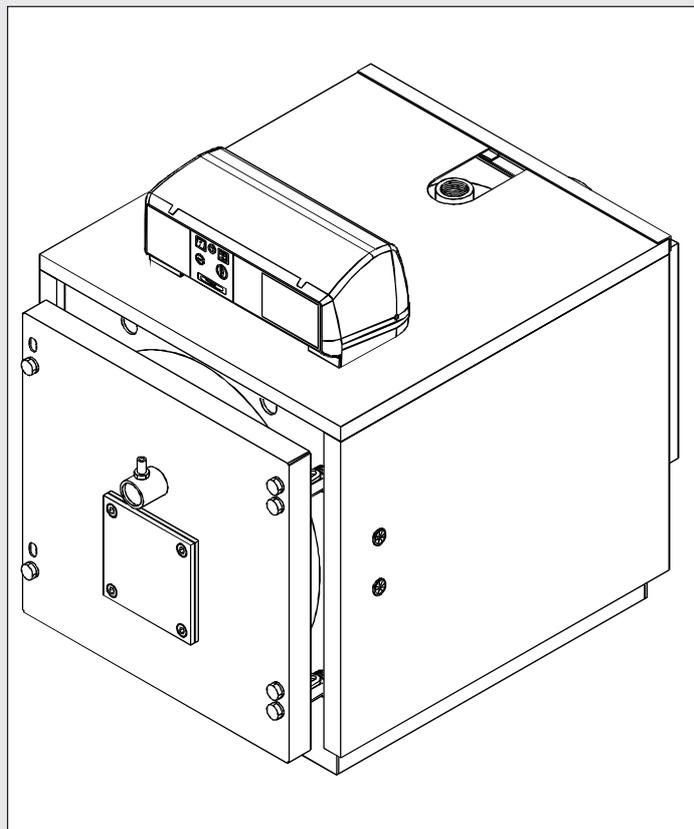


# Unical<sup>®</sup>

## *MODAL*



**INSTALLATION, USE AND  
SERVICING INSTRUCTION**  
(to be kept by the user)

## WARNING

When the boiler is operated with a pressure jet gas burner, because it does not belong to any of the categories among those listed in the Annex II to the Directive 97/23/CE (regarding pressure equipment) and being, furthermore, mentioned in the Directive 90/396/CE (Gas Appliance Directive) to which the art. 1, clause 3, paragraph 6.5 makes reference, it is excluded from the scope of the Directive.

## GENERAL INFORMATIONS

### Introduction

This manual supplies a summary of what has to be followed during the installation, use and servicing of the UNICAL boilers, MODAL range.

### Choice of the boiler

For a correct choice and application of the MODAL boilers it is necessary to follow the instructions given in this manual.

### Installation

The installation of the boilers and the auxiliary equipments, related to the heating system, must be in conformity with all the regulations and rules in force.

It is law that all the gas appliances are installed, commissioned and serviced by a registered installer in accordance with the regulations below. Failure to install appliances correctly could lead prosecution. It is in your own interest, and that of the safety, to ensure the law is complied with.

The following must be complied with:

Current Building Regulations and Clean Air Act.

Water authority regulations.

Local Authority Regulations and Regional Bylaws.

Gas Safety Regulations.

Any special regional requirements of local Electricity and Gas undertaking.

Fire Service and Insurance Company requirements.

### Commissioning

The main purpose of the commissioning is to verify the correct operation of all the safety and control devices.

Before leaving the installation the commissioner has to control the operation of the boiler for, at least, a complete working cycle.

### Guarantee

The boiler guarantee is bound to the compliance of the requirements stated in this manual, and any non-fulfilment or modification will make it void.

### Normative

It is the responsibility of the installer to fulfil all the regulations concerning the boiler house, the safety devices, the chimney, the fuel supply lines, the electrical installations and all the other local requirements and safety instructions.

### Approvals

The UNICAL boilers, MODAL range, have been tested and CE certified for the gas operation by GASTEC ITALIA, who has recognised to these boilers the conformity certificate according to the following directives:

- Gas Appliances Directive (90/396 CE), compulsory as per 1st January 1996;
- Efficiency Directive (92/42 CE), compulsory as per 1st January 1998;
- The conformity to the Low Voltage Directive (73/23 CE), compulsory as per 1st January 1997 has been verified and ascertained by GASTEC ITALIA.

The conformity to the EMC (Electro Magnetic Compatibility 89/336 CE), compulsory as per 1st January 1996, is not applicable to the MODAL boilers because they do not have electronic components.

For the time being there are no European Directives covering the oil fired boilers, except the Efficiency Directive (92/42 CE).

### Data plate and Serial No.

The data plate, supplied in a separate envelope with the relevant documents, makes reference to a serial No, embossed in an aluminium plate riveted to the front tube plate in the lower RH side corner.

### Use of the boiler

**This boiler has to be used for heating the water at a temperature not higher than the boiling temperature in the installation conditions.**

## GAS SAFETY (INSTALLATION AND USE) REGULATIONS, 1994

It is law that **all** gas appliances are installed and serviced by a CORGI registered installer in accordance with the above regulations.

Failure to install appliances correctly could lead to prosecution.

It is in your own interest, and that of safety, to ensure the law is complied with.

The installation of the boiler **MUST** also be in accordance with the latest I.E.E. Wiring Regulations, local building regulations, by-laws of the local water authority, the building regulations and the Building Standards (Scotland) and any relevant requirements of the local authority.

Detailed recommendations are contained in the following

British Standard Codes of Practice:

- BS 6891 Low pressure installation pipes.
- BS 5449 Forced circulation hot water systems.
- BS 5546 Installation of gas hot water supplies for domestic purposes (2nd Family Gases).
- BS 6644 Ventilation (for gas appliances of rated input exceeding 60 kW).

## HEALTH & SAFETY DOCUMENT No. 635

**The Electricity at Work Regulations, 1989.**

The manufacturer's notes must **NOT** be taken, in any way, as overriding statutory obligations.

**IMPORTANT.** These appliances are CE certificated for safety and performance. It is, therefore, important that no external control devices, e.g. flue dampers, economisers etc., are directly connected to these appliances unless covered by these Installation and Servicing Instructions or as otherwise recommended by **Unical** in writing. If in doubt please inquire.

Any direct connection of a control device not approved by **Unical** could invalidate the certification and the normal appliance warranty.

### Notes.

To obtain the gas consumption:-

- a. For l/s divide the gross heat input (kW) by C.V. of the gas (MJ/m<sup>3</sup>).
- b. For ft<sup>3</sup>/h divide the gross heat input (Btu/h) by C.V. of the gas (Btu/ft<sup>3</sup>).

1

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# 1

## CONSTRUCTIONAL-DIMENSIONAL TECHNICAL CHARACTERISTICS

### 1.1 - CONSTRUCTION OF THE MODAL BOILERS

The construction completely satisfies the requirements of the EN 303- part 1.

The sheet metal parts of the pressure vessel are manufactured of certified carbon steel, type S235JRG2, according to EN 10025, with melting certificate 3.1.B, according to EN 10024; whereas the pipes are of steel ST 37.0 according to DIN 1626.

