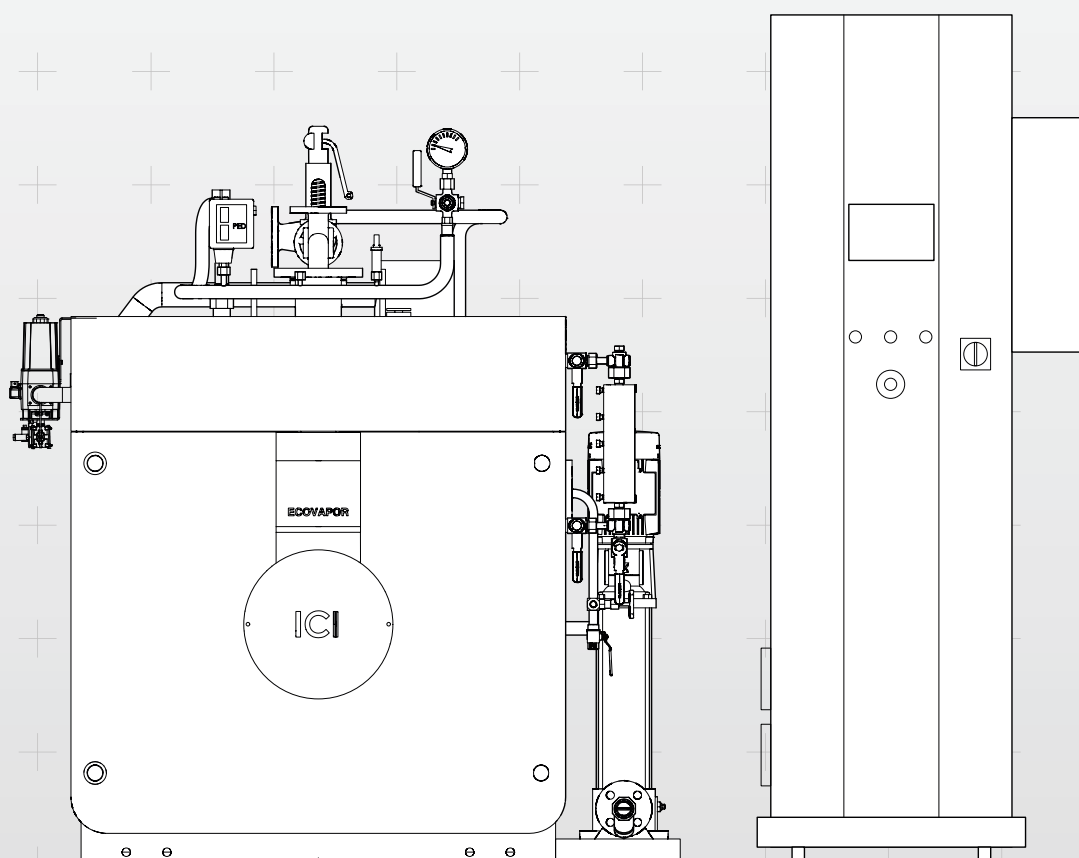




EN

Steam generating unit with integrated burner

ECOVAPOR



INSTALLATION, USE AND MAINTENANCE MANUAL



ECOVAPOR_350_3000_en_03 - 11/2020

INDEX

General information

- 4 Introduction
- 4 Range
- 4 Compliance
- 4 Warranty
- 5 Warnings
- 6 Prohibitions
- 6 Hazards
- 7 Hazards
- 7 Paperwork
- 8 Fire prevention
- 8 Identification
- 9 Appliance description
- 9 Structure
 - 9 *Front view*
 - 10 *Side view*
- 11 Dimensions and connections
 - 11 *Front view*
 - 12 *Side view*
- 13 P&ID
- 15 Technical data
 - 15 *Safety component calibrations*
- 15 Components
 - 15 *Pressure gauge*
 - 16 *Safety valves*

Combustion system

- 19 Description
- 21 Burner modulation strategy
- 21 Compliance
- 22 System logics **ECOVAPOR** in case of no flame
 - 22 *Failure upon ignition*
 - 22 *Failure during standard operation*

Adjustment and control system

- 23 Control panel
- 25 Graphic interface
- 28 Operating modes
- 31 Complete list of menus and parameters
 - 31 *Main parameter menu*
 - 33 *Information menu*
 - 37 *Generator parameter menu*
 - 40 *Service parameter menu*
- 41 Modbus/slave interface parameters

Installation

- 43 Product receipt
- 44 Handling
- 44 Film removal
- 45 Installation room
 - 45 *Positioning*
 - 45 *Room ventilation*
- 46 System cleaning
- 46 Hydraulic connections
- 47 Flue exhaust
- 47 Gas train assembling
- 48 Front door opening
- 48 Front door adjustment
 - 48 *Door adjustment (opening on the right)*
- 49 Turbulator assembly
- 49 Electrical connections

First commissioning

- 50 Preliminary activities to be carried out before the "first" commissioning
 - 50 *Hydrostatic head diagram*
 - 51 *Water characteristics*
 - 52 *Frequency of analysis*
- 52 Water feeding procedure
- 53 Level probe positioning
- 53 FIRST START-UP
- 55 Combustion system calibration
- 56 Checks after commissioning
- 56 Stop periods

Maintenance

- 57 Filter cleaning
- 57 Periodic verifications
- 59 Lifecycle of main components
- 59 Methods for checking the safety devices
 - 59 *Checking of the minimum level safety level switches*
 - 59 *Check the maximum level switch (if any)*
 - 59 *Check of the safety pressure switch*
- 60 Routine maintenance
- 60 Extraordinary maintenance
 - 60 *Level switch replacement*
- 61 Any anomalies and remedies
- 61 Protecting the environment

- 61 Decommissioning and disposal
- 62 System for 24 or 72 h operation without continuous supervision

Optional components

- 64 Backup supply pump
- 64 Second level indicator
- 64 Second safety valve
- 65 Steam outlet electric valves
- 65 Steam non-return valves
- 65 Steam flow meter
- 65 Electrical energy meter
- 66 Mid thermal energy meter
- 66 Turbine gas meter
- 66 Gas manual shut-off valve
- 66 Gas pressure controller

Useful information and declarations

- 67 QR code

Appendixes for Technical Personnel

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 **ECOVAPOR**, 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
Models for 24 h Operation without Continuous Supervision(ECS24)	ECOVAPOR 350 _ECS24 BOILER 350 KG/H 12 BAR	86440350
	ECOVAPOR 500 _ECS24 BOILER 500 KG/H 12 BAR	86440500
	ECOVAPOR 650 _ECS24 BOILER 650 KG/H 12 BAR	86440650
	ECOVAPOR 800 _ECS24 BOILER 800 KG/H 12 BAR	86440800
	ECOVAPOR 1000 _ECS24 BOILER 1000 KG/H 12 BAR	86441000
	ECOVAPOR 1350 _ECS24 BOILER 1350 KG/H 12 BAR	86441350
	ECOVAPOR 1700 _ECS24 BOILER 1700 KG/H 12 BAR	86441700
	ECOVAPOR 2000 _ECS24 BOILER 2000 KG/H 12 BAR	86442000
	ECOVAPOR 2500 _ECS24 BOILER 2500 KG/H 12 BAR	86442500
	ECOVAPOR 3000 _ECS24 BOILER 3000 KG/H 12 BAR	86443000
Models for 72 h Operation without Continuous Supervision (ECS72)	ECOVAPOR 350 _ECS72 BOILER 350 KG/H 12 BAR	86440354
	ECOVAPOR 500 _ECS72 BOILER 500 KG/H 12 BAR	86440504
	ECOVAPOR 650 _ECS72 BOILER 650 KG/H 12 BAR	86440654
	ECOVAPOR 800 _ECS72 BOILER 800 KG/H 12 BAR	86440804
	ECOVAPOR 1000 _ECS72 BOILER 1000 KG/H 12 BAR	86441004
	ECOVAPOR 1350 _ECS72 BOILER 1350 KG/H 12 BAR	86441354
	ECOVAPOR 1700 _ECS72 BOILER 1700 KG/H 12 BAR	86441704
	ECOVAPOR 2000 _ECS72 BOILER 2000 KG/H 12 BAR	86442004
	ECOVAPOR 2500 _ECS72 BOILER 2500 KG/H 12 BAR	86442504
	ECOVAPOR 3000 _ECS72 BOILER 3000 KG/H 12 BAR	86443004

COMPLIANCE

The steam generators Series **ECOVAPOR** 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 serial number is indicated on the boiler nameplate.

WARRANTY

The warranty conditions for boilers series **ECOVAPOR** are included in the CONSTRUCTION - WARRANTY CERTIFICATE supplied 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 **ECOVAPOR** 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.**.
- The first Commissioning must be carried out by Technical Assistance Service **ICI CALDAIE S.p.A.** after the necessary preliminary checks. Once the commissioning operations are completed, the Technical Assistance Service must fill out the System Booklet and deliver it to the User.
- 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.
- 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.
- Level switch operation must be manually checked every 24 or 72 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 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.



IMPORTANT

- 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).
- Climb up and down the top of the boiler body to perform ordinary and extraordinary maintenance operations using PPE according to the Regulations in force in the Unit Installation Country.
- 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 downgrading, comply with what specified in the Regulations in force in the Unit Installation Country.
- Boiler design takes into account only the loads due to static internal pressure, temperature, equipment weight in operating conditions (static load), weight in test conditions (static load), boiler support connection.
- In order to limit boiler operating cycles, it is started at pressures below 0.5 barg.

