPLY
FUEL_VALVE 1
FUEL_VALVE 2
FUEL_VALVE 3
IGNITION
PGMin
BURNER SAFETY_LOOP
BOILER SAFETY_LOOP
AIR PRESSURE_SWITCH
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
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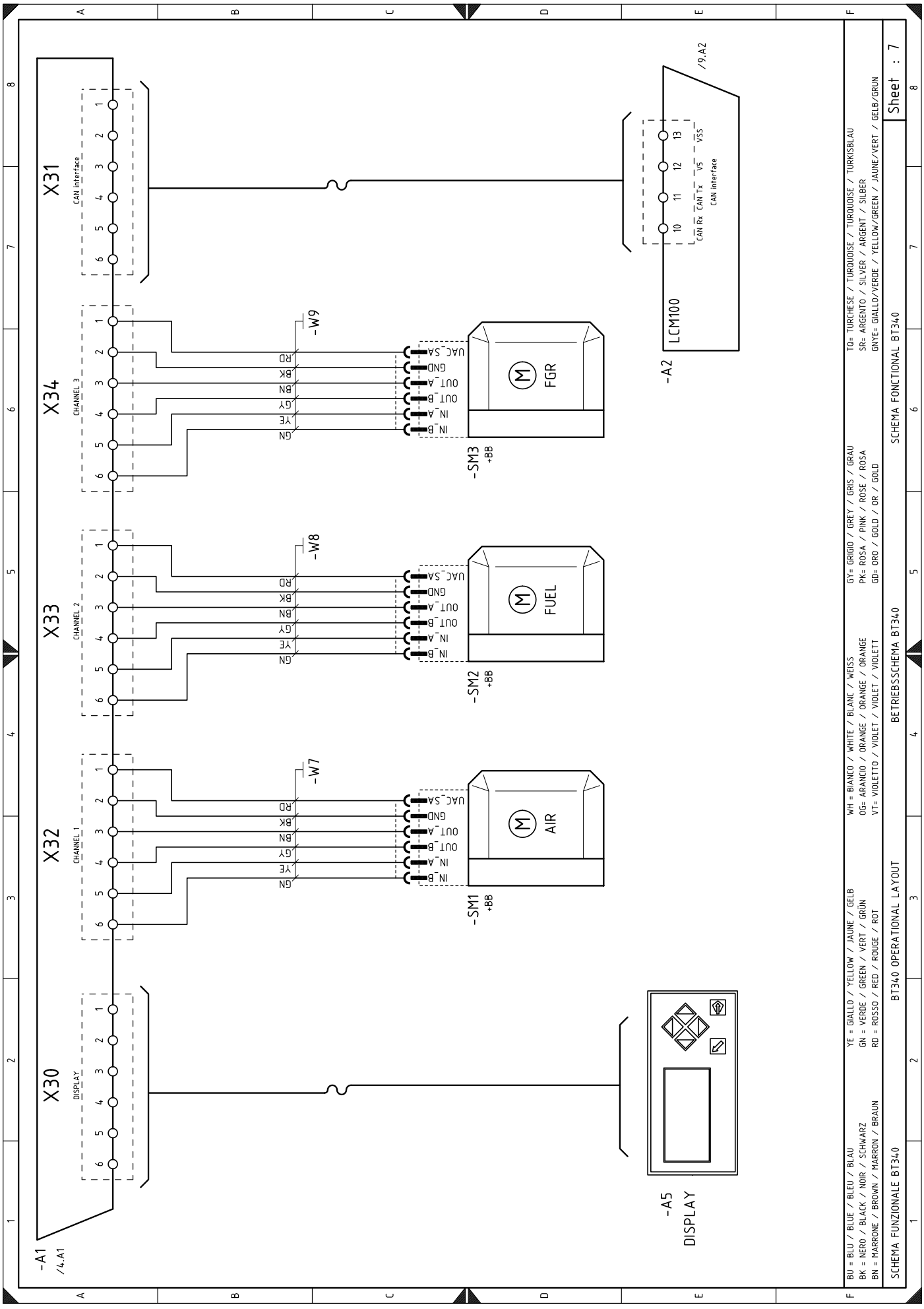
GY = GRIGIO / GREY / GRIS / GRAU
PK = ROSA / PINK / ROSE / ROSA
GD = ORO / GOLD / OR / GOLD
TQ = TURCHESE / TURQUOISE / TURQUOISE / TURKISBLAU
SR = ARGENTO / SILVER / ARGENT / SILBER
GNYE = GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN


-A1
/4.A1
X30
DISPLAY
X32
CHANNEL 1
X33
CHANNEL 2
X34
CHANNEL 3
X31
CAN interface
-A5
DISPLAY
-A2
LCM100
/9.A2
CAN Rx CAN Tx VS VSS
CAN interface
-SM1 +BB
AIR
-SM2 +BB
FUEL
-SM3 +BB
FGR
-W7
-W8
-W9
GN YE GY BN BK RD
IN_B IN_A OUT_B OUT_A GND VAC_SA
BU = BLU / BLUE / BLEU / BLAU
BK = NERO / BLACK / NOIR / SCHWARZ
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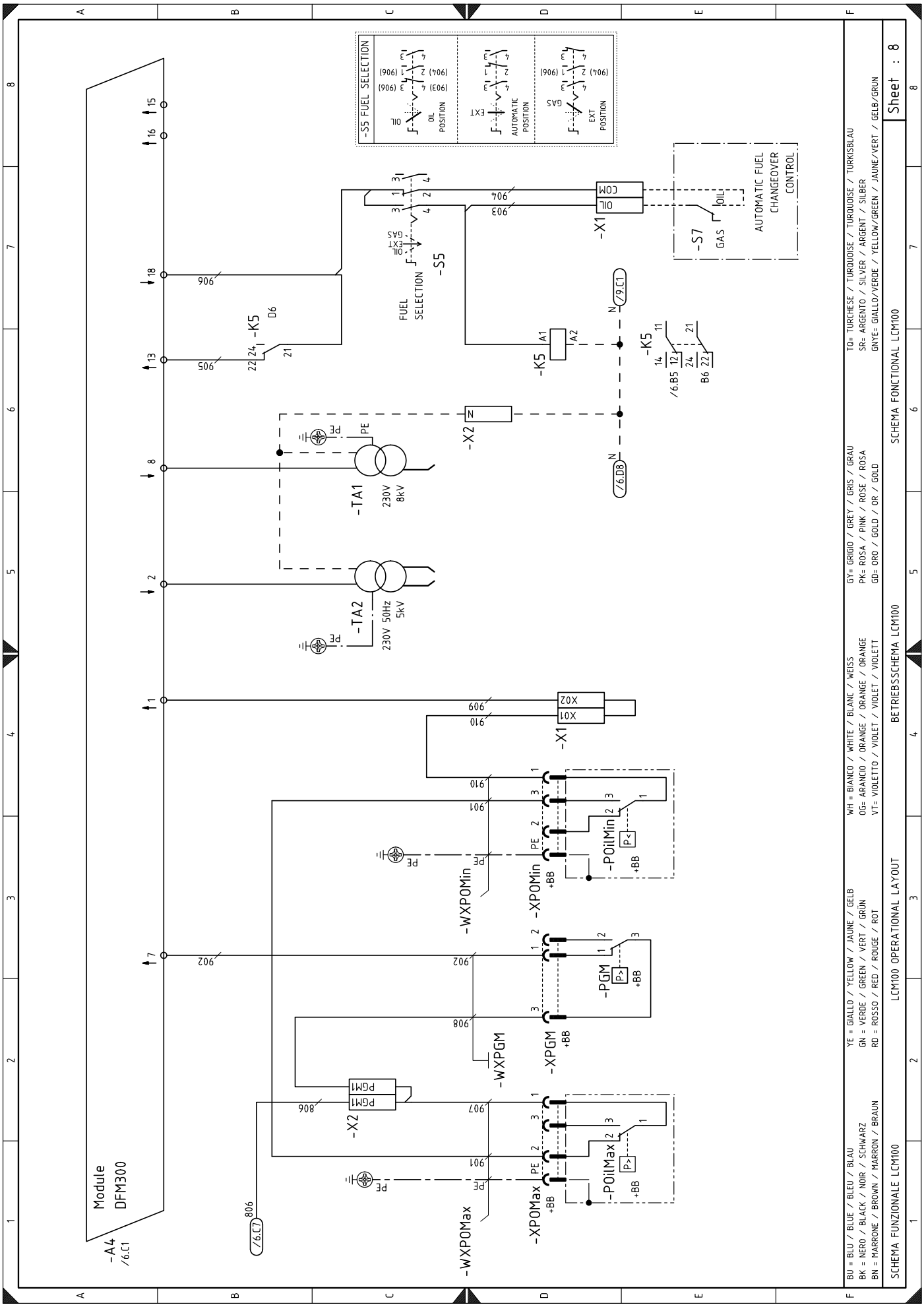
SCHEMA FUNZIONALE BT340
BT340 OPERATIONAL LAYOUT
BETRIEBSSCHEMA BT340
SCHEMA FONCTIONAL BT340
Sheet : 7