The welders and the WPS (Welding Procedures Specifications) have been approved according to EN 287 and EN 288 by TUEV (DE).

The boilers are equipped with a reversible inged door, which can be opened, for this

reason, from L.H. or R.H. side.

The outer shell is insulated with a glass wool mattress, thick 60 mm, protected by a textile in mineral fiber.

The upper part of the outer shell is equipped with uplift hook(s).

The boilers are provided with two 1/2" bulb holders with inner diameter of 15 mm (for 3 bulbs each), suitable to locate the thermostats and thermometer bulbs.

The casing side panels are provided with holes for the cables of the electrical supply, of the pumps, of the burner and any other

auxiliary equipment.

**Note:** The MODAL boilers are to be equipped with ON/OFF burner; alternatively they can be equipped with a two stage or modulating burner, provided the minimum reachable heat input is not lower than the figure shown on the data plate for the fuel used on site.

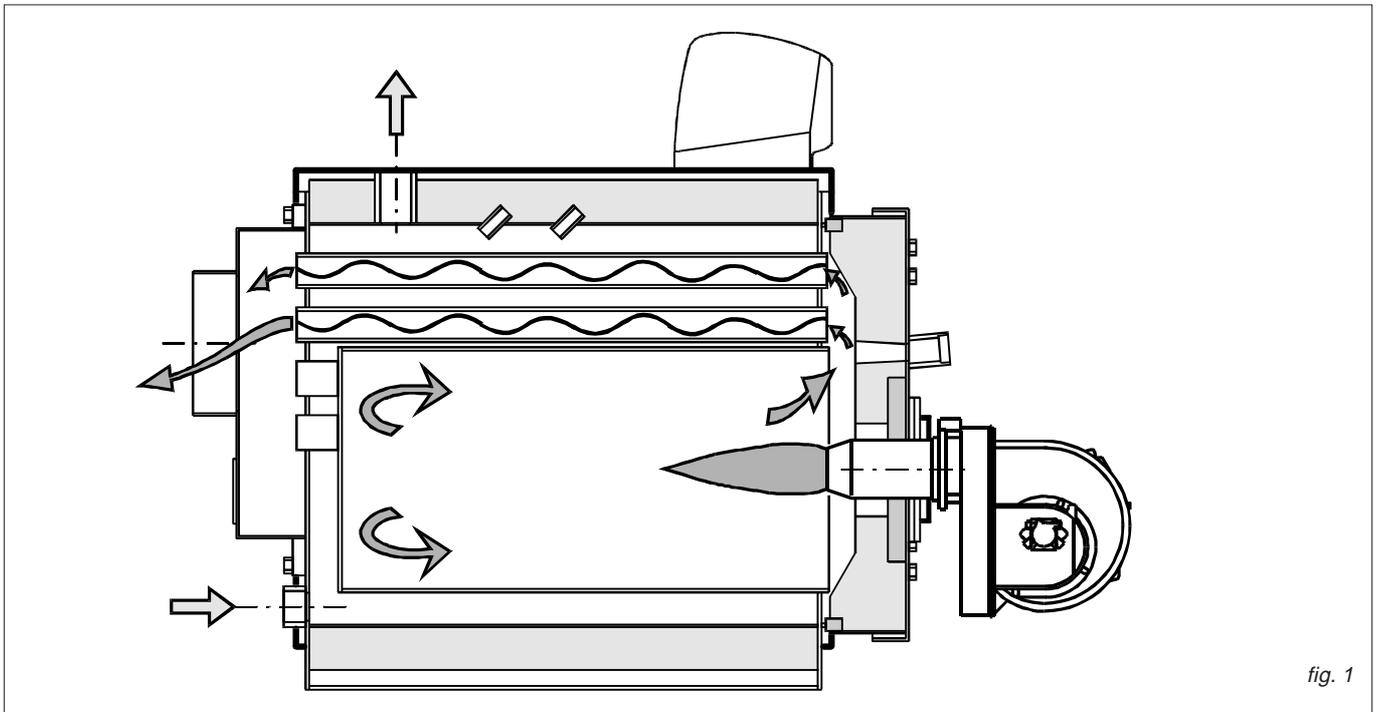


fig. 1

## 1.2 - DIMENSIONS AND HYDRAULIC CONNECTIONS OF MODAL BOILERS

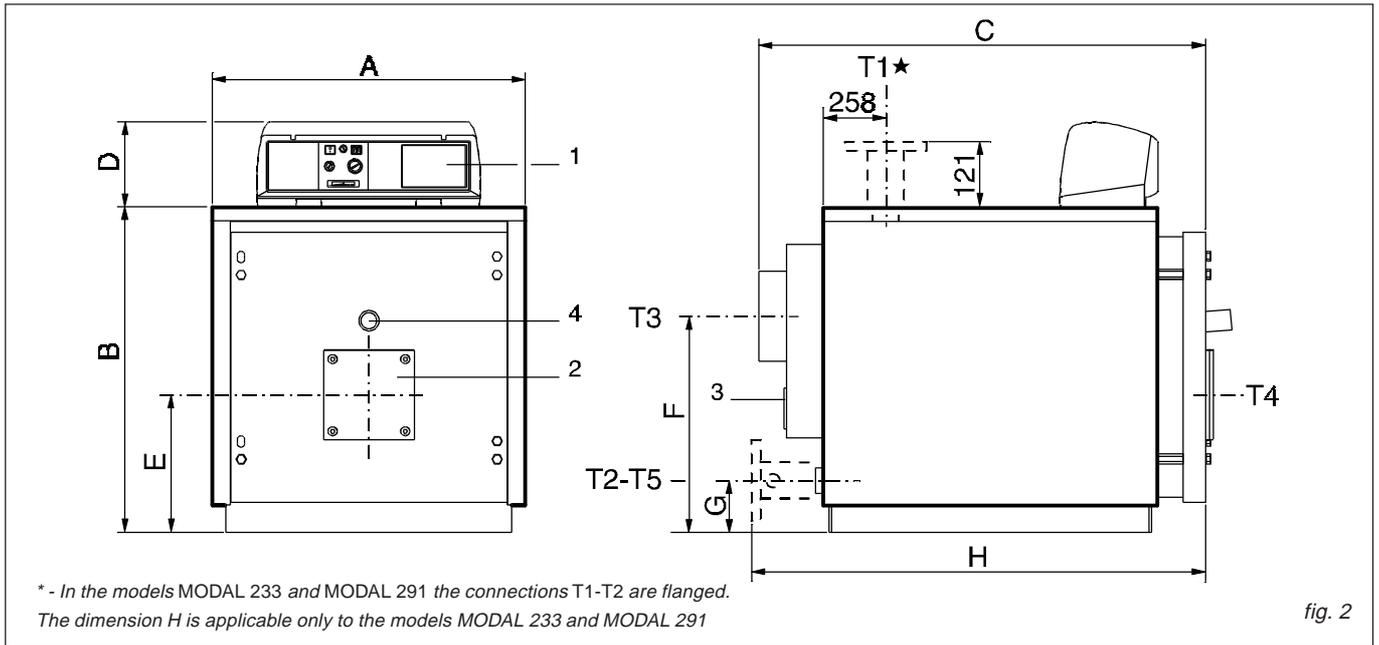


fig. 2

- 1 Panel board
- 2 Burner connecting plate
- 3 Cleaning door

- 4 Sight glass
- T1 C.H. flow
- T2 C.H. return

- T3 Flue connection
- T4 Burner axis
- T5 Boiler drain

MODAL Type	Output Input		DIMENSIONS							CONNECTIONS					Combustion chamber dimensions Ø1 x Lg mm	Boiler capacity liters	Water side press. loss(*) m w.c.	Smoke side press. losses mm w.c.	Max. allow. working pressure bar	Weight kg
	(kW) kcal/h	(kW) kcal/h	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	T1 - T2 ISO 7/1 UNI 2278 PN16	T3 Ø mm	T4 Ø mm	T5 ISO 7/1						
<b>64</b>	(64) 55.000	(71) 61.000	690	722	990	190	305	480	115	--	Rp 1½	200	130	Rp ¾	330 x 670	86	0,10	1,5	5	195
<b>76</b>	(76) 65.000	(84) 72.000	690	722	990	190	305	480	115	--	Rp 1½	200	130	Rp ¾	330 x 670	86	0,13	1,8	5	195
<b>93</b>	(93) 80.000	(102) 88.000	690	722	990	190	305	480	115	--	Rp 1½	200	130	Rp ¾	330 x 670	86	0,16	2,5	5	195
<b>105</b>	(105) 90.000	(115) 99.000	760	812	1205	190	350	500	130	--	Rp 2	200	180	Rp ¾	390 x 850	126	0,10	3	5	280
<b>116</b>	(116) 100.000	(128) 110.000	760	812	1205	190	350	500	130	--	Rp 2	200	180	Rp ¾	390 x 850	126	0,10	3	5	280
<b>140</b>	(140) 120.000	(155) 133.000	760	812	1205	190	350	500	130	--	Rp 2	200	180	Rp ¾	390 x 850	126	0,14	5	5	280
<b>163</b>	(163) 140.000	(180) 155.000	760	812	1385	190	350	500	130	--	Rp 2	200	180	Rp ¾	390 x 1030	151	0,20	8	5	318
<b>186</b>	(186) 160.000	(206) 177.000	760	812	1385	190	350	500	130	--	Rp 2	200	180	Rp ¾	390 x 1030	151	0,25	14	5	318