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.
- Use generator fittings as pipe supporting points.
- 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.
- An improper use of the system.

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.

HAZARDS



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.

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.

FIRE PREVENTION

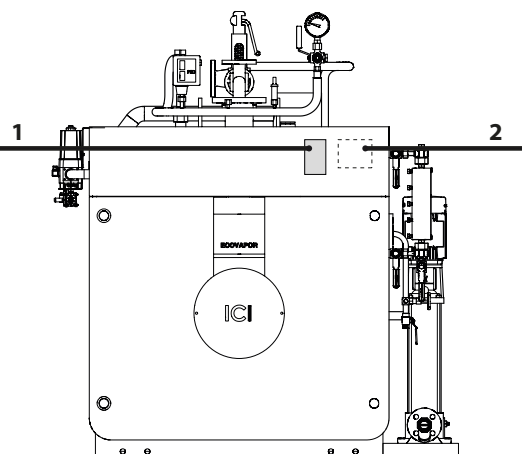
Refer to the Regulations in force in the Unit Installation Country.

IDENTIFICATION

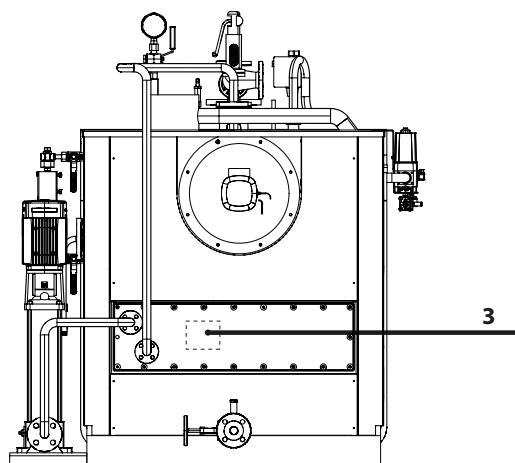
Each system **ECOVAPOR** is identified by the following nameplates:

- **Assembly nameplate (1):** it is glued on the external surface of the front plate coating of the front panel; this plate carries the data relating to the boiler complete with the accessories, which may vary from those of the generator body only.
- **Generator body nameplate (2):** it is positioned under ICI CALDAIE logo, which is screwed to the upper coating of the front plate; this plate carries the main data of the generator body and is riveted on a special support.
- **Energy saver nameplate (3):** it is positioned under the coating panel, on the rear side; this plate carries the main data of the energy saver and is riveted on a special support. To access it, remove the fastening nuts and slide out the panel.

EVO1n		ICI CALDAIE	
ICI CALDAIE S.p.A. Via G. Pascoli, 38 - 37059 ZEVIO (VR) - ITALIA -			
Tipo - Type			
ECOVAPOR 500			
Codice - Code	Data - Date	Numero di Serie - S. N.	
86440504	07.12.2017	200031736	
PORTATA TERMICA - HEAT INPUT		379 kW	325.600 Kcal/h
POTENZA UTILE - HEAT OUTPUT		341 kW	293.000 Kcal/h
TS min: -10 °C	RIF. DISEGNO - DRAWING REF.		
PS: 12 BAR	CORPO - BODY: SIXEN5001200		
TS max: 191,7 °C	INSIEME - ASSEMBLY: ECOVAPOR_P-ID_01		
BRUCIATORE - BURNER			
COMBUSTIBILE - FUEL	GAS TYPE: G20 (34,02 MJ/mc)		
METANO - NATURAL GAS	GAS CAT.: I2H		
PRESSIONE - PRESSURE	PORTATA COMBUSTIBILE - FLOW FUEL		
17 - 25 mbar	38 Smo/h		
DESTINAZIONE - DESTINATION	ALIM.ELETT. - VOLTAGE-ALIM.ELECT.		
AT, CH, CL, DK, EE, ES, FI, GB, GR, RO, SE, IT, LT, LV, NO, PT, SE, SI, SK	V 3/N - 400 - Hz 50		
		CLASSE PROTEZIONE - PROTECTION CLASS	
		IP55	
GENERATORE EQUIPAGGIATO PER ESSERE ESERCITO SENZA LA SUPERVISIONE CONTINUA FINO A 72 ORE DI FUNZIONAMENTO.			
STEAM GENERATOR FOR WORKING WITHOUT CONTINUOUS SUPERVISION UNTIL 72 HOURS.			
S.N. Body 1: 100030216			
DATI CARATTERISTICI: VEDI DICHIARAZ. CONFORMITA'			
SEE THE DECLARATION OF CONFORMITY FOR TECHNICAL DATA			



ICI CALDAIE S.p.A.			
Via G. Pascoli, 38 / Fraz. Campagnola			
37059 ZEVIO (VR) - ITALY			
MODELLO	N.F.	DATA	SUP. RISCALDATA
BOILER TYPE	S.N.	DATE	HEATING SURFACE
PS	PT	TS Max.	TS Min.
POTENZA	POTENZA	PRODUZIONE VAPORE	
HEAT INPUT	HEAT OUTPUT	STEAM CAPACITY	
CATEGORIA	CLASSE FLUIDO	COMBUSTIBILE	
CATEGORY	FLUID GROUP	FUEL	
CE 1370	I	kg	
CAPACITA'/CAPACITY		MASSA/WEIGHT	



ICI Caldaie SpA Via G. Pascoli, 38 37059 Campagnola di Zevio VR		
Serial N. 1773F17	YEAR 2017	
Fam/Type: C1 - 92GF-4T 4R 650A 3P 4NC	Description: ECXV 2-6	
TS °C	Tube Inside	Tube Outside
PS barg	22	atm
PT barg	32	/
Fluid: WATER Volume: 2,3 L		
Fabbricante/Manufacture DAVCOIL Srl		
Via dell'Artigianato 11 - 37029 San Pietro In Cariano (VR)		

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

APPLIANCE DESCRIPTION

Systems **ECOVAPOR** are automatically-operated appliances for high pressure (12 bar) steam production from 350 to 3000 kg/h. The horizontal combustion chamber is of the reverse flame type and the tube bundle is complete with helical turbulators. The patented combustion system, with pre-mixing and flue gas recirculation, only for natural gas (CH₄), allowing to obtain high efficiency levels, low emissions and a thermal power modulation from 1 to 10, is integrated inside the front door and in the rear smokebox.

The generator body is thermally insulated through a high-density mineral wool mattress protected by stainless steel panels to minimise losses.

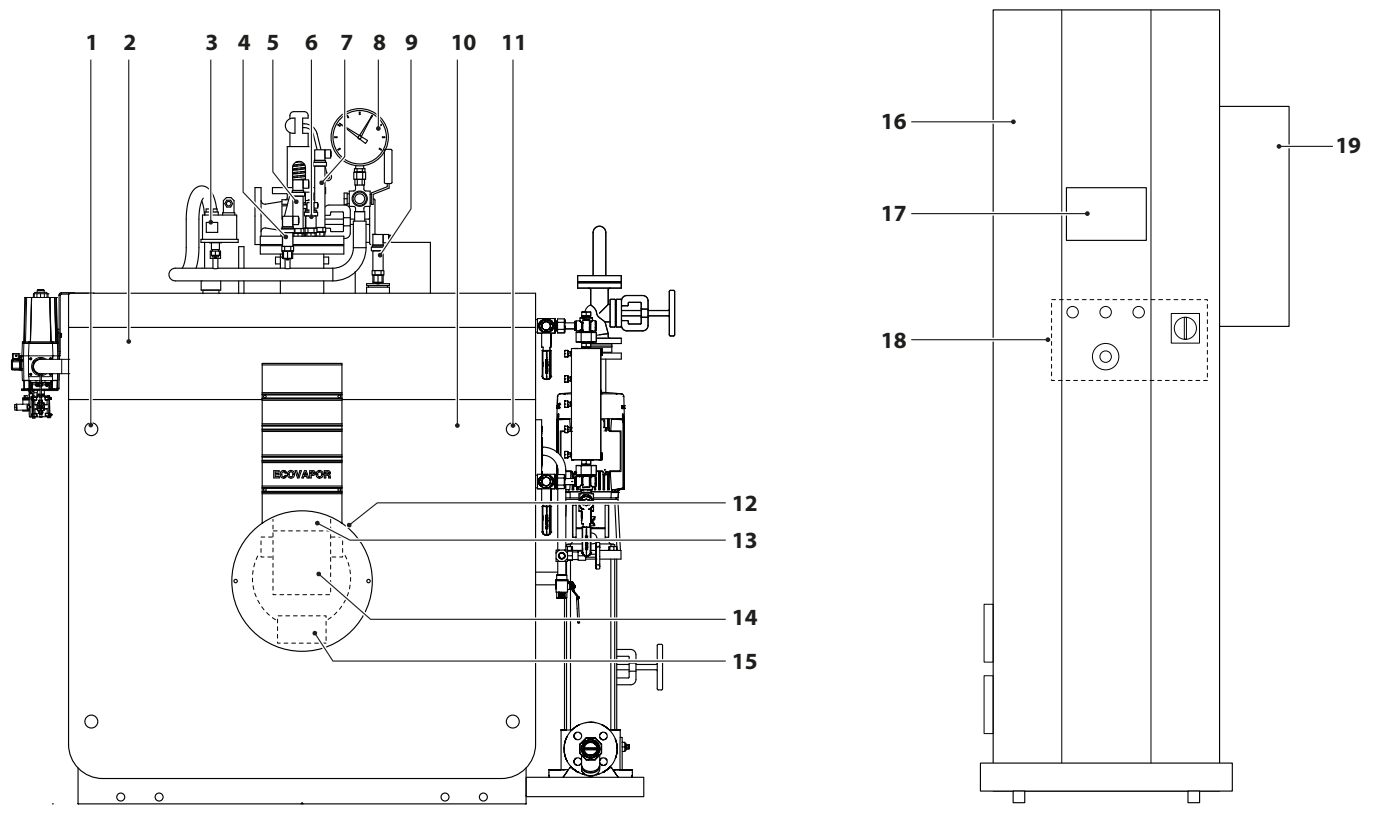
They use a single control panel where the whole electric wiring of the appliance merges, and including the touch-screen operator's panel, the burner managing control unit, with display, the burner motor inverter, controls of several devices and an air-conditioning system to ensure a temperature suitable to the devices.

