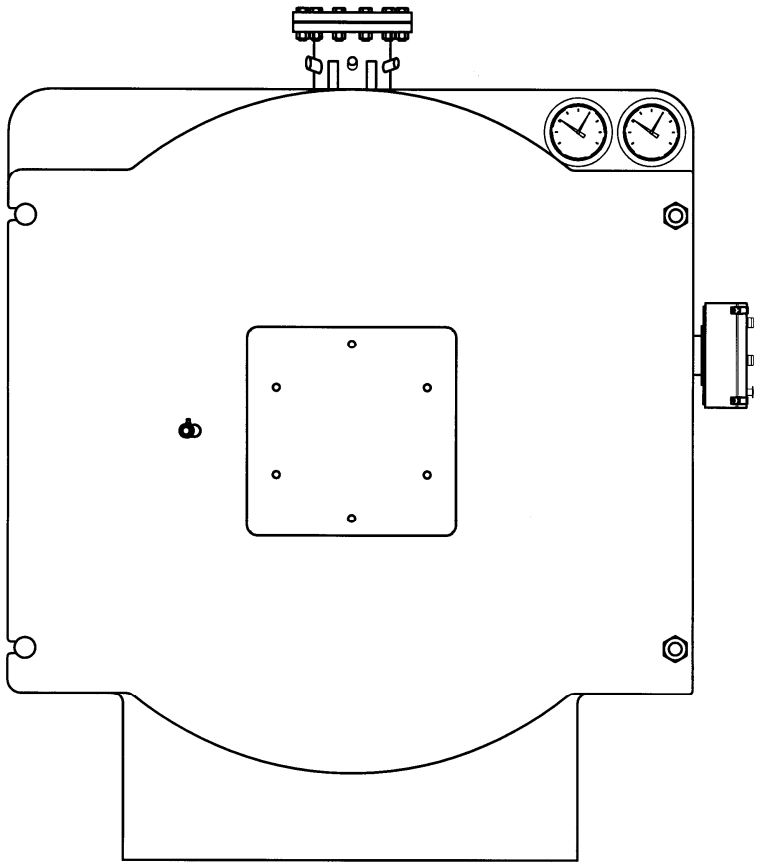
TECHNICAL MANUAL

GB



The above picture is only for reference.

TNX

THREE PASS WET BACK HOT WATER BOILER

TNOX

THREE PASS WET BACK HOT WATER BOILER
LOW NOx

INDEX

1. GENERAL WARNINGS

Each generator is provided with a **manufacture plate** that can be found in the envelope with the boiler documents. The plate lists:

- Serial number or identification code;
- Rated thermal output in kcal/h and in kW;
- Furnace thermal output in kcal/h and in kW;
- Types of fuels that can be used;
- Max operating pressure.

IMPORTANT: This boiler has been designed to heat hot water at a temperature inferior to the boiling temperature at atmospheric pressure and must be connected to a heating plant and/or a domestic hot water plant within the limits of its performance and output.

2. TECNICAL SPECIFICATIONS

Characteristics	Heat output		Heat input		Efficiency 100% (N.C.V.)	NG max flow rate G20	NG max flow rate G30	NG max flow rate G31	Max flow rate of flues	Minimum output		Minimum input		Efficiency at 30% (N.C.V.)	NG min flow rate G20	NG min flow rate G30	NG min flow rate G31	Min flow rate of flues
	kW	kcal/h	kW	kcal/h	%	m³/h	kg/h	kg/h	kg/h	kW	kcal/h	kW	kcal/h	%	m³/h	kg/h	kg/h	kg/h
	Medium Temp. 70°C				Medium Temp. 70°C					Medium Temp. 70°C				Medium Temp. 70°C				
TNX 3000	3000	2.580.000	3261	2.804.000	92,00	345,02	256,07	253,30	5140,80	1.500	1.290.000	1595,7	1.372.340	94,00	168,86	125,33	123,97	2516,04
TNX 3500	3500	3.010.000	3803	3.271.000	92,03	402,49	298,72	295,48	5997,10	1.750	1.505.000	1861,1	1.600.550	94,03	196,94	146,17	144,58	2934,44
TNX 4000	4100	3.526.000	4457	3.833.000	91,99	471,64	350,05	346,25	7027,44	2.050	1.763.000	2181,1	1.875.730	93,99	230,80	171,30	169,44	3438,95
TNX 5000	5000	4.300.000	5435	4.674.000	92,00	575,12	426,85	422,22	8569,29	2.500	2.150.000	2659,6	2.287.230	94,00	281,44	208,88	206,62	4193,40
TNX 6000	6000	5.160.000	6522	5.609.000	92,00	690,17	512,24	506,68	10283,53	3.000	2.580.000	3191,5	2.744.680	94,00	337,72	250,66	247,94	5032,08
TNX 7000	7000	6.020.000	7609	6.544.000	92,00	805,22	597,63	591,15	11997,78	3.500	3.010.000	3723,4	3.202.130	94,00	394,01	292,43	289,26	5870,77