<b>233</b>	(233) 200.000	(258) 222.000	860	937	1437	190	421	580	165	1482	DN 65	250	180	Rp ¾	470 x 1070	203	0,22	18	5	420
<b>291</b>	(291) 250.000	(322) 277.000	860	937	1687	190	421	580	165	1732	DN 65	250	180	Rp ¾	470 x 1320	247	0,30	22	5	480

(\*) Pressure losses with a water flow rate related to a delta T of 15 K.

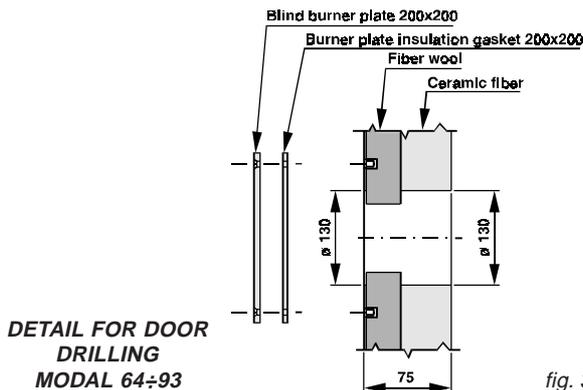


fig. 3

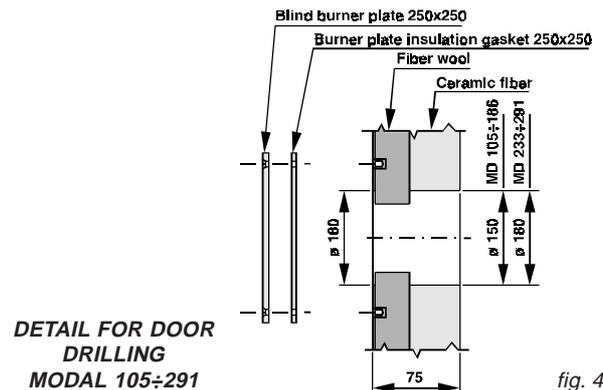


fig. 4

## 2

# INSTALLATION

## 2.1 - PACKAGING

The MODAL boilers are supplied complete with door and smoke chamber already fitted, whilst the casing with the insulation mattress are contained in separate cardboard packaging(s). The panel board and the accessories are inside the combustion chamber. Before starting the installation make sure that

the length and the width of the boiler body received correspond to the dimensions of the ordered boiler, shown in the previous tables and that the cartons, containing the casing, or part of it, are marked with the same model. In addition to the a. m. panel board, packed in its own carton, in the combustion chamber, as accessories, there are also:

- a carton containing the flanges for flow, return and safety connections (if applicable)

with relevant gaskets and bolts, the cylindrical brush for the cleaning of the smoke pipes.

- cleaning brush handle extension.
- turbulators extractor.
- ceramic fiber rope for the insulation between the door and burner blast tube.

## 2.2 - HANDLING

The boiler can be moved into position by lifting, through the upper hook(s), or by the use of rollers placed under the strong L profiles of the basement.

If it necessary, due to the dimensions of the boiler, it is possible to remove the front door and the smoke chamber to facilitate the introduction in the boiler house.

## 2.3 - POSITIONING IN THE BOILER HOUSE

The installation of the boiler must be in accordance with the relevant requirements of the Gas Safety Regulations, current I.E.E. Regulations, local water authority bye-laws and it should also comply with any relevant requirements of the local gas supplier, local authority and the relevant Standard Codes of Practice and building regulations.

The boiler house must be ventilated through permanent openings having a total surface not lower than  $1/30^{\text{th}}$  of the floor area of the boiler house, with a minimum of 0.5 m<sup>2</sup>.

Ventilation by grilles communicating directly with the outside air is required at both, high and low levels.

The boiler must be positioned so that there is enough space available for the following:

- Access around the boiler for servicing
- Space to open the boiler front door
- Space to access the burner.