The steam generating system **ECOVAPOR** has been designed for the installation inside closed heating plant rooms with an ambient temperature below 50 °C; it rests on a support made of carbon steel section bars ensuring its stability.

They are equipped with water side inspection opening (flanged hatch).

STRUCTURE

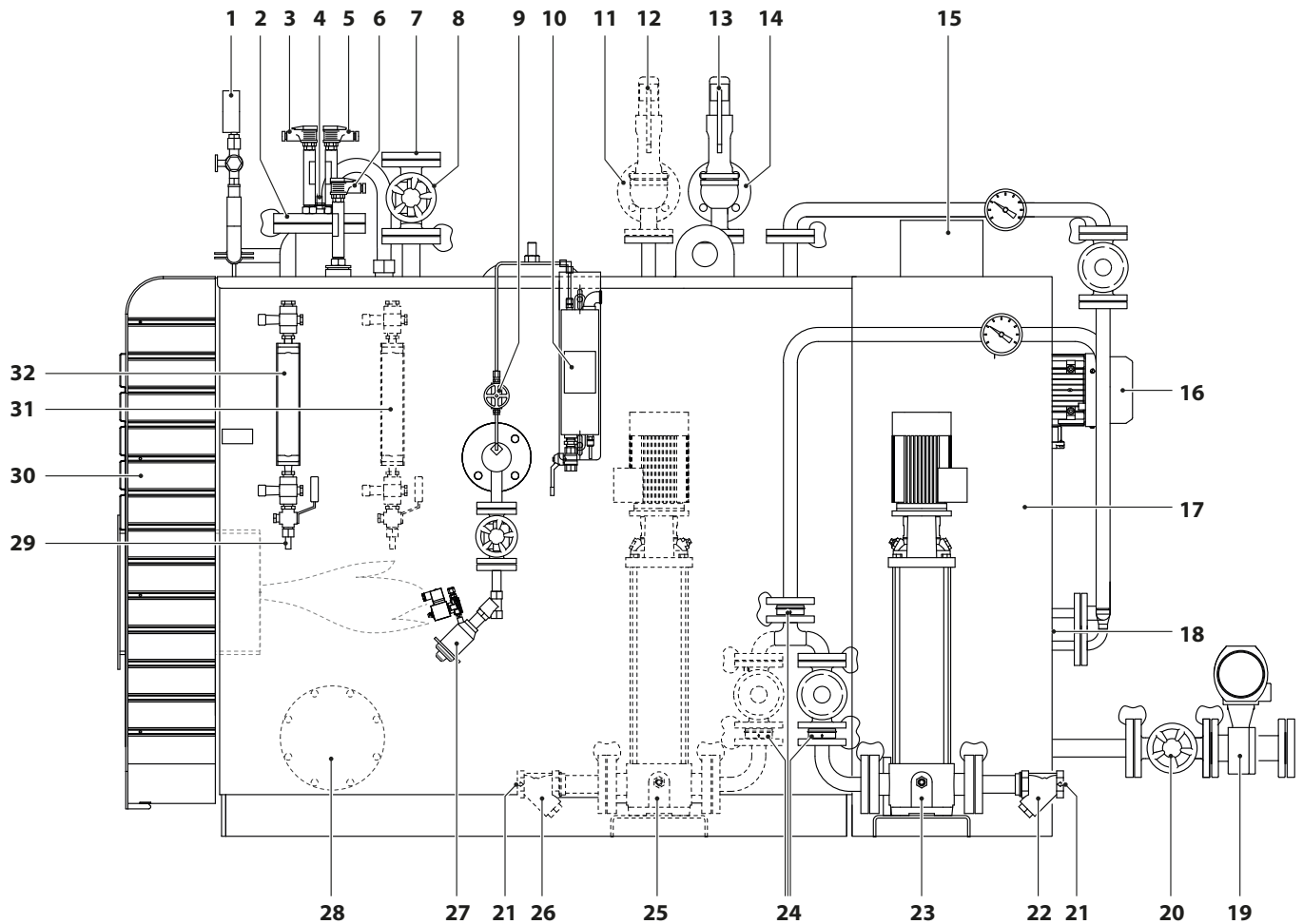
FRONT VIEW



- 1 Door locking system
- 2 Front door
- 3 Pressure transducer
- 4 Pressure transducer
- 5 First safety level probe (minimum)
- 6 Maximum level probe
- 7 Capacitive probe with pre amplifier
- 8 Pressure gauge
- 9 Second safety level probe (minimum)
- 10 Front door

- 11 Front door
- 12 Pressure transducer
- 13 Pressure transducer
- 14 First safety level probe (minimum)
- 15 Maximum level probe
- 16 Capacitive probe with pre amplifier
- 17 Pressure gauge
- 18 Second safety level probe (minimum)
- 19 Front door

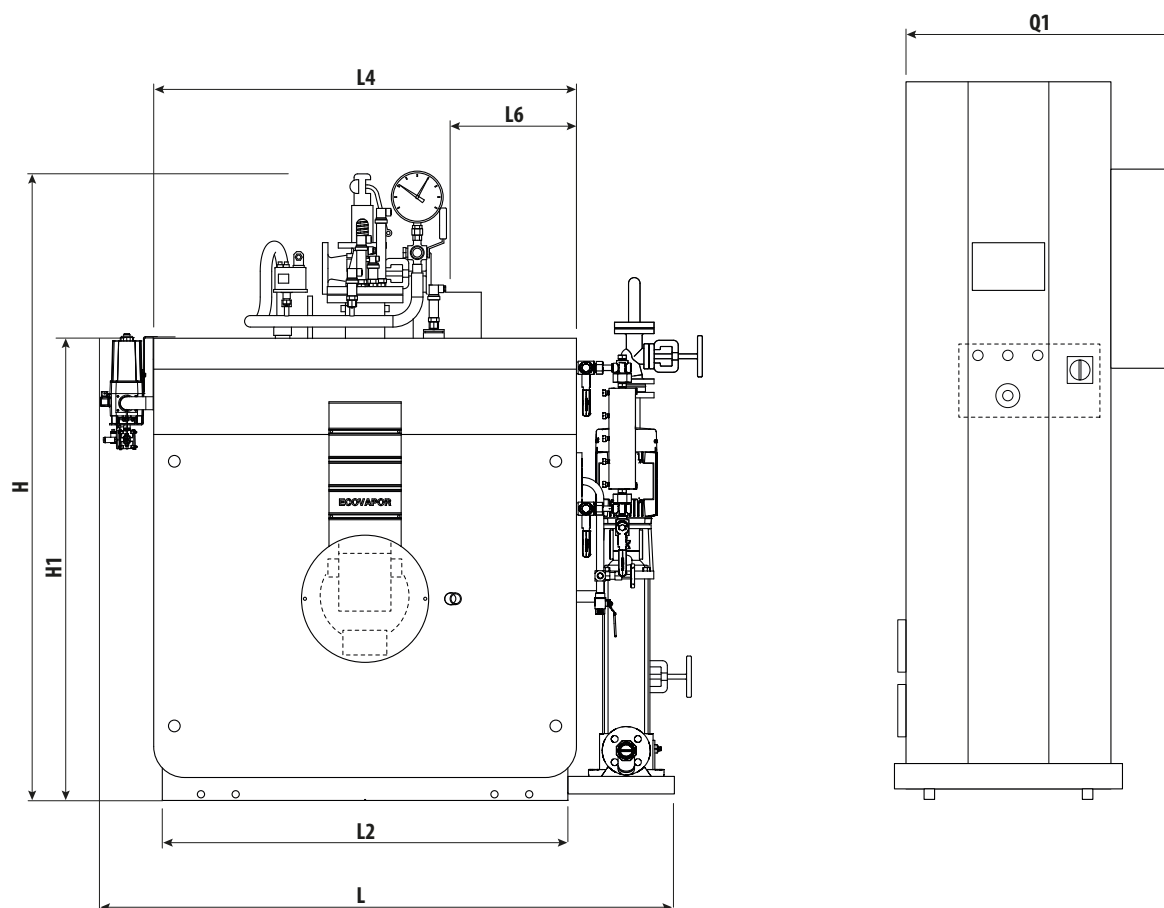
SIDE VIEW



- | | |
|--|---|
| 1 Pressure gauge | 17 Rear smoke chamber |
| 2 Probe holder cylinder | 18 Economiser |
| 3 Capacitive probe with pre amplifier | 19 Sludge separator pneumatic drain valve (optional for versions ECS24) |
| 4 Maximum level probe | 20 Globe valve |
| 5 First safety level probe (minimum) | 21 Water inlet |
| 6 Second safety level probe (maximum) | 22 First feed filter |
| 7 Steam Outlet | 23 First electric feed pump |
| 8 Steam outlet valve | 24 Check valves |
| 9 Sanitisation check probe | 25 Second electric feed pump (optional) |
| 10 Sample cooler (optional for ECS24 versions) | 26 Second feed filter (optional) |
| 11 Second safety valve drain (optional) | 27 Salinity control system |
| 12 Second safety valve (optional) | 28 Lower inspection point |
| 13 First safety valve | 29 Level indicator discharge |
| 14 First safety valve drain | 30 Front door |
| 15 Chimney fitting | 31 Second level indicator (optional) |
| 16 Fan | 32 First level indicator |

