TECHNICAL MANUAL

EN

The above picture is only for reference.

GSX

STEAM BOILER
WITH THREE-GAS-PASSES

1 INTRODUCTION

Dear Customer,
Thank you for having chosen our **generator.**
In your interests, we invite you to follow and observe the instructions in this manual to ensure the highest level of efficiency and duration of the unit.

IMPORTANT: failure to observe the instructions in this manual will void the warranty conditions.

THIS MANUAL REFERS TO GENERATORS WITH "STANDARD ACCESSORIES"
FOR GENERATORS "EXEMPT FROM CONSTANT SURVEILLANCE" BY AN OPERATOR, SEE THE SPECIFIC TECHNICAL MANUAL.

2 SAFETY WARNINGS

IMPORTANT

For safety and for proper operation, carefully read this TECHNICAL MANUAL before installing and starting the generator.
The manual is an integral and essential part of the generator and must accompany it from installation until disposal. The generator must be used for the purpose for which it was strictly intended and any liability by the Manufacturer for damages to people, animals or property due to lack of maintenance or for improper use, is excluded.

It is the user's responsibility to ensure appropriate resources to operators for the activities of ordinary and extraordinary maintenance under current legislation in the country of use.

Safety of the thermal power plant

For safety purposes, the qualified technical personnel in charge of running the system must consider the following requirements:

- Follow the accident prevention and environmental safety regulations in force.
- Ensure the generator installation in the thermal power plant complies with the standards in force.
- Ensure that the electrical and hydraulic system complies with the standards in force.
- Ensure that the boiler room complies with the standards in force and is sufficiently ventilated.
- Ensure that the boiler fumes are conveyed outside the thermal power plant through a flue compliant with the standards in force.
- Ensure that the acidic condensation that may develop during system start-up, is evacuated outside the thermal power plant after a neutralisation process in compliance with the standards in force.
- Ensure that there is no danger due to frost inside the thermal power plant.

Original equipment verification

The first generator ignition must be preceded by verification by a **competent body**, unless the generator has already been previously hot tested during manufacturing.

Periodic verifications

The generator must be periodically checked by a **notified body** in order to ascertain the state of preservation of the body and of the adjustment and safety accessories.

Danger of explosion

Routine and extraordinary maintenance must be entrusted to **professionally qualified personnel** with the purpose of promptly detecting any damage to the generator's pressurised body and the safety and control accessories.

Danger deriving from the fuel

Sensing the presence of fuel in the thermal power plant, it is appropriate to follow the precautions below to avoid the risk of explosions and fires:

- Do not smoke or cause sparks.
- Do not turn on lights or electrical devices in general (mobile phones).
- Open doors and windows.
- Close the fuel shut-off valve normally placed outside the thermal power plant.
- Disconnect the electrical power supply by using the switch normally placed outside the thermal power plant.

Danger of burns

During normal operation, the generator has hot parts that, upon accidental contact without suitable personal protection, can cause serious burns. Potentially hot parts include:

- Accessories and valves connected to the generator.
- Door and smoke chamber.
- Upper tread walkway.

Danger from fumes

An incorrect adjustment of the closing door or an insufficient draught in the flue can leave fumes inside the thermal power plant, causing fatal intoxication deriving from carbon monoxide which, by its nature, is colourless and odourless. Therefore, ensure the generator is properly installed and adjusted and the presence of ventilation openings in the thermal power plant are compliant with the regulations in force.

Repairs

Any generator repair must be carried out or authorised by the manufacturer in order to avoid risks to people and property, as well as to prevent **voiding the Warranty Conditions being** . Generator maintenance must be entrusted to competent personnel.

Spare parts

In order to ensure maximum safety and reliability, it is essential that all removable defective accessories and parts are replaced with **Original Spare Parts** supplied by the Manufacturer.

3 TECHNICAL CHARACTERISTICS

3.1 GENERAL

This model is a medium pressure steam boiler, with three-gas-passes, passing flame and wet fund.

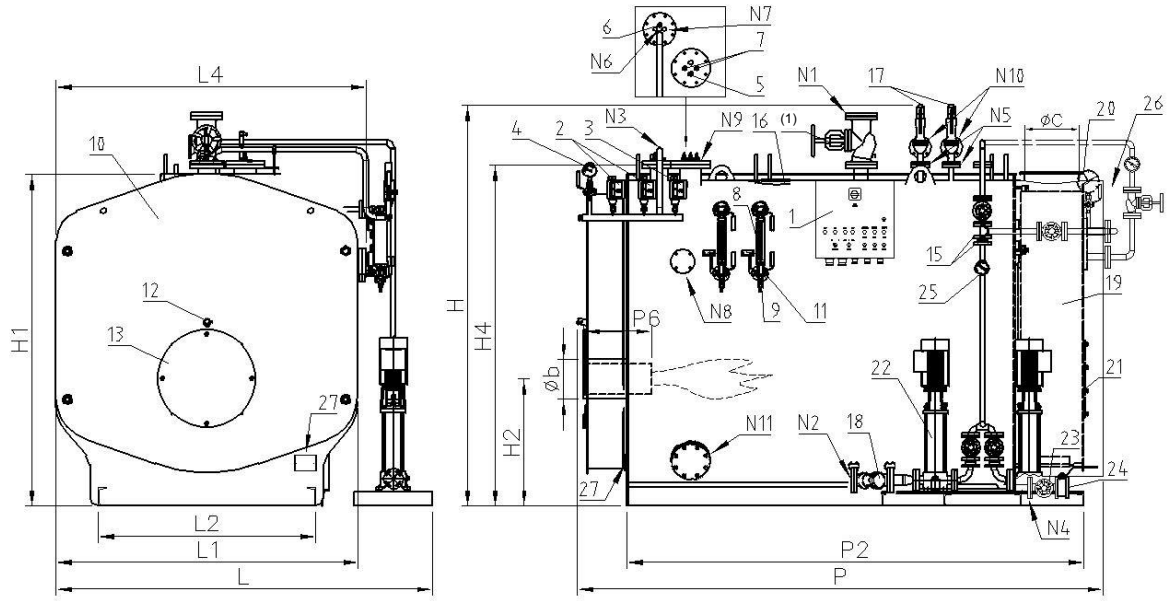
This boiler is equipped with accessories able high quality saturated steam, owing to its wide evaporation area which avoids water intake even with fast steam demand.

If matched with electrical panel and accessories its handling automatic which, however, requires continuous supervision by professionally qualified personnel

The boiler inner parts are easy-to-control both for cleaning and maintenance by the user and following all the national regulations.

Safety, reliability, high efficiency and high quality saturated steam are the characteristics of our boilers. Please consult the instructions with attention.

3.2 TECHNICAL DATA



LEGEND

1. Switchboard
2. Control pressure switches
3. Safety pressure switch
4. Pressure gauge
5. 1st safety level probe (minimum)
6. 2nd safety level probe (minimum)
7. Level control probes (start/stop)
8. Level gauge
9. Level gauge drain
10. Front plate
11. Level test valves
12. Flame inspection hole
13. Burner plate
14. Steam take-off
15. Non return valve
16. Inspection door
17. Safety valves
18. Feed filter
19. Back smokebox
20. Smokestack connection
21. Cleaning door
22. Feed pumps
23. Exhaust valve
24. Rapid exhaust valve
25. Thermometer
26. Economizer (opzional) ***
27. Data label

N1 Steam intake
N2 Feed
N3 Instrumental fitting
N4 Boiler exhaust
N5 Safety valves fitting
N6 2nd safety level probe fitting
N7 Maximum level fitting
N8 Salinity check fitting
N9 Probes holder barrel
N10 Safety valves exhaust
N11 Inferior inspection

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

***** Economizer: see specific manual ECO-G**

Characteristics	Heat output		Heat output		Pressure losses flue gas side	Design Pressure	Total capacity	On level capacity	Evaporating surface	Steam capacity*	Total weight	Electric supply	Frequency	Insulation class	Electric power	Fuel			
	kW	kcal/h	kW	kcal/h	mbar	bar	l	l	m²	kg/h	kg	Volt ~	Hz	IP	W	Nat. gas	Lpg	Gasoil	Heavy oil
GSX 350	**238**	205.100	262	225385	1,8	12	1900	1600	1,87	350	3800	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 500	**341**	293.000	374	321978	3,5	12	1900	1600	1,87	500	3800	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 650	**443**	380.900	487	418571	6,0	12	1900	1600	1,87	650	3800	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 850	**579**	498.100	643	547363	3,6	12	4000	2953	3,27	850	5700	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 1100	**750**	644.600	824	708352	6,0	12	4000	2953	3,27	1100	5700	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 1500	**1022**	879.000	1.123	965934	7,5	12	3800	2800	3,16	1500	6850	3/N~ 400	50,0	IP55	7000	X	X	X	X
GSX 2000	**1363**	1.172.000	1.498	1287912	8,5	12	4500	3350	3,71	2000	7650	3/N~ 400	50,0	IP55	15000	X	X	X	X
GSX 2500	**1703**	1.465.000	1.872	1609890	8,5	12	5900	4200	4,32	2500	9450	3/N~ 400	50,0	IP55	15000	X	X	X	X
GSX 3000	**2044**	1.758.000	2.246	1931868	10,5	12	7000	5000	6,16	3000	10450	3/N~ 400	50,0	IP55	15000	X	X	X	X
GSX 3500	**2385**	2.051.000	2.621	2253846	9,0	12	8000	6800	5,25	3500	13150	3/N~ 400	50,0	IP55	20000	X	X	X	X
GSX 4000	**2726**	2.344.000	2.996	2575824	11,0	12	9800	7300	5,90	4000	13750	3/N~ 400	50,0	IP55	20000	X	X	X	X
GSX 5000	**3407**	2.930.000	3.744	3219780	11,0	12	10900	9200	7,05	5000	15550	3/N~ 400	50,0	IP55	20000	X	X	X	X

Characteristics	Heat output		Heat output		Pressure losses flue gas side	Design Pressure	Total capacity	On level capacity	Evaporating surface	Steam capacity*	Total weight	Electric supply	Frequency	Insulation class	Electric power	Fuel			
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GSX 650	**443**	380.900	487	418571	6,0	15	1900	1600	1,87	650	4150	3/N~ 400	50,0	IP55	7000	X	X	X	X
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Dimensions	H	H1	H2	H4	L	L1	L2	L4	P	P2	P6	Øb	Øc	N1	N2	N1/N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
	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	DN/in	DN/in	DN/in	DN/in	DN/in
GSX 350	**2226**	1790	757	1840	**2040**	1590	1200	1590	**3345**	1939	320-370	220	250	65	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 500	**2226**	1790	757	1840	**2040**	1590	1200	1590	**3345**	1939	320-370	220	250	65	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 650	**2226**	1790	757	1840	**2040**	1590	1200	1590	**3345**	1939	320-370	220	250	65	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 850	**2486**	2050	813	2100	**2300**	1850	1400	1875	**3425**	2508	320-370	290	350	65	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 1100	**2486**	2050	813	2100	**2300**	1850	1400	1875	**3425**	2508	320-370	290	350	65	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 1500	**2586**	2100	819	2200	**2400**	1950	1400	1975	**3477**	2510	320-370	320	400	80	40	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 2000	**2586**	2100	819	2200	**2400**	1950	1400	1975	**3906**	2940	320-370	320	400	80	50	16	1"	32	25	1/2"	1/2"	50	125	40	125
GSX 2500	**2958**	2400	937	2510	**2650**	2200	1550	2200	**4106**	2938	320-370	400	450	100	50	16	1"	32	32	1/2"	1/2"	50	125	50	150
GSX 3000	**2958**	2400	937	2510	**2650**	2200	1550	2200	**4676**	3508	320-370	400	450	100	50	16	1"	32	32	1/2"	1/2"	50	125	50	150
GSX 3500	**3073**	2525	970	2625	**2800**	2350	1700	2300	**4676**	3508	320-370	400	550	100	50	16	1"	32	32	1/2"	1/2"	50	125	50	150
GSX 4000	**3073**	2525	970	2625	**2800**	2350	1700	2300	**5209**	3940	320-370	400	550	125	50	16	1"	32	32	1/2"	1/2"	50	125	50	150
GSX 5000	**3073**	2625	970	2625	**2900**	2450	2000	2450	**5832**	4440	320-370	400	600	125	50	16	1"	32	32	1/2"	1/2"	50	125	50	150

* 80°C feeding water ** Smokestack connection flanged

Electric powers only foreseen for gas or gasoline combustibles

Flue gas temperature (°C): Gas=227; Gasoil=230; Heavy oil=229

4 ACCESSORIES

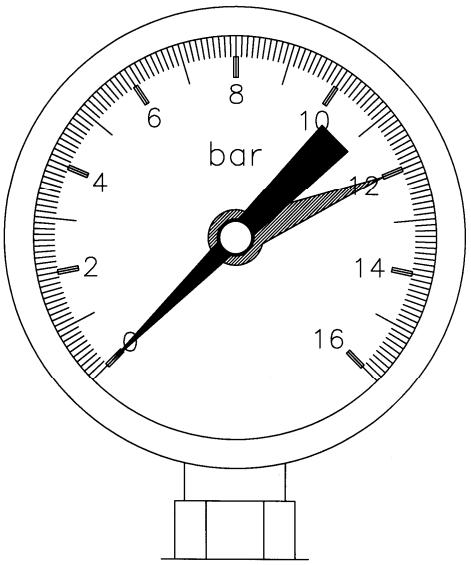
These steam boilers are fitted with a series of accessories that can be subdivided as follows:
- Safety accessories (safety valves, water level limits, safety pressure switches).
- Observation accessories (level gauge, pressure gauge, flame inspection).
- Control accessories (level ad pressure switches, transmitters).
- Feed water accessories (centrifugal pump, injector or alternating steam pump).
- Manual operation accessories (stop valves, purge valve).

