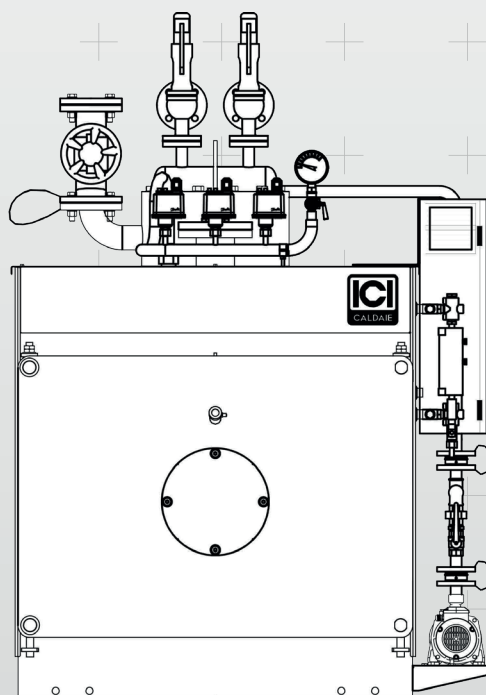




EN

Flame inversion steam generator

BNX



INSTALLATION, USE AND MAINTENANCE MANUAL



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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 **BNX**, 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	MODEL	CODE	MODEL	CODE
BNX 0,98 bar		BNX 0,98 bar		BNX 0,98 bar	
BNX 100	86420100	BNX 700	86420700	BNX 1700	86421700
BNX 150	86420150	BNX 850	86420850	BNX 2000	86422000
BNX 350	86420350	BNX 1000	86421000	BNX 2650	86422650
BNX 500	86420500	BNX 1400	86421400	BNX 3000	86423000
BNX EXP 0,98 bar		BNX EXP 0,98 bar		BNX EXP 0,98 bar	
BNX EXP 100	86420104	BNX EXP 700	86420704	BNX EXP 1700	86421704
BNX EXP 150	86420154	BNX EXP 850	86420854	BNX EXP 2000	86422004
BNX EXP 350	86420354	BNX EXP 1000	86421004	BNX EXP 2650	86422654
BNX EXP 500	86420504	BNX EXP 1400	86421404	BNX EXP 3000	86423004
BNX EXP 0,7 bar		BNX EXP 0,7 bar		BNX EXP 0,7 bar	
BNX 100	86420106	BNX 700	86420706	BNX 1700	86421706
BNX 150	86420156	BNX 850	86420856	BNX 2000	86422006
BNX 350	86420356	BNX 1000	86421006	BNX 2650	86422656
BNX 500	86420506	BNX 1400	86421406	BNX 3000	86423006

COMPLIANCE

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

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



NOTE

The factory number is shown on the steam generator data plates.

WARRANTY

The warranty conditions for the BNX series boilers are set out in the CONSTRUCTION - WARRANTY CERTIFICATE provided with the product.

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 steam generator, ensure the integrity and completeness of the supply and, if it does not comply with the order, promptly contact **ICI CALDAIE S.p.A.**
- The **BNX** steam generators must be installed by a Certified Company which, at the end of the work, must issue the owner with the declaration of conformity for proper installation, ie in compliance with the national and local laws and regulations in force, and the instructions given 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.
- Make sure the safety valves properly open at the design pressure.
- Make sure the safety pressure switch intervenes properly which, by shutting down the burner, eliminates the cause of the pressure increase.
- 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.
- 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 manhole, check that the pressure in the boiler body is equal to the atmospheric pressure (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

- Climb onto and down from the roof of the generator body in order to perform routine and extraordinary maintenance operations using the P.P.E. according to the Italian Legislative Decree 81/08.
- 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.
- For any downgrades, comply with the standards in force (MD 329/04).
- **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).
- Modify the safety or adjustment devices without the steam generator manufacturer's permission and instructions.
- 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

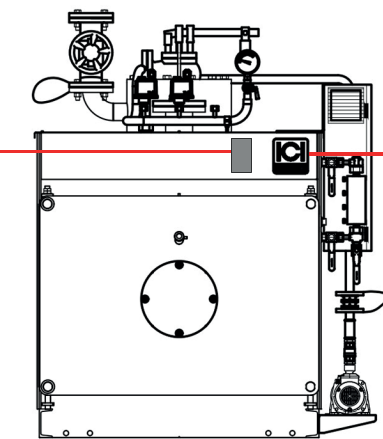
- **Danger deriving from the fuel.** Sensing the presence of fuel in the thermal power plant, it is appropriate to follow the precautions below to avoid the risk of explosions and fires:
 - do not smoke or cause sparks
 - do not turn on lights or electrical devices in general (mobile phones)
 - open 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 **BNX** steam generator is identified by two different data plates:

- **Boiler body data plate:** it is positioned below the ICI CALDAIE logo, screwed to the upper covering of the front plate; this plate bears the significant data of the boiler body and is riveted on specific support.
- **Assembly data plate:** it is glued outside the front covering panel of the front plate; this plate bears the data of the boiler complete with accessories that may differ from those of the boiler body only.

ICI CALDAIE S.p.A. Via G. Pascoli, 38 - 37059 ZEVIO (VR) - ITALIA -	
Tipo - Type - Typ - Modèles	
0	
Code - Code - Code - Code	Data - Date
N° Fabbrica	
GENERATORE DI VAPORE - STEAM BOILER GÉNÉRATEUR DE VAPEUR - GENERADOR DE VAPOR	
PORTATA TERMICA - HEAT INPUT DEBIT TERM. - POTENC. TERM.	POTENZA UTILE - HEAT OUTPUT DEBIT TERM. UTILE - POTENCIA UTIL.
MIN. kW MAX. kW	MIN. kW MAX. kW
TS min. °C PS BAR TS max esercizio °C	Riferimento disegno: corpo: Isolame:
COMBUST. LIQUIDO - LIQUID FUEL MOLTO - LIGHT OIL MOLTO - HEAVY OIL BRUCIAT. - BURNER - BRULEUR - QUEMADOR	GAS CATEG. TIPO - TYPE - TYP V. CATEG. BRUC. GAS BRUCIATORE
ALIMENTAZ. - VOLTAGE - ALIM. ELET. - TENSION D'ALIMENT. V. 1N-230 CLASSE PROT. - PROTECT CLAS - CLASSE DE PROD. - PROTECT. IP20 DESTINAZIONE - DESTINATION - DEST. CE (DATI CARATTERISTICI VEDI DOCUMENTI DI CONFORMITA')	
S.N. Body 1: S.N. Body 2:	CE 1370
TARGA DATI CORPO GENERATORE: VEDI FLANGIA LUNA INFERIORE SULL'OTTO LA TARGA DATI LIVELLO OTTATO E' SITUATA ALL'INTERNO DEL QUADRO ELETTRICO.	



ICI CALDAIE S.p.A. Via G. Pascoli, 38/S.S. 434 km.9 37059 CAMPAGNOLA DI ZEVIO (VR)-ITALIA			
MODELLO BOILER TYPE	N.F. S.N.	DATA PT DATE PT	SUP. RISCALDATA HEATING SURFACE m ²
bar	bar	°C	°C
PS	PT	TS Max.	TS Min.
MW	MW	kg/h	
POTENZA HEAT INPUT	POTENZA HEAT OUTPUT	PRODUZIONE VAPORE STEAM CAPACITY	
CATEGORIA (PED)	CLASSE FLUIDO (PED)	COMBUSTIBILE FUEL	
CE 1370	I	kg	
CAPACITA'/CAPACITY		MASSA/WEIGHT	

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

The **BNX** steam generators are automatically operated single-block appliances.

The horizontal combustion chamber is with flame inversion and the tube bundle is complete with helical turbulators.

The single front door is thermally insulated with refractory materials and is mounted on adjustable hinges, easily opened without having to remove the burner; it is equipped with visor for flame control.

The smoke box is fixed with bolts to the back of the generator. It is equipped with smoke duct fitting, cleaning door and can be dismantled.

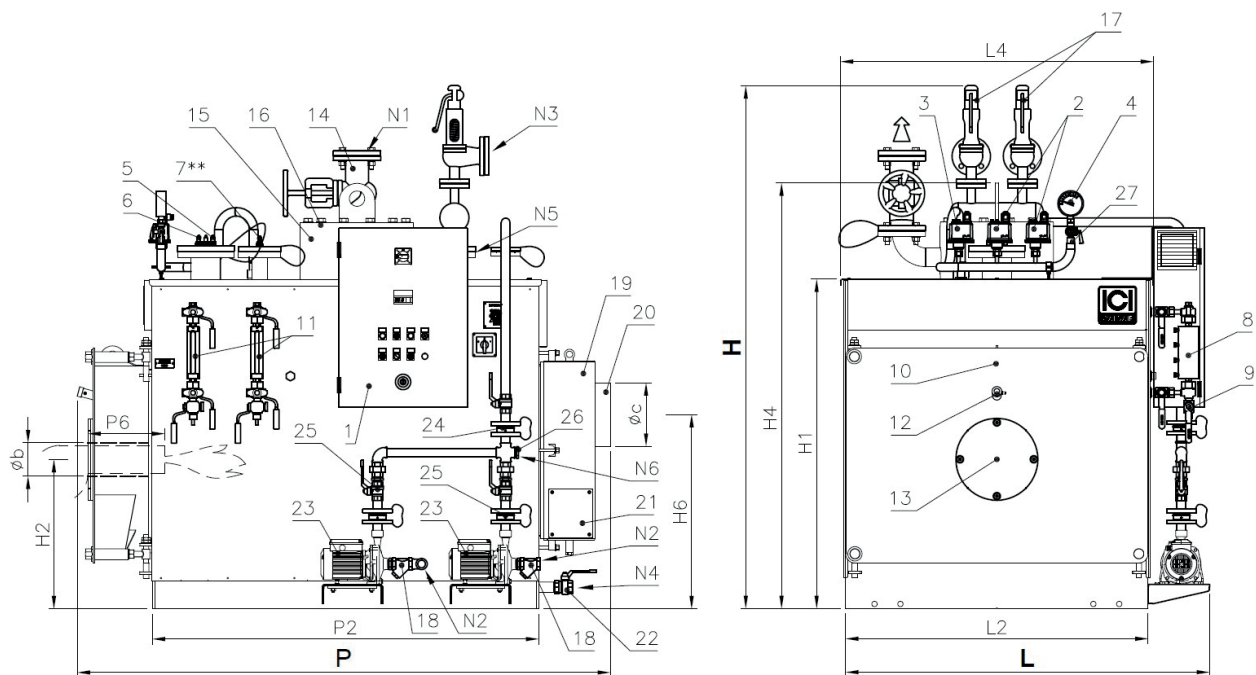
The body is thermally insulated with high density rock wool mat, protected with stainless steel panels.