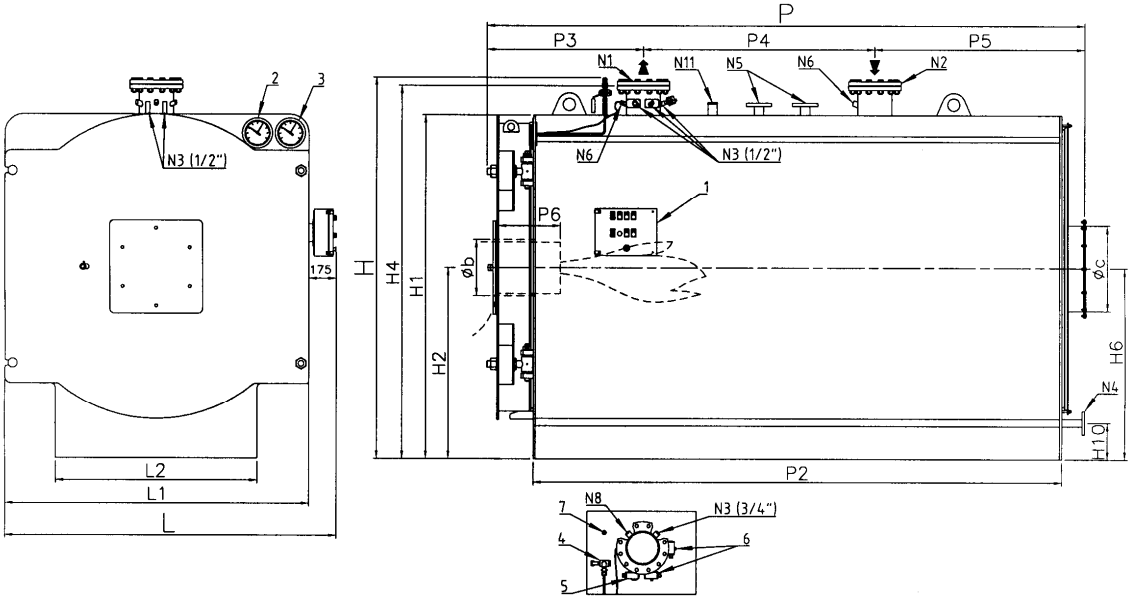
Characteristics	Pressure losses flue gas side	Heat losses through the chimney	Heat losses through the casing	Heat losses with burner off	Flue gas temp. at boiler output and air at 20 deg. C	CO2	Press. losses water side	Design Pressure	Capacity	Total capacity	Total weight	Electric supply	Frequency	Insulation class	Electric power	Fuel			
	mbar	%	%	%	°C	%	mbar	bar	l	l	kg	Volt ~	Hz	IP	W				
					GAS	GAS	(ΔT=12K)									Nat. Gas	Lpg	Gasoil	Heavy
TNX 3000	13,5	7,70	0,30	0,10	202	10,5	55	6	4496	4496	6300	230	50	IP X0D	1000	X	X	X	X
TNX 3500	18,0	7,67	0,30	0,10	201	10,5	75	6	5746	5746	6950	230	50	IP X0D	1000	X	X	X	X
TNX 4000	11,7	7,71	0,30	0,10	202	10,5	103	6	6441	6441	8200	230	50	IP X0D	1000	X	X	X	X
TNX 5000	14,0	7,70	0,30	0,10	202	10,5	63	6	7335	7335	8970	230	50	IP X0D	1000	X	X	X	X
TNX 6000	12,0	7,70	0,30	0,10	202	10,5	91	6	9088	9088	11280	230	50	IP X0D	1000	X	X	X	X
TNX 7000	14,0	7,70	0,30	0,10	202	10,5	123	6	10066	10066	12160	230	50	IP X0D	1000	X	X	X	X