In the following description the accessories are subdivided as to the physical parameter they control (pressure and level).

4.1 PRESSURE

4.1.1 Pressure gauge

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.



The gauge is carried on a three-way valve to allow the following operations:
- Communication between boiler and gauge (normal operation position).
- Communication between gauge and the atmosphere (position necessary to purge the siphon).
- Communication between the boiler, the gauge and a test gauge (position necessary to verify the gauge).

4.1.2 Pressure transmitter

The high precision pressure transmitter is designed to be used in most industrial applications and guarantees a reliable pressure measurement, even in difficult atmospheric conditions.

The programme of the pressure transmitter covers an analog output signal. It disposes of an attachment by means of a rotating connecter and a vast range of pressure and electrical attachments.

4.1.3 Operation pressure switch

Device that controls the boiler pressure and holds the pressure between the set maximum and minimum values.

4.1.4 Safety valves

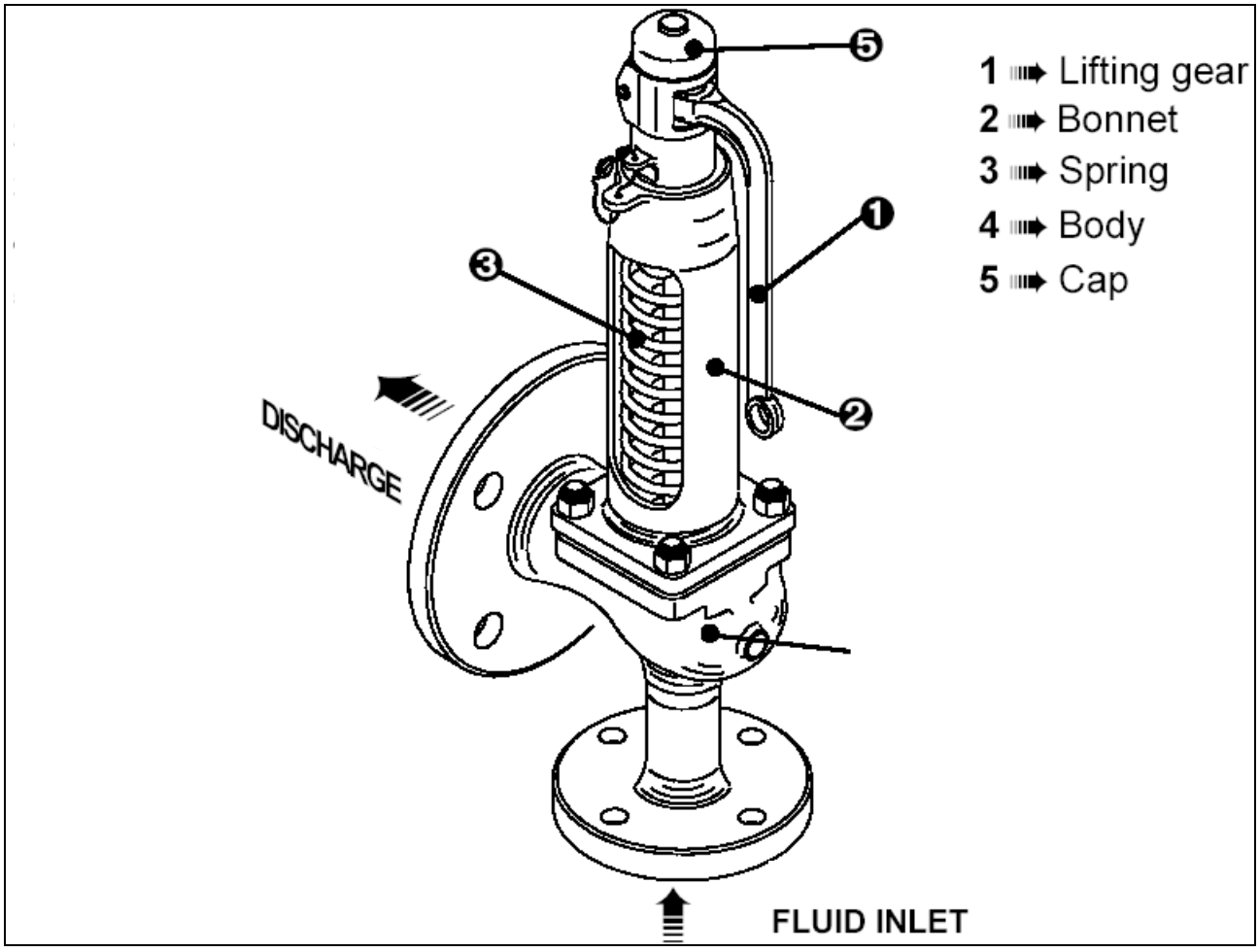
These valves have the function of discharging steam when the maximum design pressure of the boiler is reached.

These valves follow precise national and international regulations. They are designed, tested, fitted and controlled following all current regulations and the instructions in this manual.

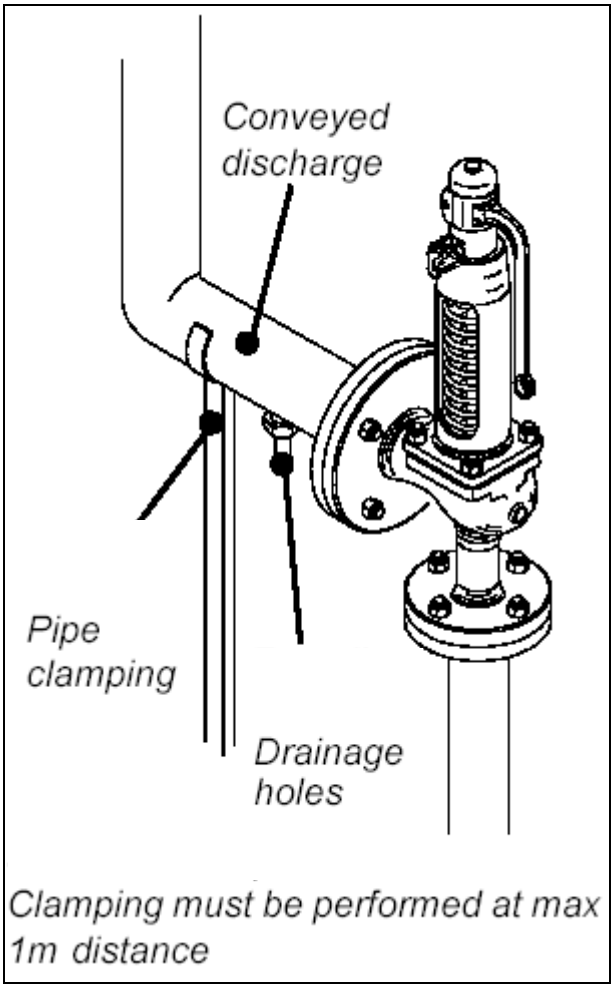
Security valves come after many years of experience fulfilling all the safety regulations of pressure devices.

They are completely able to avoid maximum pressure exceed, even when all the other safety devices are out of order.

The safety valve main parts are displayed in Fig.



In case of conveyed discharge, be sure to clamp the conveying pipe so as to compensate the strength when discharging the water. (see Fig.).
It is good practice to provide conveyed pipes with one or more drainage holes for the discharge of possible condensate.
The drainage must be on air, be sure to place the valves away from persons and things.



It is good practice to check the valves once a week when the boiler is on pressure, by acting on the manual lever. Be sure to check the valve adjustment once a year directly on the plant or by test-bed.
The valves should be replaced every 10 years.
Valves operation is particularly sensitive to pressure drops in conveyed drainage pipes when opened.
Regarding pressure drops in the drainage pipe, the maximum value must not exceed setting pressure by 15%.

Maintenance
These are the main instructions for control and maintenance of the valves:

- Be sure that no circuits are on pressure in every part of the plant.
- Allow the parts to cool below 30°C.
- The valve must go under maintenance every two years.

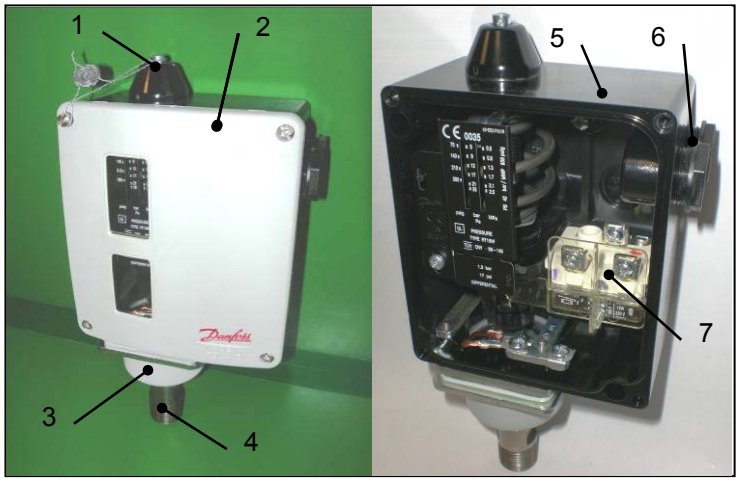
Valve is a very sensitive accessory. The boiler operator must pay attention and control its working order.
If necessary, please contact a technician authorised by the manufacturer.
The safety valves are designed and manufactured to work without greasing; be sure to keep them clean and efficient.

4.1.5 Pressure switch

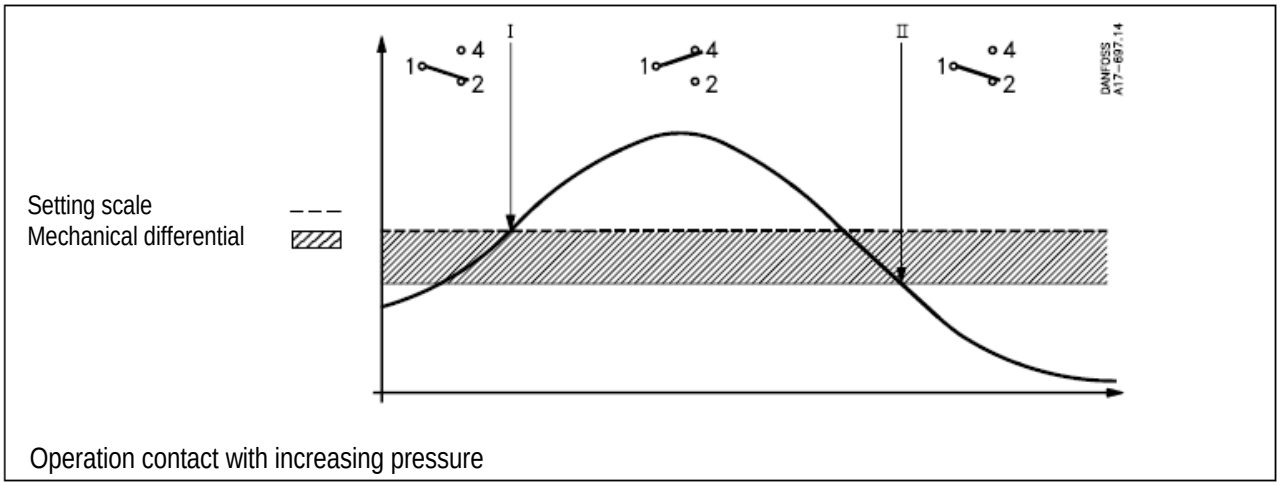
The pressure switch is equipped with a lever. Its contact position depends on the pressure at the connection and on the set value.
This switch is set at a higher pressure than the maximum of the control pressure switch, but always lower than the opening pressure of the safety valves.