DIMENSIONS AND CONNECTIONS

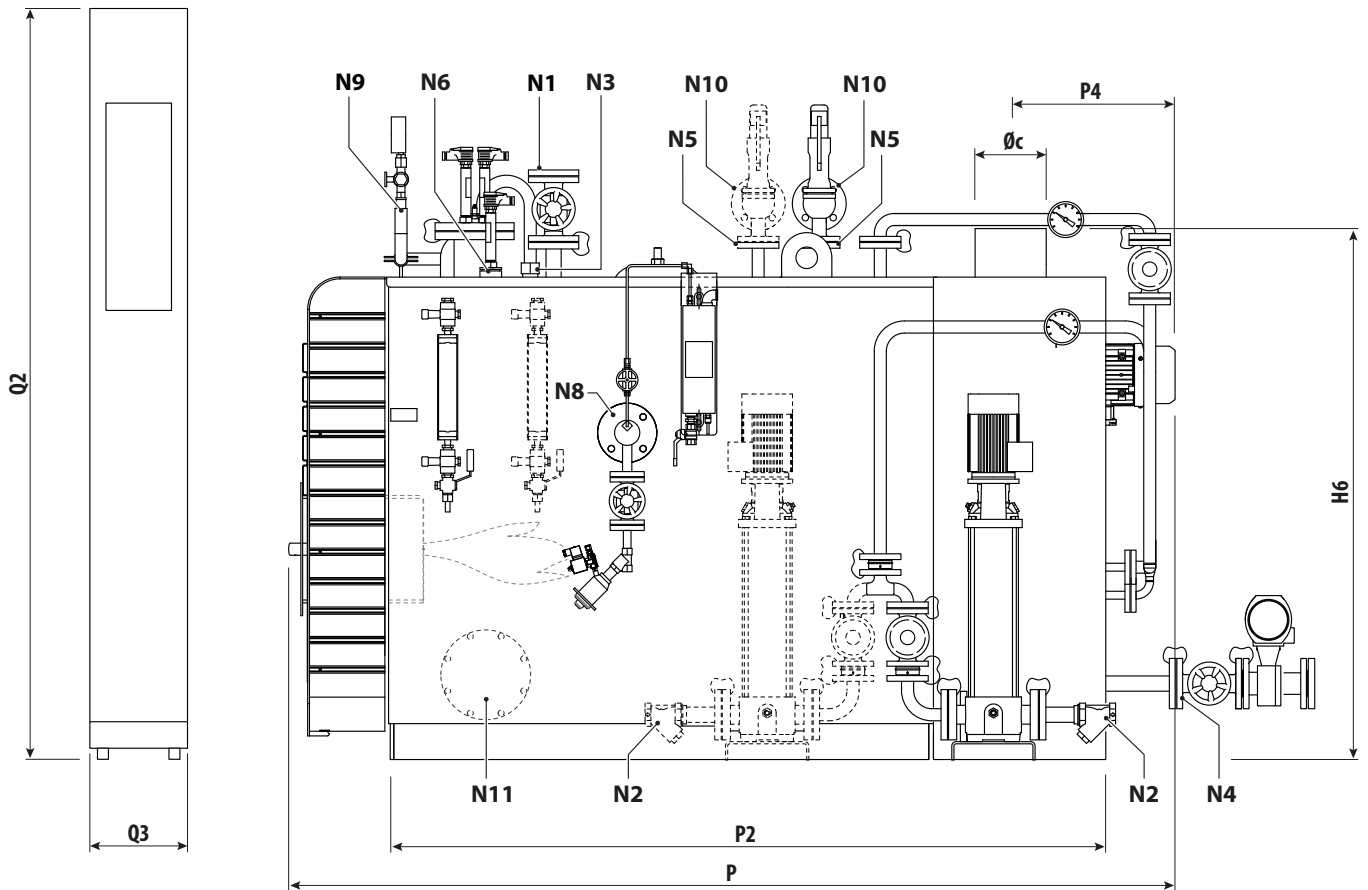
FRONT VIEW



Dimensions

Description	u.m.	ECOVAPOR									
		350	500	650	800	1000	1350	1700	2000	2500	3000
H	mm	1825	1825	1930	1943	2150	2150	2300	2300	2460	2540
H1	mm	1350	1350	1468	1468	1680	1680	1840	1840	2000	2000
L	mm	1810	1810	1965	1965	2160	2160	2370	2370	2540	2540
L2	mm	1180	1180	1300	1300	1510	1510	1660	1660	1840	1840
L4	mm	1230	1230	1350	1350	1560	1560	1710	1710	1890	1890
L6	mm	376	376	415	415	495	495	495	495	538	538
Q1	mm	980	980	980	980	980	980	1000	1000	1000	1000

SIDE VIEW



Dimensions

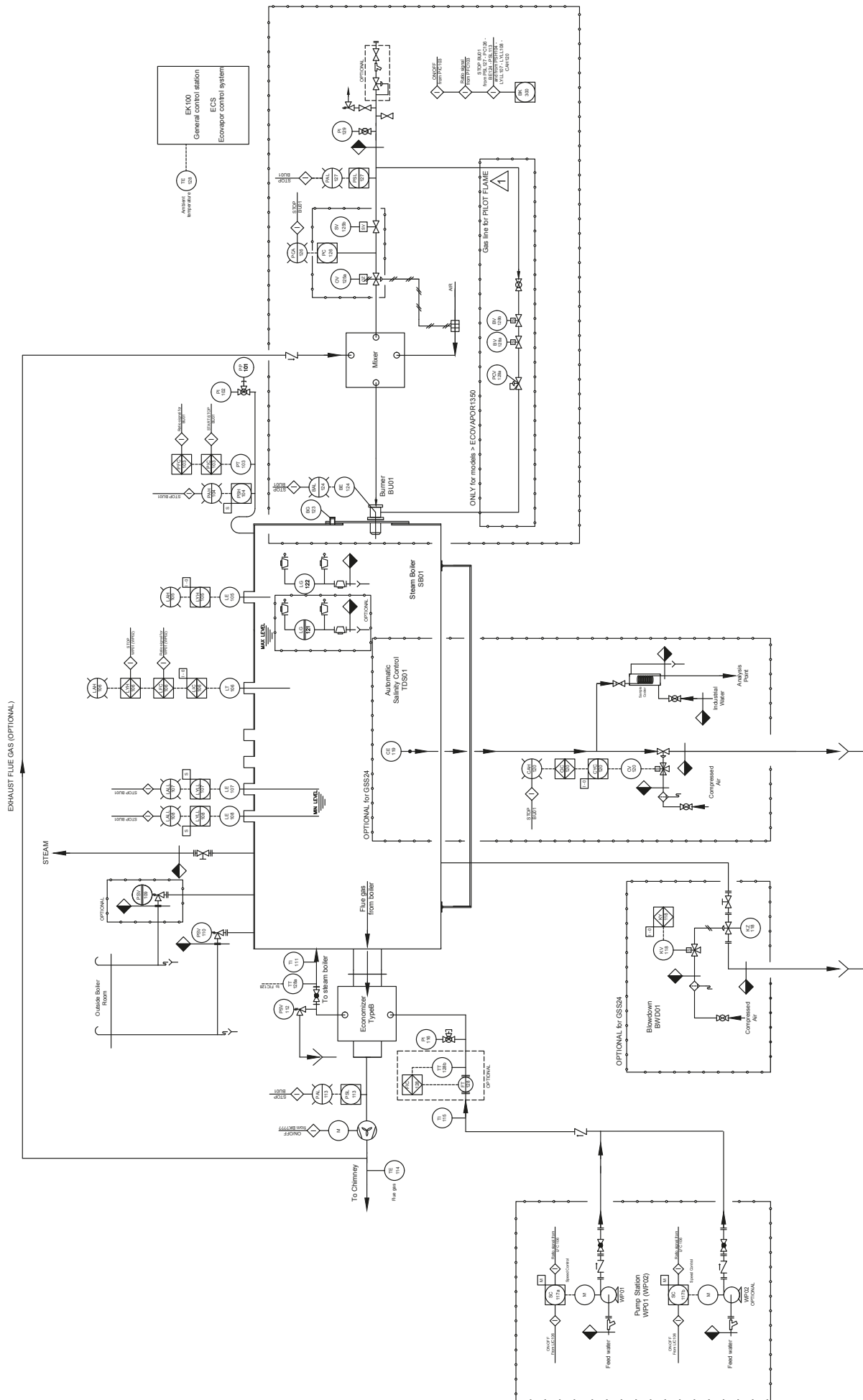
Description	u.m.	ECOVAPOR									
		350	500	650	800	1000	1350	1700	2000	2500	3000
H6	mm	1489	1489	1640	1640	1870	1870	2103	2103	2287	2287
P	mm	2580	2580	2925	2925	2990	3400	3630	3990	4245	4685
P2	mm	1925	1925	2200	2200	2210	2620	2715	3075	3180	3620
P4	mm	490	490	520	520	595	595	760	760	935	935
Øc	mm	198	198	248	248	298	298	348	348	448	448
Q2	mm	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Q3	mm	400	400	400	400	400	400	400	400	400	400
tb (ØxP) ^[1]	mm	36x1220	36x1220	36x1500	36x1500	36x1220	36x1500	36x2000	36x2000	48x2400	48x2400
tb ^[1]	mm	20	26	30	40	40	58	64	72	74	74

