Unical

TECHNICAL MANUAL

INSTALLATION, USE AND MAINTENANCE INSTRUCTIONS

TERNOx

THREE PASS
HOT WATER BOILERS

Dear Customer,

Thank you for choosing a boiler by UNICAL.
In your interest and to maintain the highest level of performance and duration of your appliance, we recommend that you follow the instructions contained in this booklet and have regular maintenance performed by qualified personnel.
We would like to remind you that failure to follow the instructions contained in this booklet may invalidate the guarantee.

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WARNING

Different types of burners can be installed on this boilers – even those not included in the approved lists but always respecting the furnace output and counter pressure values.

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GENERAL WARNINGS

This instruction booklet is an integral and essential part of the product..

Should the appliance be sold or transferred to another owner, or if you move and leave the appliance behind, always ensure that this booklet accompanies the appliance so that the new owner and/or installation technician can consult it.

This appliance must be used for the purpose for which it was specifically intended.
All contractual or non-contractual responsibility of the manufacturer is excluded in the event of damages to persons, animals or things caused by errors in installation, adjustment, maintenance and improper use.

The manufacturer's responsibility is excluded for all damage to persons and/or things resulting from a clear risk for the user which he could have avoided by taking suitable safety measures.

After having removed the packaging, check the contents for breakages. If you are in doubt do not use the appliance, contact your supplier.
Do not leave the packaging materials (wooden cage, nails, staples, plastic bags, polystyrene foam, etc.) within the reach of children, as they are potential sources of risk.

The installation must be performed in compliance with the regulations in force, following the manufacturer's instructions, by professionally qualified personnel.
The term "professionally qualified personnel" means persons with specific technical skills in the sector of heating systems and components for domestic use and domestic hot water production.

To guarantee the efficiency of the appliance and ensure correct operation, it is indispensable to have regular maintenance performed by professionally qualified personnel, following the manufacturer's instructions.
Any repairs to the appliance must be carried out using only original spare parts.

If you decide not to use the appliance for a long period, ensure you have professionally qualified personnel to carry out the necessary operations to preserve the boiler (see chapter "Turning off the boiler" page 17).

GENERAL SAFETY RULES

The use of any component utilising energy power, fuels and water requires that certain fundamental rules be respected, such as:

Do not allow children or unskilled people to use the appliance;

If you notice smell of gas, do not turn on electric switches, household appliances, telephone or any other objects that could cause sparks. If this is the case:
- open doors and windows immediately to clear the air in the room;
- turn off the fuel taps;
- contact professional qualified personnel.

Do not touch the appliance with wet or damp parts of the body and/or with bare feet.

Do not perform any maintenance and cleaning operations without having disconnected the electric power and turned off the fuel supply tap.

Do not pull, disconnect, unwind electric cables coming from the boiler, even if they are disconnected from the mains supply.

Do not block or reduce the ventilation openings in the room to prevent the formation or toxic and explosive mixtures caused by gas leakage; it is also uneconomic and polluting because it causes bad combustion.

Do not expose the appliance to atmospheric agents.
The generator has not been designed to work outdoors and is not provided with automatic anti-freezing systems. Keep the boiler turned on in freezing conditions.

Other important warnings to be respected:

- If the power cable of the appliance is damaged, have it replaced by professionally qualified personnel;

- do not fix (and do not allow other persons to fix) electric cables on the system pipes or near sources of heat;

- ensure that the earthing cables of the appliance are not connected to the water system;

- do not touch the hot parts of the system (in particular the manhole and the smoke box) as they normally remain hot even for some time after the appliance has been turned off.

In the event of a water leak, turn off the system and contact exclusively professionally qualified personnel.

DESCRIPTION OF THE APPLIANCE

The steel boiler from the **TERNOx** range, is a high performance heat generator for three-gas passes heating systems externally-fired with wet reversal chamber.

The flame runs through the furnace and, from the bottom passing through the inversion chamber, it is conveyed in the tube bundle for the 2^{nd} gas pass.
Gasses return to the front part for the passage in the tube bundle (3rd gas pass). After leaving the tube bundle, gasses are collected in the rear chamber and conveyed to the stack.