They use a single control panel in which the entire electrical wiring converges.

The appliance rests on a carbon steel profile base that ensures its stability.

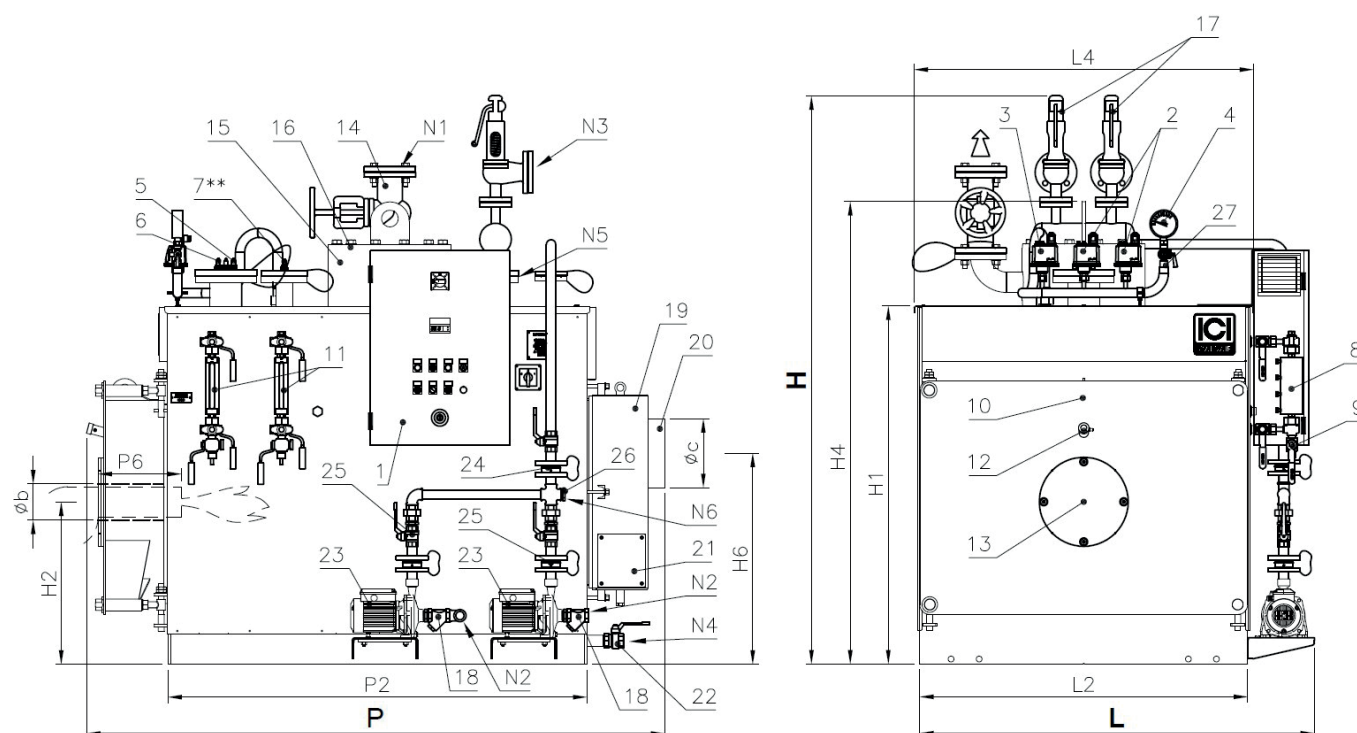
The **BNX** steam generators have obtained suitability for liquid and gaseous fuels for the production of low pressure (0,7-0,9 bar) 100 to 3000 kg/h steam.

STRUCTURE



- | | | |
|--|--|----------------------------|
| 1 Electrical panel | 13 Burner application plate | 24 Check valves |
| 2 Adjustment pressure switch(es) | 14 Steam inlet valve | 25 Supply valve |
| 3 Block pressure switch | 15 Steam dome | 26 Auxiliary supply valve |
| 4 Pressure gauge | 16 Inspection hatch | 27 Pressure gauge valve |
| 5 1st safety level probe (minimum) | 17 Safety valve | |
| 6 Level adjustment probes (start/stop) | 18 Supply filter | |
| 7 2nd safety level probe (minimum) | 19 Rear smoke chamber | |
| 8 Level indicator | 20 Chimney fitting | |
| 9 Level indicator discharge | 21 Cleaning door | |
| 10 Front door | 22 Drain valve | |
| 11 Level test valves | 23 Supply electric pump (2 electric pumps only for EXP versions) | |
| 12 Flame control warning light | | |
| | | N1 Steam inlet |
| | | N2 Supply |
| | | N3 Safety valve drain |
| | | N4 Boiler drain |
| | | N5 Safety valve connection |
| | | N6 Auxiliary supply |

DIMENSIONS AND CONNECTIONS



Dimensions

Description	u.m.	BNX											
		100	150	350	500	700	850	1000	1400	1700	2000	2650	3000
H	mm	1280	1465	1795	1790	1790	2045	2045	2325	2325	2760	2510	2510
H1	mm	905	995	1245	1290	1290	1465	1465	1640	1640	1855	1995	1995
H2	mm	385	420	575	585	585	630	630	685	685	810	850	850
H4	mm	1280	1460	1760	1665	1665	1560	1560	1760	1760	1960	2110	2110
H6	mm	485	560	720	760	760	800	800	835	835	1000	1080	1080
L	mm	1000	1160	1340	1440	1440	1560	1560	1770	1770	1940	2100	2100
L2	mm	740	900	1080	1180	1180	1300	1300	1510	1510	1680	1840	1840
L4	mm	820	980	1160	1260	1260	1380	1380	1590	1590	1760	1920	1920
P	mm	1225	1720	2060	2085	2335	2625	2625	2625	2925	3160	3720	3720
P2	mm	820	1170	1510	1510	1760	2010	2010	2010	2310	2515	3015	3015
P6	mm	240-290	280-330	280-330	310-360	310-360	350-400	350-400	370-420	370-420	370-420	420-470	420-470
Øb	mm	130	160	180	225	225	280	280	280	280	320	360	360
Øc	mm	180	200	250	250	250	300	300	350	350	400	450	450

Attachments

Description	u.m.	BNX											
		100	150	350	500	700	850	1000	1400	1700	2000	2650	3000
N1	DN/in	1"1/4	40	50	65	65	80	80	100	100	125	150	150
N2	DN/in	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
N3	DN/in	1"	40	65	80	100	125	125	125	150	150	125	125
N4	DN/in	1"	1"	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4	1"1/4
N5	DN/in	3/4"	25	40	50	65	80	80	80	100	80	100	100
N6	DN/in	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"

TECHNICAL DATA

DESCRIPTION	u.m.	BNX					
		100	150	350	500	700	850
Effective rated ^[1]	kW	69,8	105	233	349	465	581
Thermal capacity	kW	77,4	115	256	383	511	639
Efficiency at 100% (ref. P.C.I.) ^[1]	%	90,00	91,00	91,00	91,00	91,00	91,00
Pressure drops on exhaust side	mbar	0,7	1,5	3,5	3,5	5,0	4,5
Rated pressure	bar	0,98	0,98	0,98	0,98	0,98	0,98
Total capacity	l	198	410	805	875	995	1400
Capacity at level	l	146	250	515	690	800	1100
Exchange surface	m ²	2,30	3,60	6,00	9,00	10,50	13,50
Steam production ^[1]	kg/h	100	150	350	500	700	850
Rated frequency ~ voltage	Volt ~ Hz	1/N~ 230 ~ 50	1/N~ 230 ~ 50	1/N~ 230 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50
Electric protection rating	IP	55	55	55	55	55	55
Absorbed electrical power ^[2]	W	1500	1500	1500	6000	6000	6000
Allowed fuels		Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha
Total weight	kg	470	660	1080	1300	1400	2000

DESCRIPTION	u.m.	BNX					
		1000	1400	1700	2000	2650	3000
Effective rated ^[1]	kW	698	930	1163	1395	1744	2035
Thermal capacity	kW	767	1022	1278	1533	1917	2236
Efficiency at 100% (ref. P.C.I.) ^[1]	%	91,00	91,00	91,00	91,00	91,00	91,00
Pressure drops on exhaust side	mbar	6,0	5,5	7,0	7,5	6,5	7,5
Rated pressure	bar	0,98	0,98	0,98	0,98	0,98	0,98
Total capacity	l	1400	2010	2280	3020	4240	4240
Capacity at level	l	1100	1560	1790	2050	3100	3100
Exchange surface	m ²	15,50	22,00	26,00	31,00	42,00	46,00
Steam production ^[1]	kg/h	1000	1400	1700	2000	2650	3000
Rated frequency ~ voltage	Volt ~ Hz	3/N~ 400 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50	3/N~ 400 ~ 50
Electric protection rating	IP	55	55	55	55	55	55
Absorbed electrical power ^[2]	W	6000	6000	9500	9500	12500	12500
Allowed fuels		Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha	Methane - LPG - Diesel - Naphtha
Total weight	kg	2000	2500	2700	3600	4900	4900

^[1] Average temperature 70°C.