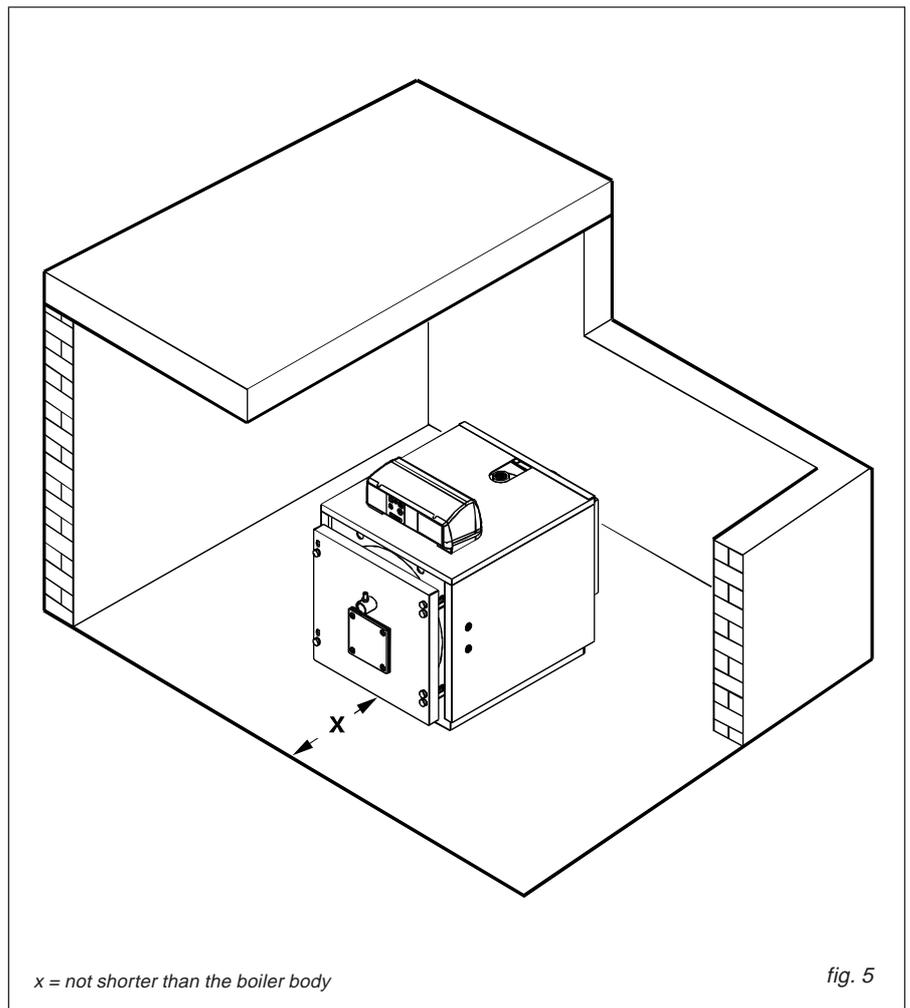
The installation of the boiler as close as possible to the chimney position is highly recommended.

To allow the cleaning of the smoke pipes, in front of the boiler a clearance equal to the length of the boiler, has to be available.

With the boiler door opened at 90°, the distance between the front of the door and the adjacent wall must be equal, at least, at the length of the burner.

The boiler must stand on a non-combustible floor (i.e. concrete or brick), which must be flat, level and of a suitable load bearing capacity to support the weight of the boiler (when filled with water) and any ancillary equipment.

Once the installation has been made the boiler must result perfectly horizontal and well stable (to avoid vibrations and noise).



## 2.4 - CASING ASSEMBLY

N.B. It is suggested to verify that the boiler is positioned in its final place and that all the hydraulic connections are made correctly before starting the casing assembly. Before opening the casing carton(s) make sure they are stamped with the right boiler model, corresponding to the boiler to be installed.

N.B.: The packaging containing the panel board is delivered inside the combustion chamber, as well as the documents and the guarantee certificate.

Refer to diagram fig. 6 & 7 for details

A. Fit the insulation blanket (1) onto the boiler shell and secure it in place using the elasticated straps (2) provided, ensuring that the metal clips grip in to the external surface of the insulation.

B. Locate the side panels (3) and (4) with the lower bend inside the bottom L profiles and the upper bend in the seats of front and rear tube plates.

To determine which is the left and right panel ensure that the cable glands are positioned facing toward the front edge.

C) After removal of the two side screws from the panel board rotate its cover frontwards. Fit the panel board to the upper panel (5) and after having passed the cables (mains, room thermostat, burner etc.) through the cable glands fitted to the side panel insert these cables and the capillaries of thermometer and thermostats through the slots on its base. Fit the casing upper panel, complete with the panel board, to the side panels (3 & 4), directing the capillaries of thermostats and thermometer to the bulb holder.

D) Insert the thermometer and thermostat bulbs in the bulb holders as shown in fig. 7 and connect the mains, the burner, the pump(s) and any ancillary equipment to the panel board. Close the panel board.

E) Fit the upper panel rear reinforcement (6).

F) Remove the protective paper film from data plate and ventilation requirement label (7) and fit them at the top front corner of the most accessible side panel after removal of dust from the surface.

**The data plate and label are in the documents envelope.**

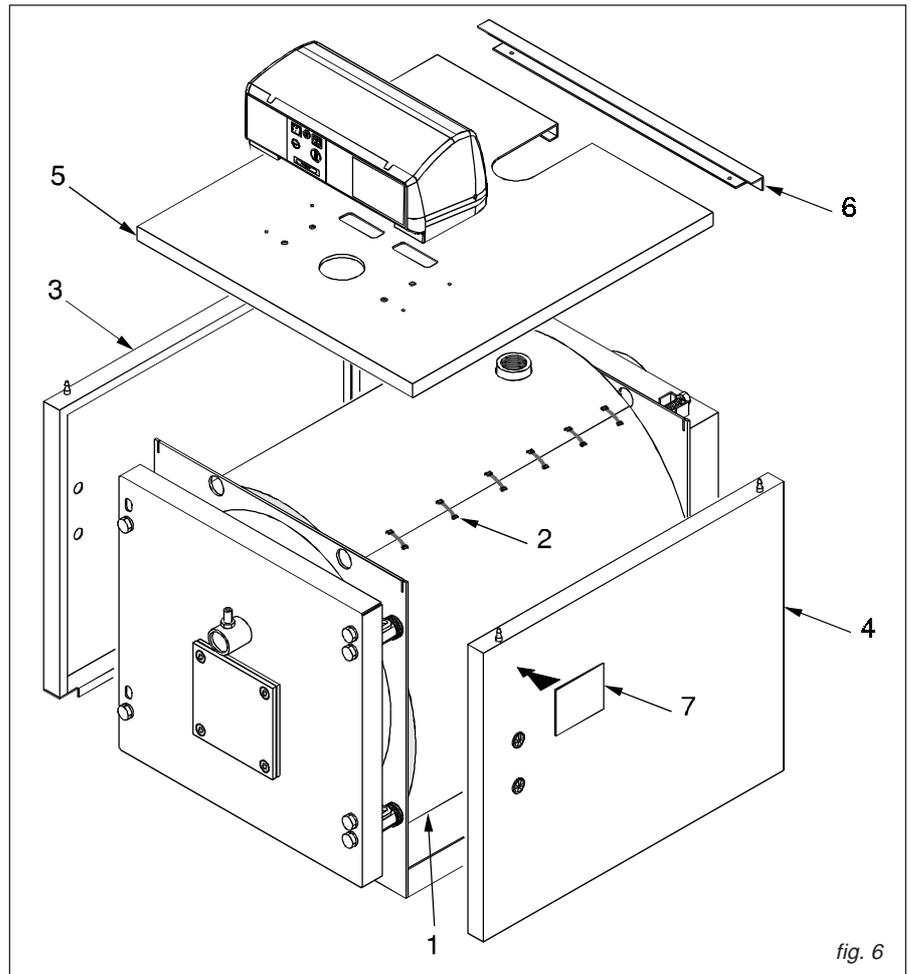
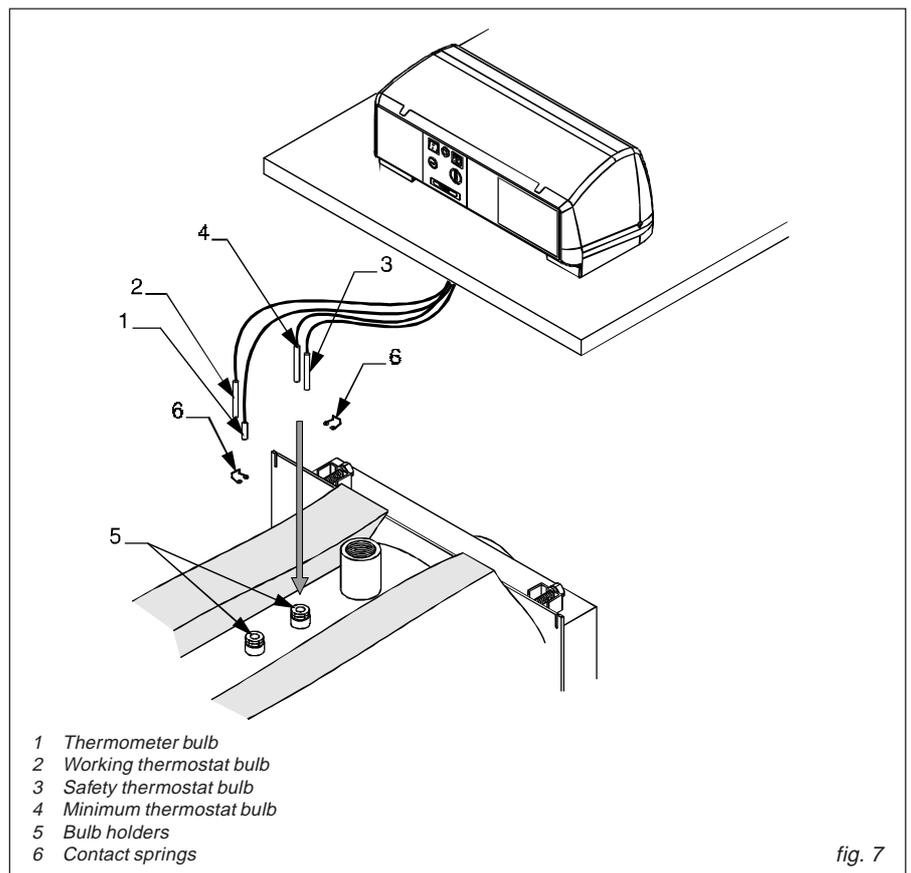


