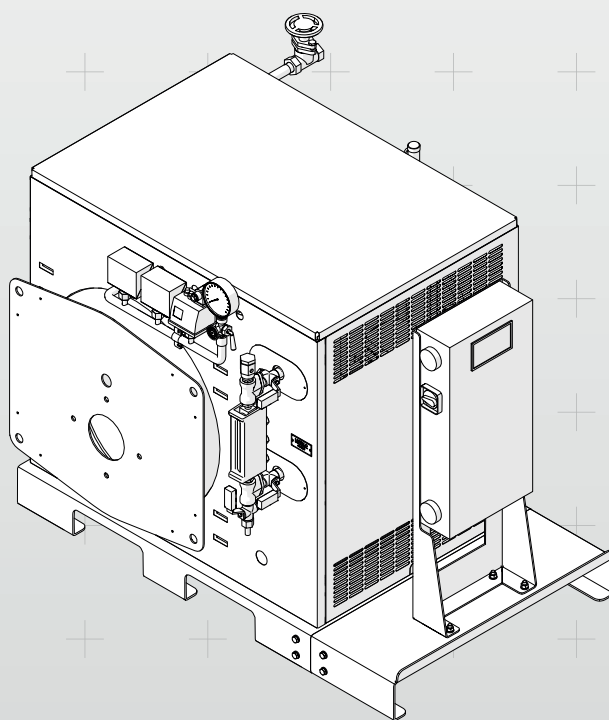




EN

Instantaneous fire tube steam boiler

FX N / FX DUAL N



INSTALLATION, USE AND MAINTENANCE MANUAL



FX_N_FX_DUAL_N_en_08 - 04/2020

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SYMBOLS USED IN THE MANUAL



DANGER

To indicate actions that, if not performed correctly, can result in injury of generic origin or may generate malfunction or damage to the appliance; therefore require particular caution and adequate preparation.



IT IS FORBIDDEN

To indicate operations that SHOULD NOT be performed.



IMPORTANT

To indicate particularly useful information and important.

The illustrations and data presented are not binding. The company reserves the right to make without prior notice any changes it deems appropriate for continuous improvement and constant updating.

1 *General information*

INTRODUCTION

Dear Customer,

Thank you for having chosen an appliance of the series **FX N**, a high quality and efficiency product, reliable and safe.

We recommend entrusting its maintenance to **Professionally Qualified Personnel** who, when necessary, uses original spare parts.

This manual contains important information and suggestions that must be observed for easier installation and best possible use of the appliance.



IMPORTANT

Failure to observe the instructions in this manual will void the warranty conditions.

RANGE

MODEL	CODE
FX 50 N	86014065
FX 100 N	86014115
FX 150 N	86014165
FX 100 DUAL N (FX50 N + FX50 N)	86014113
FX 200 DUAL N (FX100 N + FX100 N)	86014215
FX 300 DUAL N (FX150 N + FX150 N)	86014315

COMPLIANCE

The steam generators Series **FX N** comply with the following European Directives:

- Directive 2014/68/EU (PED)
- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility Directive 2014/30/EU
- UNITS 11325-3



NOTE

The serial number is indicated on the boiler nameplate.

WARNINGS



IMPORTANT

- The instructions manual is an integral and essential part of the product. If the body is sold or transferred to a new owner or if you relocate and leave the system, always make sure that the manual accompanies the boiler body, so that it can be consulted by the new owner and/or by the installer. In case of damage or loss, request a copy from Technical Assistance Service **ICI CALDAIE S.p.A.**. This body must be intended for the use it was expressly designed for. The manufacturer will be exempted from any liability, contractual and extra-contractual, for any injury/damage caused to people, animals, or property due to the failure to perform maintenance and/or scheduled periodic checks and improper uses.
- Upon receipt of the generator, make sure that the supply is intact and undamaged and promptly contact **ICI CALDAIE S.p.A.** if it does not correspond to the order
- The installation of **FX N** generator must be performed by a Certified Company which, at the end of the operation, must provide the owner with the declaration of conformity certifying that the installation has been correctly carried out, namely in compliance with the Standards and the national and local Laws in force, and with the indications included in the instruction manuals supplied by **ICI CALDAIE S.p.A.**
- If the appliance is not used for a long period, professionally qualified personnel must intervene to perform the operations described in the specific paragraph, necessary for storing the steam generator.
- The periodic check and maintenance of the appliance is a legislative obligation. The User must have it performed by professionally qualified personnel.
- Make sure the safety valves properly open at the design pressure.
- It is necessary to check the correct activation of the safety pressure switch that eliminates the cause of pressure increase by stopping the flow in the burner.
- Check the correct connection of the accessories to the boiler body (gasket seal check).
- Pay the due attention during handling and installation.
- Periodically check the condition of the same accessories (exclusion of fractures).
- Once installation is completed, check the intervention of the safety valve by carrying out a preventive hydraulic test (at the PT pressure indicated on the ID plate).
- Make sure the safety level switch is working properly, in accordance with the contents of the technical manual supplied with the boiler.
- It is necessary to check that the operating water conductivity values are within those provided in the supplied technical manual.
- Make sure the water loading pump is working properly as described in the technical manual provided with the boiler (pump wear, hydrostatic head in suction, water supply temperature, pump connection/disconnection from the level control probes).
- Analyse the water when necessary, ascertaining that the values are within the limits expressed in this technical manual and carry out the due chemical treatments. Check the intervention of the safety probes by lowering the level below the minimum required.
- Manually check that the level switch is working properly every 6 hours.
- Do not step on or damage the protective sheath of the cable with any other mean.
- It is not necessary to consider the boiler connections as support points for the weight of the pipes.
- It is good practice to provide expansion joints and appropriate supports for the pipes connecting the boiler to the system
- Check that the panel power supply complies with the wiring diagram supplied.
- Make sure the generator is properly earthed.
- Check the plant's electrical system.
- Before opening the inspection outlets, it is necessary to check that the pressure in the boiler body is equal to the atmospheric one (0 relative bar).
- Before opening the door, check that the burner is off and disconnected.
- Switch off the burner and the pump before closing the shut-off valve.
- Avoid contact with the non-insulated parts of the equipment during its operation. When adjustments or checks are carried out during operation, it is necessary to protect oneself with suitable clothing (P.P.E. according to Italian Legislative Decree 81/08).



IMPORTANT

- Pay attention to sharp edges on the generator and its accessories.
- The boiler must be kept sheltered from adverse weather conditions, with regard to the minimum temperature (-10 °C) and from the rain.
- The user is responsible for considering the seismic degree of the user area in the design of the heating plant.
- After an earthquake, have technical personnel assess any damage by carrying out NDCs (non-destructive checks), if necessary.
- The manufacturer shall not be held liable in the event of accidents caused by incorrect decommissioning.
- The personnel in charge must be able to prove to have sufficient knowledge and experience relating to the safety and control / regulation accessories supplied with the generator and good familiarity with the instructions contained in the use and maintenance manual and be capable and physically suitable.
- During handling, always maintain a distance of at least 5 m from the projection of the appliance to the ground
- In case of violent impact during handling, visually check the integrity of the appliance, all over; run the hydraulic test again.
- **The generators are sized only for loads due to pressure, temperature and contained fluid.**

PROHIBITIONS



IT IS FORBIDDEN

- Operate electrical devices or appliances such as switches, household appliances, etc. if you smell fuel or unburnt materials. In this case:
 - ventilate the room by opening doors and windows
 - close the fuel shut-off device
- Perform any technical or cleaning intervention before disconnecting the appliance from the electrical power supply and wearing the Personal Protective Equipment (P.P.E. according to Italian Legislative Decree 81/08).
- Modifying safety or adjustment devices without the boiler manufacturer's authorisation and indications.
- Plug or dimensionally reduce the ventilation openings of the installation room. The ventilation openings are essential for proper combustion.
- Perform any welding/repairs. If necessary, contact the manufacturer/verifying party for operation (in Italy according to MD 329/04).
- Expose the generator to atmospheric agents.
- Leave flammable substances and containers in the room where the appliance is installed.
- Disperse the packaging material in the environment and leave it within the reach of children as it may be a potential source of danger. It must be disposed of in accordance with the legislation in force.

HAZARDS



DANGER

- Dangers due to **water leaks**. Disconnect the boiler from the electrical power supply, close the water supply and promptly contact the Technical Assistance Service Authorised **ICI CALDAIE S.p.A.** or professionally qualified personnel.
- **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.