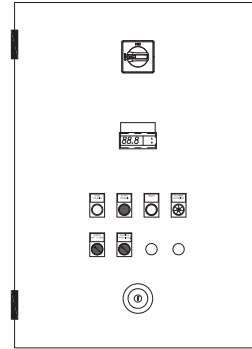
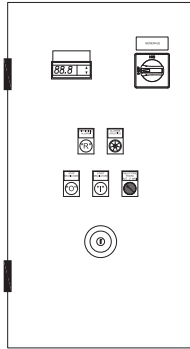
^[2] With electronic control unit (circulator and burner excluded).

CONTROL PANEL

The BNx 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.



ALARM VIEWER

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 = Maximum Level Alarm
- A.05 = Pump Protection Alarm (only for versions with three-phase control panel/pump)
- A.06 = Emergency Alarm Enabled

BURNERS

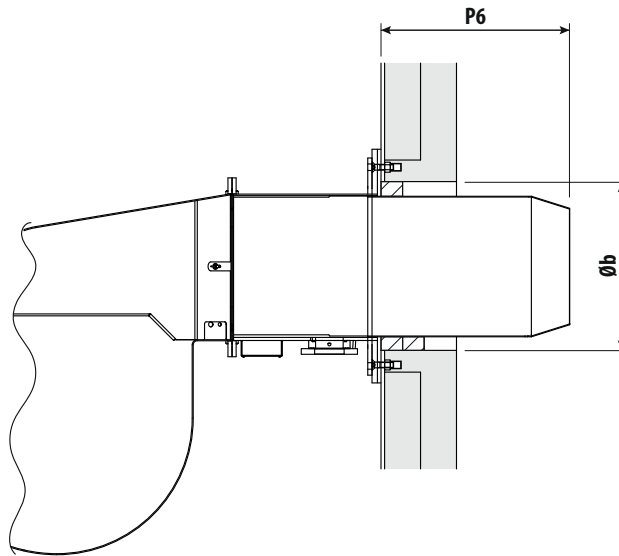
The burners that can be installed on the **BNX** boilers must be CE marked according to European Directives:

- Gas Directive 2009/142/EC
- Electromagnetic Compatibility Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- Machinery Directive 2006/42/EC (for liquid fuel burners)

They must also be able to operate on boilers with flame inversion combustion chamber.

Since the optimal operation of the steam generator depends on the correct choice of burner and its adjustment, below are some points to consider:

- The working range of the burner must include the operating point of the steam generator (flow rate-back pressure in combustion chamber considering also the possible resistance/draught of the smoke duct)
- the length of the combustion head must be adequate to the penetration into the combustion chamber provided by ICI and shown in the table
- the length and shape of the flame must be suitable to the flame inversion combustion chambers. The burner manufacturers have this information as they are required by certification.



Description	u.m.	BNX											
		100	150	350	500	700	850	1000	1400	1700	2000	2650	3000
Øb	mm	130	160	180	225	225	280	280	280	280	320	360	360
P6	mm	240-290	280-330	280-330	310-360	310-360	350-400	350-400	370-420	370-420	370-420	420-470	420-470



IMPORTANT

The gap between the mouthpiece and door must be filled with flame-resistant thermoceramic material.

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.

COMPONENTS

The **BNX** 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).

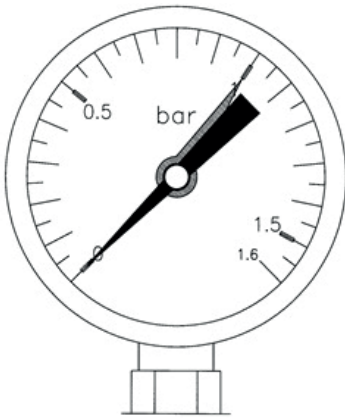
In the following descriptions, the accessories are divided according to the physical quantity they control (pressure and level).

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 communicates with the inside of the generator whose pressure is to be measured; the other end, closed and free to move, is connected to the index by a toothed sector lever system. 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).



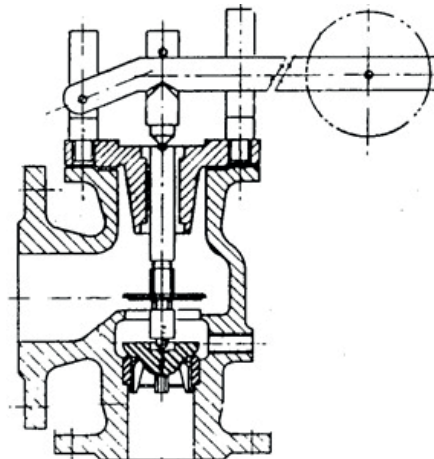
Indicative figure for generator at 0.98 bar.

SAFETY VALVES

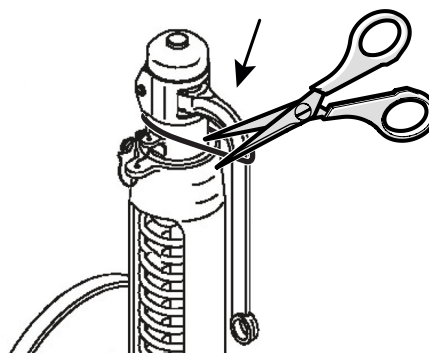
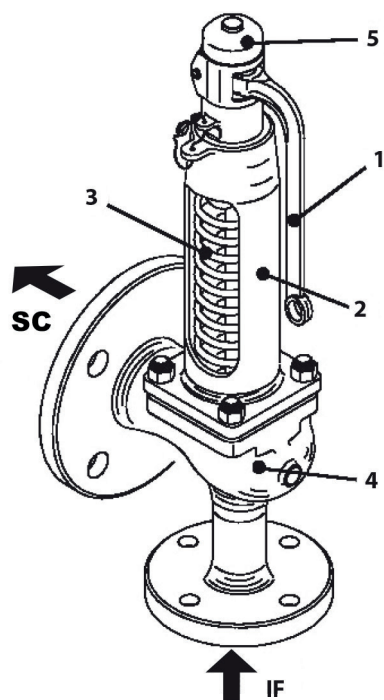
The safety valves are able to maintain the pressure in the generator to the design pressure (save temporary peaks of 10% max of the max PS of the whole) even if all other pressure control devices (pressure switches and transmitters) are out of use.

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.



The main components of the safety valve are:



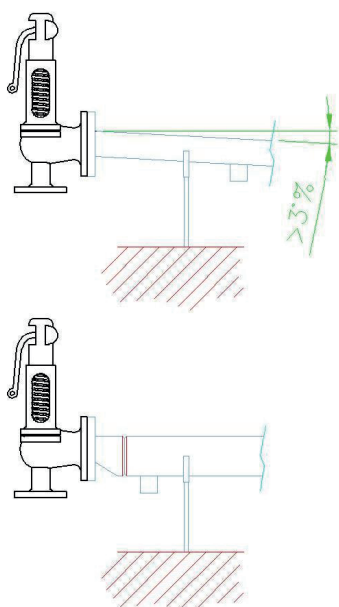
- 1 Lifting lever
- 2 Hat
- 3 Spring
- 4 Valve body
- 5 Cap
- SC Drain
- IF Fluid inlet



IMPORTANT

Before starting the generator, remove the steel wire that blocks the lever during transport. Make sure that the lifting lever is free to move.

In case of conveyed drain, bracket the conveying pipe to compensate the reaction force generated when the fluid is drained. Make one or more draining holes in the conveying pipe to drain any condensate. Drain must take place in the atmosphere, direct the valve so as not to harm people or damage property.



Typical suggested scheme

Interception valves must not be provided.

The exhaust pipe must be designed in such a way that any low temperatures do not create ice that obstructs the outlet.

N.B.: Bracket at no more than 1 m away



IMPORTANT

The operation of the safety valves is sensitive to pressure losses that occur in the drain conveying pipe during their opening. The pressure losses in the drain conveying pipe of the safety valves must be 0. The nominal diameter of the exhaust pipe must be greater than or equal to the size of the safety valve outlet connection. A diameter ≥ 1.5 DN (PSV) is suggested.

VALVE MAINTENANCE

The valve is a very delicate mechanism, so the system operator must check its efficiency. If necessary, contact a technician authorised by the manufacturer.

It is good practice for the safety valves installed to protect the plant:

- to be operated (once a week) with system pressurised, by activating the manual lifting lever of the shutter
- to have their calibration checked once a year, directly on the system or with bench test
- to be subjected to overhaul every two years
- to be replaced after ten years of operation



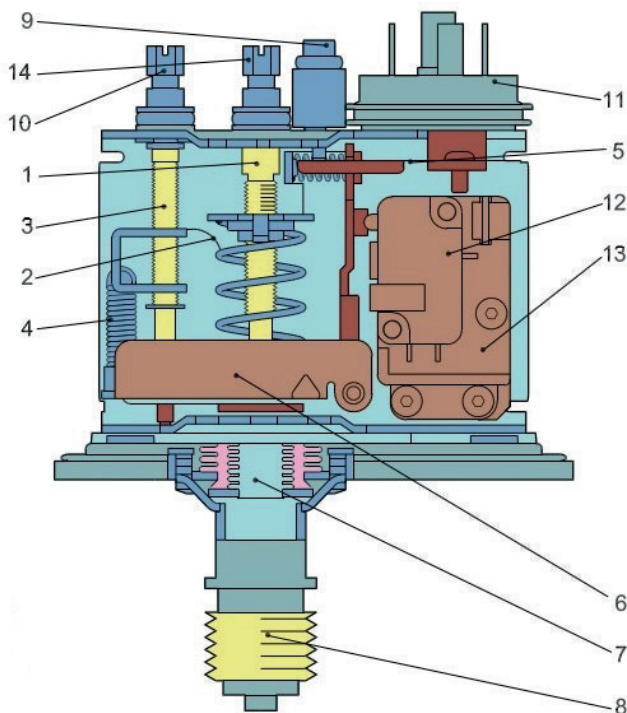
IMPORTANT

The safety valves are designed and built to operate without lubricant; simply keep them clean and efficient. Always refer to the specific manual.