fig. 6



- 1 Thermometer bulb
- 2 Working thermostat bulb
- 3 Safety thermostat bulb
- 4 Minimum thermostat bulb
- 5 Bulb holders
- 6 Contact springs

fig. 7

## 2.5 - CONNECTION TO THE CHIMNEY

The chimney has a fundamental importance for the good operation of the boiler. Due to the low temperature of the smokes during the intermittent operation, it is necessary that the chimney is perfectly impermeable to the condensate of the combustion products and manufactured with corrosion resistant materials.

The different connections must be sealed with an approved boiler putty so that the inlet of fresh air, with consequent increase of the possibility of condensate formation, is avoided. Furthermore the possible condensate or rain water coming from the chimney must be avoided from entering the smoke chamber of the boiler.

As far as the cross section and the high of the chimney is concerned, it is necessary to make reference to the local and national rules in force.

**In the flue pipe, between the boiler and the chimney, convenient sampling points for smoke temperature and combustion products analysis must be provided.**

## 2.6 - FEEDING WATER QUALITY

- The chemical-physical characteristics of the C.H. system and reinstatement water are fundamental for the good operation and safety of the boiler.
- Among the inconvenients caused by the bad quality of the feeding water the most frequent and serious is the scaling of the heat exchange surfaces.
- Less frequent, but also dangerous, is the corrosion of the water side surfaces of all the circuit.
- It is well known that the lime, due to its very low thermal conductivity, reduces the heat transfer so that also a scaling of a

few millimeters produces very dangerous localized overheating.

1 mm of lime reduces the heat transfer from metal to water by 10%.

It is suggested to make a water treatment in the following cases:

- A- high hardness of the water available on site (higher than 20°f).
- B- very large C.H. systems.
- C- large quantities of reinstatement water due to water leaks.
- D- subsequent fillings of the system due to maintenance works.
- E- mixing of different metals in the CH circuit.

For the treatment of filling water it is suggested to address them self to specialized firms.

The same firms are able to provide for the descaling of the boilers.

Every C.H. system needs reinstatements of water, du to evaporation, small or large water leaks or for maintenance works.

It is, therefore, necessary to be able to evaluate the entity of the reinstatement water to avoid inconvenients due to untreated water.

For that reason it is suggested to fit, in the feeding line to the boiler, a water meter for small capacities.

### 2.6.1 - SHUNT PUMP

The MODAL boilers must always operate in forced circulation hot water systems and with a minimum return temperature of 55 °C..

So, it is suggestable to adopt a shunt pump, having also an anti-condensation purpose,

installed between the flow and return connections, upstream an eventual 3 or 4 way mixing valve.

This pump will be sized according to the following formula:

$$Q = P \times 22$$

where **Q** = Water flow rate in liter/h

**P** = Boiler nominal output in kW and the manometric head 1-2 m w.c.

### 2.6.2 - CHOICE OF THE BURNER

The correct choise and the adjustment of the burner are fundamental for the best operation of the boiler and then they shall be accurate and not under evaluated.

The burner will be selected by verifying that its working diagram (fuel flow rate - pressure in the furnace) is compatible with the same features declared for the boiler.

Remember that the smoke side resistance, i.e. the counterpressure in the furnace, are referred to "0" draught at the chimney base. It is also convenient that the burner blast tube have its length not shorter than that shown in table 8 and that the flame have a shape suitable to the characteristics of the MODAL furnace.

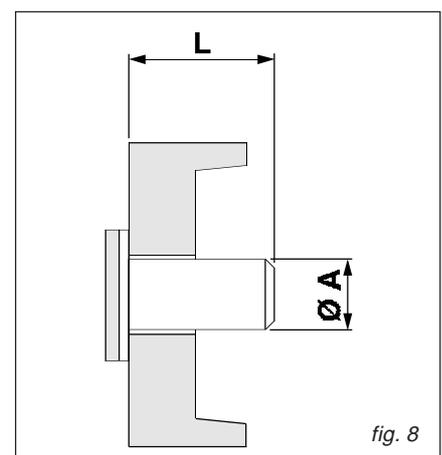
In fact to better exploit all the heating surface of the reversed flame furnace it is necessary to use burners capable to guarantee a long and narrow flame at all operating conditions or also at minimum input in case of two stage or modulating burners.