^[1] Tb=Turbulators size and quantity

Hydraulic fittings

Description	u.m.	ECOVAPOR									
		350	500	650	800	1000	1350	1700	2000	2500	3000
N1	DN/in	32	32	40	40	50	50	65	65	80	80
N2	DN/in	1"1/2	1"1/2	1"1/2	1"1/2	1"1/2	1"1/2	1"1/2	50	50	50
N1/N2	PN ^[2]	16	16	16	16	16	16	16	16	16	16
N3	DN/in	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
N4	DN/in	32	32	32	32	32	32	32	32	32	32
N5	DN/in	25	25	25	25	25	25	25	25	25	32
N6	DN/in	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
N8	DN/in	50	50	50	50	50	50	50	50	50	50
N9	DN/in	100	100	100	100	125	125	125	125	125	125
N10	DN/in	40	40	40	40	40	40	40	40	40	50
N11	DN/in	50	50	50	50	50	50	50	50	50	50

^[2] PN=Nominal pressure



Identification letters (ISA Symbols)					
	First letter		Succeeding letters		
	Measured or initializing variable	Modifier	Readout or passive function	Output function	Modifier
A	Analysis		Alarm		
B	Burner Combustion		User's choice	User's choice	User's choice
C	User's choice - Conductivity -			Control	
D	User's choice	Differential			
E	Voltage		Sensor (Primary element)		
F	Flow rate	Ratio (Fraction)			
G	User's choice		Glass Viewing device		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time Time schedule	Time rate of change		Control station	
L	Level		Light		Low
M	User's choice	Momentary			Middle Intermediate
N	User's choice		User's choice	User's choice	User's choice
O	User's choice		Orifice Restriction		
P	Pressure Vacuum		Point (Test) Connection		
Q	Quantity	Integrate Totalize			
R	Radiation		Record		
S	Speed Frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable Vibration		Multifunction	Multifunction	Multifunction
V	Mechanical analysis			Valve, Damper Louver	
W	Weight Force		Well		
X	Unclassified	X Axis	Unclassified	Unclassified	Unclassified
Y	Event, State or Presence	Y Axis		Relay, Compute, Convert	
Z	Position Dimension	Z Axis		Driver, Actuator Final control element	

	Primary location	Field mounted	Optional	
Discrete instruments				
Shared display Shared control				
Computer function				
Programmable logic control				
Pilot Light				
Instruments supply or connection to process				
Pneumatic signal				
Electric signal				
Interlock logic				
Reset for latch-type actuator				
ON - OFF				
Analog output variable				
Limit of supply				

TECHNICAL DATA

DESCRIPTION	u.m.	ECOVAPOR									
		350	500	650	800	1000	1350	1700	2000	2500	3000
Useful nominal power ^[1]	kW	238	341	443	545	681	920	1158	1363	1703	2044
Nominal thermal flow	kW	254	362	471	580	725	979	1232	1450	1812	2175
Minimum nominal power	kW	30	43	55	68	85	115	145	170	213	256
Minimum thermal flow	kW	31	44	58	71	89	120	151	177	222	266
Efficiency at 100% (ref. P.C.I.) ^[1]	%	94									
Furnace depression (Flue gas pressure drop)	mbar	n.a.	-32	n.a.							
Rated pressure	bar	12-15									
Total capacity	l	921		1250		1830	2190	2640	3050	3380	4020
Capacity at level	l	673		950		1280	1475	2000	2300	2490	2825
EXCHANGE surface	m²	8,30		12,80		14,20	22,30	25,00	31,5	40,5	48
Steam production ^[1]	kg/h	350	500	650	800	1000	1350	1700	2000	2500	3000
Rated frequency ~ voltage	Volt /Hz	400/50									
Electric protection rating	IP	IP55									
Absorbed power	kW	6			7	9		14,5	15,5	19,5	
Allowed fuels		Natural gas									
Lower calorific value	MJ/m³	34,2									
Max. / min. fuel pressure values	mbar	17,25									
Fuel nominal flow rate (G max gas flow rate)	Stm³/h	26,85	38,35	49,86	61,37	76,71	103,56	130,40	153,42	191,77	230,12
Minimum fuel flow rate	Stm³/h	3	4	5	6	8	10				
Flue gas temperature at nominal power	°C	135	135	135	135	135	135	135	135	135	135
Total weight	kg (12 bar version)	2180	2180	2550	2550	3240	3690	4400	5250	5920	6320

^[1] 80 °C treated water feed temperature.

SAFETY COMPONENT CALIBRATIONS

The components listed below are adjusted at the indicated pressure values

- safety valve: 12 bar (factory sealed - do not modify)
- safety pressure switch: 11 bar (factory sealed - do not modify)
- pressure transducer: 10 bar (adjust during installation, if necessary).

COMPONENTS

The steam generating systems **ECOVAPOR** feature a series of components that can be divided into:

- Safety components (safety valves, safety level switches, safety pressure switch).
- Indicators (level indicator, manometer, flame light).
- Adjustment components (level adjusters, pressure switches, pressure transducers).
- Feed components (centrifugal pump).
- Operation components (shut-off valves, drain valve).

Hereinafter are the descriptions of the operation of each single component.

PRESSURE GAUGE

The manometer indicates the reached steam pressure value. The value of the design pressure is shown in red on the graduated scale.

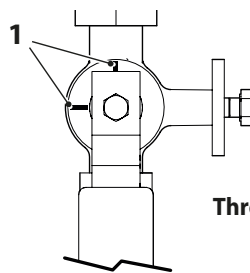
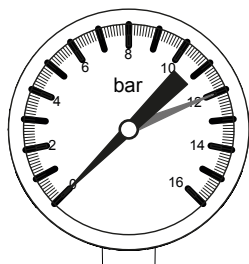
The manometer is fitted onto a three-way valve allowing to carry out the following operations:

- 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).



IMPORTANT

To define the desired position, refer to the two marks (1) present on valve handle.



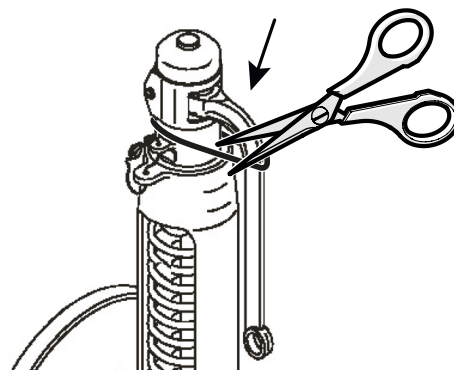
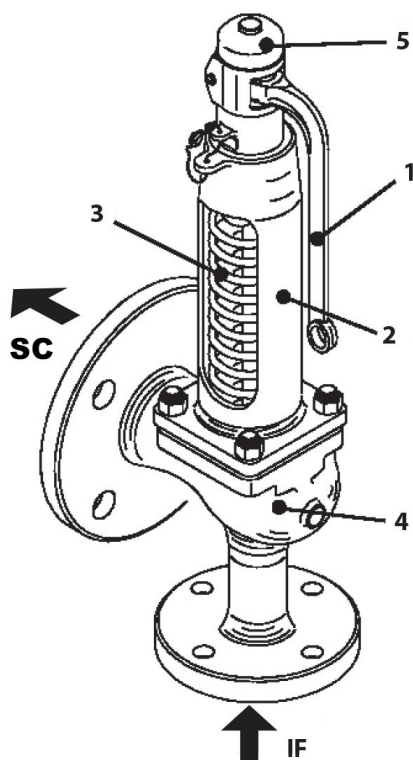
Three-way valve

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
- 6 Drainage hole (if any)

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.



ATTENTION

Drainage hole placed at the bottom of the valve body (6).

Drainage hole with diameter 1/4" BSP-f until DN80.

For higher DN sizes, the hole diameter is equal to 1/2" BSP-f.

Remove the red plastic cap (if any) and provide for collecting draining suitably. (provided by the customer).

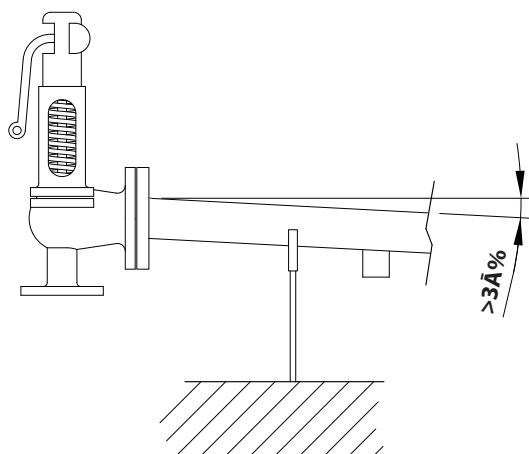
For further information, refer to the supplier's manual.