SAFETY PRESSURE SWITCH

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. It is calibrated at a higher pressure compared to the maximum one of the pressure transmitter, but always lower than the opening pressure of the safety valve.

The safety pressure switch intervenes in case of steam pressure regulator failure (adjustment pressure switch or pressure transmitter) and permanently stops the burner.



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



IMPORTANT

The safety pressure switch is calibrated and sealed during generator construction.

Operation

When the system pressure exceeds the set value, the pressure switch automatically stops the plant.

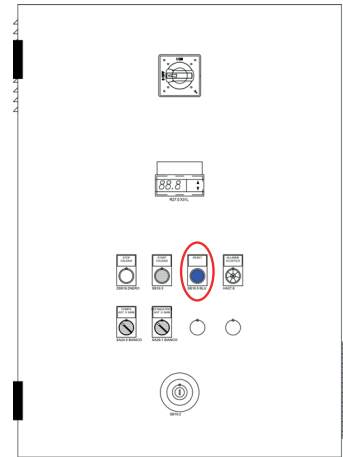
The failure of the internal bellows decreases the cut-in pressure of the pressure switch by about 3 times with respect to the set value, causing the plant to stop.

The failure of the external bellows decreases the cut-in pressure of the pressure switch by about 3 bar with respect to the set value, to guarantee an intrinsically safe operation.

Manual reset in case of block

In the event that the burner is blocked by the safety pressure switch, simply reset it manually.

To do this, use the control panel, pressing the blue "RESET" button (circled in red in the image to the side) located to the right of the "START" button, for a few seconds.



OPERATING PRESSURE SWITCH (2 for EXP version; 1 for IT version)

Device that controls the generator pressure and keeps it within the preset value.

Pressure switch calibration

- For pressure switches with AUTOMATIC reset: Set the cut-in pressure on the RANGE scale and the differential on the DIFF scale, The restart pressure is the same as the cut-in pressure, less the preset differential value.
- for Automatic pressure switches with MANUAL reset or lock pressure switches at maximum pressure: Set the cut-in pressure on the RANGE scale, the block pressure switch can only be manually reset by pressing the reset button with a screwdriver when the pressure drops below or is equal to the cut-in pressure less the differential value.

LEVEL

LEVEL INDICATOR

The level indicator consists of a pair of valves connected to a reflecting box containing a prismatic glass.

This appliance is connected to the generator above and below the normal water level, while at the lower end it is equipped with a purge valve to evacuate the sludge and keep the glass clean.

With these valves you can periodically test the efficiency of the level control system by performing the following operations. Open the purge valve for a few seconds and close it again.

If the water disappears and then quickly returns to the starting point with large swings, it can be assumed that the level works well. Whereas, if the water slowly returns or stops at a different point from the previous, it means that one of the communications is obstructed; to ascertain which of the two and to try purging it, close the steam valve leaving the water valve open, then reopen the purge valve: water should come from here, taking with it any muddy deposits formed in the ducts.

When the water valve is closed, the steam valve opens and steam must come out from the purge.

By closing the purge valve and leaving the two steam and water side valves open, the water must return to the starting point. If this does not happen, clean the connecting ducts of the level indicator to the generator.

During commissioning, make sure that the vent and drain are closed. During operation the shut-off valves must be fully open.

To reduce the possible leaks, the indicators must be periodically insulated to check that the tightening torque of bolts is at least 30 Nm.

Do not proceed with maintenance without having firstly checked that:

- The generator pressure is equal to the atmospheric pressure.
- The indicator temperature is equal to the environment temperature.

Maintenance must be carried out when:

- The crystal loses part of its transparency, partially opaque, signs of internal roughness due to erosion or corrosion as it involves loss of geometry and reading becomes difficult.
- Minimal leaks from the gaskets or shut-off groups are also noticed.

AUTOMATIC LEVEL REGULATOR AND SAFETY LEVEL SWITCH

The detection and control principle of the level is based on the electrical conductivity of the water.

The following conditions must be met to ensure the proper operation of the level switch:

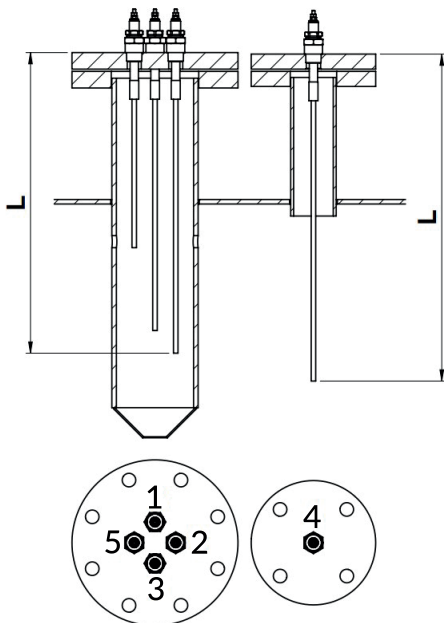
- Water conductivity: $>250 \mu\text{S/cm}$
- Generator temperature: $<210^\circ\text{C}$
- Pressure: $<20 \text{ bar}$

(See the "Operating water" paragraph).

The appliance consists of a part located in the control panel (electronic relays) and probes of different length immersed in the generator body.

The operation includes:

- **Automatic start and stop of the pump:** it is managed with two probes inserted in the generator, one longer (2) to start the pump and one shorter (1) to stop it, connected to a single adjustment relay in the control panel
- **Burner stop for low level:** it is managed with two probes (3 and 4) of the same length, inserted in the generator and connected to two separate adjustment relays in the control panel. They generate a burner stop if the water level drops below the minimum limit allowed.



Probes in the generator:

- 1 Pump stop
- 2 Pump start
- 3 1st minimum level safety (burner lock and alarm insertion)
- 4 2nd minimum level safety (burner lock and alarm insertion)
- 5 Maximum level

N.B.: In addition to the ringing of the alarm in the installation room, it is advisable to add an acoustic or visual signal in a regularly attended place.

2 *Installation*

PRODUCT RECEIPT

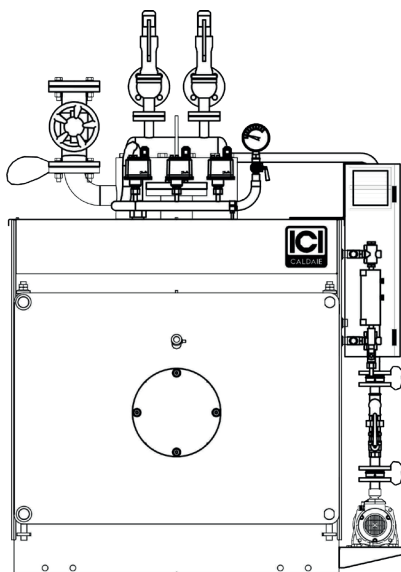
The **BNX** generators are supplied complete with accessories.

The combustion chamber contains:

- turbulator unit to be inserted in the smoke pipes during installation
- thermoceramic material to be inserted in the gap between burner mouthpiece and door insulation

The control panel contains the following documentation:

- declaration of conformity
- use and maintenance manual
- safety valve certificate, with declaration of conformity and use and maintenance manual
- feed pump characteristic curve
- electrical diagram

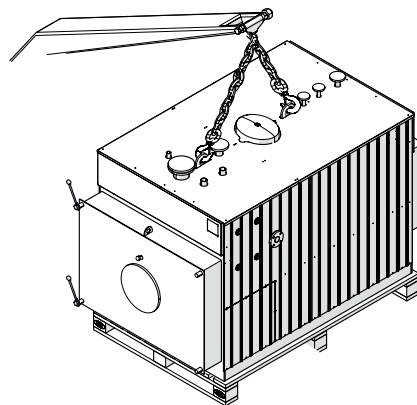
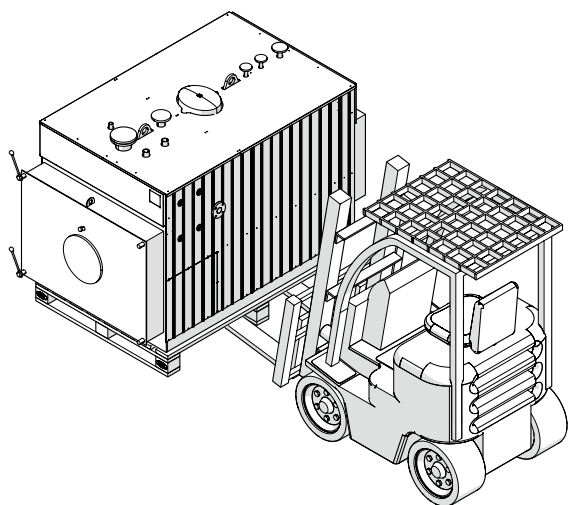


IMPORTANT

The instruction manual is an integral part of the appliance and so **MUST** be carefully read before installing and commissioning the generator, carefully stored for future consultation and **MUST** always accompany the appliance.

HANDLING

The **BNX** steam generator must be handled using means adequate to the size and weight of the appliance, using the provided lifting eyebolts.



ATTENTION

The Personal Protective Equipment required by current legislation must be used.