-S5 FUEL SELECTION
OIL POSITION
AUTOMATIC POSITION
EXT POSITION
FUEL SELECTION
-S5
-S7
AUTOMATIC FUEL CHANGEOVER CONTROL
-X1
-K5
-TA1
230V 8kV
-TA2
230V 50Hz 5kV
-X2
-A4
/6.C1
Module DFM300
-POilMin
-POilMax
-PGM
-XPOMin
-XPOMax
-XPGM
-WXPOMin
-WXPOMax
-WXPGM
BU = BLU / BLUE / BLEU / BLAU
BK = NERO / BLACK / NOIR / SCHWARZ
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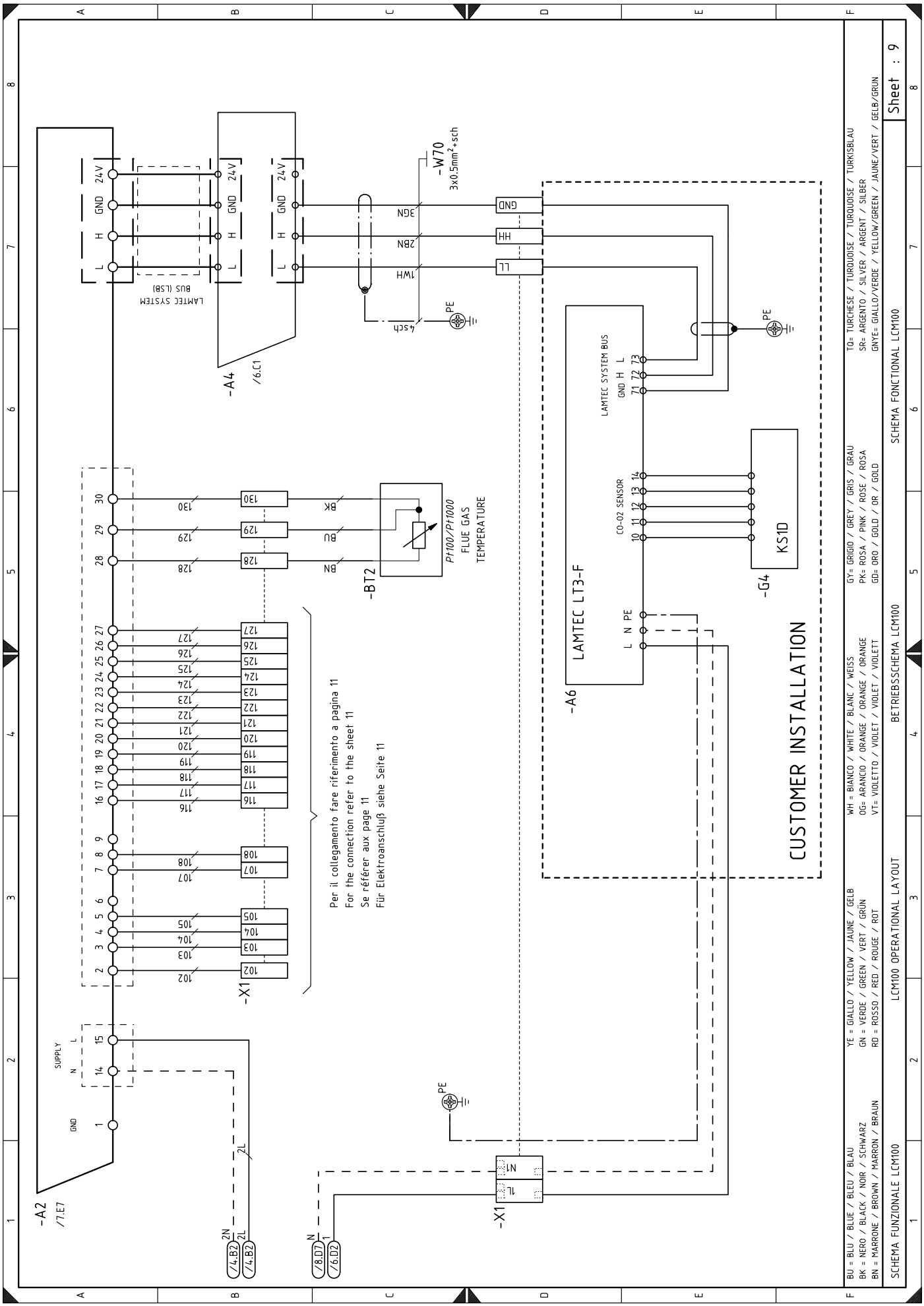
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN
SCHEMA FUNZIONALE LCM100
LCM100 OPERATIONAL LAYOUT
BETRIEBSSCHEMA LCM100
SCHEMA FONCTIONAL LCM100
Sheet : 8


CUSTOMER INSTALLATION
LAMTEC LT3-F
-A6
-A2
-A4
-X1
-BT2
-G4
-W70
3x0.5mm²+sch
KS1D
P1100/PT1000
FLUE GAS
TEMPERATURE
CO-O2 SENSOR
LAMTEC SYSTEM BUS
BUS (LSB)
SUPPLY
Per il collegamento fare riferimento a pagina 11
For the connection refer to the sheet 11
Se référer aux page 11
Für Elektroanschluß siehe Seite 11
BU = BLU / BLUE / BLEU / BLAU
BK = NERO / BLACK / NOIR / SCHWARZ
BN = MARRONE / BROWN / MARRON / BRAUN
YE = GIALLO / YELLOW / JAUNE / GELB