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

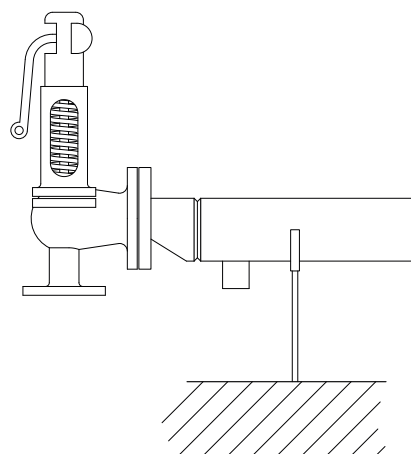
In case of conveyed drain, blow the conveyor pipe so as to compensate the reaction force generating upon fluid drainage (refer to the valve use manual supplied with the appliance).

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.



NOTE: Clamp at no more than 1 m



Typical suggested diagram

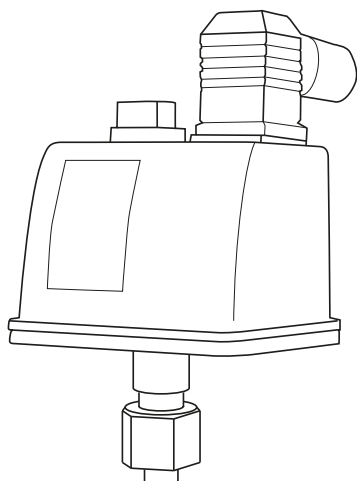


IMPORTANT

The operation of the safety valves is affected by the load losses occurring in the drain conveyor pipe, if any, during their opening. The load losses inside safety valve drain conveyor pipe must be equal to 0. The nominal diameter of the drain pipe must be greater than or equal to the size of the outlet fitting of the safety valve. A diameter ≥ 1.5 DN (PSV) is recommended.

SAFETY PRESSURE SWITCH

The safety pressure switch detects the steam generator pressure and is activated in case of steam pressure controller failure (regulation pressure switch or pressure transducer) by permanently stopping the burner. The burner will be switched on again only after the steam pressure value has decreased under the calibration pressure value of the safety pressure switch and the control panel has been manually reset. For further details, refer to the manual of the supplied component.



IMPORTANT

The safety pressure switch is calibrated at 11 barg and is sealed.

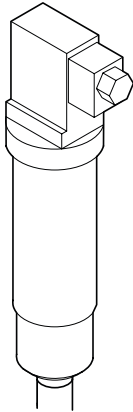


IT IS FORBIDDEN

Modify the adjustment of the safety pressure switch.

PRESSURE TRANSDUCER

The 0 - 16 bar (4 - 20 ma) pressure transducer detects the steam pressure inside the generator and converts it into a current value, then transmits it to the control panel supervising generator operation.



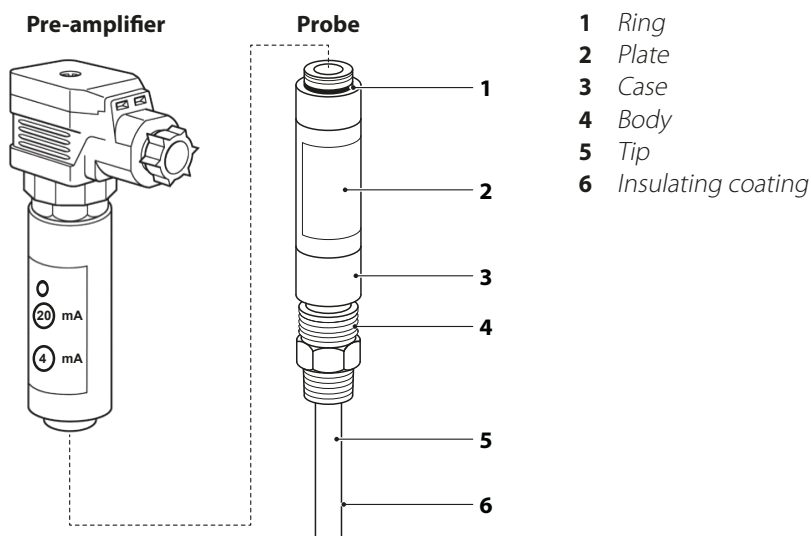
IMPORTANT

The technical specifications of this device are available in the manual supplied with it.

CAPACITIVE PROBE

The capacitive probe, combined with the pre-amplifier, has been designed for the adjustment or ON-OFF control of the conductive liquid level. It can also be used with one or more control units/transducers to provide, besides the control, also any level and/or outlet alarms of a BMS supervision system.

The pre-amplifier is finger screwed on probe upper end, and can be easily removed without affecting the operation of the probe.



Pre-amplifier

The pre-amplifier is a current loop level transducer to be used in combination with the capacitive probes. It generates a 4 – 20 mA output signal, which is proportional to the water level present inside tank or generator.

It features two keys and a two-colour (red and green) light signal indicator to be used during commissioning. The device consists of an austenitic stainless steel tubular body screwed on the top of the capacitive probe, and features a DIN 43650 connection head and a Pg 11 cable gland. Do not replace the cable gland with another one not of the Pg 11 type.

Probe

The capacitive probe is a metal bar with a special coating ensuring a complete isolation from the liquid where it is immersed. It measures the capacity of a tank through the capacity variation, which is directly proportional to the level variation. The capacity value is measured by the pre-amplifier and transmitted to a control unit or to a transducer as a direct current signal. Controls and settings are on the control unit. The pre-amplifier sensitivity is defined based on the immersed length of the probe, and the relevant wiring diagrams are included in the related installation and maintenance instructions.

2 *Combustion system*

DESCRIPTION

The steam generating system **ECOVAPOR** is equipped with a patented combustion system with premixing and external recirculation, integrated into the boiler, with vector flame development, characterised by the presence of a suction fan in the rear part. Therefore, the mixing-combustion process occurs under depression, preventing any possible leakages and further increasing the safety level. More specifically, the combustion system consists of the following components.

AIR/GAS MIXING SYSTEM

It is fitted inside the generator system, with no moving parts subject to wear, containing:

- **system for pre-heated air suction** through the boiler body and door holes to increase the system energy efficiency
- **gas supply line** consisting of gas train and flexible supply duct. The gas train features a combined pneumatic gas valve for adjustment and safety operations with continuous modulation. Complete with filter, minimum pressure switch and tightness control pressure switch
- **air filter**, contributing to the cleaning and additional air pre-heating
- **cone**; the sucked air binds to the gas inside the cone, keeping the mixing ratio within the limits of a good combustion.

COMBUSTION HEAD

Patented, with low emissions and wide modulation range, containing:

- stainless steel **cylinder body**, resistant to corrosion and high temperatures
- **metal braid** cylinder internal coating, made of patented refractory stainless steel metal fibre
- **electrode ignition system** specifically designed to reduce the effects of deformation due to high temperature
- **flame detection** with ionisation probe.

In sizes from 1700 to 3000, burner is ignited by the flame.

Burner start-up is allowed by an ignition pilot flame, basically consisting of a gas supply tube, an ignition electrode and an ionisation electrode.

Once the control device enables the start-up, the electrode sets off a spark, the pilot flame gas valves open and allow the ignition of the pilot flame which, in the second phase, ignites burner main flame.

After a set time, the control device will turn the pilot flame off.

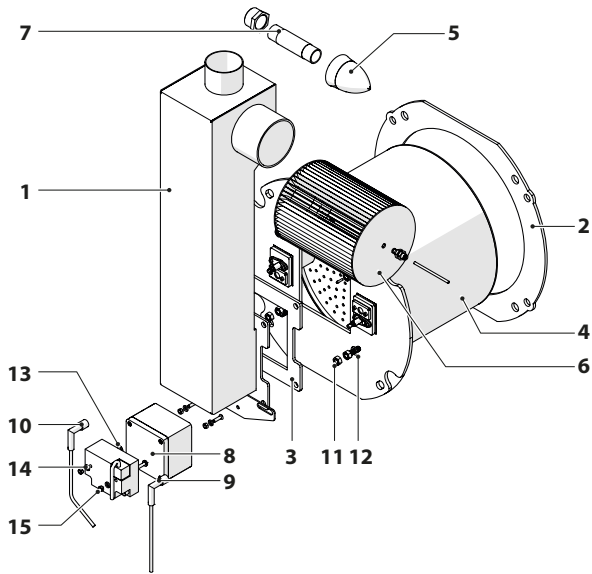
FLUE GAS SUCTION

It is integrated into the rear chamber, composed of a centrifugal fan with AISI 316L backward-curved blade impeller.

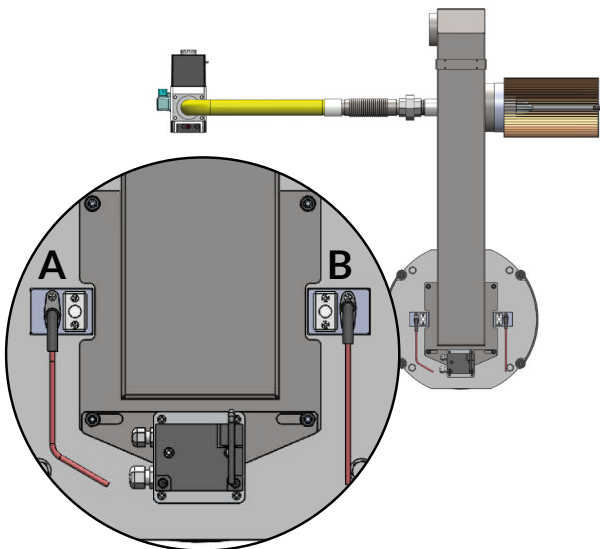
SAFETY AND CONTROL SYSTEMS

For the correct operation of the combustion system through:

- **safety pressure switch on the air side** to stop the combustion in case of fan abnormal operation
- **combustion management system** consisting of a flame electronic supervisor, interconnected with the steam production control system.