INSTALLATION ROOM

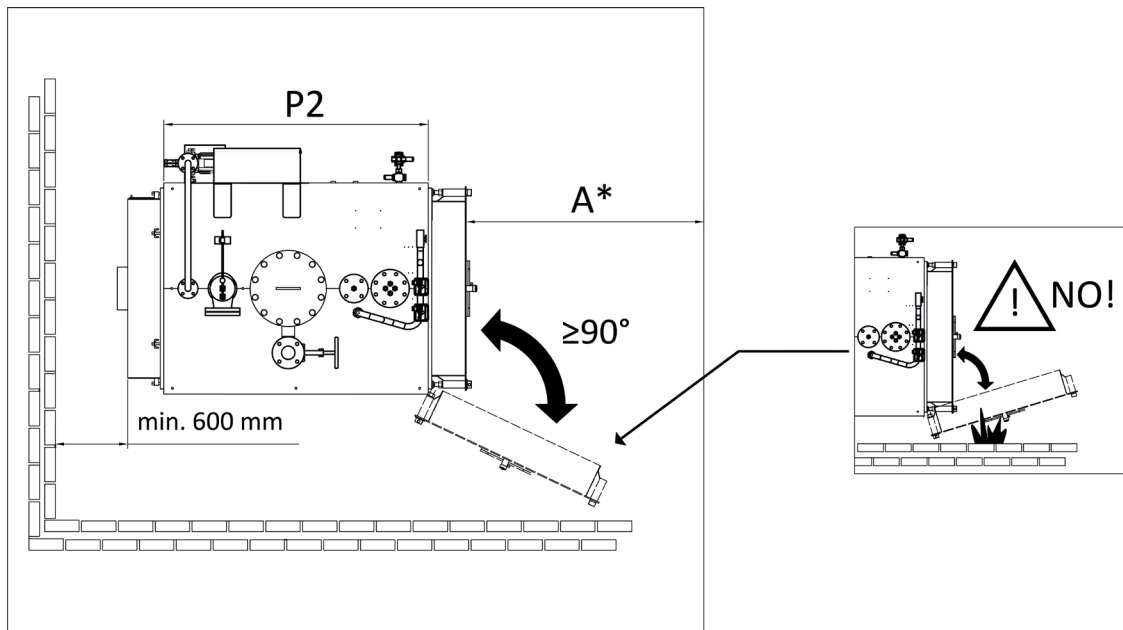
POSITIONING

The **BNX** boiler installation room must be for exclusive use, meet the Technical Standards and Legislation in force and equipped with adequately sized ventilation openings.

It is recommended to position the boiler, if possible, lifted from the floor to minimise dust extraction by the burner fan.

For information only, below is some useful information:

- the room must be provided with a main entrance for steam generator passage and two doors with panic bar for personnel. It must also be provided with an adequate fire-fighting system
- the support base of the generator must be flat and able to withstand the weight of the appliance full of water, complete with accessories and pipes for the possible execution of the on-site hydraulic test
- it must be equipped with ventilation openings created as established by the relevant Technical Standards
- the installation room must be for the exclusive use of personnel working on the steam generator. **Prohibition for unauthorised people to access should be appropriately indicated**
- buffer zones must be provided around the generator, wide enough to allow operators to safely carry out the running, control and maintenance of all installed components
- consider the possible the need to replace components that fail over time.



IMPORTANT

- A space is necessary at the front of the generator, at least equal to the length of the tube bundle to allow the extraction of the turbulators to clean the pipes and possibly replace the smoke pipes.
- All generator, safety valves discharges, etc., must be suitably conveyed to inspectionable collection points.



ATTENTION

- Consider the spaces necessary to access the adjustment and safety devices and to perform maintenance.
- If the burner is fed with gas of specific weight greater than that of the air, the electrical parts must be positioned at least 500 mm from the ground.

ROOM VENTILATION

The installation room must be equipped with a ventilation system according to the current legislation.

For the dimensions of the openings, always refer to the current legislation.

The ventilation openings are used to allow the inflow of combustion air and to eliminate any fuel gas pockets from the room.

Indicatively, if gases lighter than air (methane) are used, the ventilation openings must be placed at the highest point of the room; vice-versa, for fuel gas heavier than air (lpg), the ventilation openings must be placed flush with the floor.

SYSTEM CLEANING

All system pipes, especially those already installed, must be carefully cleaned and/or washed, to eliminate processing residues and any sludge. The gaskets interposed in the joints must not reduce the pipe section.

HYDRAULIC CONNECTIONS

Once positioned, the steam generator bodies must be connected to the system in the following points:

- **Water;** From the condensate collection tank (if present, otherwise from the purified water collection) to the feed pump intake.
- **Steam;** From the main steam inlet valve to the uses (distribution manifold or others), from the safety valves outlet to outside the room, in a safe position.
- **Drains;** From the level indicator discharge, from the boiler discharge to the drain mains.
- **Fuels;** Connection to burner provided for methane gas, lpg, diesel and naphtha.
- **Compressed air;** The air pressure must be between 4 and 10 bar.



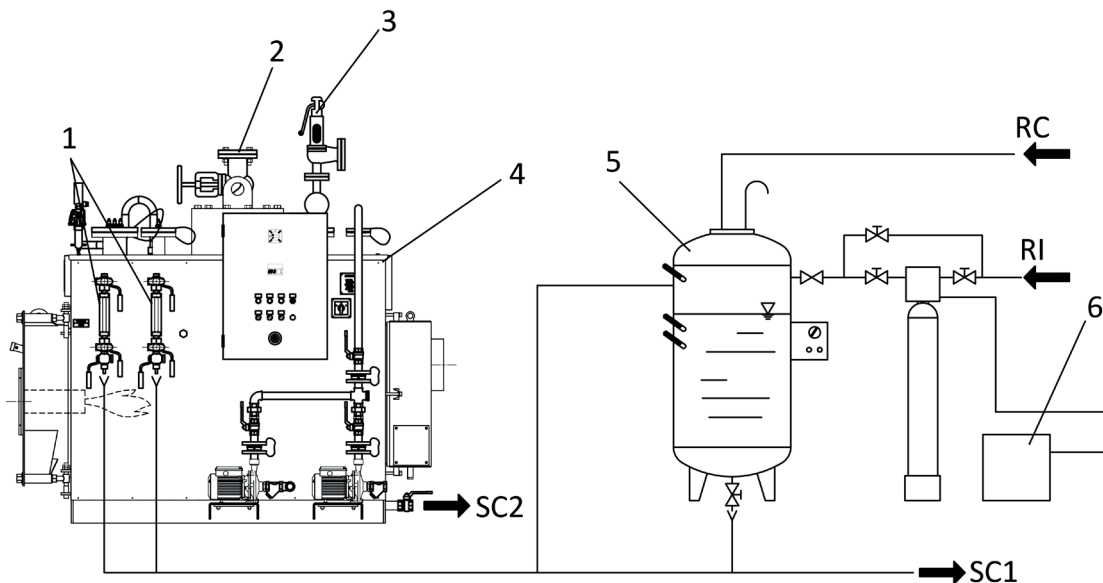
IMPORTANT

We recommend insulating the system pipes to avoid heat dispersion and greater fuel consumption.
Make sure that the drains of the generator safety valves have been connected to a drain well in order to avoid that, in case of intervention, the rooms are flooded.
Make sure that the water and heating system pipes are not used as earthing point of the electrical system.
The air must be filtered with 25 µm mesh.



IMPORTANT

ICI CALDAIE S.p.A. is not liable for any harm to people, animals or property damage caused by errors in the choice of components or in the construction of the plant.



- 1 Visual level indicator
- 2 Steam inlet
- 3 Safety valve

- 4 Steam generator
- 5 Condensate tank
- 6 Feed water purifier

- RC Condensate return
- RI Water mains
- SC Drains

FLUE EXHAUST

The main chimney features, such as height, section, type of outlet in the atmosphere, control points, smoke mass, must be established by a company specialised in the sector that will operate according to the applicable Standards and Legislation. The connection between chimney and generator (smoke duct) must be made according to the specific plant requirements.



IMPORTANT

The diameter of the connection between chimney and generator (smoke duct) must not be less than that shown in the "DIMENSIONS AND CONNECTIONS" table (ØC value).

FRONT DOOR OPENING

The door is adjusted in the factory with standard opening to the left (Sx) and hinges on the right (Dx).



DANGER

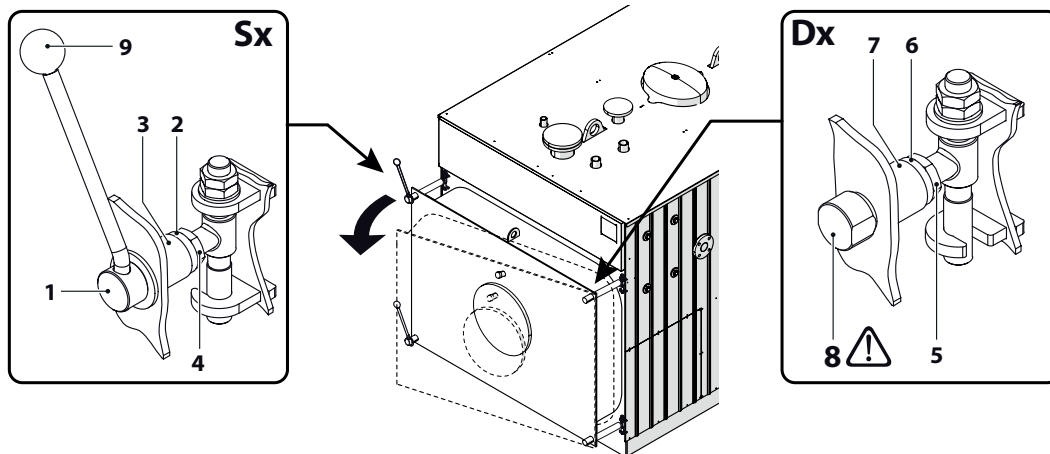
It is DANGEROUS TO UNSCREW the ferrules (8) on the side of the hinges. This may cause the door to detach, with possible serious harm to people and property damage.