Characteristics	Heat output		Heat input		Efficiency 100% (N.C.V.)	NG max flow rate G20	NG max flow rate G30	NG max flow rate G31	Max flow rate of flues	Minimum output		Minimum input		Efficiency at 30% (N.C.V.)	NG min flow rate G20	NG min flow rate G30	NG min flow rate G31	Min flow rate of flues
	kW	kcal/h	kW	kcal/h	%	m³/h	kg/h	kg/h	kg/h	kW	kcal/h	kW	kcal/h	%	m³/h	kg/h	kg/h	kg/h
	Medium Temp. 70°C				Medium Temp. 70°C					Medium Temp. 70°C				Medium Temp. 70°C				
TNOX 2500	2500	2.150.000	2688	2.312.000	93,01	284,48	211,14	208,85	4238,75	1.250	1.075.000	1315,7	1.131.460	95,01	139,22	103,33	102,21	2074,41
TNOX 3000	3000	2.580.000	3226	2.774.000	92,99	341,33	253,33	250,59	5085,82	1.500	1.290.000	1579,1	1.358.040	94,99	167,10	124,02	122,68	2489,82
TNOX 3500	3500	3.010.000	3763	3.236.000	93,01	398,18	295,53	292,32	5932,88	1.750	1.505.000	1841,9	1.584.040	95,01	194,91	144,66	143,09	2904,17
TNOX 4000	4100	3.526.000	4409	3.792.000	92,99	466,59	346,30	342,55	6952,19	2.050	1.763.000	2158,1	1.855.980	94,99	228,37	169,50	167,66	3402,74
TNOX 5000	5000	4.300.000	5376	4.623.000	93,01	568,84	422,19	417,62	8475,72	2.500	2.150.000	2631,3	2.262.920	95,01	278,44	206,66	204,42	4148,83
TNOX 6000	6000	5.160.000	6452	5.549.000	92,99	682,79	506,76	501,26	10173,57	3.000	2.580.000	3158,2	2.716.080	94,99	334,20	248,04	245,36	4979,65

Characteristics	Pressure losses flue gas side	Heat losses through the chimney	Heat losses through the casing	Heat losses with burner off	Flue gas temp. at boiler output and air at 20 deg. C	CO2	Press. losses water side	Design Pressure	Capacity	Total capacity	Total weight	Electric supply	Frequency	Insulation class	Electric power	Fuel			
	mbar	%	%	%	°C	%	mbar	bar	l	l	kg	Volt ~	Hz	IP	W				
					GAS	GAS	(ΔT=12K)									Nat. Gas	Lpg	Gasoil	Heavy
TNOX 2500	9,1	6,69	0,30	0,10	179	10,5	38	6	4496	4496	6300	230	50	IP X0D	1000	X	X	X	X
TNOX 3000	12,5	6,71	0,30	0,10	179	10,5	55	6	5746	5746	6950	230	50	IP X0D	1000	X	X	X	X
TNOX 3500	10,7	6,69	0,30	0,10	179	10,5	75	6	6441	6441	8200	230	50	IP X0D	1000	X	X	X	X
TNOX 4000	11,5	6,71	0,30	0,10	179	10,5	42	6	7335	7335	8970	230	50	IP X0D	1000	X	X	X	X
TNOX 5000	10,0	6,69	0,30	0,10	179	10,5	63	6	9088	9088	11280	230	50	IP X0D	1000	X	X	X	X
TNOX 6000	11,0	6,71	0,30	0,10	179	10,5	91	6	10066	10066	12160	230	50	IP X0D	1000	X	X	X	X

KEY

1	Electrical panel	N1	Flow
2	Manometer	N2	Return
3	Thermometer	N3	Fitting for instruments
4	Manometer holder tap	N4	System filling/drainage
5	Regulation thermostat	N5	Connections for safety valves
6	Safety thermostats	N6	Bulb wells
7	Fitting for safety pressure switch (not supplied)	N8	Inspection well
		N11	Fitting for level minimum probe



TNX 3000/TNOX 2500 - TNX 7000/TNOX 6000

NOTE: drawing, legend and data refer to standard models. For specific models, please refer to the provided accessory drawing.