BOILER TYPE	øA mm	L mm
MODAL 64 ÷ 93	130	150
MODAL 105 ÷ 140	180	170
MODAL 163 ÷ 186	180	170
MODAL 233 ÷ 291	180	170

Too short flames can cause a localized overheating of the front part of the furnace, and the combustion products, not sufficiently cooled down, entering the smoke pipes at a too high temperature, can cause important damages to the boiler.

The burner manufacturing companies are able to supply the flame dimensions developed by their burners.

More informations are given in the paragraph "Commissioning".



BURNER BLAST TUBE DIMENSIONS

# 3

## STANDARD PANEL BOARD

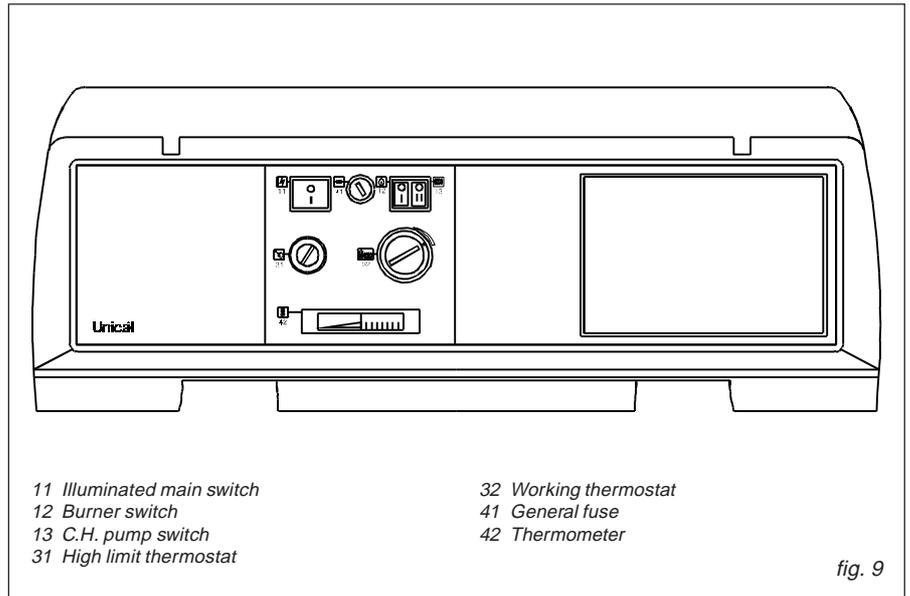
### 3.1 - PANEL BOARD TYPE 21057 - FUNCTIONS DESCRIPTION

Through the main switch [11] the panel board and all the equipments connected to it will be under power.

The switches [12] & [13] switch On and OFF the power to the burner and the Heating pump (via a relay, if necessary).

With the thermostat [32] the working temperature of the boiler can be adjusted. This thermostat is provided with a DPDT contact, for the control of a two stage burner. The differential between the switching points of the two double pole is 6°C (not adjustable). The minimum thermostat, accessible through the opening of the panel board cover, switches OFF the C.H. pump during the reacing of the steady state and up to the obtention of 50 °C within the boiler.

On the electrical supply line to the boiler a switch with fuses is to be forseen.



11 Illuminated main switch  
12 Burner switch  
13 C.H. pump switch  
31 High limit thermostat  
32 Working thermostat  
41 General fuse  
42 Thermometer

fig. 9

### 3.2 - ELECTRICAL WIRING DIAGRAM FOR SINGLE PHASE BURNER AND PUMP

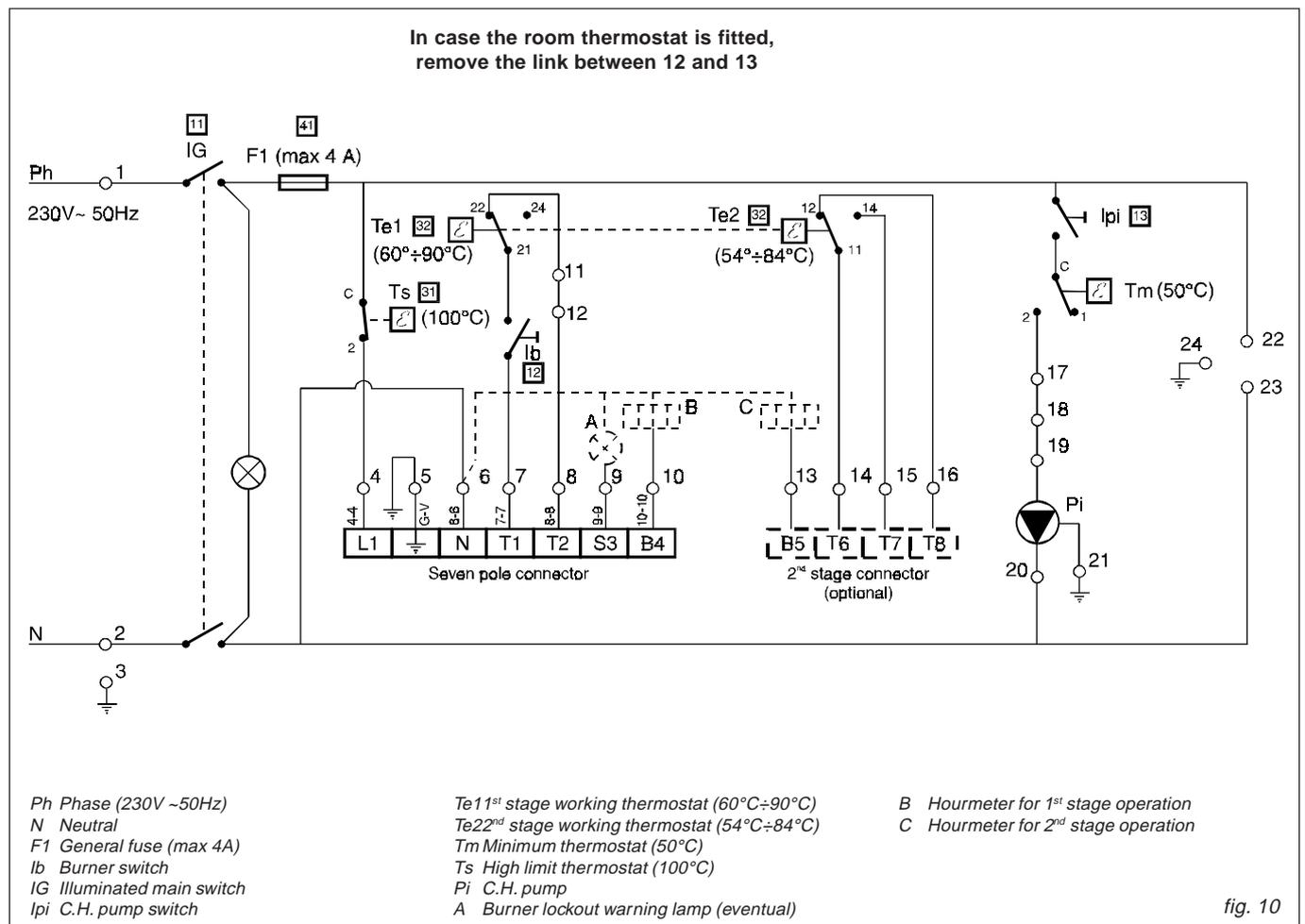


fig. 10

## 4

# COMMISSIONING AND OPERATION

## 4.1 - POSITIONING THE TURBULATORS

The MODAL boilers are foreseen to operate at the nominal output declared. If the boiler

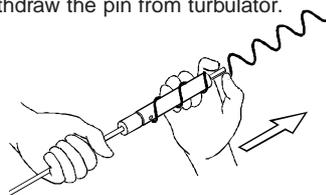
is used at a lower output, the resulting smoke temperature can be lower than 160°C and in this case the turbulators can be positioned against the rear wall of the smoke chamber. In the other cases the turbulators are positioned inside of the relevant pipes at

approx 2 to 4 cm from the front tube plate. The commissioning of the burner will be done under the responsibility of a qualified burner technician, sent by the burner manufacturer. In that occasion a commissioning report will be filled in.