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GD= ORO / GOLD / OR / GOLD
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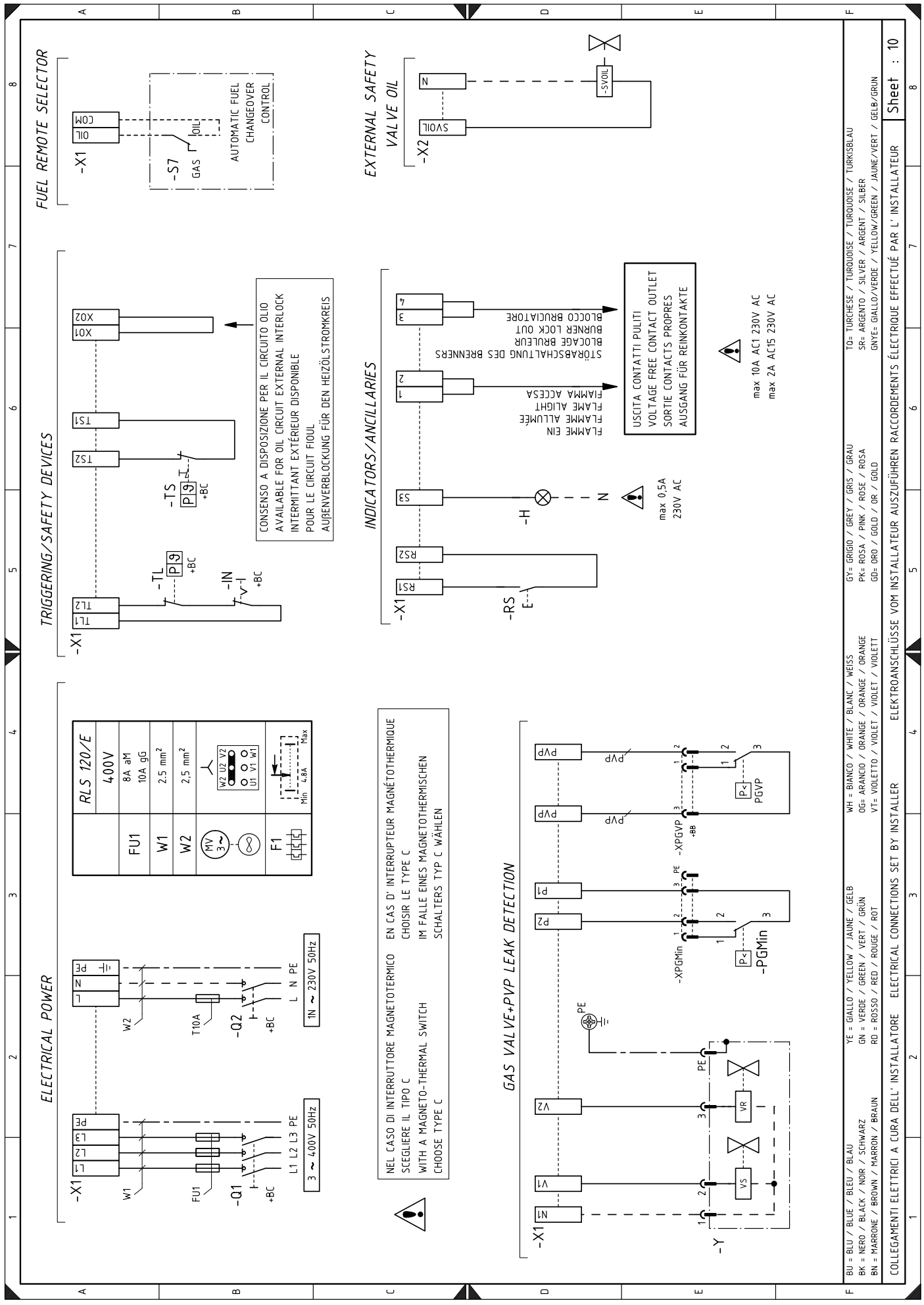
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN
SCHEMA FUNZIONALE LCM100
LCM100 OPERATIONAL LAYOUT
BETRIEBSSCHEMA LCM100
SCHEMA FONCTIONAL LCM100
Sheet : 9


FUEL REMOTE SELECTOR
-X1
COM
OIL
-S7
GAS
OIL
AUTOMATIC FUEL CHANGEOVER CONTROL
EXTERNAL SAFETY VALVE OIL
-X2
N
SVOIL
-SVOIL
TRIGGERING/SAFETY DEVICES
-X1
TL2
TL1
TS2
TS1
X01
X02
-TL
-TS
-IN
+BC
CONSENSO A DISPOSIZIONE PER IL CIRCUITO OLIO
AVAILABLE FOR OIL CIRCUIT EXTERNAL INTERLOCK
INTERMITTANT EXTÉRIEUR DISPONIBLE
POUR LE CIRCUIT FIOUL
AUßENVERBLOCKUNG FÜR DEN HEIZÖLSTROMKREIS
INDICATORS/ANCILLARIES
-X1
R51
R52
S3
-RS
-H
N
max 0,5A
230V AC
FLAMME EIN
FLAMME ALLUMÉE
FLAME ALIGHT
FLAMMA ACCESA
STÖRABSCHALTUNG DES BRENNERS
BLOCAGE BRULEUR
BURNER LOCK OUT
BLOCCO BRUCIATORE
USCITA CONTATTI PULITI
VOLTAGE FREE CONTACT OUTLET
SORTIE CONTACTS PROPRES
AUSGANG FÜR REINKONTAKTE