Dimensions		H	H1	H2	H4	H6	H10	L	L1	L2	P	P2	P3	P4	P5	P6	Øb	Øc	N1	N2	N1/N2	N3	N4	N5	N6	N8
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	DN/in	DN/in	PN	DN/in	DN/in	DN/in	DN/in	DN/in
TNX 3000	TNOX 2500	**2460**	2210	1230	2400	1230	125	**2135**	1960	1300	**3872**	3430	1005	1500	1367	300-400	400	550	200	200	16	1/2"-3/4"	40	50	1/2"	3/4"
TNX 3500	TNOX 3000	**2460**	2210	1230	2400	1230	125	**2135**	1960	1300	**4372**	3930	1005	2000	1367	300-400	400	550	200	200	16	1/2"-3/4"	40	50	1/2"	3/4"
TNX 4000	TNOX 3500	**2700**	2420	1335	2610	1335	125	**2345**	2170	1400	**4372**	3930	1006	2000	1367	300-400	450	600	200	200	16	1/2"-3/4"	40	50	1/2"	3/4"
TNX 5000	TNOX 4000	**2700**	2420	1335	2615	1335	125	**2345**	2170	1400	**4872**	4430	1255	2200	1417	300-400	450	600	250	250	16	1/2"-3/4"	40	65	1/2"	3/4"
TNX 6000	TNOX 5000	**2820**	2570	1410	2765	1410	125	**2495**	2320	1600	**5382**	4930	1257	2700	1425	300-400	450	700	250	250	16	1/2"-3/4"	40	65	1/2"	3/4"
TNX 7000	TNOX 6000	**2820**	2570	1410	2765	1410	125	**2495**	2320	1600	**5882**	5430	1257	3200	1425	300-400	450	700	250	250	16	1/2"-3/4"	40	65	1/2"	3/4"

3. ACCESSORIES

The hot water boilers are fitted with a series of accessories that can be subdivided as follows:

- Safety accessories (safety valves, safety pressure switches, safety thermostat)
- Control accessories (thermostat)
- Observation accessories (temperature gauges, pressure gauge, flame inspection)

3.1 THERMOSTATS

There are usually three: one for limiting or regulating; the others for safety or locking.

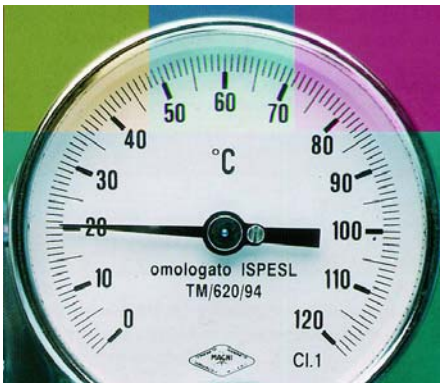
- The limiting thermostat shuts down the burner when it has reached the temperature: and automatically restarts it at a predetermined value; moreover, it provides for a contact to actuate the second flame of the two stage burner.
- The safety thermostat locks the burner at a fixed temperature value and sends out an alarm signal. Restarting occurs only after the cause of the alarm has been removed and the system has be reset by operating the reset button on the switchboard.

3.2 MANOMETER

The pressure gauge is Bourdon type consisting of a flat elliptical section metal tube, bent to an arc. One end of the tube is open and communicates with the boiler where the pressure is to be measured; the other end, closed and free to move is connected by a lever system to a toothed arc and to the gauge indicator hand.
The gauge shows in red the design pressure.

3.3 TERMOMETRO

The stainless steel thermometer has a great dial, with a suitable full scale and 4000 mm capillary.



4 INSTALLATION

Before **connecting** the boiler, perform the following operations:

- Thoroughly clean all the **system pipes** in order to remove any foreign matter that could affect correct operation of the boiler;
- Check that the **flue** has an **adequate draught**, that there is no narrowing of passages and that it is free from debris; also check that other appliances do not discharge into the flue (unless designed to serve several utilities). See the regulations in force.