The safety pressure switch acts in the case of a fault to the steam pressure regulator (control pressure switch or pressure transmitter) and stops the burner permanently.

Key
1. Sealed anti-tampering cap
2. Cover
3. Stainless steel bellow
4. Pressure connection G 1/2 A
5. Protection IP 66
6. 2 x PG 13.5 Cable diameter 6 ÷14 mm
7. Contact system SPDT, interchangeable

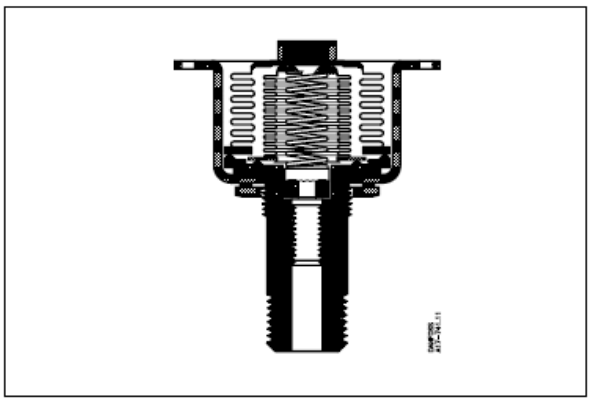


OPERATION
On reaching the set pressure, the contact 1-4 turns to 1-2. When the pressure goes below the set pressure, the contacts are back to their start position, minus the differential switch.
I. Alarm starting when the pressure goes above the set value
II. Alarm starting when the pressure decreases below the set value, minus the differential switch.



Operation contact with increasing pressure

Operation at actual safety for increasing pressure. Picture no. 7 shows, a section of the bellows for increasing pressure.
On increasing the pressure, the lever blocks the contact between terminals 1 and 2.
If the inner bellow is pierced, pressure is turned to the outer ones. The outer bellow is three times bigger than the inner one.
The connection between terminals 1 and 2 is blocked. If the outer bellow is pierced, the pressure will be atmospheric between the two ones.
The system blocks the contact between terminals 1 and 2. Owing to its double bellow structure, in case of breaking, no fluid will be drop inside the room.



4.2 LEVEL

4.2.1 Level indicator gauge

The level indicator consists of a pair of valves connected to a sight glass box containing a prismatic glass. This device is connected to the boiler both above and below the normal water level, while the lower part is fitted with a purge valve so that any sludge can be removed, to keep the glass clean. Using these valves, the efficiency of the level control system can be verified periodically by carrying out the following operations:

- Open for a few seconds and then close the purge valve. If the water disappears from the sight glass and then appears again with ample level oscillation, then it can be considered that the level operates correctly. If on the other hand the water returns slowly or stops at a level differing form the preceding level, then on of the communications may be obstructed. To make sure which of the two is obstructed, and to attempt a purge, close the steam valve leaving the water valve open, then open the purge valve. This valve must release water taking with it any sludge formed in the pipes. Then close the water valve and open the steam valve: steam should be released from the purge valve. Closing the purge valve and leaving the two water and steam valves open, the water should return to the initial level. If this does not occur, the communication pipes between the level and the boiler must be cleaned. During normal operation, the isolating valves must be completely open.

To avoid possible leaks, the indicators must be periodically isolated to check that the bolt clamping is at least 30 N.m.

Be sure to proceed with maintenance if:

- Boiler pressure is like the atmospheric one.
- Temperature indicator shows the same temperature as the room one.

Maintenance must be performer when:

- The glass loses its clearness, is partially opaque, shows inner signs of erosion or corrosion, coming into a difficult reading.
- Even slight leaks are noticed in gaskets or isolating groups.

4.2.2 Automatic level regulator and water level limits

The physical principle employed to detect and control the water level is based on the electrical conductivity of the water.

In order to guarantee the correct operation of the device, following conditions must be fulfilled:

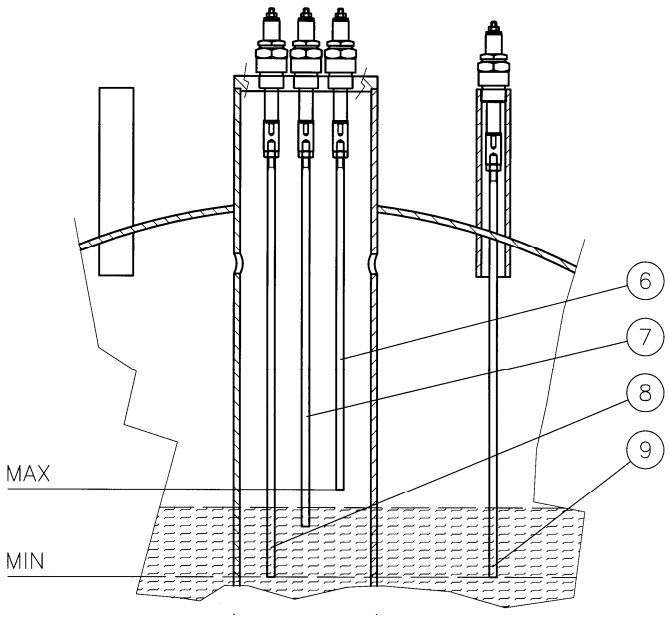
- **Water conductivity > 250 S/cm**
- **Water temperature < 210°C**
- **Pressure < 20 bar**

(See. " Operating water ").

The control device consists of a part sited in the control panel (electronic relays) and of probes of differing lengths immersed in the boiler shell.

Operation of the system provides for:

- **Automatic pump start and stop**: Two probes inserted in the boiler, of which the longer starts, and the shorter stops the pump, connected to a single control relay in the control panel.
- **Burner stop at low water level**: two probes of the same length, inserted in the boiler and connected to two distinct control relays in the control panel, stop the burner permanently if the water level drops below the admissible level.



Boiler probes:

6 Pump stop
7 Pump start
8 1st safety burner stop and alarm on.
9 2nd safety burner stop and alarm on.

N.B.: we suggest that as well as the acoustic alarm in the boiler room, a further acoustic alarm be provided in an area where personnel is normally present.

4.3 FEED WATER

An electric centrifugal pump supplies the water. The inlet side of the pump must never be under suction pressure, but always under positive pressure due to the difference in height between the pump itself and the feed water tank. While a pump can operate under suction head from a cold water tank (up to 5-6 m), if the water is hot the pump cannot operate and indeed needs the water to be delivered under a certain pressure.

The height of the feed water tank varies with the temperature, as shown in the following table:

WARNING

- **Oxygen dissolved in water causes corrosion in the boiler. Reference should be the maximum permissible values indicated in the relevant section of the technical manual.**
- **To avoid pump cavitation problems, you must perform the following table.**

DEAERATOR TYPE	**Feed water temperature** (°C)	**Positive water head** (meters)
ATMOSPHERIC DEAERATOR	60	1
	70	2
	80	3
	90	4,5
DEAERATOR THERMOPHYSICAL PRESSURISED 0,5 barg	105	6
DEAERATOR THERMOPHYSICAL PRESSURISED 3 barg	120*	7

*** NOTE: the maximum of the pump inlet temperature is 120 ° C**

4.3.1 Water characteristics

All the values listed as follow are taken by tables 5.1 and 5.2 contained in the EN 12953-10 (rules related to quality features of feeding and working of boiler water).
For steam boilers **there are some regulations that require limit values for water characteristics.**
However, limits should be adopted for all generators as stated by qualified companies that recommend the type of treatment to be carried out basing on careful analysis of the available water. **Many faults and sometimes serious accidents are caused by the use of water with non-conforming features.**

FEEDWATER - LIMIT VALUES (entering the boiler)
Tab. 1

Specifications	**Measurement unit**	**Feedwater for steam boilers with pressure ≤ 20 bar**	**Integrating water for hot water boilers** (total operating range)
Appearance	Transparent, void of suspended solids		
Direct conductivity at 25 °C	µS/cm	See values in chart 2	
pH at 25°C [a]	---	> 9.2 [b]	> 7
Total hardness (Ca+Mg)	mmol/l	< 0.01 [c]	< 0.05
Iron (Fe)	mg/l	< 0.3	< 0.2
Copper (Cu)	mg/l	< 0.05	< 0.1
Silica (SiO_2)	mg/l	See chart 1.1	
Oxygen (O_2)	mg/l	< 0.05 [d]	-
Oil-based substances	mg/l	< 1	< 1
Concentration of organic substances	------	See footnote [e]	

a) With copper alloys in the system, the value of the PH must be maintained in the interval between 8.7 and 9.2.
b) With a PH value of the water softened to > 7.0, the PH value of the boiler water should be foreseen as per prospect 5-2.
c) With an operating pressure <1 bar, a total maximum hardness of 0.05 mmol/l should be acceptable.
d) Instead of complying with this value with an intermittent operation or operation without deaerator, in case of agents which form the film and/or excess of oxygen, the additive must be used.
e) The organic substances are usually a mixture of numerous different compounds. The composition of these mixtures and the behavior of their single components to the operating conditions of the boiler are difficult to predict. The organic substances can be decomposed to form carbonic acid or other acidic decomposition products, which increase the acidic conductivity and cause rust and deposits. They can also lead to the formation of foam and/or to the production of steam with suspended water, which must be maintained as low as possible.

Chart 1.1 maximum acceptable content of silica in the boiler water up to pressures of 20 bar

Alkalinity	**Silicate**
0,5 mmol/l	**80** mg/l
5 mmol/l	**105** mg/l
10 mmol/l	**135** mg/l
15 mmol/l	**160** mg/l

Note: these values are to be accepted when a thermal deaerator is installed. If not so, it is good practice to heat the water in the tank at least to 80°C to reduce the content of dissolved gasses (O_2 e CO_2). Be sure to use chemical conditioners to deoxygenate feed water and to reduce CO_2 corrosion.

OPERATING WATER - LIMITING VALUES

Chart. 2

Specifications	**Measurement unit**	**Water for steam boilers with pressure ≤ 20 bar**		**Boiler water for hot water boilers** (total operating range)
		Direct conductivity of the feedwater > 30 µS/cm	Direct conductivity of the feedwater ≤30 µS/cm	
Appearance	Transparent, without the formation of permanent foam			
Direct conductivity at 25 °C	µS/cm	< 6000 [a)]	< 1500	< 1500
pH at 25 °C	------	10,5 ÷ 12	10 ÷ 11 [b) c)]	9 ÷ 11.5 [d)]
Composite alkalinity	mmol/l	1 ÷ 15 [a)]	0.1 ÷ 1 [c)]	< 5
Silica (SiO_2)	mg/l	See chart 1.1		
Phosphates (PO_4) [e)]	mg/l	10 ÷ 30	6 ÷ 15	-
Organic substances	------	See footnote [f)]		

a) With a super-heater, consider 50% of the value normally indicated as the maximum to be the maximum value.
b) Adjustment of the basic pH by means of an injection of $NaPO_4$, further injection of NaOH only if the pH value is < 10.
c) If the acidic conductivity of the feedwater of the boiler is < 0.2 µS/cm, and its concentration of Na + K is <0.01 mg/l, the injection of phosphate is not necessary . It can be applied in AVT conditions (All-volatile treatment with volatile chemical agents, feedwater pH ≥ 9.2 and boiler water pH ≥ 8), in such case, the conductivity of the boiler water is < 5 µS/cm.
d) If there are non-iron materials in the system, i.e. aluminum, these may require a lower pH value and a direct conductivity, however, the priority is to protect the boiler.
e) If a coordinated phosphate treatment is used, considering all the other values, higher concentrations of PO_4 are acceptable.
f) The organic substances are usually a mixture of numerous different compounds. The composition of these mixtures and the behavior of their single components to the operating conditions of the boiler are difficult to predict. The organic substances can be decomposed to form carbonic acid or other acidic decomposition products, which increase the acidic conductivity and cause rust and deposits. They can also lead to the formation of foam and/or to the production of steam with suspended water, which must be maintained as low as possible.