Combustion gas inversion is clearly separated from the furnace in order to reduce NOx. Smoke stay time in the high temperature area causes NOx formation.

Burners fired with traditional liquid and gaseous fuels can be installed.

The burner is installed on a bolted plug which is coated inside with insulating material.

Inspection doors on the smoke side and the handhole on the water side (the front doors are hinged, the rear doors are bolted) improve the access for maintenance and cleaning operations. Models from 5800 to 10500 are supplied with a manhole on the water side.

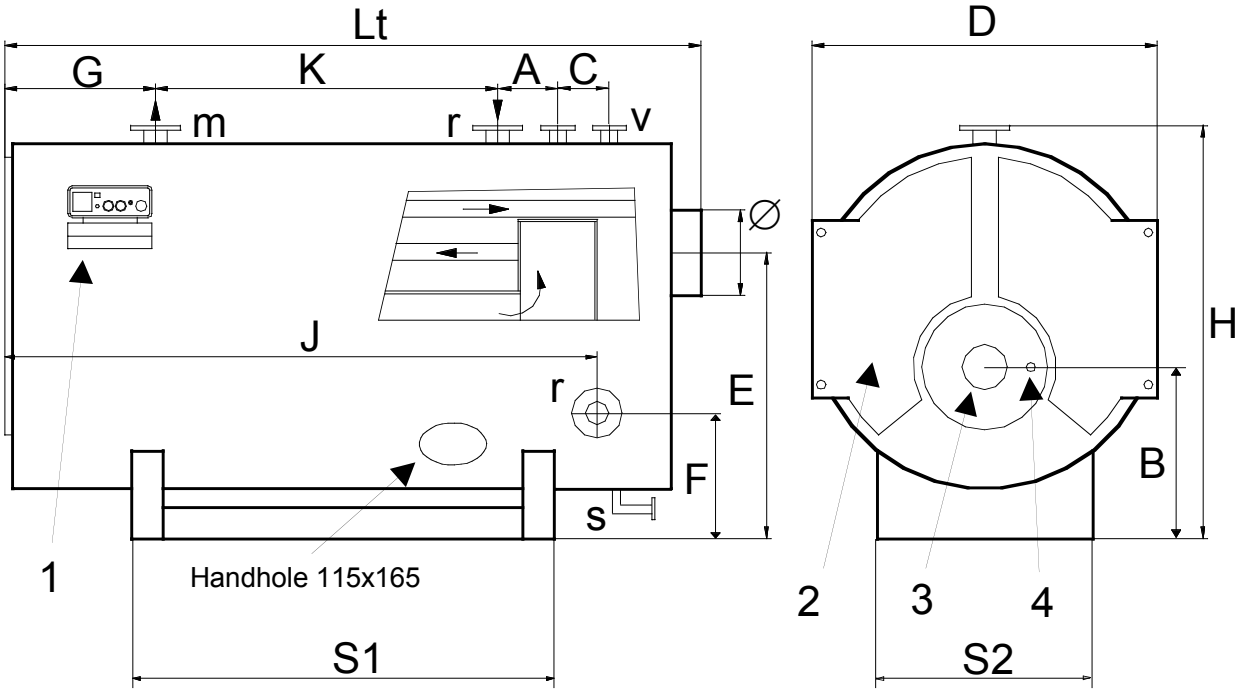
The thermal insulation of the boiler body is obtained by applying a pad of highly insulating mineral wall to reduce thermal dispersions at very low levels.
Elegant pre-painted aluminium panels complete the outside finish.

The highest admitted differential temperature of the boiler (difference between return and flow water temperatures) is 30°C under all working conditions: should this not be the case, appropriate solutions must be adopted such as installing a recirculation pump.

The pre-cables electrical panel is located on the side of the boiler and makes it work automatically.
The electrical diagram is included in the control panel.

On request, the electronic control panel for climatic regulation can be installed for operating the boiler on the base of the outdoor temperature as well as many other auxiliary functions.