4.1 BURNER

Before installation you are advised to thoroughly clean the inside of all the fuel supply system pipes in order to remove any foreign matter that could affect correct operation of the boiler. See technical specification tables and check the max pressure value inside the furnace. The value found on the table may also increase by 20% if heavy oil is used instead of gas or light oil; furthermore the following checks should also be carried out:

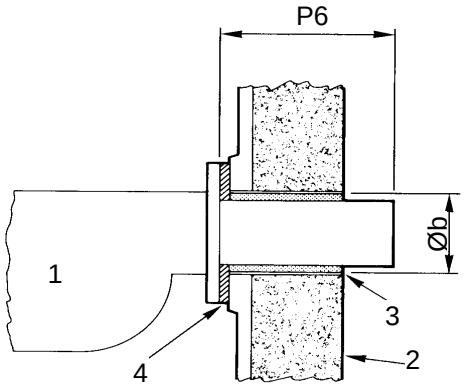
a) Check the internal and external seal of the fuel supply system;
b) Regulate the fuel flow according to the power required by the boiler;
c) Check that the boiler is fired by the correct type of fuel;
d) Check that the fuel supply pressure is within the values specified on the burner rating plate;
e) Check that the fuel supply system is sized for the maximum flow rate necessary for the boiler and that it is provided with all control and safety devices provided for by the regulations referred to above;
f) Check that the boiler room vents are sized in order to guarantee the air flow established by the regulations referred to above and that they are in any case sufficient to obtain perfect combustion.

In particular, when using gas:

g) Check that the feeding line and the gas ramp comply with the regulations in force;
h) Check that all the gas connections are sealed;
i) Check that the gas pipes are not used as earth connections for electrical appliances.

If the boiler is not going to be used for some time, close the fuel supply cock or cocks.

IMPORTANT: verify that the spaces between the burner sleeve and the plug are suitable filled with flame-resistant ceramic insulation (Fig. 1).



Key:
1. Burner
2. Door
3. Insulating material
4. Flange

All details on the draught tube length (**P6**), the diameter of the burner hole (**Øb**) and the pressurization are included in the par. Technical Specifications.

5 STARTING

WARNING: Before start up insert wholly turbolators into the smoke tubes ensuring that they have been pushed inside for at least 100 mm, till TNX 4000 and TNOX 3500 models included.

5.1 PRELIMINARY CHECKS

Before starting the boiler, check that:

- The **rating plate** specifications and power supply network (electricity, water, gas or fuel oil) specifications correspond;
- The burner **power range** is compatible with the power of the boiler;
- The boiler room also contains the instructions for the burner;
- The **flue gas exhaust pipe** is operating correctly;
- The **air inlet supply** is well dimensioned and free from any obstacle;
- The manhole, the smokebox and the burner plate are closed in order to provide a complete flue gas seal;
- The system is **full of water** and that any **air pockets** have therefore been eliminated;
- The **anti-freeze** protections are operative;
- The water **circulation pumps** are operating correctly.
- The expansion vessel and the safety valve(s) have been connected correctly (with no interception) and are properly operating.
- Check the electrical parts and thermostat operation.

5.2 WATER TREATMENT

The most common phenomena that occur in heating systems are:

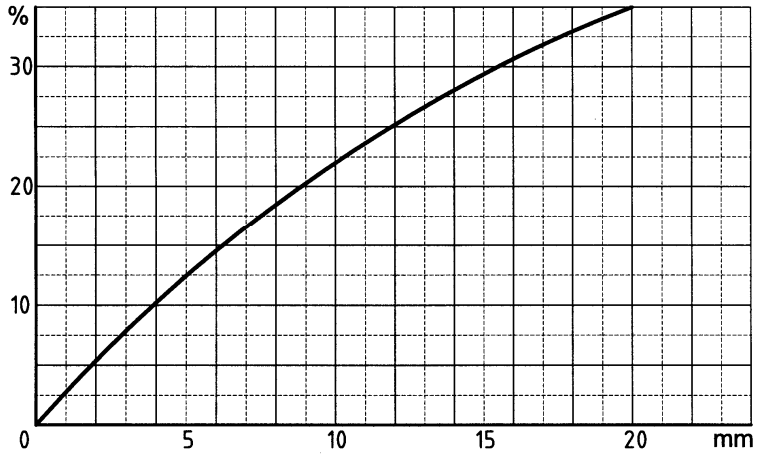
- Scaling

Scale obstructs heat transfer between the combustion gases and the water, causing an abnormal increase in the temperature of the metal and therefore reducing the life of the boiler.