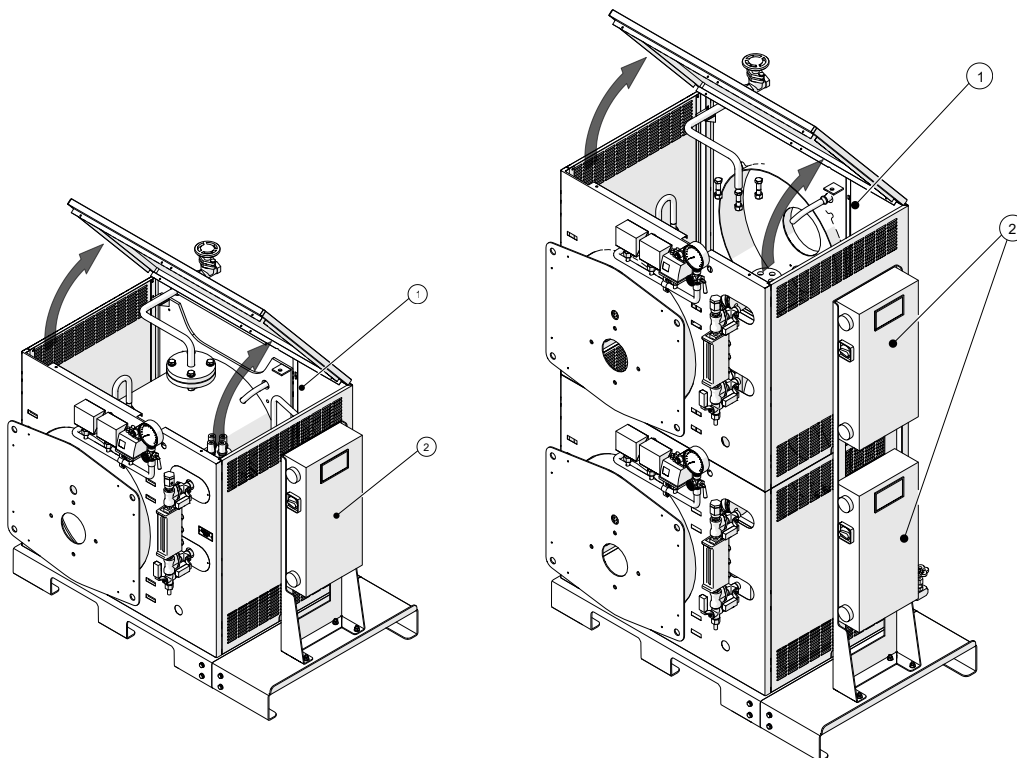
DANGER

- **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.

IDENTIFICATION

Each generator **FX N** is identified by the following nameplates:

- **Boiler body nameplate (1):** this plate carries the boiler body main data and is riveted on a special support.
- **Assembly nameplate (2):** this plate carries the data relating to the boiler complete with the accessories, which may vary from those of the boiler body only.



The appliance is also accompanied by **construction certificate** attesting the successful result of the hydraulic test.



IMPORTANT

The installation must be carried out in compliance with the local applicable regulations by **professionally qualified personnel**, ie personnel having specific technical skills in the steam production system component sector. An incorrect installation can harm people or damage property for which the manufacturer cannot be liable.

During **commissioning** check the effectiveness of all adjustment and control devices in the control panel.

The **warranty** validity is subject to compliance with the instructions in this manual.

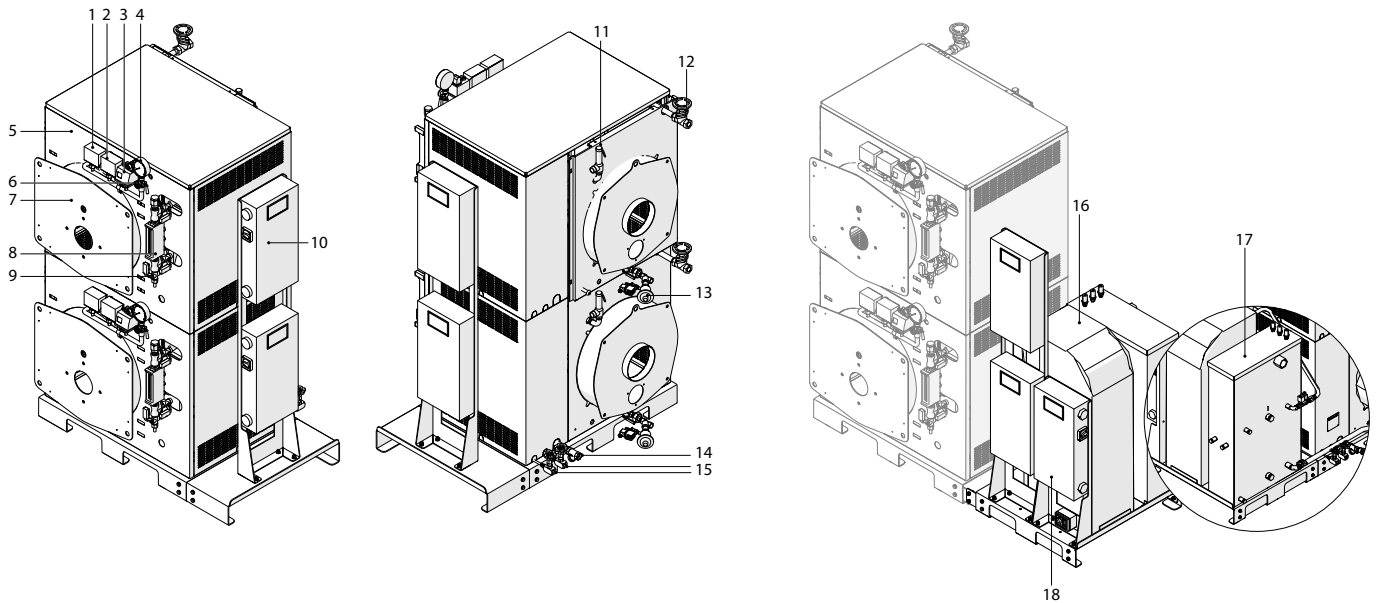
APPLIANCE DESCRIPTION

FXN steam generating systems are medium-pressure type, 5 bar, with reverse flame in the furnace and fire tubes. The generator is supplied in monobloc design and can be matched to two-stage burners running on liquid and gaseous fuels. Thanks to the low water content, operating capacity is reached very quickly and ensures high efficiency, even with intermittent operation.

Each unit features its specific electric panel, which ensures a fully automatic and safe operation thanks to its two minimum water level devices independent from the adjustment system and a steam pressure control logic.

Hydraulic and electronic connections of all devices are already made, and this helps boiler generator and start-up. The most critical generator parts and its accessories can be inspected for cleaning and maintenance purposes.