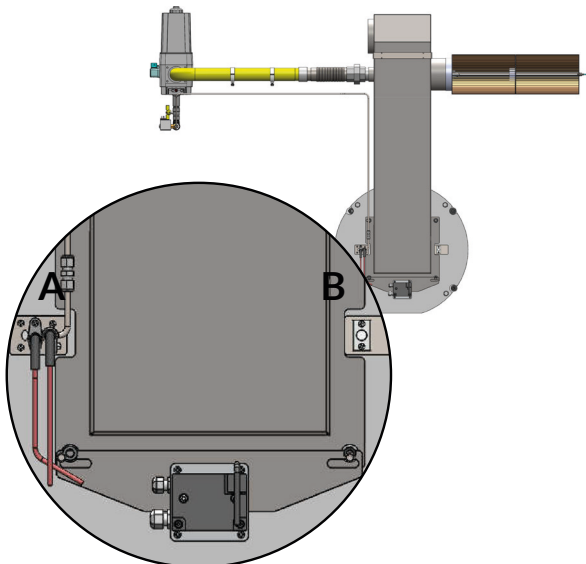


- 1 Air gas channel **ECOVAPOR**
- 2 Inverterjet gasket
- 3 Air/gas channel flange gasket
- 4 Inverterjet head
- 5 Cone assembly Ø68 (2 pcs.) **ECOVAPOR**
- 6 Air filter **ECOVAPOR** 350/500(e-1009)
- 7 Double end nipple 1" x 150 two-wire 25 Mm AISI316
- 8 Brahma high voltage transformer
- 9 Ignition electrode cable with plug
- 10 Ionisation electrode cable with plug
- 11 Galvanised M8 nut ISO 4033
- 12 Galvanised 8x15 plain washer UNI 6592
- 13 Galvanised 5x50 CH Phillips screw cl4.8
- 14 Galvanised 5x10 plain washer UNI 6592
- 15 Galvanised raised M5 nut cl8



ELECTRONIC IGNITION - Models 350 - 1350

- 1 Ionisation Electrode
- 2 Ignition Electrode



PILOT FLAME IGNITION - Models 1700 - 3000

- 1 Pilot Flame Unit
- 2 Flame Indicator

BURNER MODULATION STRATEGY

The burner is of the modulating type with PID (Proportional - Integral - Derivative) control.

The burner starts when the measured steam pressure is under the setpoint value shown in the operator panel of the control panel, less the ignition differential, while it stops when the measured steam pressure reaches the setpoint value plus the turning off differential.

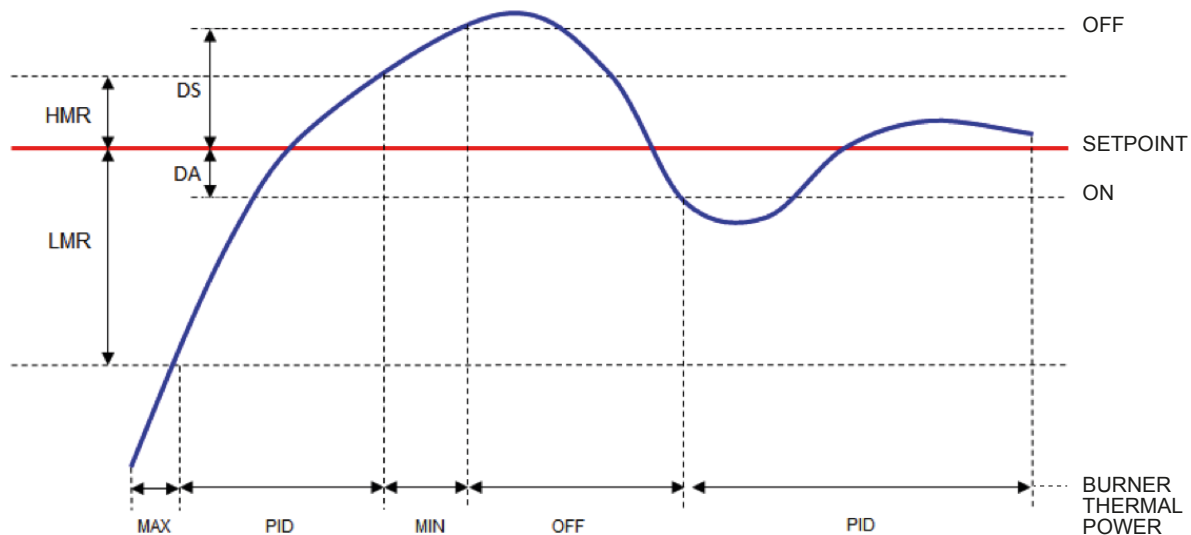
The modulation occurs within the "modulation range", which is the sum of the "low modulation range" and the "high modulation range".

The PID system is optimised to keep the pressure close to the "setpoint" value.

Above the "high modulation range" the burner will be immediately set to the minimum.

Under the "low modulation range" the burner will be immediately set to the maximum.

The sampling frequency is increased close to the upper and lower limits of the "modulation range" and converts the calculated power value into a 4-20 mA analogue signal.



HMR High modulation range

LMR Low modulation range

DA Ignition differential

DS Turning off differential

PID Proportional Integrative Derivative Modulation



IMPORTANT

All the above-mentioned parameters are set from the control panel.

COMPLIANCE

The Combustion System complies with the following European Directives and Standards:

- Directive 2009/142/EC (GAS)
- Directive 2014/68/EU (PED)
- Electromagnetic Compatibility Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- EN 676 - EN 746-2 - EN 50156-1 standards

SYSTEM LOGICS ECOVAPOR IN CASE OF NO FLAME

Hereinafter is the description of the logics that the System **ECOVAPOR** executes if the burner flame, due to a failure, does not turn on or if the flame is not detected upon ignition, or if it turns off during operation.

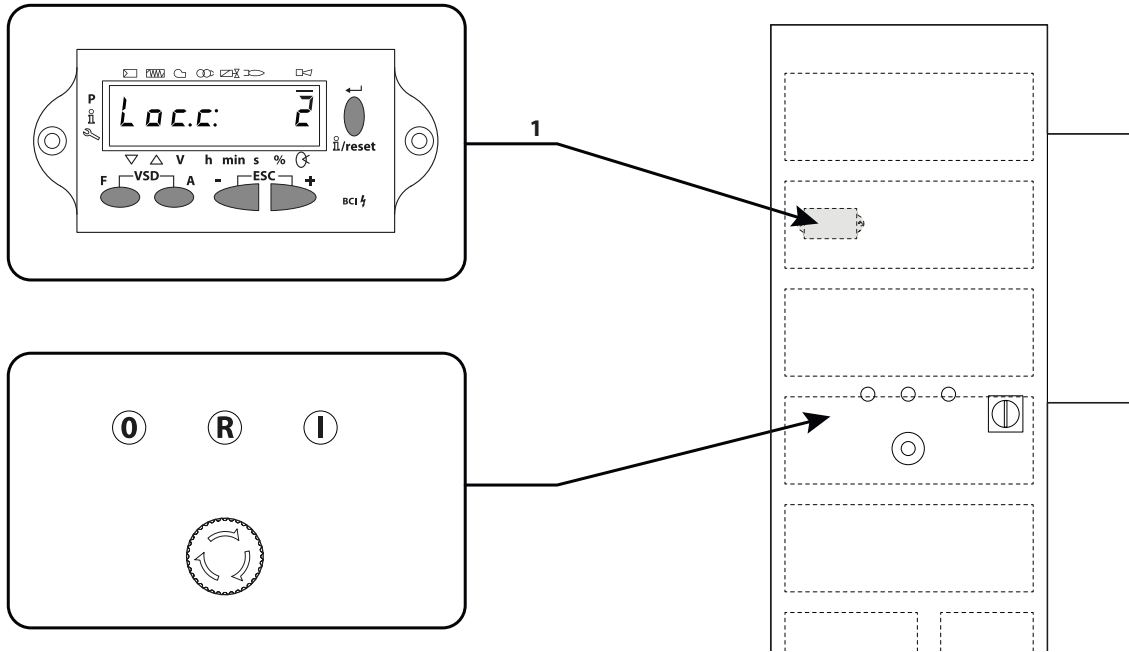
FAILURE UPON IGNITION

If the burner is not able to turn on the flame, the system closes the pneumatic gas valve and repeats the ignition phase twice (each attempt is preceded by a leak test of the gas valve). If the System cannot detect the flame after the third attempt, it shuts off the burner. The flashing error message **"Loc.c 2"** and **"Loc.d 1"** appears on the equipment display (1), inside the control panel.

FAILURE DURING STANDARD OPERATION

If the flame turns off during operation, the System closes the pneumatic gas valve and shuts off the burner, with relevant indication on the control panel display. The flashing error message **"Loc.c 7"** and **"Loc.d 0"** appears on the control unit display (1), inside the control panel.