FREQUENCY OF THE ANALYSES

The frequency of analysis must be carried out as in the table; it is advisable in any case to check the pH, the total hardness and the alkalinity of the feed and boiler waters at least every two days. Once a month, especially under conditions of variable operation, it is advisable to subject meaningful samples of the boiler and feed waters to complete analysis.

It is also advisable to inspect the return condensate for traces of any highly contaminating oily substances (reduction of evaporation from the water surface in the boiler caused by a layer of oil).

5 INSTALLATION

5.1 THERMAL POWER PLANT

Please follow your national regulations.

5.2 SITING

Our generators must be placed on a horizontal support base able to support the weight of the boiler when completely full of water for the possible on-site hydraulic test.

5.3 WATER CONNECTIONS

The steam boilers once positioned are connected to the system as follows:

Water

From the condensate collection tank (if existing; otherwise from the treated water tank) to the suction side of the feed water pump.

Steam

From the main steam take-off valve to the user services (distributor or others), from the safety valve outlets (6) to outside the boiler room in a safe position.

Drains

From the level indicator drains, the boiler drain to the drainage network.

Fuel

Connection to the burner foreseen for fuel oil or natural gas.

Compressed air

Air pressure should range from 4 to 10 bar.

Important: the air should be filtered through a mesh of 25 µm.

5.4 ELECTRIC CONNECTIONS

The boilers are provided with a switchboard (protection level IP 55) completely assembled to the various boiler accessories. Before connecting the switchboard, make sure that the electric system has been correctly installed, checking in particular the efficiency of the earthing system.

Wiring diagram

Refer to the diagram supplied with the specific switchboard.

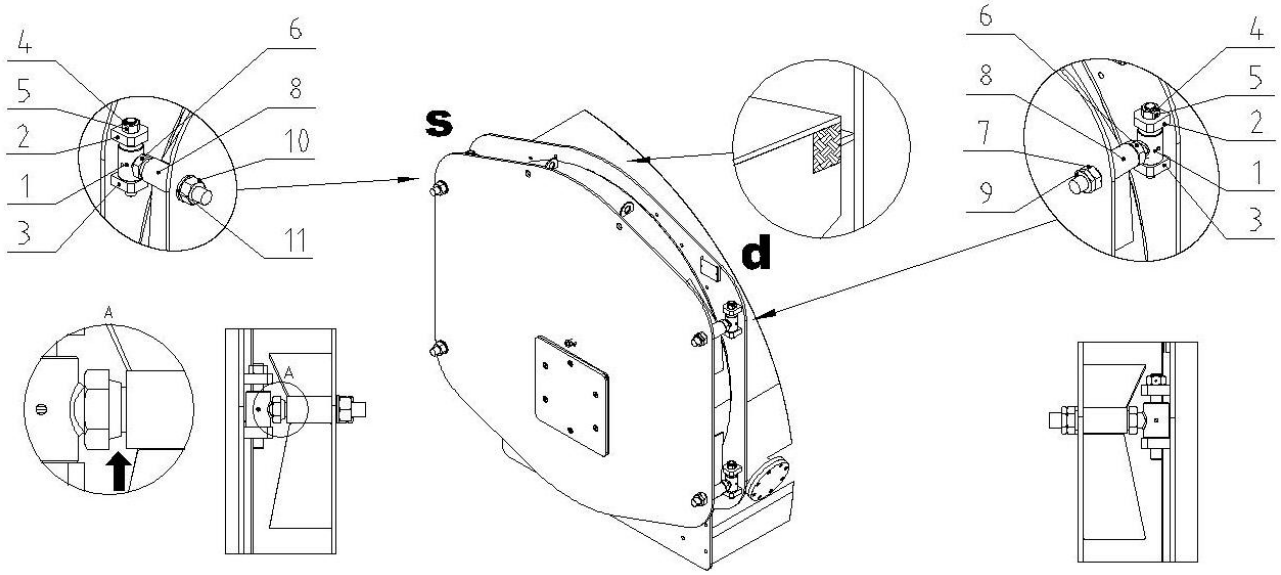
5.5 SMOKESTACK

The smokestack must be dimensioned as to applicable regulations.

5.6 DOOR

5.6.1 DOOR OPENING

The door is adjusted in the factory with **standard opening to the left (s)** and with **hinges on the right (d)**.



CAUTION: it is dangerous to unscrew the nuts (7 e 9) on the side of the hinges to avoid causing the door to detach, with possible serious damage to people and property.

5.6.2 DOOR OPENING REVERSAL (to the right)

Proceed as follows to reverse the opening direction of the door:

1. Exchanging crosswise external conical nuts (7) and locking nuts (9) of the right with the lock nuts (10) and washers (11) to the left..

CAUTION: When cross-changing the nuts, always make sure that the other two nuts are fastened, so that they hold the door.

2. Screw the front-right nuts (10) so that the seal gasket of the door is pressed in the same way as the left part. Bring the conical nuts (6d) of the right tie-rods to the mechanical tubes (8d) of the door and tighten them with appropriate wrench.
3. On the left opening side, loosen the front nuts (9) and release the rear conical nuts (6s) from the mechanical tubes (8s) of the door.
4. Check the correct adjustment of the tie-rods and hinges ensuring that, during closure, the seal gasket is **evenly pressed in the centre on the whole circumference** (see figure).

If necessary, adjust as described in the next par.

5.6.3 DOOR ADJUSTMENT (opening on right)

Vertical adjustment

1. With the door ajar, loosen the dowels (5s) on the nuts of the hinge units.
2. Act on the adjustment nuts (4s) to lift or lower the door centring the gasket on the stop plate (see figure), then block the nuts with the dowels.
3. Close the door and centre the tie-rods (1d) on the mechanical tubes (8d), working as in point 2.

Horizontal adjustment
Close the door with the key and check there is equal distance on both sides, between the stop plate and the band.
Otherwise, proceed as follows:

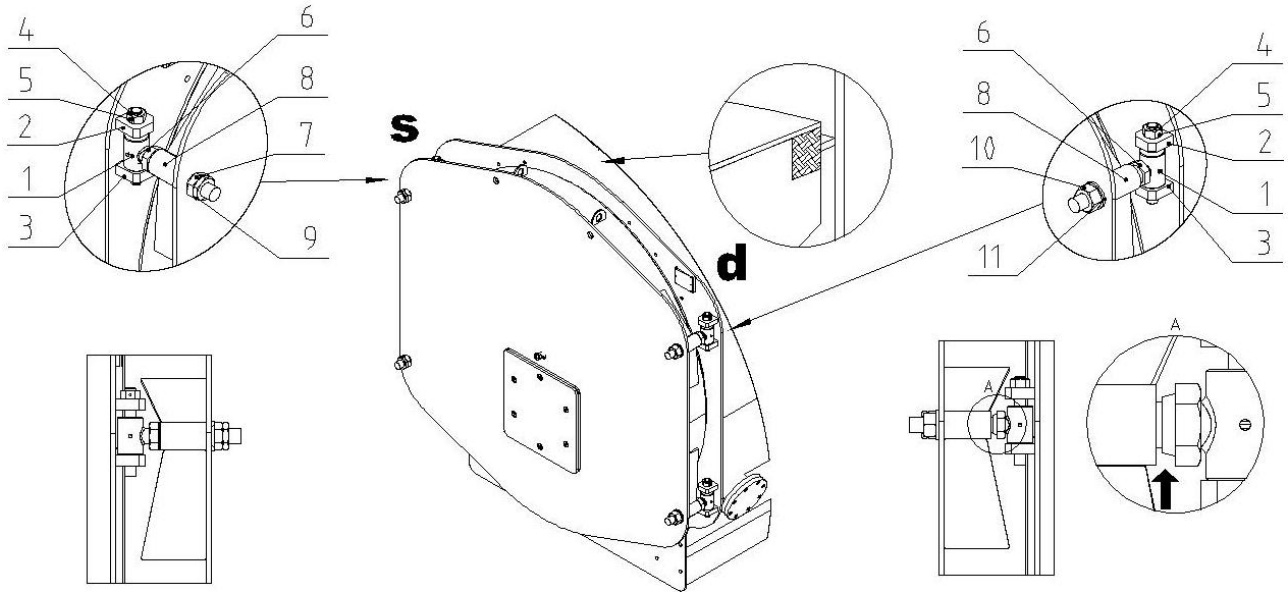
1. With the door ajar, loosen the nuts (6s) of the hinge units.
2. Act on the front conical nuts (7s) to adjust the distance in depth.
3. Screw the conical nuts (6s) blocking them on the mechanical tubes.

Check the proper adjustment in depth ensuring that the door, manually pushed up to the stop plate, naturally returns remaining ajar. This is to ensure the hinge side fume seal.

Important: on the side opening, the internal conical nuts (6d) must not be in contact with the mechanical tube (8d) in order to ensure correct the positioning of the seal on the beat, see part. A.

For any problems related to the reversal and adjustment of the door, we recommend contacting our local Authorised Technical Assistance Centre.

IMPORTANT: Incorrect door adjustment with consequent damage to people and property voids the warranty conditions.



KEY:

1. Tie-rod with pin
2. Upper bracket
3. Lower bracket
4. Vertical adjustment nut
5. Locking dowel
6. Internal locking conical nut
7. External conical nut hinge side
8. Door mechanical tube
9. Locking nut hinge side
10. Locking nut opening side
11. Washer opening side

5.7 FOOTBRIDGE AND LADDER (optional)

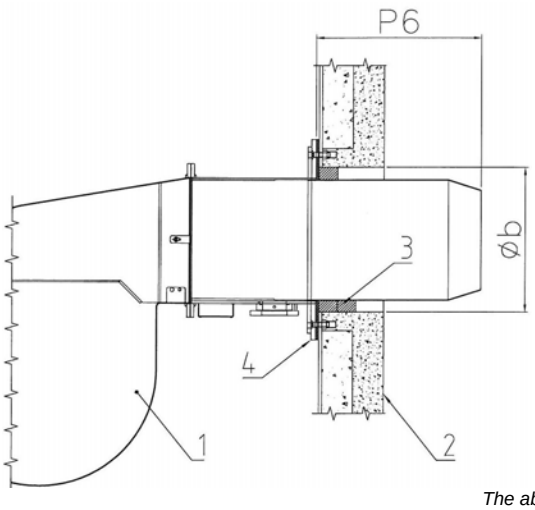
Refer to annex "TECHNICAL DATA AND SPECIFIC INSTRUCTIONS" supplied.

5.8 BURNER

To better answer to steam demand, it is advisable to install a **two-stage burner** or **a modulating burner;** this avoids large pressure variations consequent on sudden stream demands.
Further, and above all with natural gas, every burner start-up is preceded by a long period of pre-ventilation of the combustion chamber, with consequent loss of heat to the smokestack.

5.8.1 Boiler - Burner coupling

IMPORTANT: Verify that the spaces between the burner sleeve and the boiler door are suitable filled with flame-resistant ceramic insulation.
The thermoinsulating strip provided with the boiler must be wrapped around the mouthpiece for at least an entire circumference of the flame radiation to protect the flange of the burner. Not that the ceramic insulation is necessary to fill the gap until the insulation inside surface of the door.



The above picture is only for reference.

KEY:
1. Burner
2. Manhole
3. Thermoinsulating 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.

6 BOILER OPERATION

6.1 FIRST START-UP

IMPORTANT:

- **Before starting the steam boiler, it is advisable to wash the internal with cleaning agents containing soda to remove any remaining oil and then passivate the boiler. Considering the high risk from incorrect chemical treatments, the operations must be performed by qualified personnel.**
- **WARNING: Before start up, open the door and insert wholly turbolators into the front end sections of the smoke tubes, ensuring that they have been pushed inside for at least 100 mm.**

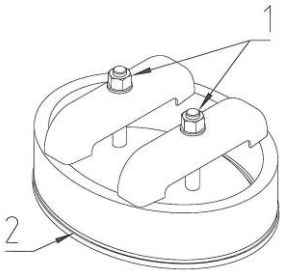
The above picture is only for reference

- Verify that all fittings are tight.
- Ensure that all safety and adjustment devices are correctly installed. The safety devices (safety valves, safety pressure switch, safety thermostat) can be supplied already calibrated and sealed during manufacture or they must be calibrated and sealed by the manufacturer and/or Certifying Body in charge at time of use. The adjustment devices must be calibrated by the user according to requirements.
- Verify that the feed water pipes are clean, carrying out a series of washing operations with drainage to waste before final boiler filling.
- **Check the quality of the system water as reported in the paragraph "WATER CHARACTERISTICS" in this manual.**
- Check the seal and proper operation of all mounted components and accessories (piping, valves, pumps, regulators, etc.).
- Close the drain valves, the steam take-off valve and the level drains.
- Open the level control valves and the feed water valve (upstream of the feed water pump).
- In the case of gas operation, check that the mains pressure is compatible with that on the gas ramp of the burner.
- Verify the correct closure of the front door and the smoke chamber ensuring that there are no leaks, progressively tighten the fixing tie-rods.