STRUCTURE

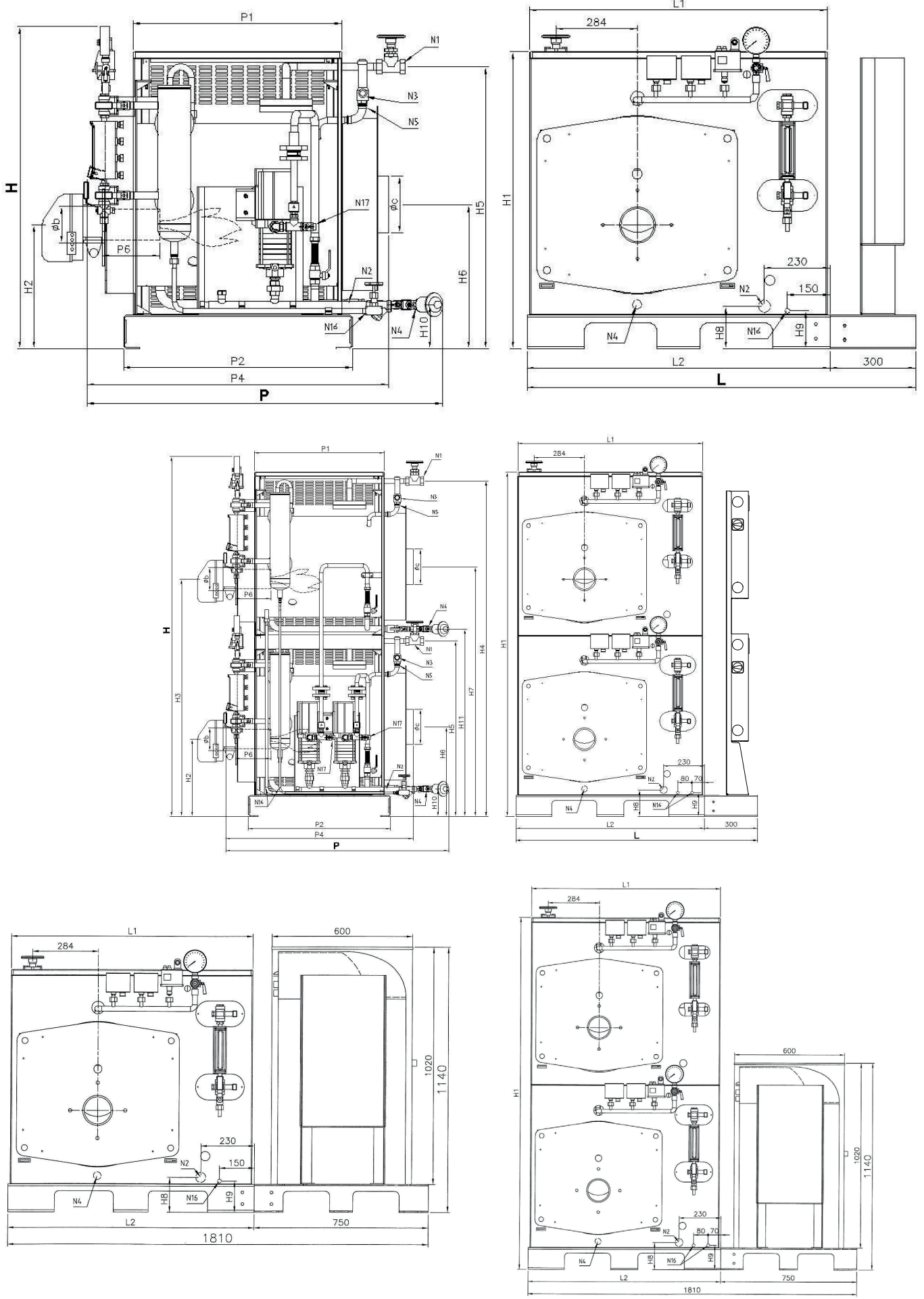


- 1 *Minimum pressure switch*
- 2 *Maximum pressure switch*
- 3 *Pressure transducer*
- 4 *Pressure gauge*
- 5 *Generator body*
- 6 *Pressure gauge valve*
- 7 *Door*
- 8 *Level indicator*
- 9 *Level drain tap*
- 10 *Electrical panel*
- 11 *Safety valve*
- 12 *Steam outlet valve*
- 13 *Sludge drain unit*
- 14 *Water inlet filter*
- 15 *Cylinder drain valve*

BASE KIT OPTION

- 16 *Softener*
- 17 *Feed water tank*
- 18 *Softener control panel*

DIMENSIONS AND CONNECTIONS



Dimensions

Description	u.m.	FX N					
		50 N	100 N	150 N	100 DUAL N	200 DUAL N	300 DUAL N
H	mm	1130	1130	1130	FX50 N + FX50 N	FX100 N + FX100 N	FX150 N + FX150 N
H1	mm	1040	1040	1040			
H2	mm	435	435	435			
H5	mm	990	990	990			
H6	mm	505	505	505			
H8	mm	150	150	150			
H9	mm	135	135	135			
H10	mm	155	155	155			
L	mm	1360	1360	1360			
L1	mm	1040	1040	1040			
L2	mm	1060	1060	1060			
P	mm	1280	1280	1280			
P1	mm	730	730	730			
P2	mm	800	800	800			
P4	mm	1055	1055	1055			
P6	mm	150-200	150-200	150-200			
Øb	mm	130	130	130			
Øc	mm	200	200	200			

Attachments

Description	u.m.	FX N					
		50 N	100 N	150 N	100 DUAL N	200 DUAL N	300 DUAL N
N1	DN/in	3/4"	3/4"	3/4"	FX50 N + FX50 N	FX100 N + FX100 N	FX150 N + FX150 N
N2	DN/in	3/4"	3/4"	3/4"			
N3	DN/in	1"	1"	1"			
N4	DN/in	1/2"	1/2"	1/2"			
N5	DN/in	1/2"	1/2"	1/2"			
N16	in	3/8"	3/8"	3/8"			

^[1] Tb=Turbulators size and quantity.

TECHNICAL DATA

DESCRIPTION	u.m.	FX N								
		50 N	100 N	150 N	100 DUAL N	200 DUAL N	300 DUAL N			
Effective rated ^[1]	kW	31,7	70,5	104,6	FX50 N + FX50 N	FX100 N + FX100 N	FX150 N + FX150 N			
Thermal capacity	kW	34,8	77,4	115						
Efficiency at 100% (ref. P.C.I.) ^[1]	%	91,09	91,04	90,96						
Pressure drops on exhaust side	mbar	0,4	1,5	3,2						
Rated pressure	bar	5	5	5						
Total capacity	l	59	59	59						
Capacity at level	l	50	50	50						
Steam production ^[1]	kg/h	50	100	150						
Rated frequency ~ voltage	Volt ~ Hz	1/N~ 230	1/N~ 230	1/N~ 230						
Electric protection rating	IP	IP55	IP55	IP55						
Absorbed electrical power ^[2]	W	2000	2000	2000						
Allowed fuels		Methane - LPG - Light oil								
Total weight	kg	430	430	430						

^[1] Water delivery **80°C**.

^[2] Electric powers only for gas or diesel fuels.

Design data

Maximum/minimum temperature

-10°C / 158,9 °C

CONTROL PANEL

The FX N steam generator is equipped with a control panel for managing and controlling the appliance. The type of panel is established according to the steam generator configuration. For more details refer to the layout and wiring diagram provided with the installed panel. The following figure shows, by way of example, two of the usable panels.

Front of message display (alarms)



- 1 Alarm output connected - Buzzer on electric panel enabled
- 2 Alarm indicator
- 3 Indication of several alarms - There is more than one alarm
- 4 Alarm/s indicator - Alarm indicator box, see the type below, if there are several alarms the display will display them alternately every 4 seconds
- 5 Alarm silencing key - Press to mute the buzzer, when a new alarm appears it will switch back on automatically
- 6 Key to reset the alarms in the memory - If signal 2 is not on and the display is flashing, alarm/s in the memory but not present, the button can be used to clear it/them.

Alarm indications

- A.01 = Minimum Level Alarm 1
- A.02 = Minimum Level Alarm 2
- A.03 = High Pressure Alarm
- A.04 = No water inside VRC
- A.05 = Burner shut off alarm

PAPERWORK

These generators, supplied in single-block, are CE marked according to the Directive 2014/68/EU "PED".

The documentation supplied with the generator is:

- declaration of conformity of the whole
- use and maintenance manual (always housed in the electrical panel)
- safety valve certificate, declaration of conformity, use and maintenance manual
- feed pump characteristic curve
- Machinery Directive 2006/42/EC (for liquid fuel burners)
- wiring diagram (always housed in the electrical panel).



USER OBLIGATIONS

Check which pressure equipment commissioning and use regulations are in force in the country of use.

Range FX N under art. 2 of Ministerial Decree no. 329 of 1/12/04 is exempted from the commissioning application.

FIRE PREVENTION

Refer to the Regulations in force in the Unit Installation Country.

COMPONENTS

The **FX N** steam generators are equipped with a set of components that can be divided into:

- Safety components (safety valves, safety level switches, safety pressure switch).
- Indicator components (level indicator, pressure gauge, flame warning light).
- Adjustment components (level regulators, pressure switches, pressure transmitters).
- Supply components (centrifugal pump).
- Operating components (shut-off valves, drain valve).

In the following descriptions, the accessories are divided according to the physical quantity they control (pressure and level).

PRESSURE

PRESSURE GAUGE

The pressure gauge is of Bourdon type and it consists of a very flat arch-shaped elliptical metal tube and shows the design pressure on the graduated scale (marked in red). One of the ends is open and it communicated with the inside of the generator whose pressures is to be measured; the other end, closed and free to move, is connected to the index by a toothed sector lever system. The design pressure is indicated in red on the manometer.

The pressure gauge is mounted on a three-way valve that allows performing the following operations:

- Communication between generator and pressure gauge (normal operating position).
- Communication between pressure gauge and the outside (position needed to purge the siphon).
- Communication between generator, pressure gauge and sample pressure gauge (position needed for pressure gauge comparison).

SAFETY VALVES

The safety valves are able to maintain the pressure in the generator to the design pressure (save temporary peaks of 10% max of the max PS of the whole) even if all other pressure control devices (pressure switches and transmitters) are out of use.

These valves are regulated by specific national and international standards, therefore they are sized, tested, installed and maintained in compliance with the applicable regulations and the contents of this manual.

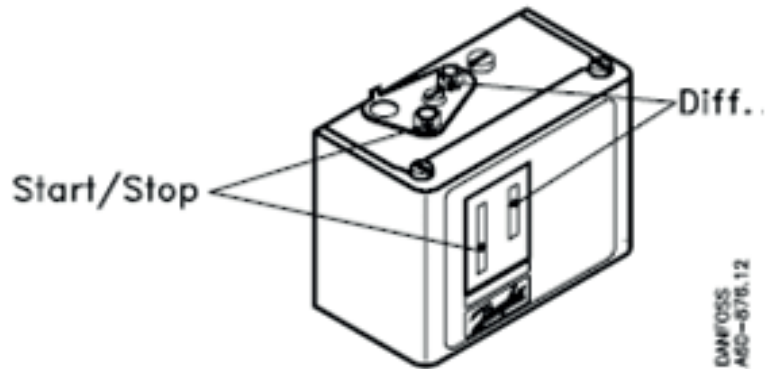
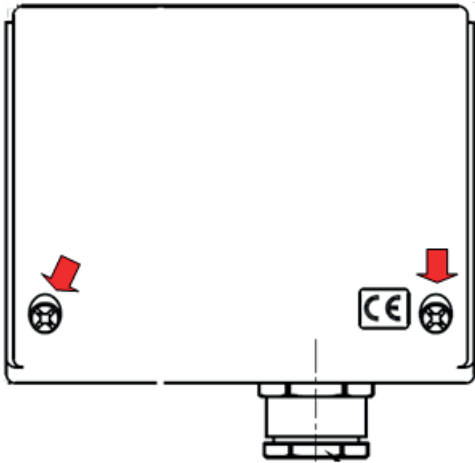
The **use and maintenance manual** is supplied with the safety valves.