DOOR OPENING REVERSAL (TO THE RIGHT)



IMPORTANT

The opening of the door can ONLY be reversed for models from BNx 100 to BNx 1700.



NOTE

The ferrules (8) can be "adjusted with wrench" or "perforated for lever adjustment".

DOOR WITH FERRULES PERFORATED ON BOTH SIDES

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

- screw the left perforated ferrules (1) so that the door seal gasket is pressed in the same way as the right part. Bring the conical washers (2) of the left tie-rods close to the mechanical tubes (3) of the door and tighten the nuts (4) using a suitable wrench
- on the right opening side, loosen the nuts (5) and free the conical washers (6) from the mechanical tubes (7) of the door.

DOOR WITH WRENCH FERRULES, HINGE SIDE



DANGER

In models equipped with wrench-adjustable ferrules (8), these must always be mounted on the hinges to prevent the door from being accidentally opened through the lever (9).

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

- screw the left perforated ferrules (1) so that the door seal gasket is pressed in the same way as the right part. Bring the conical washers (2) of the left tie-rods close to the mechanical tubes (3) of the door and tighten the nuts (4) using a suitable wrench
- cross-change the wrench ferrule of a hinge (8) with the opposite perforated ferrule (1), after loosening the locking nuts on the tie rods and freeing the conical washers
- on the left hinge side, fasten the conical washer (2) onto the door using the nut (4s)
- repeat the last two steps for the other two ferrules also.



DANGER

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

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. If necessary, adjust the door as described in the following paragraph.

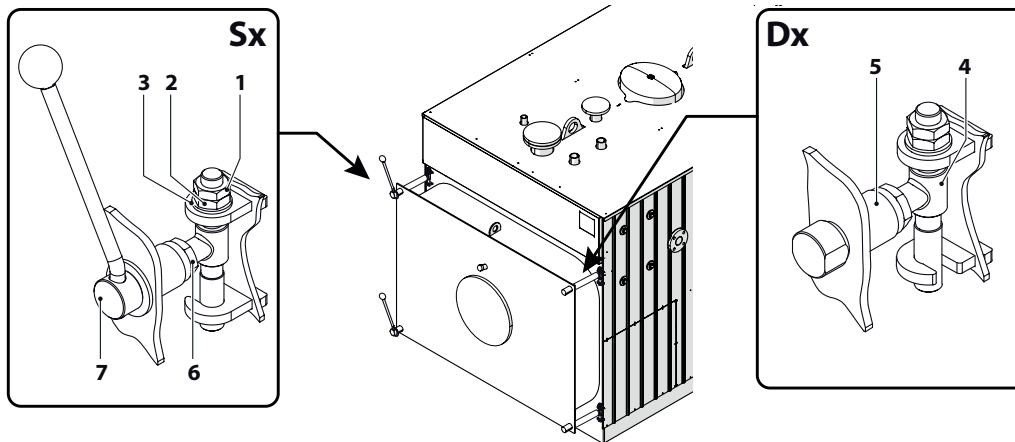
FRONT DOOR ADJUSTMENT



DANGER

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

DOOR ADJUSTMENT (OPENING ON THE RIGHT)



VERTICAL ADJUSTMENT

To make the adjustment:

- with the door ajar, loosen the counter-nuts (1) of the hinge units
- act on the adjustment nuts (2) to lift or lower the door by centring the gasket on the stop plate, then block the counter-nuts (1)
- close the door and centre the tie-rod (4) on the mechanical tube (5), proceeding as in the previous point.

HORIZONTAL ADJUSTMENT

Close the door using the lever and check that there is equal distance on both sides, between the stop plate and the band. If this is not the case:

- with the door ajar, loosen the locking nuts (6) of the hinge units
- act on the ferrule (7) to adjust the distance depth-wise
- screw the nuts (6) and block the conical washers on the mechanical tubes.



DANGER

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

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.

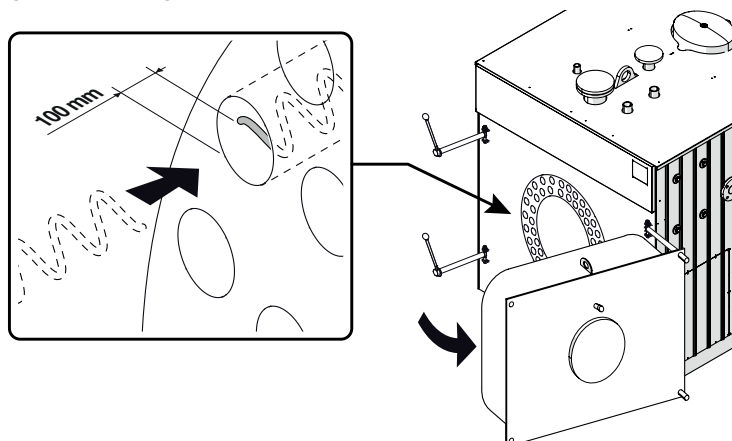
TURBULATOR ASSEMBLY

To assemble the turbulators supplied with the boiler, open the door and insert the turbulators completely into the smoke pipes, until they penetrate by at least 100 mm.



DANGER

The turbulators have very pointed and sharp ends. Therefore, wear suitable protective gloves during insertion (equipment according to current regulation).



BURNER ASSEMBLY

Having chosen the burner to be used, refer to the Manual supplied with it for information about:

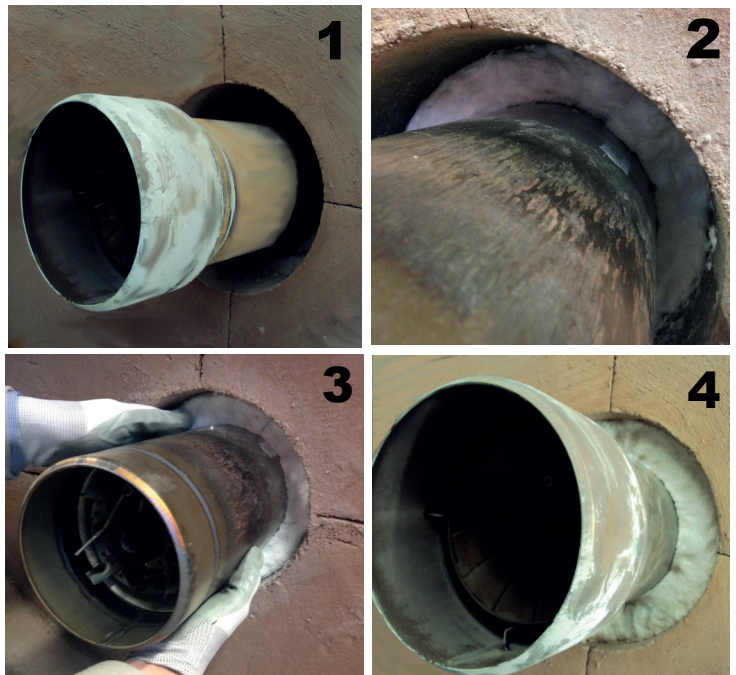
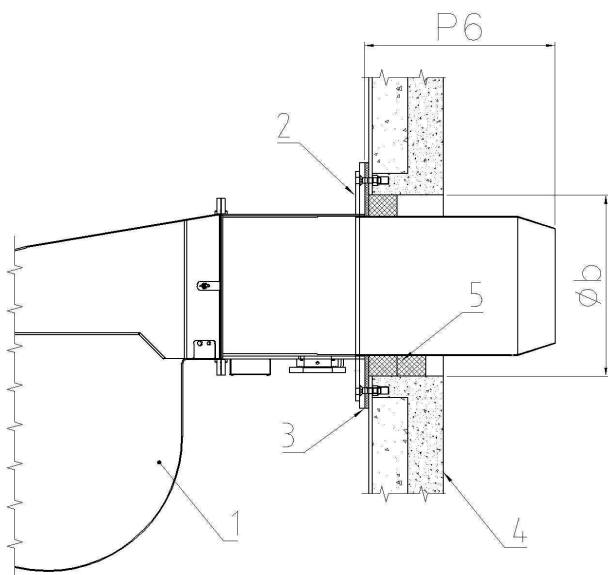
- the installation and fastening to the boiler
- the connection to the fuel supply
- the electrical connections
- the adjustments to be made
- maintenance
- the necessary checks.



IMPORTANT

The strip of ceramic insulation supplied with the generator must be wrapped all around the mouthpiece at least once to protect the burner flange from the irradiation of the flame. It is not necessary for the ceramic insulation to fill the gap up to the internal surface of the door insulation. If the supplied material is not suitable for the used burner, use other material having characteristics suitable to withstand 1000°C and dimensions suitable to completely close the gap.

Installation sequence of the ceramic thermal insulation.



- 1 Burner
- 2 Flange
- 3 Gasket
- 4 Door
- 5 Thermoceramic material

ELECTRICAL CONNECTIONS

The generators are equipped with electrical panel (IP 55 protection rating) complete with all connections to the various generator components, already made in the factory. The panel model is determined by the version of the ordered generator and the wiring diagram, specific and detailed, is present inside the panel. The installer connections must be made by professionally qualified personnel, in compliance with the applicable Technical Standards and the local and national Legislation.



IMPORTANT

Connect the generator to an efficient earthing system. **ICI CALDAIE S.p.A.** is not liable for any damage caused by the lack of earthing and failure to comply with the wiring diagram.



PROHIBITION


Do not use the water and heating system pipes for the **earthing connections**.