- Start the boiler as follows:

1) Switch on the control panel by turning the main switch.
2) Check that the drive shaft of the feed water pump is free to turn. By starting the pump manually for an instant, check that the shaft turns in the correct direction.
3) Set the pump switch to AUT and verify that burner cannot start before the attainment of the minimum level;
4) Check that the pump stops when the maximum level is reached by observing the level indicators and checking the positions of the indicator valves.
5) Press and keep pressed the safety water level reset button for at least 10 seconds, the conductivity relay being of the delayed type.
6) Open the boiler drain and check on the level indicator at what level the pump-start probe acts.
7) Set the pump switch to “0” leaving the drain open and check the actuation level of the safety probes with respect to the minimum level reference plate.
8) Close the drain and set the pump switch to AUT
9) Switch on the burner and bring the boiler up to pressure adjusting the operation pressure.

WARNING: On boilers with a man-way, during the first start-up it is important to tighten progressively the nuts (1) on the man-way cover as the pressure increase. Otherwise a hazardous situation is created due to steam leaks that quickly deteriorate the gasket (2) creating a dangerous situation for the boiler room personnel.



Ensure the intervention of all safety and adjustment accessories described in the appropriate chapter.

6.2 NORMAL OPERATION

With cold start-ups, verify that:

- The boiler is full of water to the minimum level;
- The increase of the water volume due to heating does not raise the water level too far: if necessary drain the boiler at regular intervals to bring the visible level back to the centre of the water level sight glasses;
- On reaching the set pressure, the steam take-off valve can be opened very gradually in order to heat the steam delivery lines eliminating any condensate that may be present in the pipework;
- The man-way gasket does not leak.

6.3 MONITORING

6.3.1 Water level

The professionally qualified personnel present in the thermal power plant must continuously verify that the visual level of the water in the boiler stays above the minimum level indicated by the glass level; a possible drop below the minimum value must cause the intervention of the two safety level switches.

6.3.2 Min-max

The professionally qualified personnel present in the thermal power plant must continuously verify that the pressure of the steam in the boiler stays below the maximum level indicated on the generator data plate; a possible abnormal increase of the pressure must cause, at first, the intervention of the safety pressure switch, then the opening of the safety valves.

7 MAINTENANCE

IMPORTANT

Carry out thorough cleaning and periodic maintenance to ensure a correct and safe operation of the system. A perfectly clean tube bundle increases the thermal exchange between fumes and water contributing to energy saving and reducing air pollution.

7.1 PREPARATION FOR INSPECTION AND MAINTENANCE

Before carrying out any kind of maintenance, in order to avoid risks, the operator must be equipped with all the personal protection provided by the standards in force.

Maintenance must be entrusted only to **technically qualified personnel** and can be either mechanical or electrical.

The preparation and status of the generator may be different, depending on the operations to be performed:

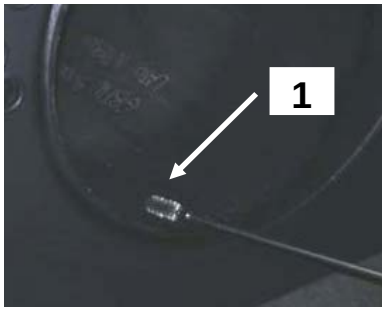
- **With the boiler running,** to check the integrity of the generator when hot (fume trace seal, water side gasket seal, flue draught, operation of adjustment and safety accessories),
- **With switch-off and complete cooling** of the generator, when having to open the front door with inspection inside the furnace and fume chamber.
- **With cooling, complete empting and safe shut-off of the generator** towards the system of use, in the case of water side internal visit.

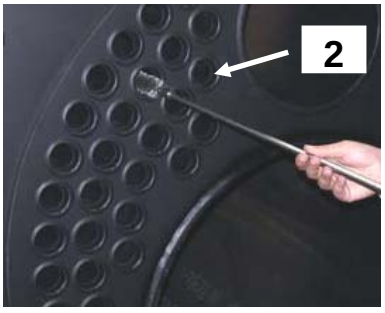
Particular precautions must be taken to avoid the risk of electric shock since the system on the generator has accessories powered at 230V and/or at 400V.

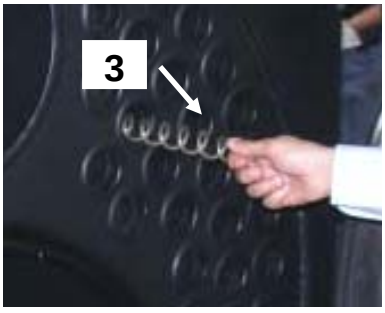
Before intervening on the generator, ensure that the connection to the electrical system has been made according to current standards, also ensuring proper earthing connection to the system.

7.2 ORDINARY

- Carry out burner maintenance (as to the specific instructions);
- Check the tightness of flange bolts and the state of the gaskets;
- Check the conditions of the boiler door internal covering and of the glass fibre braids;
- Check the integrity of the flame warning light.
- Periodically clean the furnace (1) and the tube bundle (2) using a brush.
- Check the integrity and cleanliness of the turbulators (3), if any; in general gaseous fuels should not produce any carbon deposit while with the use of liquid fuels, it is necessary to clean frequently to avoid substantial fouling.



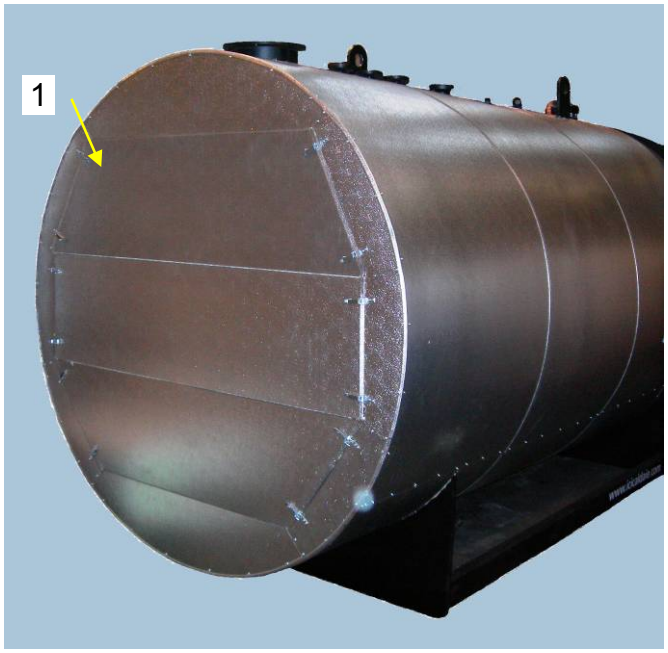


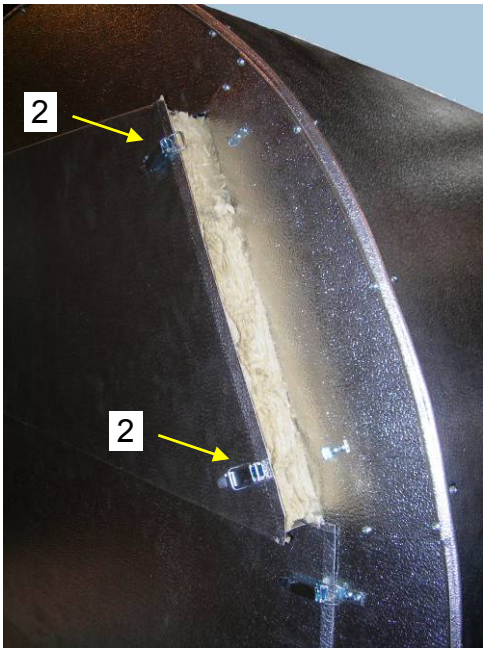


- Check the condition of the welds between the rods tube and tube plate
- Check for wear to the discharge valves; these tend to wear more quickly, due to the abrasive effect of the sludge during blow-down.
- Check the integrity of the electrical system on the generator.
- Check the integrity of the electrical panel, both outside (IP protection) and inside (check of all components inside the electrical panel).

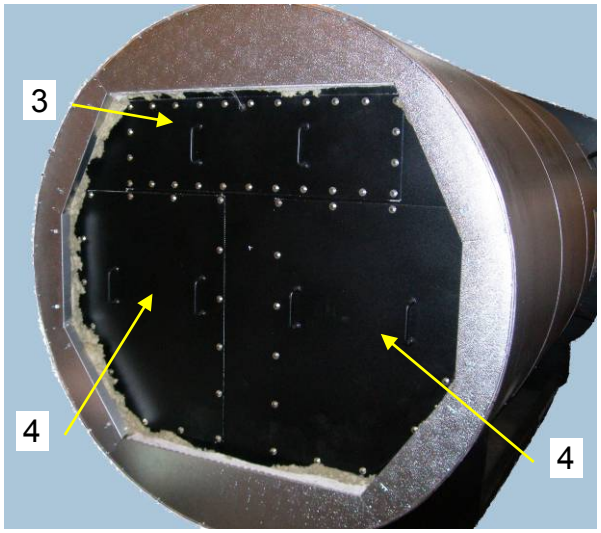
7.2.1 Rear inspection

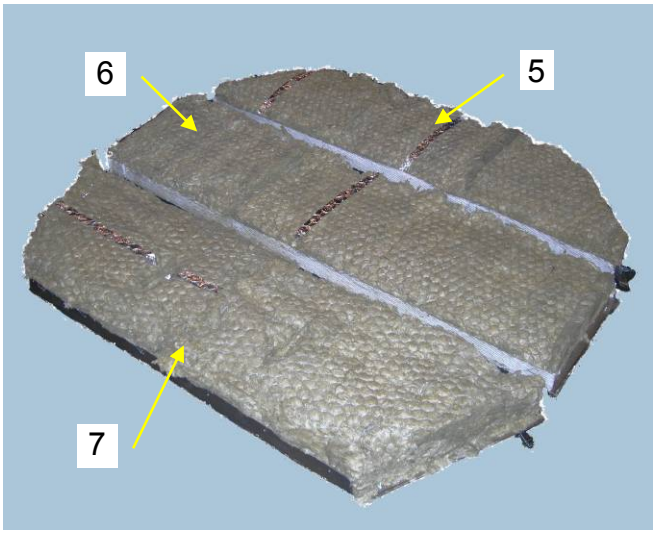
To inspect the rear tube plate, remove the covering of the fume chamber consisting of rock wool panels and aluminium sheet metal.





The rear part is covered by 3 shaped panels (1) fixed with snap hooks (2) that quickly open and close.





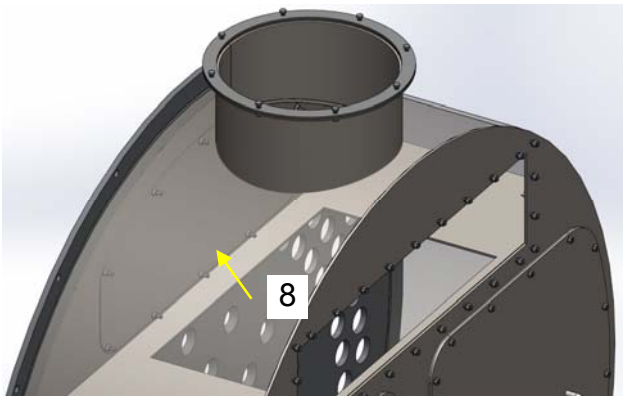
To access the energy saver door (3) and the fume chamber doors (4), open the fixing hooks and, in sequence, remove the upper panel (5), the intermediate panel (6) and the lower panel (7).