OPERATING PRESSURE SWITCH

The pressure switch allows adjusting generator pressure and keeping it close to the required value.

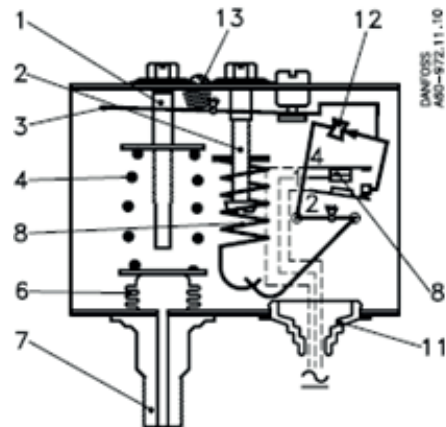
For calibration, loosen the protection screws (fig. on the left) and remove the cover to reach the pressure switch.

Trigger pressure and differential pressure can be set using the top screws (fig. on the right) and can be displayed on the two graduated scales.



KEY

- 1 Adjuster screw
- 2 Differential adjuster screw
- 3 Main arm
- 4 Main spring
- 5 Differential spring
- 6 Bellows
- 7 Connector
- 8 Contact system
- 9 Contact terminals
- 10 Ground terminal
- 11 Cable grommet
- 12 Inverter
- 13 Locking plate



SAFETY PRESSURE SWITCH

The safety pressure switch is triggered in case of operating pressure switch fault and permanently stops the burner.

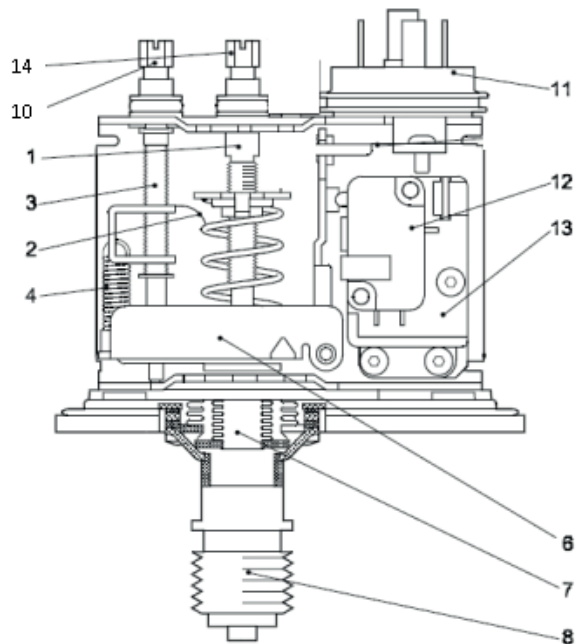
The pressure switch is equipped with a single-pole switch, of which the position of the contact depends on the pressure on the relevant connection and on the value set.

The safety pressure switch is set at a pressure higher than the operating pressure switch setting, but always lower than safety valve opening value.



KEY

- 1 Main shaft
- 2 Main spring
- 3 Differential shaft
- 4 Differential spring
- 5 Activation lever
- 6 Bellows
- 7 Pressure connection
- 8 Differential knob
- 9 DIN plug
- 10 Micro-switch
- 11 Micro-switch bracket
- 12 Adjustment knob



SAFETY VALVE

It releases the steam when generator maximum design pressure is reached.

The valve used on boilers is of the spring-type.

The operator must pay the utmost attention to the safety valve, careful and accurate maintenance is important. The safety valve is the most important and delicate accessory of the generator, and ensures that the pressure in the generator never exceeds the design pressure.

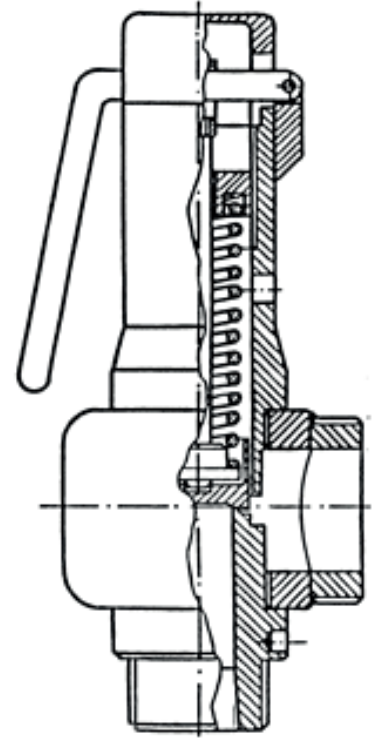
As the safety valve never trips during boiler normal operation, it is good practice to make sure it is not jammed, i.e. that the shutter is not stuck to its seat, by working the side lever (spring valve) or the horizontal lever that is holding the load (load valve and lever) until steam starts to come out.

ATTENTION

Upon first start-up, check that safety valve is calibrated at generator design pressure. The spring-type safety valve is usually supplied already calibrated. The drain of the safety valve installed on generators must be conveyed outside the room. When preparing the drain pipes, specific recommendations should be considered; a few examples are listed below.

- We recommend preparing the drain pipes using pipes having a diameter at least equal to safety valve output flange diameter.
- Drain pipe curves shall have a wide radius.
- All drain pipes must be laid out so as to avoid any condensate build-up. This means that they must be suitably slanted to ensure full drainage.

Special care should be taken when grinding the shutter and the seat; should this be necessary because of leakage or sweating, make sure to use silicon carbide or carborundum based abrasive agents and oil. It is recommended to carry out a first grinding pass using a fine-grained abrasive agent and then a second pass using a very fine-grained abrasive agent.



LEVEL

LEVEL INDICATOR

The level indicator includes a set of two taps connected to a reflex box that contains a prismatic glass. This equipment is connected to the boiler above and below normal water level, while at its lower end it features a blowdown tap used to discharge the sludge and keep the glass clean. The efficiency of the level control system can be periodically inspected using these taps as follows:

Open the blowdown valve for a few seconds and then close it. If no water is there and it then goes quickly back to the previous point with wide oscillations, you can consider the level to work fine. While if water comes again slowly or stops at a different point than before, it means that one of the communications is obstructed. To check which one of the two is obstructed and try to blow it down, close the steam valve and leave the water one open, then open again the blowdown valve: water should drain out of it together with any sludge built up in the pipes. Close the water valve and open the steam one: steam should come out of the blowdown. Close the blowdown valve and leave the water and steam ones open: water should go back to the starting point. If that is not so, clean the pipes connecting the level indicator to the generator. During commissioning, make sure that the vent and drain are closed. During operation, shut-off valves must be fully open.

To reduce the possibility of leakage, the indicators must be periodically insulated to make sure that the tightening torque of the nuts and bolts is at least 30 Nm.

Do not proceed with maintenance without having firstly checked that:

- pressure in the generator is not equal to the atmospheric pressure.
- The indicator temperature is equal to the environment temperature.

Maintenance must be carried out when:

- The sight glass clearness partially deteriorates, it is partially matt, marks of internal roughness due to erosion or corrosion, entailing loss of proper geometry and difficult reading.
- There are leaks, even slight, through the seals or shut-off units

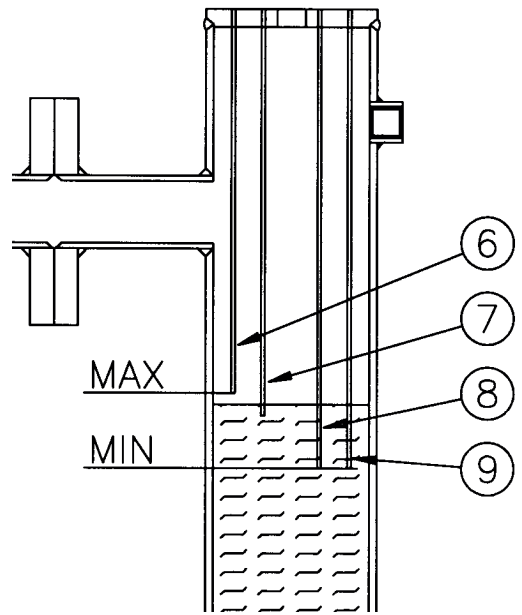
AUTOMATIC LEVEL REGULATOR

It is of the electric conductivity type, with electronic relays in the electric panel. Operation involves water pump start and stop and a low level safety device:

Probes in the cylinder:

- 6 Pump stop
- 7 Pump start-up
- 8 Burner shut off 1st safety device and alarm triggering
- 9 Burner shut off 2nd safety device and alarm triggering

NOTE: It is recommended to add to the alarm buzzer in the boiler room also an acoustic or visual warning in a usually manned place.