LOADING AND SUPPLY OF THE GENERATOR/SYSTEM

The steam generator is fed with a multistage centrifugal pump. The water must reach the pump intake with a certain head in order to avoid cavitation.

The minimum temperature of the sucked water must be greater than 60°C; this favours the elimination of oxygen which, in any case, must be completely eliminated with suitable chemicals. Also, a water temperature > 60°C reduces the risk of thermal shock in the boiler.

The feed tank must be positioned at a height that depends on the temperature of the water in the degasser/feed tank, on the conformation of the degasser/pump-feed tank connection pipe and on the features of the pump itself (refer to the pump manual).



ATTENTION

- The oxygen dissolved in the water corrodes the boiler. Refer to the maximum allowed values indicated in the relevant section of the technical manual.
- Follow the table below to avoid pump cavitation problems.

DEGASSER TYPE	Water supply temperature (°C)	Head on the intake (metres)
Atmospheric degasser	60	1
	70	2
	80	3
	90	4,5
0.5 bar pressurised thermo-physical degasser	90	6

^[1] The maximum intake temperature of the pump is 90°C.

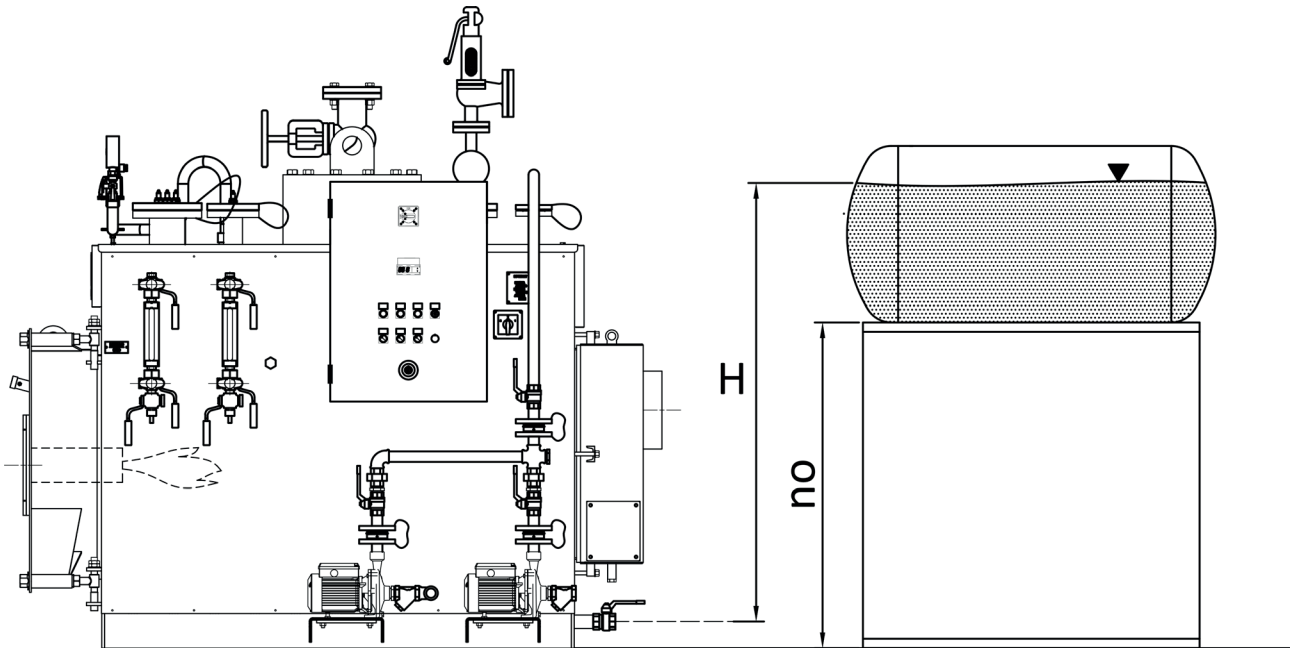


IMPORTANT

- Avoid using feed water at a temperature below 60°C because rich of dissolved oxygen, thus such to cause corrosion.

HYDROSTATIC HEAD DIAGRAM

Below is an example of hydrostatic head diagram.



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.

5.1 Water supply - Threshold values (in input)

CHARACTERISTICS	u.m.	Steam generator water with pressure up to 20 bar
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]
Total hardness (Ca+Mg)	mmol/l	< 0,01 ^[c]
Iron (Fe)	mg/l	< 0,3
Copper (Cu)	mg/l	< 0,05
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
Concentration of organic substances	-	See note ^[e]

^[a] With copper alloys in the system, the pH value must be kept between 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	
		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	< 1500
pH at 25°C	---	10,5 - 12	10 - 11 ^[b] ^[c]
Composite alkalinity	mmol/l	1 - 15	0,1 - 1 ^[c]
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) ^[d]	mg/l	10 - 30	6 - 15
Organic substances	-	See note ^[d]	

^[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 treatment with coordinated phosphate is used, considering all other values, higher concentrations of PO₄ are acceptable.

^[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 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).

3 Use

PRELIMINARY CHECKS



IMPORTANT

- Before starting the steam generator, it is advisable to perform "**Alkaline boiling**" with subsequent passivation, to remove any processing residues. Considering the high risk deriving from incorrect chemical treatments, the operations must be carried out by **professionally qualified personnel**.
- 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.

- Check that all connections are fully tightened
- Check that the feed water pipe is clean, repeatedly washing it before final filling
- Close the drain valve, steam inlet and level indicator discharge
- Open the level and supply shut-off valves (upstream and downstream of the water pump)
- Check that the door closes properly
- Verify the presence and condition of all control and safety accessories supplied with the generator.

COMMISSIONING

To start the steam generator:

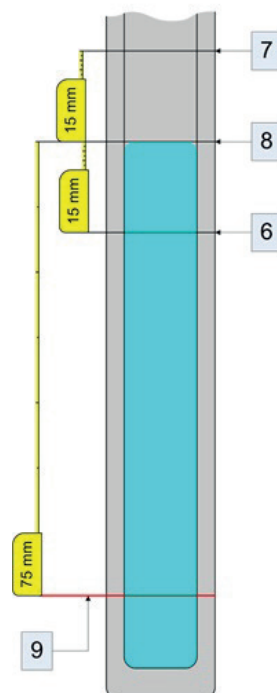
- place the main switch at "**ON**" and electrically power the control panel
- electrically power the pump, briefly activating the selector, and check that:
 - the rotor rotates freely
 - for the three-phase version, that the rotation direction is correct (indicated at the back of the motor)
- place the pump selector at "**AUT**" and check that there is no consent to start the burner before the water has reached the minimum level
- check that the pump stops when the water reaches the operating level, visible in the glass indicator
- press the reset button for a few seconds to enable the safety and control circuit.
- open the generator drain and check on the level indicator at which point the probe intervenes to start the pump
- position the pump selector at "**0**" leaving the generator drain open and check the level of intervention of the safety probes with reference to the minimum level plate
- close the generator drain and position the pump selector at "**AUT**"
- electrically power the burner, pressurise the generator and adjust the pressure value.

9) Minimum level

6) ON pump

8) Operating level

7) OFF pump



CHECKS AFTER COMMISSIONING

With cold start, check that:

- the generator is filled with water up to the minimum level
- the volume increase due to heating (thermal expansion of the water) does not excessively increase the level making draining necessary at regular intervals to bring the level back to half scale of the glass indicator
- once the set pressure is reached, the steam outlet valve must be gradually opened in order to heat the delivery pipe, eliminating any condensation in the ducts
- the manhole gasket seals.

MANDATORY PERIODIC VERIFICATIONS

WATER LEVEL MONITORING

The operator of the system in the installation room must frequently check the glass indicator so as that the water level in the generator remains above the minimum value indicated in the glass level. A possible drop below the minimum value must cause the intervention of the two safety level switches.

PRESSURE MONITORING

The operator of the system in the installation room must frequently verify that the pressure of the generator steam remains below the maximum value indicated on the generator assembly 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.

STOP PERIODS

The most serious corrosions for the generator often occur during the stop periods.

The operations to be carried out to store the generator correctly essentially depend on the duration of the downtime. When the generator needs to be stopped **for long periods, dry storage** can be done. When the stops are **for short periods** or when the generator is used as a spare and must start running in a short amount of time, a **wet storage** can be made.

In both cases, the operations described below tend to eliminate any possible cause of corrosion.

When possible, wet storage reduces the time required to reach the operating conditions.

Dry storage

It is necessary to empty and dry the generator carefully, subsequently pouring a hygroscopic substance inside the cylindrical body (e.g. quick lime, silica gel, etc.).

Wet storage

Drain the water out and clean the entire generator. Fill the unit up to the normal operating level, and after a brief period of evaporation it is essential to vent all the dissolved gases into the atmosphere. Then, completely fill the generator, using enough DEHA (diethyl hydroxyl amine) to develop a residual concentration of more than 100 ppm, to prevent the attacks of oxygen dissolved in the water. Also add trisodium phosphate, so that the overall alkalinity is greater than 400 ppm.

Then, close all the connections.

Make sure there are no leaks from the connections or joints and draw samples of water at regular intervals, to check that the alkalinity value has not been altered.

4 Maintenance

Periodic maintenance is an obligation required by the safety Legislation and duration of the appliance, and it must only be entrusted to professionally qualified personnel.

The frequency of the operations is shown in the specific paragraph.



IMPORTANT

Before performing any maintenance or cleaning:

- disconnect the electrical power supply by placing the main switch of the system, of the control panel and of the burner, if any, at "OFF"
- close the fuel supply
- use all Personal Protective Equipment required by current Standards and Legislation
- wait for the generator and the system to cool down.