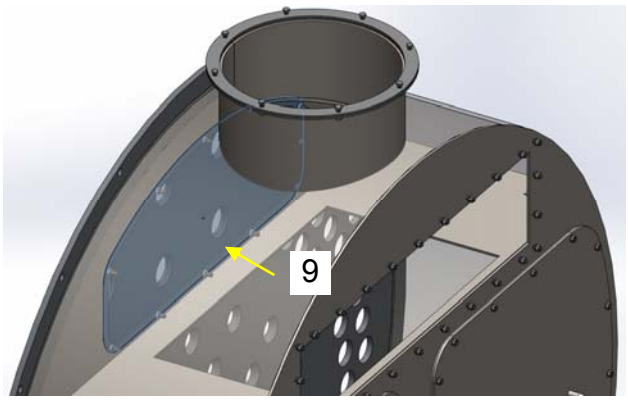
Open the doors to check the integrity and cleanliness of the fume chamber and tube bundle.

To assemble, proceed in reverse order.

7.2.2 Rear extraordinary inspection

Remove the economizer or the door closure, remove the internal door (8) and check the condition of the welds between the tie rods and the tube plate (9).





To assemble, proceed in reverse

7.3 PERIODIC

7.3.1 Verifications - Check-List

Scrupulously observe the table contents, with its frequency.

Observation and test	6 hours	1 day	1 week	1 month	3 months	6 months	12 months
Safety valves		O				T(9)	
Level indicators		T(4)					
“TDS-BWD” Unloading devices (If present)		T(5)					
Shut-off valves		O				T(10)	
Water load control devices		O					
Low level protection devices	T(1)	O					T(15)
High level protection devices (if present)				T(3)			
Temperature and pressure indicators		O					
High pressure protection devices		O	T(2)				T(15)
Protection devices, quality of water in generator (if present)		O		T(7)			
Protection devices, quality of supply water (if present)		O				T(11)	
Safety systems		O				T(12)	
Pressurised parts, piping, flanges, joints				O			
Temperature, pressure control devices		O				T(13)	
Load system, pumps/valves		O			T(8)		
Analysis of the water quality		T(6)					
Burner control (combustion)		O					T(14)

Continues

Notes

O	Observe the proper operation of the generator in all its parts. There must be no leakage from the safety valves. There must be no leakage from the shut-off valves, piping, flanges, joints, pressurised parts in general. Visually check, through the glass indicators, the correct water level. Check pump(s), modulating valve (if present). Verify the correct display and adjustment of temperatures/pressures. Check for alarms from the protection devices. Verify the proper operation of the burner.
T(1)	Physical verification of the intervention of the devices (as described in the following par.)
T(2)	Physical verification of the intervention of the device (as described in the following par.)
T(3)	Physical verification of the intervention of the device (as described in the following par.)
T(4)	Purge the level indicators
T(5)	Manually verify, using the selectors on the panel front, the opening of the valves.
T(6)	Analysis of the water quality by taking a sample from the generator, check if it meets the specifications of EN12953-10 (see par. "water quality")
T(7)	Analysis of the water quality by taking a sample from the generator and check it meets the indications of the TDS automatic control device.
T(8)	Carefully check the load system, correspondence of level in the glass indicators with the parameters described in this manual.
T(9)	Verification of safety valves by applying a sample pressure gauge to the generator, as reference of the exact intervention pressure. **Verifications must be performed by qualified personnel.**
T(10)	Check correct seal, grease, lubricate where necessary.
T(11)	Analysis of the water quality by taking a sample from the supply/treatment system, check if it meets the specifications of EN12953-10 (see par. "water quality"). **Verifications must be performed by qualified personnel.**
T(12)	Check the proper operation of all safety, electric and electronic circuits. **Verifications must be performed by qualified personnel.**
T(13)	Check the correct indications of the instrumentation with sample thermometers/pressure gauges. **Verifications must be performed by qualified personnel.**
T(14)	Check the burner, combustion control, safety devices. **Verifications must be performed by qualified personnel.**
T(15)	Bench check of the safety devices. **Verifications must be performed by qualified personnel.**
NOTE IMPORTANT	**Attention! The durability of the safety level switches is 8 years. They must be replaced after the eighth year of operation. To be evaluated, during cleaning/maintenance, the other mechanical, electromechanical and electronic parts.**

7.3.2 Verifications - Safety devices

All operations must be carried out by authorised and trained personnel.

Procedure for checking the minimum level safety level switches.

Stand in front of the electrical panel, leave the steam outlet valve with removal regulator open, turn off the pump by placing the selector at "0", wait for the natural lowering of the generator water level, to speed up the operation act on the mud discharge valve (BWD, if present).
Pay the utmost attention, wait for the intervention of both safety devices, ensuring that this does not happen below the minimum level indicated next to the glass indicators.
If the test is positive, reset the pump control by putting the relative selector to the "AUT" position.

Procedure for checking the maximum level switches (if present)**.**

Stand in front of the electrical panel, leave the steam outlet valve with removal regulator open, bring the pump to manual operation by placing the selector at "MAN", wait for the generator water level to rise, to speed up the operation close the steam outlet valve if not required by the process.
Pay the utmost attention, wait for the intervention of the level switch, ensuring that this does not happen above the maximum glass indicator view.
If the test is positive, reset the pump control by bringing the relative selector to "AUT" position.

Procedure for checking the safety pressure switch.

Stand in front of the electrical panel, leave the steam outlet valve with removal regulator open, bring the limit pressure switch calibration pressure, burner ON-OFF, to maximum boiling value, e.g. 12 bar, wait for the generator pressure to increase, to speed up the operation close the steam outlet valve if not required by the process and/or also bring the calibration of the burner second stage pressure switch, if present, to maximum boiling value.
Pay the utmost attention, wait for the intervention of the safety pressure switch, ensuring that this does not happen before the opening of the safety valve.
If the test is positive, reset the operating parameters.

7.3.3 Maintenance

Safety devices, electrical system and panel

All operations must be carried out by authorised and trained and/or qualified personnel.

1) Depending on the degree of pollution of the premises, frequently clean the ventilation and/or the air conditioner (if present) filters and grilles.
2) Every 2-3 months check for dust deposits inside the panel, vacuum and/or blow to eliminate any deposits.
3) Every six months check the clamping of the connections to the inner components, paying particular attention to the power circuits.
4) Every six months check the clamping of the connections to the field control/safety devices, including any junction boxes.
5) Annually check the proper earthing connection of the electrical panel, generator and thermal power plant equipotential.
6) Every six months check the condition of the safety devices (probes, pressure switches, thermostats, etc.), disassemble and clean.
7) Every six months check the command and control circuits causing their intervention:
   water load pump(s) on-off, burner on-off.
   Pay the utmost attention that the behaviour of the verified parts complies with the sets originally set.

In order to preserve the proper operation of the generator over time, we recommend requesting a half-yearly/yearly inspection by the Assistance Service, for a general check of all parts.

7.4 SCHEDULED

- All boilers must be periodically stopped for careful inspection and maintenance: the time interval between stops is established by experience, by the operating conditions, by the quality of the feed water and by the type of fuel used.
- Every valve must be locked and if necessary isolated by removing a piece of pipework or by inserting a blind flange.
- Before entering the boiler shell for inspection or for cleaning, check carefully that there is no possibility of entry of water or steam via the pipework to which the boiler is connected.

• Inspection access points (see technical data section):

1. Step of Man (Ref 16). Allows visual access and devices. Located at the top near the inversion chamber, it allows inspecting the hearth, the inner front plate and the inversion chamber plating.
2. Lower Inspections N11. Allows device access. Positioned at the bottom of the front of the boiler on the accessory side, allow inspecting the front plate, hearth, and plank.
3. Lower Inspections N11. Allows device access. Located down at the back of the boiler on the accessory side, allow inspecting the hearth, the inner front plate and the inversion chamber plating.
4. Probe Door N3. Allows device access. Positioned at the top near the front plate allows inspecting the front plate, the hearth and the plaster.

- The parts under pressure must be carefully examined internally to identify any encrustation, **corrosion** and other potential **sources of danger linked to the feed water**.
- All deposits must be removed mechanically or chemically and **the effective thickness of the internal parts must be verified using suitable instruments to make sure that it has not been modified due to corrosion.**
- All pustules or other types of corrosion must be scraped and cleaned with a steel wire brush to white metal.
- Leaks between fire tubes and tube plates must be carefully examined: any welding must be done in all cases observing legal obligations, without forgetting that a steam boiler is a pressure vessel with danger of explosion and subject to control by competent authorities.
- During inspection also verify all the accessories, with priority to safety valves, level probes and pressure switches.

7.4.1 Water level limits substitution

To replace the water level limits or parts of it, follow strictly the instructions below:

1) Ensure that the new ceramic plug is intact
2) Check the length of the rod
3) Ensure that the rod is coaxial to the plug axis
4) Inspect the electrical system and, in particular, ensure that the resistance of the electric circuit linking the ceramic plug to the electrical panel is intact (resistance must be over 2 MOhm)
5) Check the integrity of the probe with particular regard to the isolation between the central electrode and the external part, that must be ≥ at 10 MOhm.
6) Ensure that the automatic level control consisting of the two ceramic plugs and their conductivity-relays, work well

Important! The durability of the safety level switches is 8 years. They must be replaced after the eighth year of operation. To be evaluated, during cleaning/maintenance, the other mechanical, electromechanical and electronic parts.

7.5 CONSERVATION DURING WHEN OUT OF SERVICE

Often during periods of disuse the worst cases of corrosion appear. The operations to be carried out to guarantee correct conservation of the boiler depend essentially on the duration of the stop.
The boiler can be subjected to dry conservation if the period of disuse is long, or to a wet conservation for short stops or if the boiler has a back-up function and must be ready to come on-line in a short time.
In both cases, the necessary operations tend to eliminate the causes of possible corrosion.

7.5.1 Dry conservation

If the generator is exposed to rigid temperatures, a "dry" storage is required as follows:

1. Make a complete drainage and an internal and external cleaning both on the smoke side and on the water side. Then dry it with compressed air.
2. The boiler must be drained and dried carefully, then placing in the boiler shell a hygroscopic substance (for example lime or silica gel etc)
3. Also drain the tank for condensate, pump and all pipes.

7.5.2 Wet conservation

1. Drain the water and clean the generator completely.
2. Fill the body up to the normal operation level and after a brief evaporation period it is essential to purge into the atmosphere to eliminate all dissolved gases.
3. Then fill the generator completely, dosing a sufficient amount of DEHA (diethyl hydroxyl amine) to develop a residue concentration of more than 100 ppm that prevents attacks of oxygen dissolved in the water.
4. Also add trisodium phosphate, until the total alkalinity reaches over 400 ppm.
5. Now close all the connections.
6. Control all the connections to make sure that there are no leaks and take water specimens at regular intervals noticing that the alkalinity value has not had alterations.

A “wet” conservation” is always advisable because there are greater guarantees of perfect conservation and a smaller interval to reach operation conditions.

8 USER DUTIES

Please follow your national regulations.

8.1 FIRE PREVENTION

Please follow your national regulations.

9 REMARKS

This manual is an essential part of the product.
In case the body is sold or moved, please ensure that this manual is forwarded to the new owner.
This boiler body has to be used according to its own purpose.
Any contractual or extra-contractual responsibility is excluded when referring to damages occurred to people, animals or things caused by failure of maintenance, scheduled control or misuse.

1. **Avoid contact between non insulated parts of the device during operation. When regulating or controlling during operation, be sure to use adequate protections and garments. (D.P.I. equipment according to D.Lgs.81/08)**
2. **During maintenance when getting up and down from the boiler roof, be sure to use D.P.I. equipment according to D.Lgs.81/08.**
3. **Watch out for sharp corners on the boiler and its accessories.**
4. **The boiler body must be protected from low temperature (-10 Celsius) and rain.**
5. **The generators are dimensioned for the only loads owed to pressure, temperature and contained fluid.**
6. **The generator must be put into operation at reduced power (maximum 50%) until the water temperature of exercise in order to avoid thermal shock and thermal expansion between the various constituent parts of the body.**
7. **After an earthquake, non-destructive testing for possible damages should be carried out by technical personnel.**
8. **The producer is not responsible in case of damages during boiler disconnection.**
9. **When moving the boiler, place yourself at least 5 meters away from the area.**
10. **In case of a hard collision during boiler moving, verify its integrity and carry out a new hydraulic test.**
11. **For possible declassing, please follow DM 329/04 regulation.**
12. **No welding or repair is allowed, please contact your verifying producer for boiler operation (in Italy DM 329/04).**

10 PROTECTING THE ENVIRONMENT

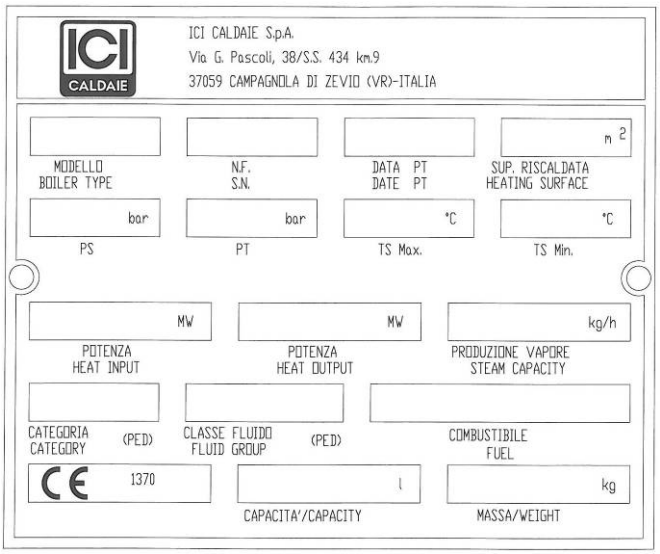
Protection and respect for the environment is a fundamental principle for **ICI CALDAIE S.p.A.** The quality of products, lower costs and protection of the environment are of equal importance for the company. **ICI CALDAIE S.p.A.**, also through ISO 14001 certification, strictly adheres to European laws and standards for the protection and preservation of the environment. In order to reduce its impact on the environment, the company uses the best technology and materials in its production processes and always considers their economic impact.