max 10A AC1 230V AC
max 2A AC15 230V AC
ELECTRICAL POWER
-X1
L1
L2
L3
PE
W1
FU1
-Q1
+BC
3 ~ 400V 50Hz
L1 L2 L3 PE
T10A
W2
-Q2
1N ~ 230V 50Hz
L N PE
RLS 120/E
400V
FU1
8A aM
10A gG
W1
2,5 mm²
W2
2,5 mm²
M 3~
W2 U2 V2
U1 V1 W1
F1
Min 4,8A
Max
NEL CASO DI INTERRUTTORE MAGNETOTERMICO
SCEGLIERE IL TIPO C
WITH A MAGNETO-THERMAL SWITCH
CHOOSE TYPE C
EN CAS D' INTERRUPTEUR MAGNÉTOTHERMIQUE
CHOISIR LE TYPE C
IM FALLE EINES MAGNETOTHERMISCHEN
SCHALTERS TYP C WÄHLEN
GAS VALVE+PVP LEAK DETECTION
-X1
N1
V1
V2
PE
-Y
VS
VR
P1
P2
-XPGMin
-PGMin
P<
-XPGVP
-PGVP
PVP
+BB
BU = BLU / BLUE / BLEU / BLAU
BK = NERO / BLACK / NOIR / SCHWARZ
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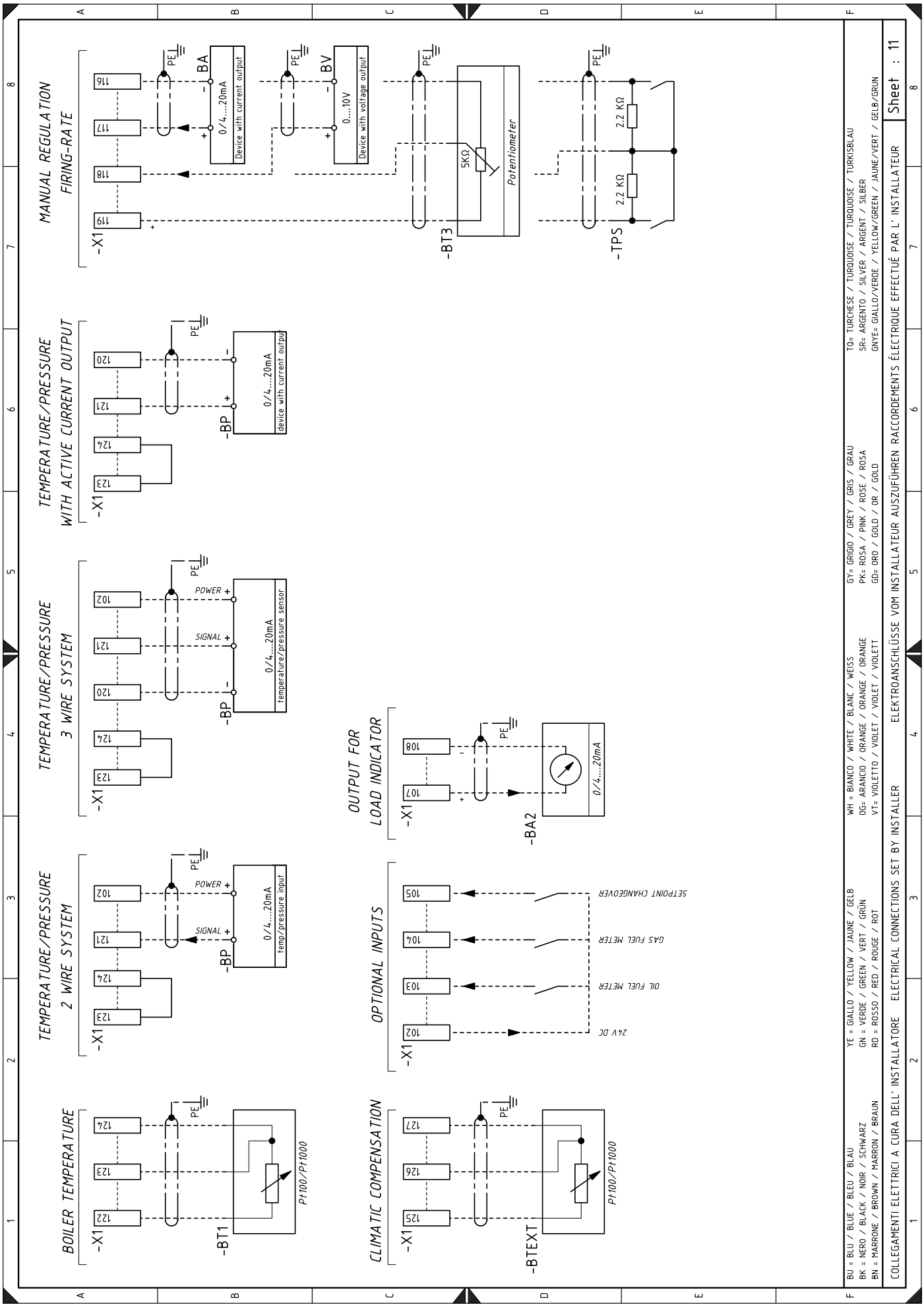
SR= ARGENTO / SILVER / ARGENT / SILBER
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN
COLLEGAMENTI ELETTRICI A CURA DELL' INSTALLATORE
ELECTRICAL CONNECTIONS SET BY INSTALLER
ELEKTROANSCHLÜSSE VOM INSTALLATEUR AUSZUFÜHREN
RACCORDEMENTS ÉLECTRIQUE EFFECTUÉ PAR L' INSTALLATEUR
Sheet : 10