SAFETY LEVEL SWITCH

The safety level switch includes several parts (2 level rods, 2 probes, cylinder inside or outside the generator, electric cables, 2 electronic relays with conductivity trip point, electrical operation logic) suitable for preventing water level in boilers from getting too low as this could result in overheating of the parts in contact with combustion products.

The principle for measuring and controlling the level is based on water electric conductivity. To ensure level switch proper operation, the following conditions must be met:

- Water conductivity >250 uS/cm
- Boiler temperature <210°C
- Pressure <20 bar

(See par. "Operating water").

SUPPLY

Water is fed using a centrifugal pump. The pump should not be sucking against the inlet opening, but should rather be “under positive suction head”, i.e. under the pressure of a water column due to the difference in height between water level in the collection tank and the pump.

Consider a water head of at least 1 metre to ensure pump proper suction.

ATTENTION

– Avoid using water delivery at a temperature below 60°C because it would be rich in dissolved oxygen and cause corrosion.

Version with supply unit (optional)

The generator can be equipped with an assembly consisting of Softener and Condensate collection tank, which is located, together with the switchboard, onto a suitable base next to the boiler.

Softener

The softener is of the cabinet type with automatic regeneration control. The cylinder containing resin and brine tank are contained in a single appliance that also includes the mixing valve for residual hardness adjustment.

For more information on the softener, refer to the relevant manual supplied with the unit.

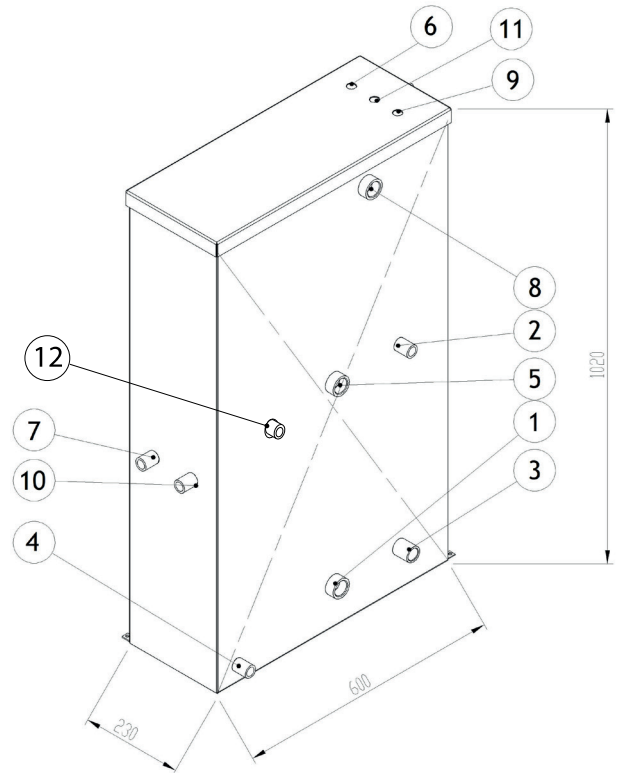
Feed water tank

The condensate collection tank is in stainless steel AISI 304L and includes:

- 3 level probes;
- regulation thermostat;
- thermometer;
- heating steam fitting complete with steam ejector;
- drain valve;
- overflow/bleed fitting;
- condensate return fitting.

Condensate collection tank fittings

- 1 1" Pre heating steam inlet (optional kit)
- 2 1/2" Water inlet
- 3 1" Pump flow
- 4 1/2" Drain
- 5 1" Condensate return
- 6 1/2" Minimum level probe
- 7 1/2" Thermometer
- 8 2" Overflow/bleed fitting
- 9 1/2" Maximum level probe
- 10 Thermostat (optional kit)
- 11 1/2" Loading start probe
- 12 High-temperature kit thermostat - 1/2"



2 Installation

INSTALLATION ROOM

Heating plant room

The user is responsible for ensuring that the heating plant room is designed in compliance with the prevailing rules on the matter in the country of use.

The user is responsible for ensuring that the heating plant room is designed in compliance with the prevailing rules on the matter in the country of use.

Positioning

Our generators must be positioned on a horizontal base that can bear the weight of the boiler when full of water, in case the hydraulic test is carried out on site.

Hydraulic connections

Once positioned, the steam generating systems must be connected to the system in the following points:

Water

From the condensate tank (10) (if present, otherwise purified water tank) to the supply pump suction (9).

Steam

From steam main outlet valve (3) to the users (distribution header or others), from the safety valve outlet (6) outside the room in safety position.

Drains

From the level indicator drain and cylinder (16) and from the boiler drain (17) to the drain line.

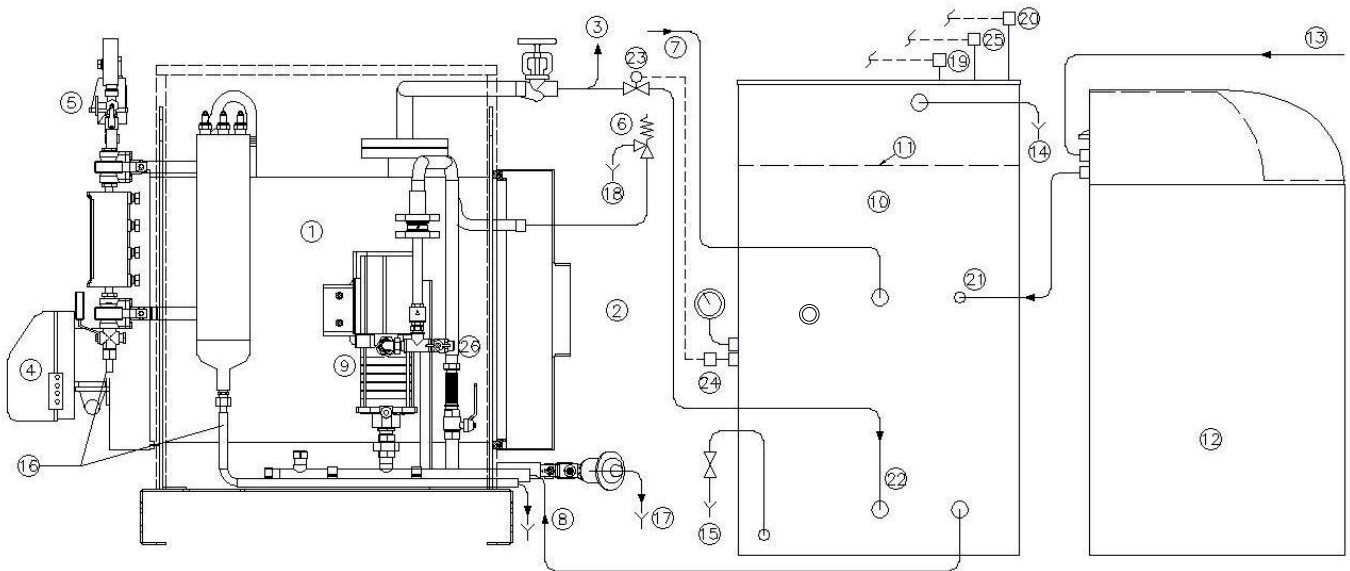
Fuel

Connection to burner preset for Light oil or methane gas/LPG.

Compressed air

The air pressure must be between 4 and 10 bar.

Important: the air must be filtered with a 25 µm mesh.



- | | | |
|---------------------|---------------------------------------|---|
| 1 Generator | 10 Condensate collection tank | 19 Maximum level probe |
| 2 Chimney | 11 Water level | 20 Minimum level probe |
| 3 Steam outlet | 12 Water softener | 21 Water inlet |
| 4 Burner | 13 Water mains | 22 Pre heating steam inlet (optional kit) |
| 5 Instruments | 14 Overflow/bleed fitting | 23 Solenoid valve (optional kit) |
| 6 Safety valve | 15 Condensate tank drain | 24 Thermostat (optional kit) |
| 7 Condensate return | 16 Level indicator drain and cylinder | 25 Loading start probe |
| 8 Supply | 17 Boiler drain | 26 Pump bleed valve |
| 9 Supply pump | 18 Safety valve drain | |

OPERATION WITH ONE MODULE ONLY

If only one of the two modules is permanently working, it is recommended to electrically and hydraulically shut off the module not working, by working the switches (disabling burner, pump and sludge drainage) on the panel and working the ball valves that shut off the pump and the corresponding steam outlet valve.