11 DECOMMISSIONING AND DISPOSAL

Decommissioned appliances contain materials that can be recycled since they do not contain asbestos or non-reusable hazardous materials.

12 DATA LABELS

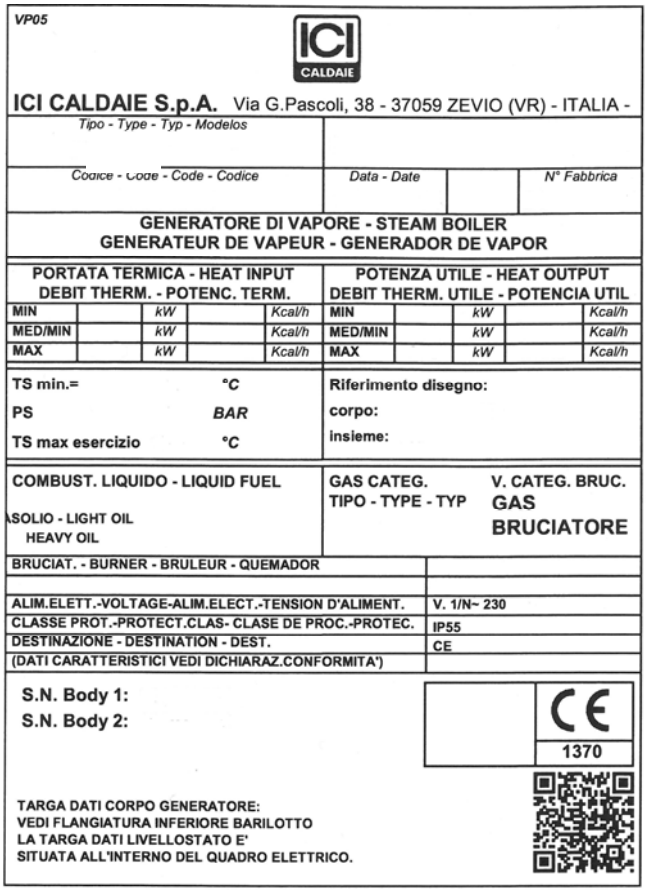
BODY DATA LABELS



Allowed limits

PS 12 bar TS -10; 191,7 °C
PS 15 bar TS -10; 201,4 °C

ASSEMBLY DATA LABEL



13 RESIDUAL RISKS

EVENT CAUSE 1	EXCESSIVE STEAM PRESSURE	Event Severity: B
- The pressure has exceeded the maximum allowed value (design pressure) due to lack of safety valve and pressure limiting auxiliary devices intervention (limit and safety switch)		
EFFECT - CONSEQUENCE		
- Induced stress higher than maximum eligible stress		
RISK - DANGER		
- Boiler explosion (furnace, casing and/or plate breaking)		
SOLUTION - PREVENTION		
- It's necessary to verify the correct opening of the safety valves to the pressure of the project. - It 's necessary to verify the correct operation of the safety pressure switch stops the burner that eliminates the cause of increase of pressure - It 's necessary to verify the correspondence between the maximum heat output of the boiler and the actual maximum power burned - NB: these solutions are borne by the user.		

EVENT CAUSE 2	COMPLIANCE OF ACCESSORIES	Event Severity: B
- Fitting unsuitable accessories and/or improperly assembled, exceeding max allowed pressure.		
EFFECT - CONSEQUENCE		
- Violent projection of fragments in the boiler		
RISK - DANGER		
- Collision against persons and/or object		
SOLUTION - PREVENTION		
- Matching accessories as required by the relevant regulations EN 12953.		

EVENT CAUSE 3	OVERHEATING DUE TO LOW WATER LEVEL	Event Severity: B
- The water level has dropped below the minimum design level due to safety water level switch mal-function		
EFFECT - CONSEQUENCE		
- Frame overheating in contact with combustion products and the consequent structure collapse caused by steam pressure		
RISK - DANGER		
- Boiler explosion		
SOLUTION - PREVENTION		
- It's necessary to verify the correct functioning of the safety level switch. - Verify if boiler and supply water conductivity values match those provided in the technical manual (EN 12953-10) - It is necessary to check that feed pump is working properly (pump wear, hydrostatic suction, water-feed temperature, connection/disconnection resulting from pump control sensors level) - N.B: These activities must be ensured by the user		

EVENT CAUSE 4	OVERHEATING DUE TO DEPOSIT FORMATION	Event Severity: B
- Excessive limescale in water may form deposits on combustion gas products pass-through membranes		
EFFECT - CONSEQUENCE		
- Calcareous deposit within combustion gas products a pass-through membranes prevents water from removing heat properly, which can lead to overheating of the same		
RISK - DANGER		
- Material collapse with possible boiler body explosion. Local fractures with steam leakage; possible frame rupture, frames with cracks could lead to possible boiler explosion		
SOLUTION - PREVENTION		
- Analyse boiler and supply water with the frequency given in the manual, making sure the values are within standard limits (EN 12953-10)		

EVENT CAUSE 5	WATER LEVEL TURBULENCE	Event Severity: C
- Water level turbulence due to incorrect supply water conditioning and lack of operating water control		
EFFECT - CONSEQUENCE		
- Incorrect water level measurement		
RISK - DANGER		
- Generator explosion due to low water level		
SOLUTION - PREVENTION		
- Make sure that boiler supply and operating water characteristics match those required by the Technical Manual and reported by (EN 12953-10)		

EVENT CAUSE 6	WATER CONDUCTIVITY	Event Severity: B
- Water conductivity values are not within the allowed range		
EFFECT - CONSEQUENCE		
- The level gauge does not detect water		
RISK - DANGER		
- Stop the burner because the level gauge switches to safety conditions associated to water absence		
SOLUTION - PREVENTION		
- Make sure that boiler supply and operating water characteristics match those required by the Technical Manual and reported by (EN 12953-10)		

EVENT CAUSE 7	SUDS	Event Severity: B
- Suds present in the water		
EFFECT - CONSEQUENCE		
- False water detection		
RISK - DANGER		
- Generator explosion due to low water level		
SOLUTION - PREVENTION		
- Make sure that boiler supply and operating water characteristics match those required by the Technical Manual and reported by (EN 12953-10)		

EVENT CAUSE 8	CAUSTIC FRAGILITY	Event Severity: B
- Excessive concentration of sodium hydrate present in the water		
EFFECT - CONSEQUENCE		
- Production of inter granular cracks in the metal		
RISK - DANGER		
- Boiler breakage due to fragility and possible boiler explosion		
SOLUTION - PREVENTION		
- Perform water analysis according to the frequency specified in the user manual - Carry out water treatments to bring the characteristic values within the limits shown in the user manual (EN 12953-10) - Purge the water by operating the exhaust valves fitted on the bottom of the boiler		

EVENT CAUSE 9	ACIDIC CORROSION	Event Severity: B
- Low water pH (acidic water)		
EFFECT - CONSEQUENCE		
- Internal part corrosion and consequent framework thinning		
RISK - DANGER		
- Boiler explosion danger (boiler static calculations inappropriate)		
SOLUTION - PREVENTION		
- Perform water analysis according to the frequency specified in the user manual - Carry out water treatments to bring the characteristic values within the limits shown in the user manual (EN 12953-10)		

EVENT CAUSE 10	CORROSION CAUSED BY OXYGEN	Event Severity: B
- High concentration of oxygen dissolved in water		
EFFECT - CONSEQUENCE		
- Internal part corrosion and consequent framework thinning		
RISK - DANGER		
- Boiler explosion danger (boiler static calculations inappropriate)		
SOLUTION - PREVENTION		
- Perform water analysis according to the frequency specified in the user manual - Carry out water treatments to bring the characteristic values within the limits shown in the user manual (EN 12953-10) - Keep water temperature above 60 °C to facilitate the deoxygenation		

EVENT CAUSE 11	SLUDGE PRESENCE	Event Severity: B
- Sludge accumulation in the lower part of the cylindrical shell		
EFFECT - CONSEQUENCE		
- Corrosion of relative frame section		
RISK - DANGER		
- reduction in the thickness of the relative frame with consequent danger of explosion		
SOLUTION - PREVENTION		
- Perform water analysis according to the frequency specified in the user manual - carry out water treatments to bring the characteristic values within the limits shown in the user manual (EN 12953-10) - purge the water by operating the exhaust valves fitted on the bottom of the boiler		

EVENT CAUSE 12	EXTERNAL LOADS	Event Severity: B
- External loads acting on boiler body connections represented by weight and thermal expansion of the pipes		
EFFECT - CONSEQUENCE		
- Connection welding rupture		
RISK - DANGER		
- Generator body explosion and/or rupture of shut-off devices		
SOLUTION - PREVENTION		
- It is important to avoid using boiler body connections as pipe weight support points - Provide expansion joints and appropriate support of the pipes that connect the boiler to the system		

EVENT CAUSE 13	STRAY CURRENTS	Event Severity: B
- Corrosion phenomena due to stray currents		
EFFECT - CONSEQUENCE		
- Internal part corrosion and consequent framework thinning		
RISK - DANGER		
- Boiler body explosion danger (inappropriate boiler static calculations)		
SOLUTION - PREVENTION		
- Make sure no stray currents exist through the generator unit - Make sure the generator unit is properly grounded - Check the electrical system of the boiler		

EVENT CAUSE 14	ACCIDENTAL OPENING OF MAN, HEAD OR HAND ACCESS HOLE, IF ANY	Event Severity: C
- Manhole accidental opening		
EFFECT - CONSEQUENCE		
- Seal coming out of its seat		
RISK - DANGER		
- Danger of steam leaks with consequent burn and/or violent door projection toward the operator		
SOLUTION - PREVENTION		
- Before opening the manhole verify on the pressure gauge that boiler body pressure is equal to atmospheric pressure (0 bar)		

EVENT CAUSE 15	ACCIDENTAL DOOR OPENING	Event Severity: D
- Accidental door opening with the burner operating or in stand-by		
EFFECT - CONSEQUENCE		
- Combustion product leakage toward the operator		
RISK - DANGER		
- Burn		
SOLUTION - PREVENTION		
- Before opening the door make sure that the system is turned off, namely the pressure is null and in terms of temperature, the boiler is completely cooled (see event n. 16)		

EVENT CAUSE 16	HOT COMPONENTS	Event Severity: C
- Accidental contact with hot generator components, operational or stopped for a short while (specially the valves, door, tubular plates)		
EFFECT - CONSEQUENCE		
- Hand or other body part burns, parts exposed to heat		
RISK - DANGER		
- Burns		
SOLUTION - PREVENTION		
- Insulate the parts that can come into contact with the user under normal use and maintenance conditions using appropriate materials (insulating refractory materials) - Avoid contact with uninsulated generator parts during its operation. If the need to carry out adjustment or control manoeuvres during operation arise, protect yourself with appropriate clothing (gloves, shoes, and thermal suit) - Protect yourself with appropriate clothing (equipment I.P.D.-individual protection devices according to current legislation) - System / boiler parts subject to this potential danger must be appropriately signalled by tags.		