MANUAL REGULATION
FIRING-RATE
-X1
116
117
118
119
PE
BA
0/4....20mA
Device with current output
BV
0....10V
Device with voltage output
-BT3
5KΩ
Potentiometer
-TPS
2.2 KΩ
2.2 KΩ
TEMPERATURE/PRESSURE
WITH ACTIVE CURRENT OUTPUT
120
121
124
123
-BP
0/4....20mA
device with current output
TEMPERATURE/PRESSURE
3 WIRE SYSTEM
POWER +
SIGNAL +
temperature/pressure sensor
TEMPERATURE/PRESSURE
2 WIRE SYSTEM
temp/pressure input
OUTPUT FOR
LOAD INDICATOR
107
108
-BA2
0/4....20mA
OPTIONAL INPUTS
102
103
104
105
24V DC
OIL FUEL METER
GAS FUEL METER
SETPOINT CHANGEOVER
BOILER TEMPERATURE
122
123
124
-BT1
Pt100/Pt1000
CLIMATIC COMPENSATION
125
126
127
-BTEXT
Pt100/Pt1000
BU = BLU / BLUE / BLEU / BLAU
BK = NERO / BLACK / NOIR / SCHWARZ
BN = MARRONE / BROWN / MARRON / BRAUN
YE = GIALLO / YELLOW / JAUNE / GELB
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SR= ARGENTO / SILVER / ARGENT / SILBER
GNYE= GIALLO/VERDE / YELLOW/GREEN / JAUNE/VERT / GELB/GRUN