ELECTRIC CONNECTIONS

The generators come with electric panel (IP 55 protection class) fully assembled to the various boiler accessories.

Wiring diagram

See the diagram inside the electric panel.

CHIMNEY

Chimneys must be sized according to current standards in the country of use.

BOILER

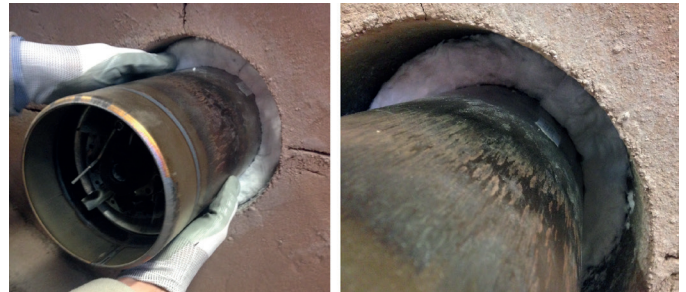
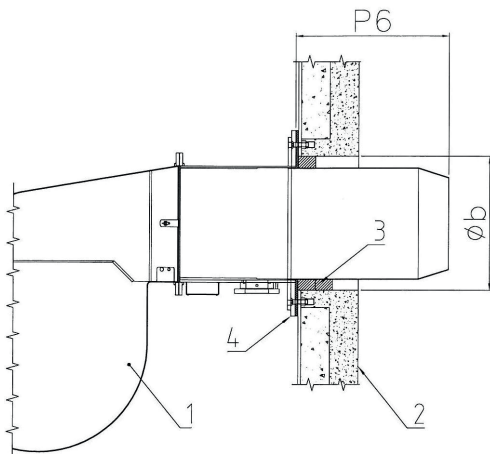
This generator has a low water content and can be used in those applications requiring a constant steam outlet. In order to better follow users' requests, recommended burner should be two-stage or modulating ; in order to avoid excessive level changes resulting from sudden outlets that would lead to boiler erratic operation.

Furthermore, especially when running on methane gas, there is a long combustion chamber "pre-flushing" with air every time the burner restarts and this cools down the small quantity of water in the boiler, thus causing a rapid pressure drop. This is why we recommend to reduce burner stops as much as possible using one of the above-specified types of burner.

MATCHING BOILER AND BURNER

Make sure that the gaps between nosepiece and door are duly filled with flame-proof ceramic insulating material.

The strip of ceramic insulating material supplied as standard with the boiler must be wrapped around the nosepiece for at least one full turn in order to protect burner flange from the flame. It is not necessary that the ceramic insulation material fills the gap up to the door insulation inner surface.



- 1 Burner
- 2 Door
- 3 Heat insulating material
- 4 Flange

See par. Technical Specifications for nosepiece length (P6), burner hole diameter (Øb) and pressure.

3 Use

COMMISSIONING

FIRST START-UP (Electromechanical panel)

Before start-up, open the door and insert the turbulators completely inside the front ends of the smoke pipes, taking care to push them inside by at least 100 mm.



The figure is indicative

- Check that all fittings are fully tightened.
- Make sure that the water delivery pipe is clean, by repeatedly flushing and draining it in the sewer before the final filling.
- Close drain valves, steam outlet and cylinder/level indicator drains.
- Open the level shut-off and feed valves (upstream and downstream the water pump).
- Make sure the door is properly closed.
- Start up the boiler as follows:
 - 1) Prime the pumps by connecting a pressurised water pipe to the boiler rear side, at the bottom;
 - 2) While checking the opening of the burner main switch, power on the boiler panel;
 - 3) Make sure that the electric pump drive shaft can turn smoothly and that direction of rotation is correct;
 - 4) Set pump switch to AUT position and make sure that burner start-up is not enabled before minimum level is reached;
 - 5) Check that pump stops when maximum level is reached, looking at the level indicators and checking the position of their taps;
 - 6) Press and hold the reset button of the water safety level for at least 10 seconds since the relay with conductivity trip point is of the delayed type;
 - 7) Open boiler drain and check level indicator to understand when pump start probe triggers (7 Fig. 8);
 - 8) Set pump switch to "0", leave drain open and check safety probe triggering level (8 and 9 Fig. 8) with reference to the minimum level plate;
 - 9) Close the drain, set pump switch to AUT position;
 - 10) Power on the burner and pressurise the boiler by setting its operating pressure.

FIRST START-UP (Electronic panel)

See the specific OPERATOR PANEL technical manual.

4 *Maintenance*

ORDINARY

- Bleed boiler and level indicators;
- check the efficiency of the control and adjustment instruments by carefully examining the electrical parts, the connections and the mechanical parts (pressure switches); **it is recommended to replace the probe ceramic spark plugs annually**
- carry out burner maintenance (according to the relative instructions)
- check the torque of the flange bolts and the state of the gaskets
- clean the tube bundle and turbulators

SCHEDULED

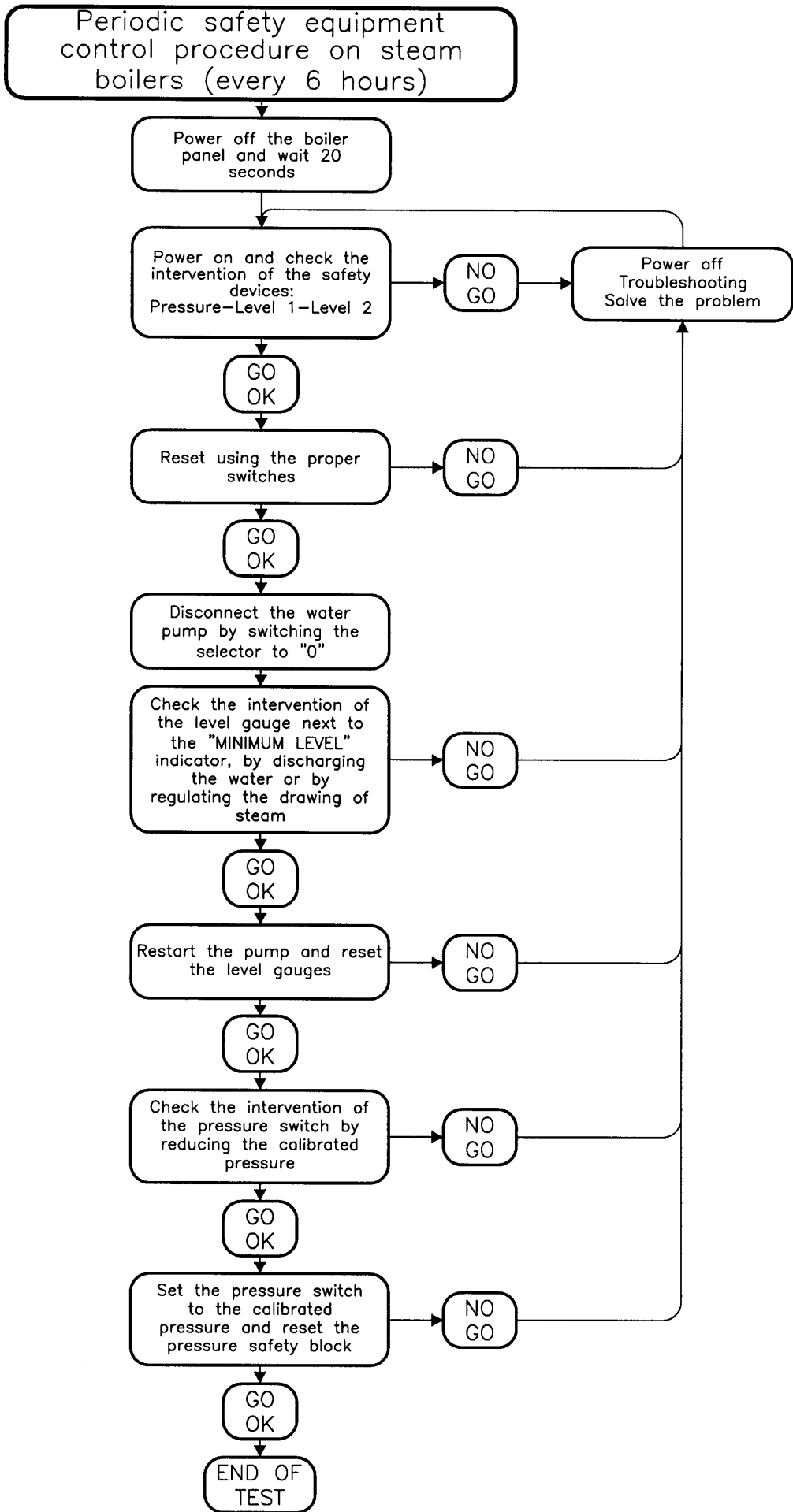
Periodical inspection every 6 hours (electromechanical panel)

Periodically (every 6 hours of operation) the operator must go to the heating plant room to check the efficiency of the safety accessories:

- Block pressure switch
- Safety level switches

If no system fault is detected, you can reset the electric panel: cut power to the electric panel for approximately 20 seconds, power on again using the main switch and then press the reset buttons.