### Turbulators removal

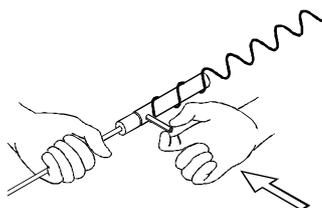
#### Detail 1:

Fit the brush handle extension onto the turbulator remover. Withdraw the pin from turbulator.



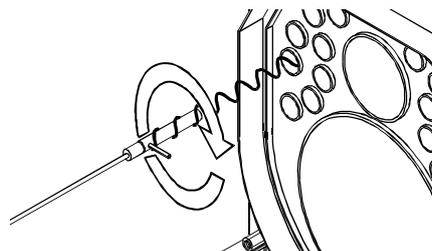
#### Detail 2:

Fit the pin in the radial hole with a hammer.



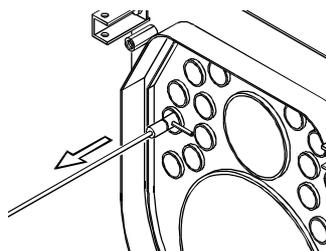
#### Detail 3:

Screw the turbulator remover onto the turbulator.



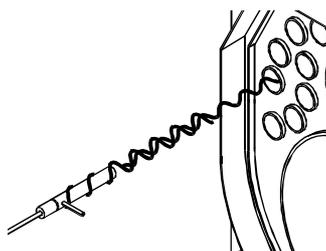
#### Detail 4:

Turn up to unblock the turbulator.



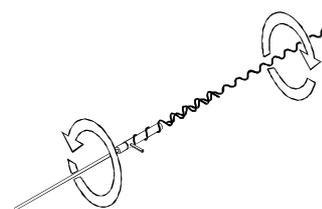
#### Detail 5:

Withdraw the turbulator



#### Detail 6:

Turn the remover counterclockwise to release the turbulator



The procedure from detail 3 to 6 has to be repeated for all the turbulators.

fig. 11

## 4.2 - PRELIMINARY CHECK

Once all the hydraulic, electrical and fuel connections have been made, before starting the boiler we suggest to ascertain that:

- The expansion vessel and the pressure relief valve are correctly connected and are in no way interceptable.
- The bulb of thermometer, working, high limit and minimum thermostats are well secured into their proper bulb holder.
- The turbulators are correctly fitted in all the smoke pipes.
- The C.H. circuit has been washed and rinsed and is free from solid impurities.

- The C.H. circuit is filled with water and has been completely purged.
- The pumps operate properly.
- The flow switch, the pressure relief valve, and the overheating discharge valve, if any, are adjusted at the right value.
- The fuel, hydraulic, electrical and safety connections are executed in conformity with national and local requirements in force.
- There are no water leaks.
- The burner has been fitted according to the instructions of the burner manufacturer.
- The mains voltage and frequency are

compatible with the burner and the electrical equipment of the boiler.

- The burner is adjusted for the fuel type, among those listed in the burner data plate, available on the installation site, and the burner output range is compatible with the boiler output.
- In the boiler house there are also the burner instructions.
- The C.H. pipes are properly insulated.
- The C.H. system is capable to absorb the heating quantity produced at the first start of the burner, during the test period.

**The shunt pump is installed as prescribed in the paragraph 2.6.1.**

## 4.3 - FIRST COMMISSIONING

At the commissioning stage of the boiler a qualified technician has to perform the following checks:

- Internal and external sound test of burner and fuel feeding pipe;
- Adjustment of the fuel throughput according

to the nominal input of the boiler (it is convenient to remember that the nominal input can be obtained by sharing the output shown in the table of pages 6), between the 1st and the 2nd stage, knowing that the 1st stage flame can go down to the

60% of the nominal output.

Proceed, then, in the following way:

- Open the fuel feeding cock and check that there are no leaks in the feeding line,
- Ascertain that all the switches of the panel board are in OFF position and adjust

the working thermostat to the minimum position.

- Switch ON the panel board through the main switch.
- Switch ON the C.H. pump: it will start to rotate as soon as the minimum water temperature thermostat detects 50°C.
- Switch the burner ON.
- Position the working thermostats of 1st and 2nd stages to the maximum setting to create a heat request.

During this phase check that:

- There are no smoke leaks from the front door, the burner plate and the chimney connection.

- There is a draught at the chimney base between 2 and 4 mm w.g.
- There are no water leaks.
- The different thermostats and the other installation safety devices work properly.
- The shunt pump operates correctly.
- The burner ignition is good.
- The burner characteristics (main adjustments and nozzle type) correspond to the boiler data plate.

With a burner properly adjusted it must be possible to reach easily, from a smoke sample taken at the chimney base, the values given below:

- 1) With light oil having a maximum viscosity

of 1.5 °E at 20 °C:

- CO<sub>2</sub> = 12 to 13 %
- Smoke index < 1
- Smoke temperature = 190 to 210 °C

2) With Natural Gas:

- CO<sub>2</sub> = 9 to 10 %
- Smoke temperature = 180 to 200 °C (values related to a clean boiler, with water at 70 °C).

It is suggested to adjust the fuel throughput to the actual needs of the C.H. installation (avoid to overcharge the boiler), without exceeding the a.m. smoke temperatures (never go below 160 °C).

## 4.4 - OPERATION OF THE BOILER

The HIGH EFFICIENCY MODAL boilers are forseen to operate with a return water temperature never below 54 °C when operated on light oil, and never below 59 °C when operated on gas, to avoid (or, at least, to reduce) the smoke acid condensation phenomenon, which can be the reason of a premature deterioration of the steel boiler body. The working thermostat, pos. 32 of the panel board, must be set at a temperature of approximately 80 to 85 °C.

The room temperature will be compulsorily adjusted through a mixing valve and, eventually, an outer compensator.

To homogenise the water temperature, or avoid as maximum as possible, returns into the boiler at a temperature below 54 °C when operated on oil, or 59°C when operated on gas, a properly dimensioned shunt pump must be fitted between flow and return pipes of the boiler.

N.B. The metal sheet corrosion due to the acid condensate is not covered by the guarantee because it depends only from the operation of the C.H. system.

The MODAL panel board is equipped with a low temperature thermostat not allowing the operation of the pump when the boiler temperature is below 50 °C (protection against cold starts).