TECHNICAL SPECIFICATIONS



1 – control panel
2 – inspection doors
3 – burner connection hole
4 – flame control warning light

Max working pressure: 5 bar - 8 bar
Max working temperature: 110°C

MODEL		TERNOx	1200	1400	1700	2000	2500	3000	3500	4000	4500	5000	5800	7000	8500	10500
Rated output		kW	1200	1400	1700	2000	2500	3000	3500	4000	4500	5000	5800	7000	8500	10500
Furnace output		kW	1300	1510	1840	2160	2700	3240	3780	4320	4850	5400	6270	7560	9180	11340
Combustion chamber pressure		mbar	4,5	6,6	5,3	5,6	5,6	5,5	7,7	5,4	7	8,2	5,6	8,4	8,1	8,7
Water side pressure loss		mbar (Δt 15°C)	75	105	72	90	55	72	95	130	170	180	120	150	220	180
Water content		dm³	2247	2476	3388	3649	5020	5610	6332	7793	8561	8561	11984	13227	16952	19733
Dimensions	D	mm	1580	1580	1800	1800	1930	2050	2050	2260	2260	2260	2500	2500	2750	2910
	H	mm	1930	1930	2200	2200	2330	2450	2460	2660	2660	2660	2950	2950	3200	3360
	Lt	mm	3240	3490	3650	3900	4510	4510	4960	5100	5550	5550	6070	6570	7020	7320
	E	mm	1250	1250	1450	1450	1530	1650	1650	1780	1780	1780	1955	1955	2110	2210
	G	mm	640	640	720	720	830	830	830	860	860	860	922	922	1022	1022
	K	mm	1300	1550	1400	1650	1970	1970	2420	2450	2800	2800	3000	3450	3600	3900
	A	mm	650	650	700	700	750	750	750	750	800	800	900	900	1000	1000
	C	mm	200	200	220	220	220	220	250	250	300	300	300	350	350	350
	J	mm	2640	2890	2940	3190	3700	3700	4150	4210	4660	4660	5020	5520	5870	6170
	F	mm	590	590	680	680	690	750	750	830	830	830	920	920	1000	1050
	B	mm	790	790	915	915	960	995	995	1070	1070	1070	1225	1225	1305	1355
	S1	mm	1750	2000	1850	2000	2400	2400	2720	2750	3000	3000	3200	3500	3700	4000
	S2	mm	1100	1100	1250	1250	1250	1310	1310	1500	1500	1500	1620	1620	1800	1900
Connections	m / r	DN	125	125	150	150	200	200	200	200	200	200	250	250	250	300
	v	2xDN	1"1/2	1"1/2	2"	2"	2"	2"	65	65	80	80	80	100	100	100
	s	DN	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Flue	Ø mm	400	400	450	450	500	500	500	600	600	600	700	700	800	900
Empty weight		(5 bar) kg	3320	3550	4700	4950	5700	7110	7650	9250	10050	10200	13300	14200	19200	23000
		(8 bar) kg	3720	3990	5220	5500	6450	8120	8750	10400	11350	11500	14950	15950	19950	23500

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IDENTIFICATION ELEMENTS

The appliance can be identified through the DATA PLATE that contains the performing values and identification data.
The plate is applied in the front upper part, right.

For any servicing and spare part the correct identification of the boiler model will facilitate all operations.

IMPORTANT: ensure that the boiler is provided with a technical plate. If not, ask the installation technician to have it installed.

LIST OF SPARE PARTS

The spare parts recommended for two years of operation are the following

n.1 working thermostat
n.1 safety thermostat
n.3 inspection doors gasket kit
n.3 hand hole gasket
n.3 manhole gasket (only models from 5800 to 10500)
n.1 flame sight glass
n.1 flame sight glass gasket

INSTALLATION

INSTALLATION PREMISES

The boiler must be installed in a room that complies with the provisions and minimum distances established by the current regulations and is provided with suitably sized air vents.

The boiler must be positioned on a flat surface capable of uniformly supporting the base structure section bars.
The surface should be raised from the floor.

CAUTION: if the burner is powered with combustible gas with specific gravity higher than the specific gravity of air, the electrical parts must be positioned above 0.5 metres from ground level.

The boiler must not be installed outside as it has not been designed for outdoor installation and is not provided with automatic anti-freeze systems

DISCHARGE OF COMBUSTION PRODUCTS

Correct burner/boiler/flue coupling drastically reduces consumption, optimises combustion with low emission of contaminants and provides effective protection against condensation.