EVENT CAUSE 17	SHOCK AND ACCIDENTAL FALLS	Event Severity: B
- Accidental fall from the plane of the upper walkway of the generator		
EFFECT - CONSEQUENCE		
- Impact to the ground by dangerous height or accidental impact against the generator body during installation and / or maintenance		
RISK - DANGER		
- Fractures and/or bruises		
SOLUTION - PREVENTION		
- Plan of upper walkway ashlar slip - Going up and down from the roof to perform ordinary and extraordinary maintenance using an appropriate scale and non-slip shoes. The floor of the upper walkway and the scale of ac-cess must be adapted to the current regulatory requirements in the country of installation. - Pay attention to sharp edges necessarily present in the generator and its accessories		

EVENT CAUSE 18	MINIMUM TEMPERATURE	Event Severity: B
- Body steam boiler subjected to low temperature during the operations of between-extruded and stop		
EFFECT - CONSEQUENCE		
- Risk of fragility of the material		
RISK - DANGER		
- Rupture due to embrittlement of the material with explosion hazard during normal operation		
SOLUTION - PREVENTION		
- Check that the temperature at which the body may be subject boiler complies with the minimum eligible project		

EVENT CAUSE 19	EARTHQUAKE	Event Severity: C
- Earthquake		
EFFECT - CONSEQUENCE		
- Generator body damage due to: - Boiler structural failure (materials falling on the generator and/or boiler support base deformation) - Damage resulting from the boiler's hydraulic and/or electrical connections		
RISK - DANGER		
- Pressurised component failure risk (explosion)		
SOLUTION - PREVENTION		
- The user must install the device according to the anti-seismic laws of the State, where it is installed		

EVENT CAUSE 20	WEATHER CONDITIONS	Event Severity: B
- Keeping the body generator in unsuitable weather conditions during transport and/or in the thermal power plant. These conditions apply to minimum temperature and effects produced by rainwater.		
EFFECT - CONSEQUENCE		
- If the minimum temperature is lower than the one indicated in the design, weld cracks may appear. - Rainwater can damage the boiler's electrical system and/or corrode from the outside the structure of the generator		
RISK - DANGER		
- Generator body explosion		
SOLUTION - PREVENTION		
- Protect the generator from adverse weather conditions.		

EVENT CAUSE 21	INSTALLATION AND START-UP	Event Severity: B
- Incorrect installation: - Hydraulic works, electrical works, smokestack - Shock and thermal expansion		
EFFECT - CONSEQUENCE		
- Hydraulic: steam leakage - Electrical: electrical leakage/boiler safety device failure - Smokestack: combustion products dispersed in the thermal power plant - Shock and thermal expansion: broken pressure and buckling in welded joints		
RISK - DANGER		
- Hydraulic: general burns - Electrical/instrumental: electrocution/explosion of generator - Intoxication by toxic combustion gas (carbon monoxide) in the thermal power plant - Boiler explosion		
SOLUTION - PREVENTION		
- Check that hydraulic connections are coupled correctly - Check the correct connection of the electrical parts - Perform proper smokestack connection - Check generator operation correct logic - The generator must be put into operation at reduced power (maximum 50%) until the water temperature of exercise in order to avoid thermal shock and thermal expansion between the various constituent parts of the body.		

EVENT CAUSE 22	LACK OF MAINTENANCE	Event Severity: B
- Maintenance is not performed as required by the Use and maintenance manual		
EFFECT - CONSEQUENCE		
- Generator body damage due to poor maintenance		
RISK - DANGER		
- Generator explosion		
SOLUTION - PREVENTION		
- Perform periodic preventative maintenance; for part repair or replacement please contact the manufacturer		

EVENT CAUSE 23	POOR STORAGE	Event Severity: B
- The generator body has not been maintained in optimum conditions during the shut-down		
EFFECT - CONSEQUENCE		
- Generator body damage due to corrosion induced by the oxygen contained in the water - Damage caused by adverse weather conditions		
RISK - DANGER		
Generator explosion		
SOLUTION - PREVENTION		
- Appliance conservation related to the water system must be carried out according to the Technical Manual (Wet conservation and dry conservation) - The generator body must be kept protected from adverse climatic conditions with regard to the minimum temperature (-10 ° C) and the effect of rain		

EVENT CAUSE 24	PRESSURISED BODY REPAIR	Event Severity: B
- Body repair (smoke pipe replacement/stubs/flange) was not correctly executed		
EFFECT - CONSEQUENCE		
- Pressurised body damage		
RISK - DANGER		
- Generator explosion		
SOLUTION - PREVENTION		
- Contact the manufacturer for repairs. Repairs must be carried out in compliance with the mandatory legislation in force in the state in which the generator is operating		

EVENT CAUSE 25	DOWNGRADING AND CHANGE OF USE	Event Severity: B
- Structural integrity compromised		
EFFECT - CONSEQUENCE		
- Compromised security and functionality of the generator during operation.		
RISK - DANGER		
- Explosion or malfunction of the generator		
SOLUTION - PREVENTION		
- Downgrading and/or change of use of the generator via the prior authorization by the competent authorities. - In case of accident due to incorrect disposal, the manufacturer does not respond.		

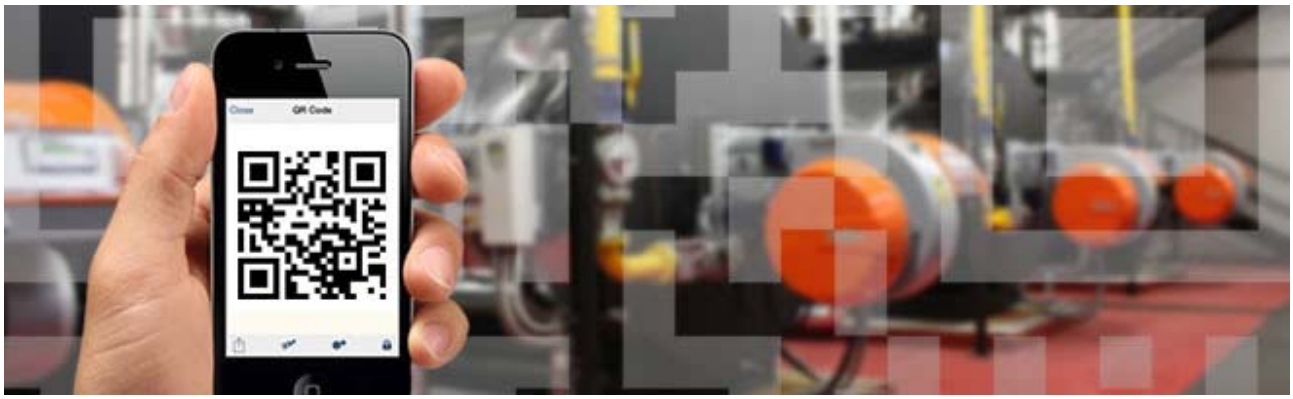
EVENT CAUSE 26	TRANSPORT	Event Severity: B
- Violent impact during lifting and transport due to lifting eyebolt removal or release or breakage of lifting device		
EFFECT - CONSEQUENCE		
- Violent impact with the ground - Boiler break		
RISK - DANGER		
- Immediate crushing danger for underlying persons or things - Danger due to any boiler or accessory fractures or faults		
SOLUTION - PREVENTION		
- Lifting eyebolt calculation - Always stay at least 5 meters away from the boiler's projection on the ground during movement - Visually check generator integrity in all its parts - Re-run the hydraulic test - Perform the movement as indicated in the manual		

EVENT CAUSE 27	FIRE	Event Severity: B
- Fire in the boiler room		
EFFECT - CONSEQUENCE		
- Damage to the boiler body		
RISK - DANGER		
- Explosion of the generator due to body damage		
SOLUTION - PREVENTION		
- Compliance with fire regulations in the country of installation - If a fire occurred, it is recommended that you contact the manufacturer to proceed with all possible checks able to assess the generator's body integrity.		

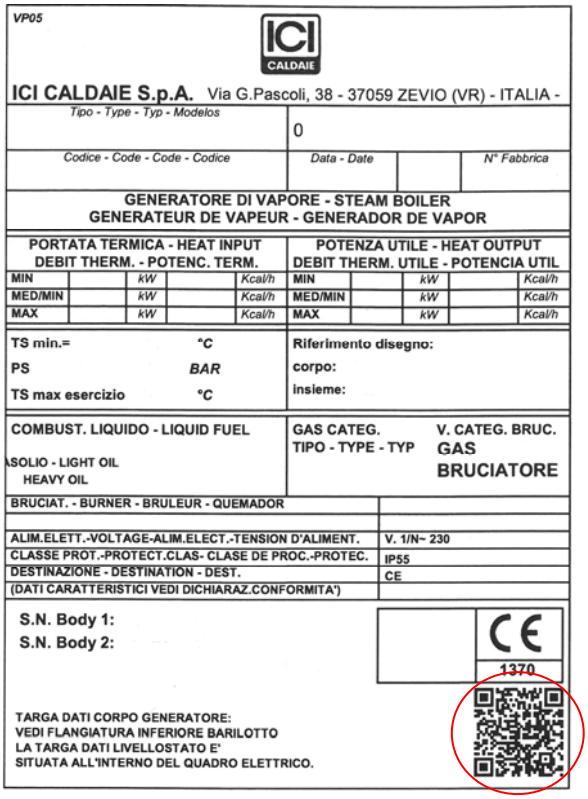
EVENT CAUSE 28	DISPOSAL	Event Severity: D
- Structural integrity compromised		
EFFECT - CONSEQUENCE		
- Compromised safety and functionality of the generator during operation		
RISK - DANGER		
Explosion or malfunction of the generator		
SOLUTION - PREVENTION		
- Disposal generator with pre-authorized by a competent Authority		

14 QR CODE

HOW TO REGISTER YOUR BOILER



The boiler registration must be completed once the product is installed, either before or after the commissioning.


VP05

ICI CALDAIE

ICI CALDAIE S.p.A. Via G.Pascoli, 38 - 37059 ZEVIO (VR) - ITALIA -

Tipo - Type - Typ - Modelos	0		
Codice - Code - Code - Codice	Data - Date		N° Fabbrica

GENERATORE DI VAPORE - STEAM BOILER
GENERATEUR DE VAPEUR - GENERADOR DE VAPOR

PORTATA TERMICA - HEAT INPUT DEBIT THERM. - POTENC. TERM.					POTENZA UTILE - HEAT OUTPUT DEBIT THERM. UTILE - POTENCIA UTIL				
MIN		kW		Kcal/h	MIN		kW		Kcal/h
MED/MIN		kW		Kcal/h	MED/MIN		kW		Kcal/h
MAX		kW		Kcal/h	MAX		kW		Kcal/h

TS min.=	°C	Riferimento disegno:	
PS	BAR	corpo:	
TS max esercizio	°C	insieme:	

COMBUST. LIQUIDO - LIQUID FUEL	GAS CATEG. TIPO - TYPE - TYP	V. CATEG. BRUC. GAS BRUCIATORE
SOLIO - LIGHT OIL HEAVY OIL		

BRUCIAT. - BURNER - BRULEUR - QUEMADOR	
ALIM.ELETT.-VOLTAGE-ALIM.ELECT.-TENSION D'ALIMENT.	V. 1/N~ 230
CLASSE PROT.-PROTECT.CLAS- CLASE DE PROC.-PROTEC.	IP55
DESTINAZIONE - DESTINATION - DEST.	CE
(DATI CARATTERISTICI VEDI DICHIARAZ.CONFORMITA')	

S.N. Body 1:
S.N. Body 2:

CE
1370

TARGA DATI CORPO GENERATORE:
VEDI FLANGIATURA INFERIORE BARILOTTO
LA TARGA DATI LIVELLOSTATO E'
SITUATA ALL'INTERNO DEL QUADRO ELETTRICO.

The steps are as follows:

1) You only need a smartphone (iPhone, Samsung Galaxy, Htc, Blackberry etc.) or a tablet.

2) Download and install a “QR Reader” application on your device (a common free application will be sufficient). Open the program and point the camera on the QR code located on the label of the boiler (red circle in the picture).

3) You will be redirected on a web page where you can register the boiler and the plant data, filling the blank spaces.

Once completed the registration, it will be necessary to authenticate your email address following the link sent on your mail box.

You will receive a further email with username and password in order to have access to all the services that ICI has developed for those who register their boiler with the QR code.

The registration entitles you, also in the future, to enjoy promotions and specified services for the registered boiler (for example: discount for spare parts, free ordinary maintenance for some types of products etc.).

info at assistenza@icicaldaie.com

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