Scale is found mostly at the points where the wall temperature is highest and the best remedy, at construction level, is to eliminate areas that overheat.
Scale creates an insulating layer which reduces the thermal transfer of the generator, affecting system efficiency. This means that the heat produced by burning the fuel is not fully exploited and is lost to the flue.

Scale diagram

Key
% % fuel not used
mm mm of scale



- Corrosion on the water side

Corrosion of the metal surfaces of the boiler on the water side is due to the passage of dissolved iron through its ions (Fe+). In this process the presence of dissolved gases and in particular of oxygen and carbon dioxide is very important. Corrosion often occurs with softened or demineralised water which has a more aggressive effect on iron (acid water with Ph <7): in these cases, although the system is protected from scaling, it is not protected against corrosion and the water must be treated with corrosion inhibitors.

5.3 FILLING THE SYSTEM

The water must enter the system as slowly as possible and in a quantity proportional to the air bleeding capacity of the components involved. Filling times vary depending on the capacity and characteristics of the system but should never be less than 2 or 3 hours.

In the case of a system with **closed expansion vessel**, water must be let in until the pressure gauge indicator reaches the static pressure value pre-set by the vessel.
Heat the water to maximum temperature and never over 90°C. During this operation the air contained in the water is released through the automatic air separators or through manual bleed valves. The water discharged from the system with elimination of the air is made up by the automatic or manual filling valve.