The FLUE must be resistant to heat and condensation, thermally insulated, hermetically sealed, without bottlenecks or obstructions, as vertical as possible and sized according to current regulations.

The CONNECTION BETWEEN THE BOILER AND THE FLUE must comply with the current regulations and legislation and consists of rigid hermetically sealed pipes resistant to high temperatures, condensation and mechanical stress.
For sealing the joints, use materials that can withstand at least 250°C.

Badly sized and shaped flues and couplings between boiler and flue can amplify the combustion noise, negatively affect the combustion parameters and cause condensation problems.

CAUTION: non-insulated outlet pipes are a potential source of danger.

HYDRAULIC CONNECTION

The choice and installation of the system components is the responsibility of the installer who must operate in accordance with correct working practice and the current legislation.

The following recommendations should be observed:

- The boiler fittings must not be strained by the weight of the system connection pipes as this can be dangerous and the latter must therefore be sustained and appropriately positioned.

- Cut-off devices must not under any circumstances be fitted between the boiler and the expansion vessel and between the boiler and the safety valves.

- The expansion vessel must be correctly sized (there must be no leaks of water due to normal expansion) and, if the expansion vessel is closed, the safety valves must open only in exceptional cases in order to minimise any subsequent introduction of water and in any case to ensure that it is introduced and controlled by one single point in the system.

- Ensure that the safety valve outlets are connected to an outlet funnel. If not, when the valves cut in they will flood the room and the manufacturer will accept no liability for this.

- Ensure that the hydraulic pipes are not used as earth connections for the electrical or telephone system. They are not suitable for this use and can rapidly deteriorate leading to serious damage..

- Before connecting up the boiler, wash all the system pipes to remove any debris that could affect correct operation..

- The water to fill the system must have the following technical features: hardness < 1 °f, acidity pH > 9; otherwise a system for water treatment should be provided.

- If the mains water supply contains impurities, a suitable filter must be fitted

- Avoid any accidental contact between the heating system water and the sanitary water as the former is not drinkable.

After connection to the hydraulic system, ensure that the latter is completely de-aerated.

You are advised to insulate the heating system pipes to avoid heat dispersion resulting in increased fuel consumption and environmental pollution.

ELECTRICAL SYSTEM AND CONNECTIONS

The electrical system must comply with the current regulations and be installed by professionally qualified personnel.

Electrical safety of the equipment is ensured only when it is correctly connected to an efficient earth system in compliance with the current safety regulations.
The manufacturer will not be liable for any damage caused by failure to earth the system.

Call professionally qualified personnel to check that the electrical system is suitable for the maximum power absorbed by the equipment, ensuring in particular that the system cable sections are suitable for the power absorbed by the equipment.

Adapters, multiple sockets and extension leads must not be used for general power supply of the equipment from the mains.

For connection to the mains, a twin-pole switch must be provided in compliance with the current regulations.

The control panel is already installed on the boiler.
Power supply: 230 V - 50 Hz.

By unscrewing the self-tapping screws, open the instrument panel and connect the boiler electrically.

All the instruments capillary probes of the panel are located in the bulb on the heating system flow connection.

Electric connections must be performed following the attached electrical diagram.

Never fix the electric cables to the front part of the boiler, to the doors or the smoke box.

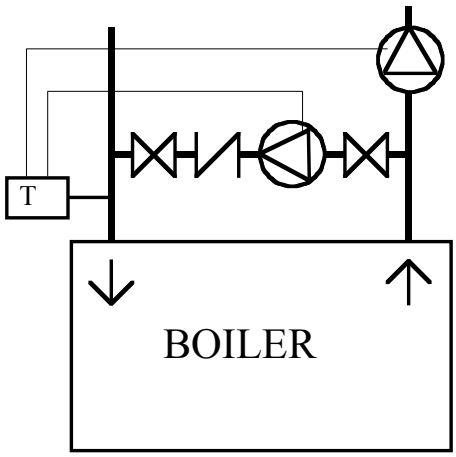
Finally, close the panel.

THE PROBLEM OF CONDENSATE

The water vapour contained in the fumes discharged from the boiler condenses when the temperature of the water returning to the boiler is below 50°C. Condensation occurs in particular when the boiler comes on in the morning after being switched off during the night.