- Periodically purge (level indicators, probe support, if any, generator) to avoid the build-up of sludge
- 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
- check the state of the internal coating of the doors
- clean the tube bundle and turbulators
- carry out proper pump maintenance (bearings, mechanical seal)
- check the wear of the drain valves, replace them if necessary.

PERIODIC VERIFICATIONS

The frequency of verifications is shown in the table. **It MUST be strictly observed.**

Observation and tests	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 (if present)	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)

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 installed).

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 paragraph "Checking of the minimum level safety level switches").
- T(2) Physical verification of the intervention of the devices (as described in the following paragraph "Checking of the minimum level safety level switches").
- T(3) Physical verification of the intervention of the devices (as described in the following paragraph "Checking of the minimum level safety level switches").
- 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 paragraph "Water characteristics").
- 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 paragraph "Water characteristics").
- 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.



ATTENTION

The electronic level relays inside the electrical panel must be replaced after 8 years of operation as they have reached the end of their life-span.

METHODS FOR CHECKING THE SAFETY DEVICES

CHECKING OF 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 putting the selector to "0", wait for the natural lowering of the generator water level. To speed up the operation act on the mud discharge valve.



IMPORTANT

The two safety devices must intervene when the water level reaches the "minimum" indicated on the side of the glass indicators. Otherwise, check the entire level switch consisting of:

- electronic level regulator; check it is intact and, if not, proceed with replacement
 - connection cable between electrical panel and probe; possible interruption and/or short circuit
 - level probe; check for possible breakage of the ceramic part and consequent loss of electrical insulation
 - level dipstick; possible scaling that prevents water-probe current pass or possible detachment of the dipstick.
- If the check is positive, place the pump command to "AUT".

CHECKING OF THE MAXIMUM LEVEL SWITCH

Position the pump selector located on the electrical panel in the MAN position and wait for the water level in the generator to rise. Check that the pump stops.

CHECK OF THE SAFETY PRESSURE SWITCH

The safety pressure switch calibration must be at least 0.5 bar below the calibration of the safety valves.

To check the correct intervention of the safety pressure switch, it is necessary to increase the calibration of the adjustment pressure switch(es) and ensure the switch-off of the burner and activation of the block on the boiler electrical panel by visually following the indication given by the pressure gauge.

ROUTINE MAINTENANCE

- Depending on the degree of pollution of the premises, clean the ventilation and/or the air conditioner (if present) filters and grilles frequently.
- Every 2-3 months check for dust deposits inside the panel, vacuum and/or blow to eliminate any deposits.
- Every six months check the clamping of the connections to the inner components, paying particular attention to the power circuits.
- Every six months check the clamping of the connections to the field control/safety devices, including any junction boxes.
- Annually check that the electrical panel, the generator and the control unit equipotential is properly connected to earth.
- Every six months check the condition of the safety devices (probes and pressure switches).
- Every six months check that the burner and pump(s) command circuits respect the original conditions (see the paragraph "Commissioning").



IMPORTANT

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

EXTRAORDINARY MAINTENANCE

The generator must be stopped periodically for a thorough inspection and maintenance: the time interval between downtime is established through experience, by operating conditions, by the quality of the feed water, and by the type of fuel used.

Before accessing the boiler body for inspection or cleaning, carefully ensure that there is no possibility of water or steam getting into the generator through the ducts that it is connected to. Every valve must be shut and, if required, isolated by removing a section of connecting pipe to the system or by placing a blind flange in between.

The pressurised parts must be carefully examined internally to look for any build-up, corrosion and other potential sources of danger pertaining to the feed water.

It is necessary to remove the deposits through mechanical or chemical action and use suitable tools to ensure that the actual thickness of the internal parts is not affected by corrosion. Any pockmark or other type of corrosion must be scraped and cleaned with an iron brush until the metal is exposed. Leaks between all fume pipes and tube sheets must be examined carefully: any welding must comply with legal requirements, not forgetting that the steam generator is a pressure appliance with an explosion hazard, subject to control by the relative Body.

During the inspection, check all safety accessories (safety valve, safety level switches and safety pressure switches).

LEVEL SWITCH REPLACEMENT

To replace the safety level switch or part of it, strictly observe the following instructions:

- check that the ceramic part of the new level probe is intact
- check the rod length
- check the coaxiality of the rod with the level probe axis
- check the integrity of the electrical system, in particular check that the insulation resistance of the electrical cable that connects the probe to the panel is above 2 MΩ
- check the integrity of the probe with particular regard to the isolation between the central electrode and the external part, that must be \geq at 10 MΩ
- check the operation of the level switch, consisting of the assembly of the two ceramic probes and relative conductivity relays.



IMPORTANT

- The electronic level relays inside the electrical panel HAVE AN AVERAGE CALCULATED DURATION (MTTFd, "Mean Time To Failure") of 8 YEARS. It is an average time before a dangerous failure occurs. Therefore, they must be replaced after this operating period. We recommend replacing the probes once a year. To be evaluated, during cleaning/maintenance, the other mechanical, electromechanical and electronic parts.
- **The faulty components must be replaced with ICI CALDAIE S.p.A. original components.**

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	Check and subsequent calibration of the valve using a sample pressure gauge
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	Valve disassembly and polishing of the internal seat with very fine abrasive paste
Pump block	Disconnected pump thermal relay	Check motor absorption
	Blocked pump shaft	Check thermal calibration
	Calibrated limit pressure switch too high	Electric pump maintenance
Block pressure switch intervention	Faulty limit pressure switch	Limit pressure switch calibration
	Clogged pressure switch coil	Limit pressure switch replacement
	Block pressure switch failure	Coil cleaning or replacement
		Pressure switch replacement
Level 1 or 2 safety intervention	Interrupted water level detection	Encrusted stainless steel rod
		Interrupted connection cable
	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

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.

DECOMMISSIONING AND DISPOSAL

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

5 Accessories

AVAILABLE ACCESSORIES

The accessories listed below are or can be installed on the **BNX** generators.

For further details see the **ICI CALDAIE S.p.A.** catalogue, at the Section INDUSTRIAL LINE – ACCESSORIES AND COMPONENTS.

When requested at the time of ordering the generator, they are installed on the appliance before delivery.

Salinity control unit (TDS electric)

The TDS control system limits the level of salts and minerals dissolved in the generator water within the value allowed by the manufacturer, thus avoiding drag risks due to excessively high levels of salinity and minimising the amount of purge required and related costs.

The system consists of an on-line kit connected to a specific connection in the generator, just below the water level.

It works by opening the drain valve at regular intervals so that a precise amount of water reaches the conductivity probe located inside the measuring chamber placed in line with the drain valve. The probe measures the electrical conductivity of the generator water, whose value is related to the concentration of dissolved salts. The detected value is compared with that set in the regulator. If lower, the valve closes at the end of the drain time. If higher, the system continues to repeat the draining cycle until the measured value returns within the limits.

Salinity control unit TDS Electric light

For \leq BX 600 , \leq BNX 1000 and \leq SIXEN 2000 generators, electrically and hydraulically assembled to the generator.

The TDS control system limits the level of salts and minerals dissolved in the generator water within the value allowed by the manufacturer, thus avoiding drag risks due to excessively high levels of salinity and minimising the amount of purge required and related costs.

The system consists of an on-line kit connected to a specific connection in the generator, just below the water level. It works by opening the drain valve at regular intervals so that a precise amount of water reaches the conductivity probe located inside the measuring chamber placed in line with the drain valve. The probe measures the electrical conductivity of the generator water, whose value is related to the concentration of dissolved salts. The detected value is compared with that set in the regulator. If lower, the valve closes at the end of the drain time. If higher, the system continues to repeat the draining cycle until the measured value returns within the limits.

Salinity Control Unit (TDS Pneumatic)

The TDS control system limits the level of salts and minerals dissolved in the generator water within the value allowed by the manufacturer, thus avoiding drag risks due to excessively high levels of salinity and minimising the amount of purge required and related costs.

The system continuously measures, just below the evaporation surface, the electrical conductivity of the generator water whose value is related to the concentration of dissolved salts. The detected value is compared with the set value. If it is higher, the purge valve opens until the value returns below the setpoint.

"BNX" - "BBNX" Automatic purging unit

The automatic bottom drain unit avoids unnecessary repetitions or purge omissions that occur with the manual system. This system allows for the sludge accumulated on the bottom of the generator to be regularly evacuated automatically through the cyclical opening of the purge valve. The frequency and duration of the purges must be set by the user according to the characteristics of the generator water as indicated in the technical manual of the generator.

The system requires compressed air.

GSS 24 24h global safety system

GSS 24 global safety system, designed and built to guarantee total safety of operation of steam generators.

GSS 72/1 72h global safety system for \leq BX 600, \leq BNX 1000, \leq SIXEN 2000 and GSX \leq 2000 generators

GSS 72/1 global safety system, designed and built to guarantee total safety of operation of steam generators.

Applicable on steam generators (BX 60÷600)-(BNX 100÷1000)-(SIXEN 350÷2000)-(GSX 350÷2000).

**ATTENTION**

The GSS 72/1 system can only be applied to boilers with boiling pressure of 12 bar or less.

GSS 72/2X global safety system

GSS 72/2X global safety system, designed and built to guarantee total safety of operation of steam generators.

Spare feed pump (for steam generators)

In order to ensure continuous operation of the generator, avoiding production stops in case of feed pump failure, a second spare pump is installed in parallel to the service pump.

Cooler for sampling

To make sure that the generator is working within the desired conductivity parameters, take water samples and analyse them. To safely obtain accurate samples, it is essential to perform adequate cooling in order to condensate any fresh steam before the sampling point. The cooler reduces the water temperature to 25°C, ready for immediate sampling.

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			
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
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.	
SOLIO - LIGHT OIL HEAVY OIL		TIPO - TYPE - TYP GAS 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 info: assistenza@icaldaie.com

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Notes

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