COLLEGAMENTI ELETTRICI A CURA DELL' INSTALLATORE ELECTRICAL CONNECTIONS SET BY INSTALLER ELEKTROANSCHLÜSSE VOM INSTALLATEUR AUSZUFÜHREN RACCORDEMENTS ÉLECTRIQUE EFFECTUÉ PAR L' INSTALLATEUR
Sheet : 11

Wiring layout key

+BB	Burner components
+BC	Boiler components
A1	Control box for the air/fuel ratio
A2	Adjustment module
A4	Fuel management module
A5	Operator panel
A6	Oxygen control module
B	Filter to protect against radio disturbance
BA2	Load indicator
BP	Pressure probe
BT1	Temperature probe
BT2	Probe Pt1000
BT3	Potentiometer
BTEXT	External probe for climatic compensation of the setpoint
F1	Fan motor thermal relay
FU	Three-phase power supply fuses
G4	Oxygen probe
H	Remote lockout signal
IN	Burner manual stop switch
K1	Relay “K1” (clean contacts “FLAME ALIGHT”)
K2	Relay “K2” (clean contacts “BURNER LOCK-OUT”)
K5	Fuel change relay
KMP	Pump motor contact maker
KM	Fan motor contact maker
MP	Pump motor
MV	Fan motor
PA	Air pressure switch
PE	Burner earth
PGM	Maximum gas pressure switch
PGMin	Minimum gas pressure switch
PGVP	Gas pressure switch for valve leak detection control device
POilMin	Minimum oil pressure switch
POilMax	Maximum oil pressure switch
Q1	Three-phase line disconnecting switch
Q2	Single-phase line disconnecting switch
UV	Flame sensor
RS	Remote burner reset button
S1	On/off selector
S5	Fuel selector
S7	Fuel remote selection selector
SM1	Air servomotor
SM2	Gas servomotor
SM3	FGR servomotor
TA1	Gas ignition transformer
TA2	Oil ignition transformer
TL	Limit thermostat/pressure switch
TPS	3 control points
TS	Safety thermostat/pressure switch
VF-VR	Oil circuit valves
VP1-VP2	Pilot valves
VS-VS1	Oil circuit valves
X1	Burner terminal strip
X2	Valve group terminal board
XPGM	Maximum gas pressure switch connector
XPGMin	Minimum gas pressure switch connector
XPGVP	Gas pressure switch connector for gas leak control
XPOilMax	Maximum oil pressure switch connector
XPoilMin	Minimum oil pressure switch connector
XUV	Flame sensor connector
XVP1-XVP2	Pilot valves connector
Y	Gas adjustment valve + gas safety valve

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http:// www.riello.com