The condensation is acid and corrosive and will gradually attack the boiler sheet metal panels.
To limit the formation of condensate as far as possible an anticondensate pump must be fitted following the diagram illustrated below.

When the burner starts, a thermostat positioned on the water return to the boiler and set to 55°C with exchange contact will start up the anti-condensate pump which will continue to operate until the set temperature is reached; the thermostat will then simultaneously switch off the anti-condensate pump and switch on the system pumps.



In order to totally eliminate the problem, the above circuit must be correctly adjusted in order to maintain the boiler constantly at 55°C even at night and a further temperature-limiting thermostat must be added to prevent the system mixing valve from sending water below 55°C to the boiler.
This will ensure long life of the boiler.

The flow rate of the anti-condensate pump is normally 25%-30% of the system pump flow rate whereas the head required is not particularly high as it only has to overcome the resistance of the boiler and the valves.

The smokebox of the TERNOx is provided with a fitting for discharge of any condensation that forms during the start-up phase.

Do not connect the fitting directly to the mains drainage system but to a collecting basin in order to monitor condensation.
For accurate monitoring, check that the condensate forming in the flue does not also end up in the basin.

The condensation is acid and corrosive and will therefore contaminate if discharged into the mains drainage system.

Before emptying the basin into the mains drainage system, the acid level must therefore be restored to between pH 6.5 and 9 using neutralising products.

FUEL SUPPLY

The fuel supply line must comply with current regulations and be laid by professionally qualified personnel.

Before installation, you are advised to thoroughly clean the inside of all the fuel supply pipes in order to remove any debris that may affect correct operation of the boiler.

Check the fuel supply system internal and external seal.
If using gas, the connections must be perfectly sealed.

Check that the fuel supply system is provided with the safety and control devices prescribed by the current regulations.

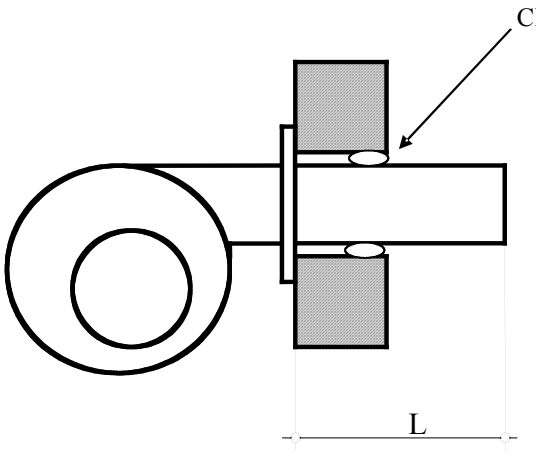
Do not use the fuel system pipes to earth electrical or telephone systems.

Check that the boiler is pre-set for operation with the type of fuel available.

BURNER CONNECTIONS

For installation of the burner, the electrical connections and the necessary settings, consult the burner instruction manual.
Ascertain that the correct type of burner has been chosen for the boiler, checking the technical specifications of both.

The burner draught tube must be sized as shown below:



TERNOx. Boiler	Burner tube min./max L mm
1200÷1400	180 / 280
1700÷2000	210 / 340
2500÷3500	250 / 480
4000÷5000	280 / 480
5800÷7000	370 / 550
8500÷10500	420 / 600

Secure the burner to the door by means of the fixing plate so that the flame is parallel and centred in the furnace; if not, combustion problems can occur with the risk of seriously damaging the boiler.

IMPORTANT: after installing the burner, fill any crack between the draught tube and the hole of the door with the material provided, resistant to 1000°C (ceramic fibre mat).

This operation prevents overheating of the door which would otherwise be permanently deformed.

If the burner is provided with an air intake, connect it by means of a rubber tube to the intake located on the flame inspection window: in this way the glass will remain clear.
If the burner is not provided with air intake, remove the intake on the flame inspection window and close the hole with a □ 1/8" BSP plug.

The fuel connections to the burner must be positioned in order to permit complete opening of the boiler door with the burner fitted.