For further details, follow the chart below.



EXTRAORDINARY

Every generator must be periodically stopped to carry out a thorough inspection and maintenance: required interval is determined by your experience, by the operating conditions, by the quality of supply water and the type of fuel used.

Before inspection or cleaning, thoroughly check that no water or steam can reach the generator through the connecting ducts. Each valve will have to be locked and, if necessary, isolated by removing a section of the connection pipe to the system or by placing a blind flange in-between.

During inspection, also check all accessories giving top priority to safety valves, level probes and pressure switches.

Level switch replacement

To change the safety level switch or any of its parts, it is necessary to carefully follow these instructions:

- 1) Check the integrity of the new ceramic holder.
- 2) Check rod length.
- 3) Ensure that rod is coaxial to holder axis.
- 4) Check the integrity of the electric system, especially the resistor of the circuit connecting the ceramic holder to the electric panel (resistance must be over 10 MOhm).
- 5) Check level switch operation, including the two ceramic holders and their relays with conductivity trip points.

The replaced parts must have the same characteristics as the original ones. To carry out calibration, refer to the Technical Manual and, if in doubt, contact the manufacturer.

STORAGE DURING IDLE PERIODS

The most significant corrosion often occurs during idle periods. The operations to be carried out to ensure a correct storage of the generator mainly depend on the duration of the stop time.

'Dry' storage can be arranged when the generator has to stay idle for a long period of time and 'wet' storage for short idle periods or when the generator is a spare one and should be able to be operating in a short time.

In both cases, the required operations tend to eliminate the causes of any corrosion.

Dry storage

Empty and thoroughly dry the generator, then inject a desiccant (such as quicklime, silica gel, etc.) inside the cylindrical body

Wet storage

Drain water and perform a complete cleaning of the generator. Fill the body up to the normal operating level and, after a short evaporation time, blowdown to the atmosphere to eliminate all dissolved gases. Then completely fill the generator, with a correct metering of DEHA (diethyl hydroxyl amine) to develop a residual concentration of more than 100 ppm preventing the attacks of the oxygen dissolved in water. Add also trisodium phosphate to ensure a total alkalinity above 400 ppm. Then close all connections. *successivamente tutte le connessioni.*

Inspect all connections to make sure there is no leakage and take water samples at regular intervals, checking that alkalinity does not change.

A "wet" storage is always recommended because it better guarantees proper storage and a lower time required to achieve operating conditions.

WATER CHARACTERISTICS

The values in the following tables are extracted from tables 5.1 and 5.2 in EN 12953-10 (requirements concerning the quality of water supply and the water in the generator).

Even for generators that are not covered by the aforementioned provision it is however necessary to adopt at least the indicated limits and however, to refer to the specialised companies that manage selecting the type of treatment to be carried out on the basis of a thorough analysis of the water available.



IMPORTANT

Many faults and sometimes serious accidents are due to the use of water having non-conforming characteristics.

5.1 Water supply - Threshold values (in input)

CHARACTERISTICS	u.m.	Steam generator water with pressure up to 20 bar	Integrating water for hot water boilers (total operating range)
Appearance		Clear, limpid, without foam or suspended solids	
Direct conductivity at 25°C	µS/cm	See table values "Operating water - threshold values"	
pH at 25°C (°)	---	> 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 the "Maximum acceptable silica content in the generator water up to 20 bar pressures" table	
Oxygen (O ₂)	mg/l	< 0,05 ^[d]	-
Oily substances	mg/l	< 1	< 1
Concentration of organic substances	-	See note ^[e]	

^[a] With copper alloys in the system the pH value must be kept within 8.7 and 9.2.

^[b] With a softened water pH value > 7.0, the pH of the generator water should be provided according to table 5.2.

^[c] At operating pressure <1 bar, a maximum total hardness of 0.05 mmol/l must be acceptable.

^[d] Instead of respecting this value with intermittent operation or operation without deaerator, in case of agents forming the film and/or excess of oxygen, the additive must be used.

^[e] Organic substances are generally a mixture of various different compounds. The composition of such mixtures and the behaviour of their individual components under the steam generator operating conditions, are difficult to predict. Organic substances can be decomposed to form carbonic acid or other acid decomposition products that increase acid conductivity and cause corrosion and deposits. They can also lead to the formation of foam and/or production of steam with suspended water, that must be kept as low as possible.

Maximum acceptable silica content in the generator water up to 20 bar pressures

Alkalinity	Silica
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 valid assuming the presence of a thermal deaerator. In the absence of the deaerator, it is appropriate, however, to raise the temperature of the water contained in the tank to at least 80°C to reduce the content of dissolved gas (O₂ and CO₂). It is, in any case, appropriate to use chemical conditioning to de-oxygenate the water supply completely and to minimise the corrosive CO₂ effects.

5.2 Operating water - threshold values

CHARACTERISTICS	u.m.	Steam generator water with pressure up to 20 bar		Boiler water for hot water boilers (total operating range)
		Direct conductivity of the supply water > 30 µS/cm	Direct conductivity of the supply water ≤30 µS/cm	
Appearance		Clear, limpid, without foam or suspended solids		
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 the previous table "Maximum acceptable silica content in the boiler generator water up to 20 bar pressures"		
Phosphates (PO ₄) ^[e]	mg/l	10 - 30	6 - 15	-
Organic substances	-	See note ^[e]		

^[a] With a superheater consider as maximum value 50% of the value indicated as maximum.

^[b] Basic pH adjustment by injecting NaPO₄, further injection of NaOH only if the pH value is < 10.

^[c] If the acid conductivity of the generator feed water is < 0.2 µS/cm, and its concentration of Na + K is <0.01 mg/l, the injection of phosphate is not required. It can be applied under AVT conditions (treatment with volatile chemicals, feed water pH ≥ 9.2 and generator water pH ≥ 8), in this case the conductivity of the generator 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 treatment with coordinated phosphate is used, considering all other values, higher concentrations of PO₄ are acceptable.

^[f] Organic substances are generally a mixture of various different compounds. The composition of such mixtures and the behaviour of their individual components under the generator operating conditions, are difficult to predict. Organic substances can be decomposed to form carbonic acid or other acid decomposition products that increase acid conductivity and cause corrosion and deposits. They can also lead to the formation of foam and/or production of steam with suspended water, that must be kept as low as possible.

FREQUENCY OF ANALYSIS

The frequency of the analysis must be carried out according to the table in the periodic verifications paragraph. However, it is advisable to check the pH value, the total hardness and the alkalinity of the feed and operating water. It is good practice, especially under variable operating conditions, to monthly submit a significant sample of the feed and operating waters for complete analysis. It is also good practice to visually check the condensate returns for any highly polluting oily substances (reduction of evaporation on the surface of generator water due to a layer of oil).

ANY ANOMALIES AND REMEDIES

ANOMALY	CAUSE	REMEDY
Safety valve(s) opening	Exceeding of the max pressure regulated on the valve that must be equal to the appliance design pressure	Adjustment of block pressure switches and/or limit too high
	Safety valve calibration loss	The valve manufacturer will perform the overhaul
Small leak from the safety valve(s) (leakage)	Dirt around the shutter seat	Cleaning of seat by sometimes acting on the manual opening lever
	Scratched shutter seat	The valve manufacturer will perform the overhaul
Pump block	Disconnected pump thermal relay	Check motor absorption Check thermal calibration
	Blocked pump shaft	Electric pump maintenance
	Calibrated limit pressure switch too high	Limit pressure switch calibration
Block pressure switch intervention	Faulty limit pressure switch	Limit pressure switch replacement
	Clogged pressure switch coil	Coil cleaning or replacement
	Block pressure switch failure	Pressure switch replacement
	Level 1 or 2 safety intervention	Interrupted water level detection
Interrupted connection cable		
Check the conductivity of the water		
Check the pump on-off trimmer calibration on the RR relay		
Faulty safety level relay		Temporary replacement of electronic safety relay with one of the two relays in the panel
		If the problem is solved, permanently replace the faulty relay.
Lack of water filling		See "Loading" Problems
Incorrect electrical panel probe power supply electrical cable wiring	Wiring diagram check	
Insufficient water loading	Pump block	See "Pump block" Problems
	Dirty pump intake filter	Filter cleaning
	Level adjustment anomaly	Temporary replacement of electronic adjustment relay with one of the two relays in the panel.
		If the problem is solved, permanently replace the faulty relay.
	Level adjustment probes short-circuit	Disassemble the adjustment probes to visually check the ceramic insulation
	Pump cavitation	Head (=height difference between the collection vessel level and the pump) insufficient in relation to the water temperature
		Pump intake filter cleaning
		Reduce resistance of the duct between collection vessel and pump by increasing the passage section
Pump rotation direction	Invert one of the phases (three-phase pump)	
Burner always on	Incorrect connection to the electrical panel	See the wiring diagram
	Faulty level safety relays	See "Level 1 or 2 safety intervention"
	Block and/or adjustment pressure switches not active	Pressure switches calibration check
		Check of pressure switch connections to the electrical panel
Burner always off	Burner problems	See specific Burner manual
	Burner fuses interrupted	Fuses replacement
	No consent to burner from adjustment pressure switch	Adjustment pressure switch replacement
	No consent to burner from level safety relays	See "Level 1 or 2 safety intervention"
	Incorrect connection to the electrical panel	See the wiring diagram

5 *Residual Risk Management*

EXCESSIVE STEAM PRESSURE

- Make sure the safety valves properly open at the design pressure.
- It is necessary to check the correct activation of the shut-off pressure switch that eliminates the cause of pressure increase by stopping the burner.
- The matching between the boiler maximum flow thermal and the actual burned maximum power must be checked.