6 OPERATION

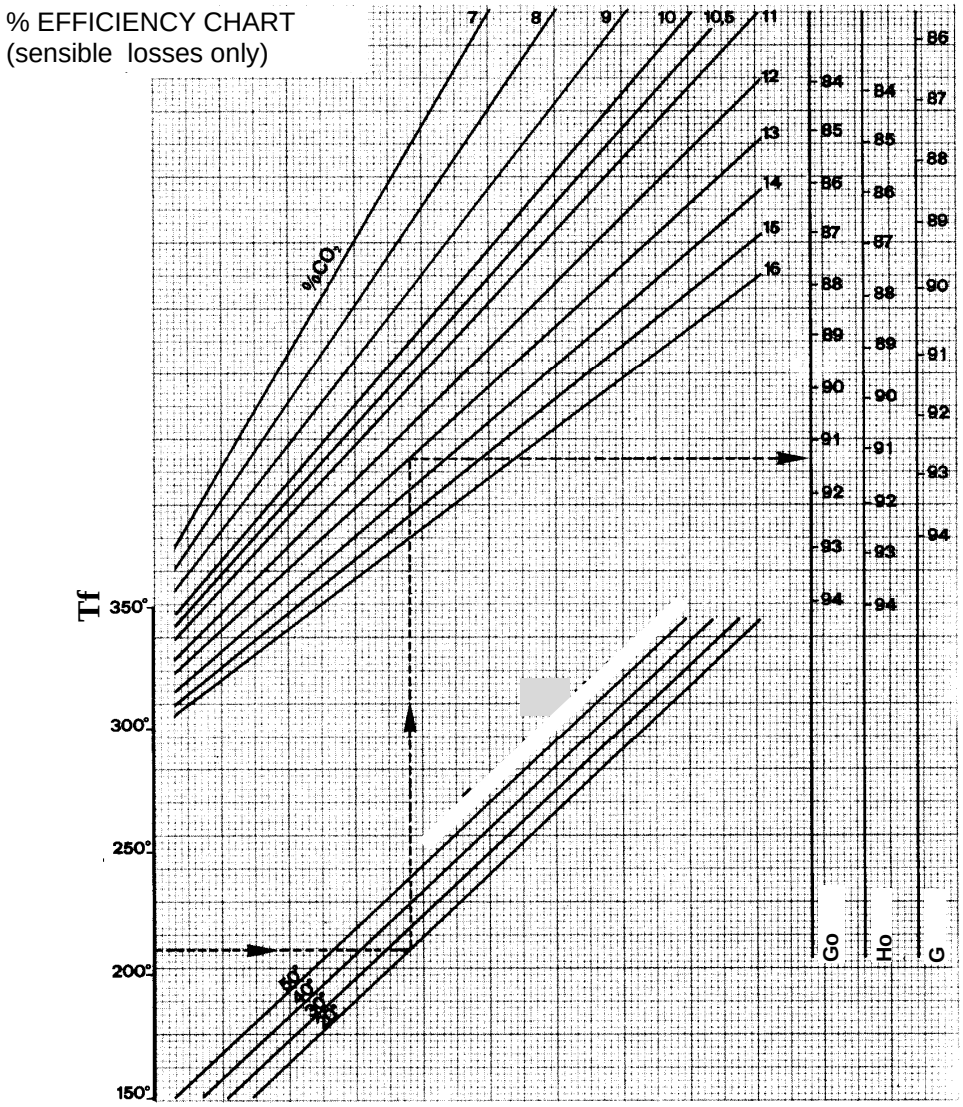
6.1 OPERATION CHECKS

The heating system must be correctly operated to ensure perfect combustion as far as possible with reduced emissions of carbon monoxide, unburnt hydrocarbons and soot into the atmosphere, and to avoid hazards and damage to people and goods.
Guide to combustion values:

FUELS	**%CO_2**	**Flue gases temperature**	**% CO**
Gas	10	190°C	0 – 20 ppm
Gas oil	13	195°C	10 – 80 ppm
Heavy oil	13,5	200°C	50 – 150 ppm

A diagram is provided in which the system efficiency is obtained according to the flue gas temperature, the ambient temperature and the percentage of carbon dioxide (CO_2). Dispersions through the boiler casings are not considered.

Example:
Fuel used…….....GAS OIL
Ambient temperature…….……20°C
%CO_2……13%
Efficiency..……91,4%



Key:
Tf Flue gas temperature °C – **Ta** Ambient temperature °C – **Go** Gas oil **– Ho** Heavy oil **– G** Gas

Pressurisation values should be included in the range given in the table of technical specifications.

WARNING

The differential temperature between boiler flow and return must not exceed 15°C in order to prevent thermal shock to the boiler structures. The temperature of the return water must be above 55°C in order to protect the boiler from corrosion due to condensation of the flue gases on cold surfaces; for this purpose it is useful to install a 3 or 4-way mixing valve. The guarantee does not cover damages caused by condensate.

A recirculation pump (anticondensate pump) must be installed to mix the cold returns. This pump should have a minimum flow rate equal to approximately 5 m^3/h or equal to 1/3 or 1/4 of the heating system pump flow rate.

It is necessary to keep the burner switch always switched on in order to maintain water temperature equal approximately to the value set through the thermostat.

If the flue gas seal is poor in the front part of the boiler (manhole and burner plate) or the back part (smokebox), the closing tie rods of the individual parts must be adjusted; if this is not sufficient, the seals must be replaced.

CAUTION

Do not open the manhole and do not remove the smokebox while the burner is working. Always wait few minutes after the burned has been switched off until the insulating parts are cooler.