PRELIMINARY OPERATIONS PRIOR TO STARTING UP

Before starting up:

- ensure that the regulation and control instrument probes are positioned correctly in their wells;

- check that the system is filled with water, de-aerated and at a correct pressure for the boiler; (minimum 1.5 bar);

- check that all the control and safety devices are in efficient working order and correctly set;

- check that the furnace is free from foreign bodies;

- check that the refractory lining of the door has not been damaged;

- check that the burner draught tube has been correctly plugged (see page 14);

- check that the discharge valves are closet and the system cut-off valves are completely open;

- ensure that the fuel is available and that fuel taps are open;

- Ensure that the electric motors of the burner fan and circulation pumps are running in the correct sense of rotation;

- Check that the water treatment system (if any) works properly;

- Start the circulation pumps and ensure that the water runs homogeneously (the plant must be de-aerated).

FIRST START UP

After performing the preliminary checks, perform the following operations to start the boiler:

- set the boiler thermostat(s) on the control panel; 60 to 90°C, according to the type of plant;

- set the master switch to "on";

- press the main control panel switch (the button light will come on).

The boiler will perform an ignition phase and, once started, will remain on until the set temperatures have been reached.
Operation will be automatic from now on.

FIRST START UP AND FURTHER CHECKS

Once the boiler has been started, check that it stops and then starts again by:

- altering the boiler thermostat setting;
- operating the main switch on the main control panel.

Check the seal on all the gaskets on the water and fume side; they must be further tightened while hot in order to guarantee a perfect seal.

This operation is of fundamental importance for the gaskets of the door, of the burner plate and of the smokebox to prevent leakage of toxic and therefore hazardous combustion fumes into the boiler room.

Warm-tight for a perfect seal.

It is also very important to check the boiler/flue coupling seal for the above reasons.

It is also very important to tight progressively the generator handhole and manhole gasket as long as the pressure increases to guarantee a perfect seal. If not, at the first leakage, the gasket must be replaced.

Use the main switch to turn off totally the appliance.

After all the conditions have been satisfied, the burner must be set at the max. output allowed by the boiler. Smokes must be analysed to reach the correct combustion and the less possible polluting emissions.

The pressure of the water contained in the system increases during operation and you should therefore check that its maximum value does not exceed the boiler boiling pressure.

ALKALINE WASHING OR "BOILER"

This treatment must be carried out by qualified companies on new boilers. After the boiler has been prepared and installed, all deposits are removed such as residues of oil, grease, metal oxides.

If these substances are not removed, they help the onset of corrosive phenomena caused by the formation of a passivating film on water-exposed surfaces.

How to perform the alkaline washing:

Boiler filling with water.
Before starting the washing, pressure switches, the manometer and the level gauge must be cut out.
Add a quantity of caustic soda or sodium carbonate or trisodium phosphate ranging from 0.3 to 1% according to total water content.
These substances must be added with a quantity of specific surface-active products ranging from 0.05 to 0.15% versus total water content.
Slowly bring the water (through the burner) to 80-90°C and make it circulate in the boiler for 12-14 hours.
Drain slowly the content and let in clean water to rinse well.

TURNING OFF THE BOILER

In the event of a long period of inactivity, turn off the boiler as follows:
- Water side preservation procedure that can be "wet" or "dry";
- Turn off the main switch from the electrical panel and power off;
- Turn off the fuel cut-off valve;
- Smoke side preservation procedure;
- Protect from dust and humidity all control, regulation and safety devices.

With "Wet preservation" the boiler must be completely filled with water which is later added with preservatives or neutralising products. The plant is subsequently sealed and all cut-off valves locked. This type of preservation procedure should not be followed in case of freezing conditions.

With "Dry preservation" the boiler is emptied. Open the manhole, dry completely the boiler inside with air and ad highly hygroscopic substance (ex. caustic lime). Close all cut-off valves and the manhole sealing the generator.

To preserve the smoke side open the door and the smoke box doors, clean thoroughly all surfaces removing all the soot (which may contain sulphur which turn into sulphuric acid when wet) and add highly hygroscopic substances (ex. caustic lime) in the furnace and smoke box.

Close and seal the door and the cleaning doors.

MAINTENANCE

Periodical maintenance is essential for the safety, efficiency and long life of the equipment.

It is also required by law and must be carried out by professionally qualified personnel.

Before carrying out any work, you are advised to perform a combustion analysis to ascertain the operating conditions and obtain any other useful information.