## 4.3 - SWITCH OFF OF THE BOILER

- Switch OFF the burner (switch No.12 to 0 position).
- Leave the pumps working up to when they are not stopped by the minimum thermostat.
- Switch Off the power to the boiler panel board.
- If it is decided not to use the boiler for a long period close also the gate valves of the fuel.

# 5

## MAINTENANCE

### 5.1 - GENERAL RULES

- All the operations must be performed by qualified personnel .
- Affix a Warning poster, to the entrance of the boiler house, signalling: WARNING .....boiler under maintenance.
- The operations must be performed after having switched Off power supply (eventually removing the fuses to avoid accidental startings of the burner) and after having closed the valves of feeding of the fuel (particularly if gas is involved).
- To protect from the dust the electric equipments of the boiler house, the boiler panel board and the burner.
- Protect themselves with convenient suits, gloves, glasses and masks, use a vacuum cleaner for the removal of the soots and and put them in the special containers with the indication of the content.
- The possible closing of valves of the heating circuit must be indicated by a warning signal.

To get a good operation and the maximum boiler efficiency, a regular cleaning of the combustion, the smoke pipes and the smoke chamber is necessary.

### 5.2 - ORDINARY MAINTENANCE

The operation conditions of the boiler are notably varying from case to case and depend on the fuel used, on the burner adjustment, on the number of startings, on the characteristics of the heating system, etc., for which it is not possible to establish previously an interval of time between a service and the following one.

It is therefore necessary that the technician establishes the interval in base to a first observation of the smudging state of the smoke circuit.

Generally speaking we recommend the followings intervals of cleaning according to the type of fuel:

- Gas fired boilers: once a year.
- Oil fired boilers: twice a year, or more often if there is reason to doubt of their good operation.

In any case local rules in terms of maintenance have to be followed.

We advise, however, to shake the turbulators - without removing them from the smoke pipes - at least once every 15-20 days of boiler operation to avoid that the combustion residues can stop them so much to make

their removal extremely difficult.

During the operations of ordinary maintenance it will be necessary to brush the tube bundle - after the removal of the turbulators - and the furnace and collect the soots through the cleaning doors on the smoke chamber.

Besides it will be necessary to verify the good operation of the protection and control devices (thermostats, thermometers) of the boiler and of the plant (manometers, flow and pressure switches, expansion vessels) and all the safety devices.

In this occasion it will be necessary to notice the quantity of reinstatement water used and decide, also in base to its hardness, an intervention of preventive descaling.

It must be considered that the calcium and magnesium salts dissolved in the raw water, with repeated reinstatements, can cause deposits in the boiler that hinder the inner circulation and subsequent overheating of the wall plates with possible serious damages that cannot be attributed to the constructive geometry and/or to the materials used and/ to the constructive technique and, therefore, they are not covered by guarantee.

On the occasion of the ordinary maintenance it is useful to perform a small discharge from the boiler to verify if sludges escape.

In affirmative case, it will be necessary to prolong the discharge up to get clear water. At the end of the drainage it will be necessary to reestablish the level of the water in the system.

At the end of the smoke circuit cleaning, to the next restart check around the burner plate and the smoke chamber for smoke leaks. In the case some smoke leaks were noticed, first of all tighten the screws fitting the smoke and, not getting result, it will be necessary to replace the sealing gasket. Similarly it will be necessary to act on the front door, increasing at first the tightening of the screws and then, if necessary, by replacing the whole gasket.

At the end check and, if necessary, restore the sealing of the connection of the chimney and of the burner with the door.

The performed operations must be recorded on the log book of C.H. system.

### 5.3 - EXTRAORDINARY MAINTENANCE

Extraordinary maintenance of end season or for long periods of inactivity.

It will be necessary to perform all the operations described in the preceding chapter and besides:

- Check the state of consumption of the turbulators to replace them in time.
- To facilitate the extraction of the turbulators, with the MODAL boilers a special

extractor is supplied.

- After the cleaning of the smoke circuit it is convenient to pass in the pipes smoke and in the furnace with a rag soaked of diluted solution of caustic soda.

After having let to dry cross again all the surfaces with a rag soaked of oil. Perfectly close the the burner air intake to avoid a continuous passage of damp air through the boiler recalled by the chimney it self.

It is advisable to put inside the furnace

some alive mortar that has an hygroscopic action.

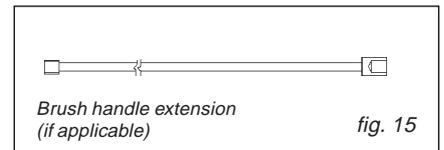
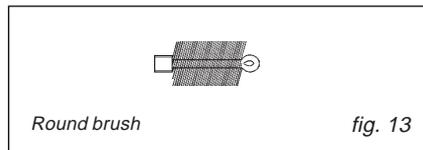
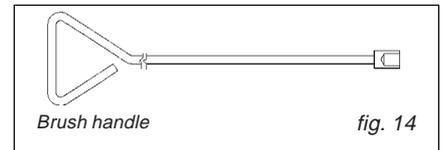
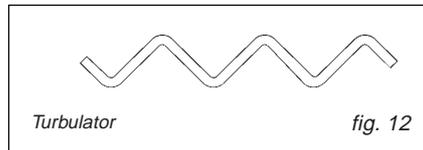
- Do not empty the C.H. system and the boiler.
- Protect the screws with graphitized fat, nuts and pivots of the door.
- Show all the operations that must be perform to the following put into operation, particularly the operation of the shunt pump must be checked.

## 5.4 - CLEANING OF THE BOILER

Follow the next sequence:

- Close the feeding of the oil.
- Cooldown the boiler to the ambient temperature.
- Switch Off the electrical supply to the boiler and the burner.
- Open the front door.
- Shake and remove the turbulators every 15-20 days of activity of the boiler to avoid that the residues of combustion can stop them so much to make difficult their removal).
- Clean the turbulators and the smoke pipes by brushing them with the brush supplied.
- Reposition the turbulators.
- Remove the cleaning door and all the soot from the smoke chamber.
- Re-fit the cleaning doors.

- Verify the state of the refractory insulation of the combustion chamber door.
- Verify the state of the door sealing rope.
- Close the door of the furnace.



## 5.5 - CHECK OF THE BOILER OPERATION

For a safe operation of the boiler it is necessary to check:

- The good operation of the working thermostat.
- The good operation of the high limit thermostat.
- The adjustment and the good operation of the minimum thermostat.
- The good operation of the shunt system.
- The good operation of the outer compensator (if fitted).
- The good operation of all the other safety and control devices imposed by local requirements.

## 5.6 - CHECK OF THE BURNER OPERATION

- See the burner instruction manual.
- Follow all the local requirement in terms of burner maintenance .

## 5.7 - BOILER HOUSE

For the combustion of oil or gas the burner needs air. Accordingly wide openings are foreseen for the entry of the air in the boiler house. These openings never have to be obstructed. Maintain the boiler house clean and dust free.

The boiler is not a closet: avoid to store any kind of materials. Maintain the entry of the boiler free and easy to reach in any moment. Ascertain that the boiler house is endowed with efficient emergency lamp.



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