6.2 CLEANING AND SERVICING

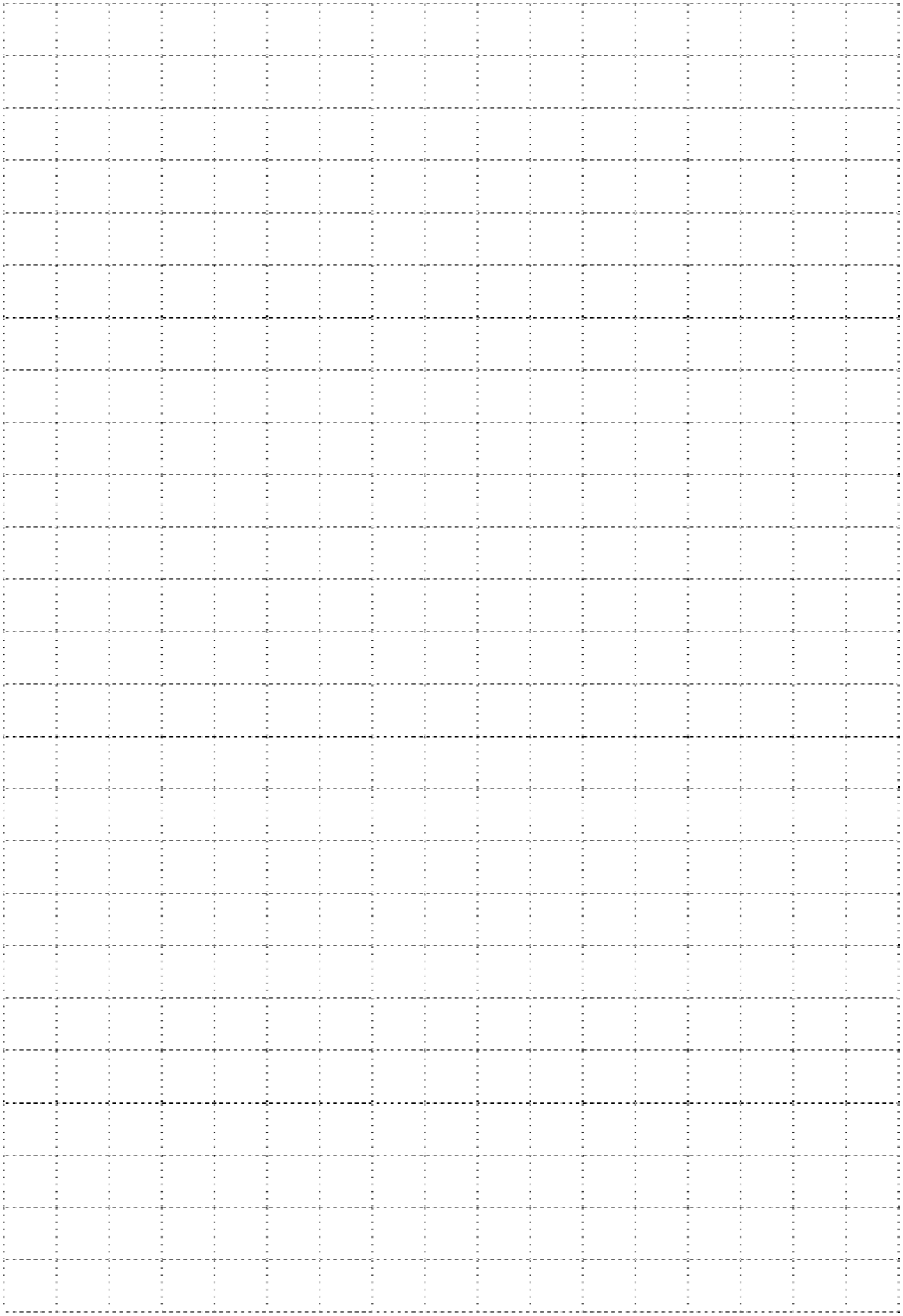
Close fuel supply and disconnect the electrical mains before starting any cleaning and servicing operations.

As economic running depends on cleaning of the exchange surfaces and regulation of the burner, the following operations should be performed:

- Clean the tube bundle and turbolators with the appropriate tube-brush every month for heavy oil-fired boilers, every three months for gas oil-fired boilers and once a year for gas-fired boilers. Cleaning schedule depends on plant features.

Quick cleaning can be performed by opening the front manhole only, taking the turnolators out and cleaning the tubes with a tube-brush. For more thorough cleaning, the smokebox must be removed to eliminated carbon deposits from the rear side.

- Have the burner calibration checked by professionally qualified personnel;
- Have the water circulating in the system analysed and provide for adequate treatment to avoid the formation of scale which initially reduces the efficiency of the boiler and in the long term will permanently damage it, making it unserviceable;
- Check that the refractory castings in contact with the flue gases are in perfect condition and if not, replace them;
- Periodically check the efficiency of the system regulation and safety instruments.



Appartenente al Gruppo Finluc, iscritto R.I. VR n. 02245640236
Via G. Pascoli, 38 - 37059 Zevio - fraz. Campagnola - VERONA - ITALIA
Tel. 045/8738511 - Fax 045/8731148
info@icicaldaie.com - www.icicaldaie.com