After performing the combustion analysis and before any other operation:

- Wait until the plant is cold;
- disconnect the electricity supply by switching off the master switch;;
- close the fuel on-off taps.

Clean the smoke side every 3 months if heavy oil is used, every 6 months with light oil, every year with gas fuels.

To clean the smoke side open the inspection doors, remove the burner, the plug. With a tube-brush, clean thoroughly all surfaces and the tube bundle to remove soot. Remove all soot from the furnace and the cleaning doors.

If you believe that the boiler is scaled inside, empty it and open the handhole/manhole; scales must never be thicker than 0.5 mm. If not, have a chemical washing carried out by qualified companies and check the softener system.

Warning: replace the handhole/manhole gasket each time you open it and tight gradually in hot and cold conditions.

CHECKS AFTER BOILER CLEANING

After performing the maintenance and cleaning operations, repeat the preliminary operations prior to switching on for the first time (see page 15), check the burner setting and perform a fume analysis.

Check the fuel supply system seal: this check is particularly important when using gaseous fuels.

Check that the fume circuit is perfectly sealed and replace any worn gaskets.

Check the system hydraulic seal to avoid unnecessary exchange of water and topping up which will increase the risk of scaling.

Check the efficiency of safety and control instruments.

Never leave highly inflammable substance containers in the premises where the boiler has been installed.

TROUBLESHOOTING

Below is the description of the most common faults and their remedy:

FAULT: the burner does not turn on.
REMEDY:
- check electric connections;
- check the regular fuel supply
- check the integrity and the cleanness of the fuel supply system and that no air is present;
- check that ignition sparks form regularly and the burner appliance works correctly;
- check the boiler safety thermostat intervention with manual reset;
- check the calibration of the environment thermostat.

FAULT: the burner turns on well but turns off immediately after.
REMEDY:
check the pilot flame, the air calibration and that the burner appliance works correctly.

FAULT: the burner is difficult to be adjusted and/or no output.
REMEDY:
- check for the cleanness of burner, boiler, boiler/flue pipes and flue;
- check the hermetic seal of the smoke circuit (door, burner plate, smoke box, boiler/flue connection);
- check that the fuel supply is flowing regularly and verify the effective power of the burner;
- check for the presence of scale and carry out a chemical washing.

FAULT: the boiler gets easily covered with soot.
REMEDY:
- check the burner regulation (smoke analysis);
- check the fuel quality;
- check the flue for clogging and the cleanness of the burner air intake (dust).

FAULT: smell of gas and/or unburnt products.
REMEDY:
- check the seal of the fuel supply system (if gas fuel);
- check the hermetic seal of the smoke circuit (inspection doors, burner plate, smoke box, boiler/flue connection);
- check that the rubber holder on the flame warning light is connected to the burner air inlet or clogged.

FAULT: the boiler does not reach set pressure.
REMEDY:
- check that the smoke side and water side of the boiler are clean;
- check the combination, regulation and performance of the burner;
- check the regulation of the pressure switches and that they work correctly;
- check the position of the thermostat gauges;
- ensure that the boiler capacity is appropriate for the plant

FAULT: the boiler reaches the appropriate temperature but the heating system is cold.
REMEDY:
- check that no air is in the system;
- check that circulation pumps are working well;

FAULT: the safety pressure switch intervenes.
REMEDY:
- check electric wires
- check the position of the thermostat probes;
- check the thermostat setting and ensure they work well

FAULT: the safety valve of the boiler intervenes often.
REMEDY:
- check the system loading pressure;
- check the efficiency of the expansion vessel;
- check the calibration of the safety valves.

FAULT: membranes overheating due to lack of water in the boiler.
REMEDY:

- Turn off the burner, do not pour water and do not open the door; wait until the ambience temperature is restored before performing any operation.

FAULT: water on the floor near the smoke box (condensate).
REMEDY:

- check the probes have been correctly positioned. Ensure that the boiler regulation thermostat has been correctly regulated and works properly (min. 60°C):
- ensure that the smoke box discharge is connected to a collecting basin;
- check that the anti-condensate pump (if any) is properly set and works well;
- check that return water temperature to the plant is no lower than 50 °C.