ACCESSORY SUITABILITY

- Match accessories according to what provided for by the reference standards EN12953-6

OVERHEATING DUE TO LOW WATER LEVEL

- The correct operation of the safety level switch must be checked in accordance with the indications set forth in the technical manual.
- It is necessary to check that the operating water conductivity values are within those provided in the supplied technical manual. (EN 12953-10)
- Make sure the water loading pump is working properly as described in the technical manual provided with the boiler (pump wear, hydrostatic head in suction, water supply temperature, pump connection/disconnection from the level control probes).

OVERHEATING DUE TO SCALE BUILD-UPS

- Analyse water at the required frequency intervals, making sure that the values are within the limits specified in the technical manual and performing the suitable treatments. (EN 12953-10)

TURBULENCES IN THE WATER LEVEL

- Check that the characteristics of the delivery and operating water of the boiler correspond to those indicated in the Technical Manual (EN 12953-10)

WATER CONDUCTIVITY

- Water delivery has to be checked and kept within the limit values declared in the instruction manual and prescribed by EN 12953-10, according to a suitable treatment with filtering, softening and conditioning processes of the mains water (specified on the user's manual and under the user's responsibility).
- Carry out operational tests of the safety devices at the times and with methods specified in the manuals.

FOAMS

- Check that the characteristics of the delivery and operating water of the boiler correspond to those indicated in the Technical Manual (EN 12953-10)

CAUSTIC EMBRITTLEMENT

- Carry out water analysis at the necessary time intervals (refer to user's manual).
- Perform water treatments in order to bring the characteristic values back within the limits specified in the use and maintenance manual (EN 12953-10)
- Blowdown by working on the drain valves present on boiler bottom.

ACID CORROSION

- Carry out water analysis at the necessary time intervals (refer to user's manual).
- Perform water treatments in order to bring the characteristic values back within the limits specified in the use and maintenance manual.

CORROSION DUE TO OXYGEN

- Carry out water analysis at the necessary time intervals (refer to user's manual).
- Perform water treatments in order to bring the characteristic values back within the limits specified in the use and maintenance manual. (ref. EN12953-10)
- Keep water at a temperature above 60°C to facilitate deoxygenation

PRESENCE OF SLUDGE

- Carry out water analysis at the necessary time intervals (refer to user's manual).
- Perform water treatments in order to bring the characteristic values back within the limits specified in the use and maintenance manual. (ref. EN12953-10)
- Blowdown by working on the drain valves present on boiler bottom.

EXTERNAL LOADS

- Boiler fittings shall not be considered as pipe supporting points (refer to the user's manual).
- It is good practice to allow for expansion joints and suitable supports for the pipes connecting the boiler to the system (refer to the user's manual).

STRAY CURRENTS

- Make sure that no stray currents are present on the generator
- Make sure the generator is properly earthed.
- Check the plant's electrical system.
- Before opening the hatch, it is necessary to check that the pressure in the boiler body is equal to the atmospheric one (0 relative bar)

ACCIDENTAL OPENING OF HATCH, HANDHOLE OR HEADHOLE, IF ANY

- Before opening the hatch, it is necessary to check that the pressure in the boiler body is equal to the atmospheric one (0 relative bar)

DOOR ACCIDENTAL OPENING

- Before opening the door, check that the burner is off and disconnected.
- The wall temperature must be such not to injure the operator

HOT SURFACES

- Insulation with glass wool or refractory materials in general of the parts that can come into contact with hot surfaces during standard use and maintenance conditions
- Avoid contact with generator uninsulated parts during operation. Should adjustment or check activities be carried out during operation, the operators must wear suitable protective equipment (gloves, shoes and thermal coverall)
- The boiler should feature plates warning on the presence of hot parts.

SHOCKS AND ACCIDENTAL FALLS

- Anti-slip embossed upper walk-on platform.
- Climb on or off the roof to carry out ordinary and extraordinary maintenance operations using a suitable ladder and anti-slip shoes. The walk-on platform and the access ladder must comply with the regulatory requirements in force in the country of installation.
- Pay attention to sharp edges on the generator and its accessories.

MINIMUM TEMPERATURE

- Make sure that the temperature the boiler can be subjected to complies to the design minimum permitted temperature.

EARTHQUAKE

- The appliance has not been dimensioned for installation in an earthquake zone

ATMOSPHERIC CONDITIONS

- Protect the generator against adverse climatic conditions.

INSTALLATION AND START-UP

- Make sure that hydraulic connections are duly joined together
- Check the correct connection of electric parts
- Perform a correct chimney fastening
- Check boiler correct operation
- The boiler must be operated at reduced power (max 50%) until reaching the water operating temperature in order to avoid thermal shocks and thermal expansions between the various parts of the body.

FAILING TO CARRY OUT MAINTENANCE

- Carry out a periodical preventive maintenance and any component repair or replacement operations according to the indications set forth in the Technical Manual and, anyway, for the cases not provided for in the manual, consult the manufacturer of the generator.

POOR STORAGE

- The appliance must be stored according to the indications given in the Technical Manual (Wet storage and Dry storage)
- The boiler body must be protected against adverse climatic conditions (minimum temperature -10 °C) and rain effects

PRESSURISED BODY REPAIR

- To carry out repair operations, contact the manufacturer and/or the Body responsible for the check of operating steam generator (technical and bureaucratic details), and use suitable means and materials

DOWNGRADE AND CHANGE OF USE

- Boiler downgrade and change of use through preventive authorisation by the relevant bodies.
- The manufacturer shall not be held liable in the event of accidents caused by incorrect decommissioning.

HANDLING

- During handling, always stay at a distance of at least 5 metres from boiler projection to the ground
- After any impact with the ground, visually inspect generator to make sure that all its parts are intact; perform the hydraulic test once again
- Always handle the generator in compliance with the indications set forth in the manual

FIRE

- The plant room must be arranged in compliance with the fire protection regulations in force in the country of installation
- Check that body and accessories are intact and not damaged after the fire

DECOMMISSIONING

- Boiler decommissioning through prior notification to the competent authorities

6

Useful information and declarations

QR CODE

How to register your appliance



The appliance must be registered once the product has been installed, either before or after start-up.

Follow these steps:

- Obtain a smartphone (iPhone, Samsung Galaxy, Htc, Blackberry etc.) or a tablet
- after downloading and installing a "QR Reader" application (any free application is usually more than enough), open it and point the camera on the QR code located on the plate of your appliance (circled in the image)
- you will be sent back to a web page on which to register the data of your appliance and system by completing the indicated spaces.

VP05			
ICI CALDAIE S.p.A. Via G.Pascoli, 38 - 37059 ZEVIO (VR) - ITALIA -			
Tipo - Type - Typ - Modelos		N° Fabbrica	
Codice - Code - Code - Codice		Data - Date	
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
MED/MIN	kW	Kcal/h	MED/MIN
MAX	kW	Kcal/h	MAX
TS min.=	°C	Riferimento disegno:	
PS	BAR	corpo:	
TS max esercizio	°C	insieme:	
COMBUST. LIQUIDO - LIQUID FUEL		GAS CATEG. V. CATEG. BRUC.	
SOLJO - LIGHT OIL		TIPO - TYPE - TYP GAS	
HEAVY OIL		BRUCIATORE	
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:			
TARGA DATI CORPO GENERATORE: VEDI FLANGIATURA INFERIORE BARILOTTO LA TARGA DATI LIVELLOSTATO E' SITUATA ALL'INTERNO DEL QUADRO ELETTRICO.			

Once registered, authenticate your e-mail address by clicking on the link that will be sent by e-mail to the provided inbox. An additional e-mail will then be received with the credentials to access all services specifically developed by **ICI CALDAIE S.p.A.** for those who will register their boiler through the QR Code. Registration entitles you, even in future months and years, to take advantage of promotions and specific services for registered appliances (e.g.: discounts on spare parts, spare parts kits on sale, free routine maintenance for certain types of products, etc.).

For information, contact the ICI headquarter or the local representative offices.
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