To restore operation, press key **R** (RESET), positioned on panel front side, several times.



IMPORTANT

The list of all possible burner failures is included in the specific chapter at the end of this manual.

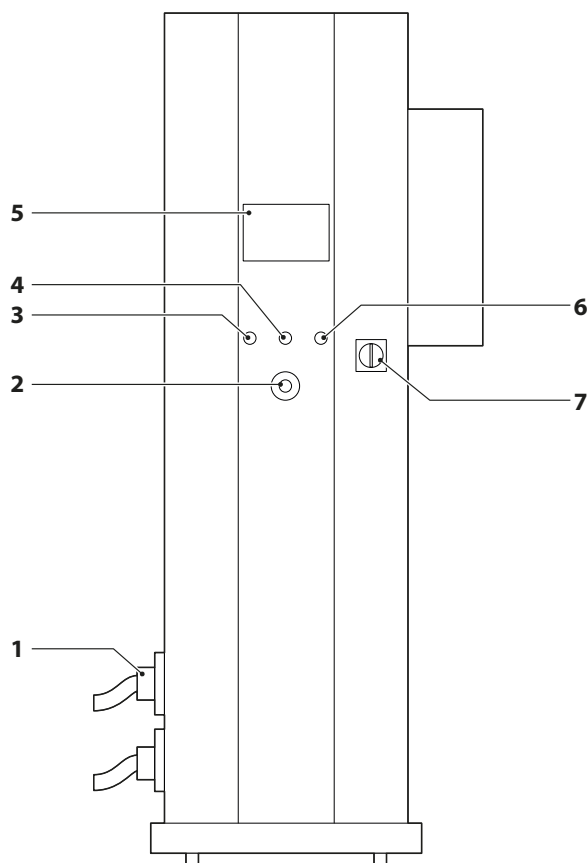
3 Adjustment and control system

CONTROL PANEL

The generator control panel **ECOVAPOR**, (400V 3N - 50Hz) complies with insulation class **IP 55** necessary to be installed inside a Heating Plant Room with ambient temperature values ranging between +5 °C and +50 °C.

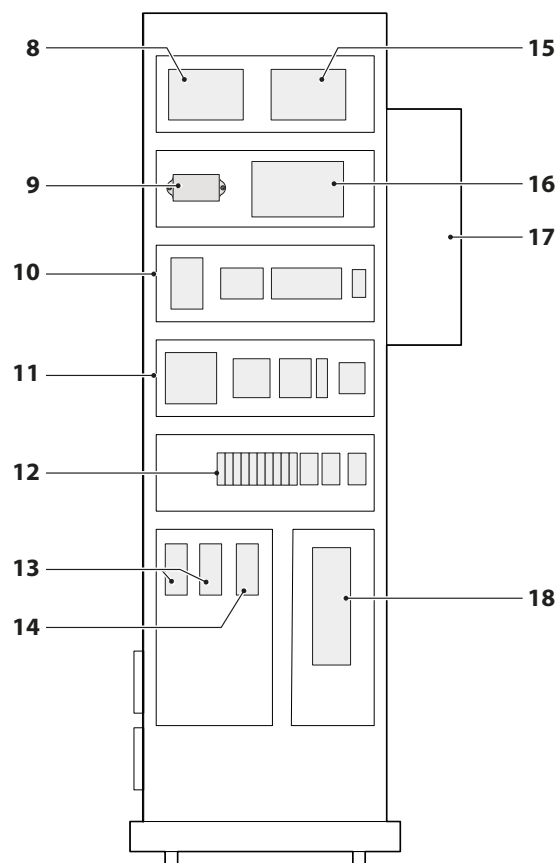
It is certified for the management of safety chains, equipped with an air-conditioning system and the control system can be expanded; in addition, it has a connectivity through LAN line, WiFi, Modbus, Modem.

Closed panel



- 1 Connectors for electrical connections
- 2 Emergency button (SCRAM)
- 3 Button for safety circuit opening
- 4 Muting of the acoustic signal and "Reset" of the alarms not automatically reset
- 5 Operator panel (touch-screen)
- 6 Button for safety circuit closing and preset for generator running
- 7 Main Switch

Open panel



Internal components

- 8 Generator managing basic board
- 9 Burner managing control unit display
- 10 Safety devices
- 11 Auxiliary equipment supply
- 12 Fuses
- 13 Water level control unit
- 14 Sludge blowdown control unit
- 15 Generator managing expansion board
- 16 Burner managing control unit
- 17 Air-conditioning system
- 18 Burner motor inverter

**IMPORTANT**

Each appliance leaving the factory bears the **Nameplate**, shown herebelow, specifying the configuration of the managed generator **ECOVAPOR**.

Nameplate**ECS-hABCDEFGH**

ECS	Name of the control panel	C	Number of pumps (1 or 2)	F	Internal sensor supply (0=No; 1=Yes)
h	Hours without continuous supervision (ECS24 or ECS72)	D	Sludge drain (0=No; 1=Yes); (compulsory for ECS72)	G	Metering/cascade (0=No; 1=Yes)
A	A Burner fan (1=3 kW; 2=5.5 kW)	E	TDS (0=No; 1=Yes); (compulsory for ECS72)	H	Motor-driven steam outlet valve (0=No; 1=Yes)
B	Pump size (1=1.5 kW; 2=2.2 kW)				

GRAPHIC INTERFACE

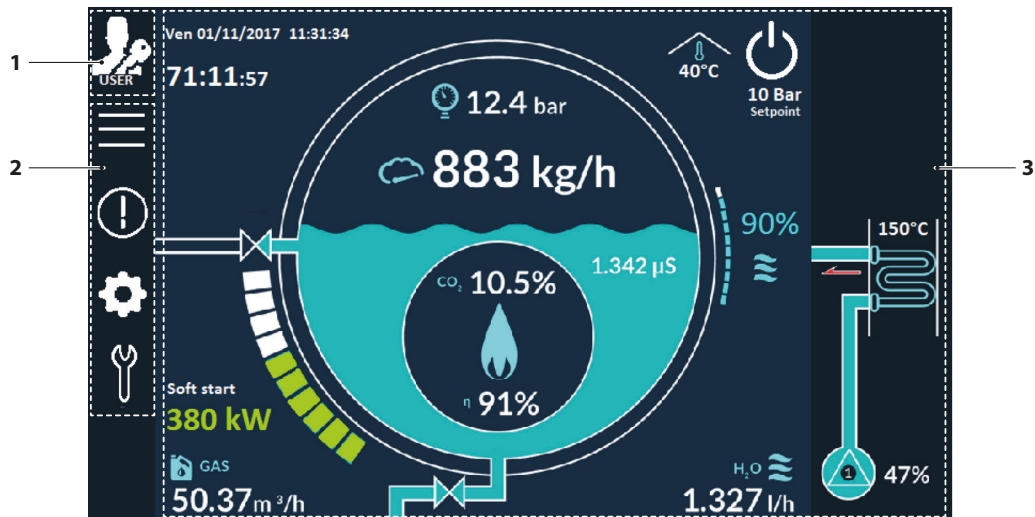
OPERATOR PANEL

The operator panel allows displaying the operating data of System **ECOVAPOR** as well as managing the parameters based on the factory setting of the appliance and on the selected access level.

The parameters that can be displayed and set, are organised in pages and depend on the structure of the appliance, on the installed components or accessories and on the selected operating access level.

MAIN PAGE

When the control panel is powered, with plant room main switch and panel switch set to **"ON"**, the main page with **USER** access level will be displayed.



- 1 Selection key of the **ACCESS LEVELS**
- 2 **MENU ACCESS** keys
- 3 Displaying area of the appliance **OPERATING DATA** when it is running or **QUICK ACCESS** to the selected item to edit it, if this is allowed.

Access levels

There are three available access levels, represented by the following icons.

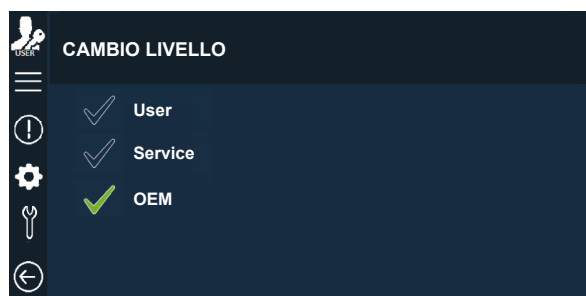


- 1 Level **USER** (for User)
- 2 Level **SERVICE** (for the technical service - requires the numerical code/Password released by **ICI SpA**)
- 3 **OEM** (exclusive for the manufacturer **ICI SpA** - requires the numerical code/exclusive Password of **ICI SpA**)

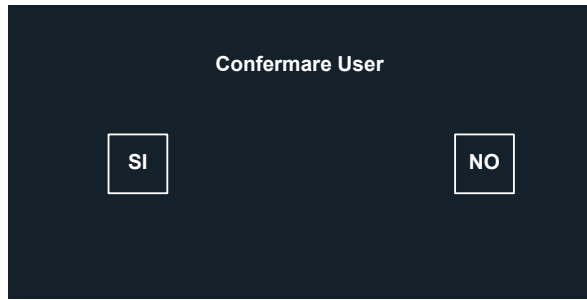
The access level icon will change based on the selected level.

To select the desired access level, proceed as follows:

- touch the  to select the access level



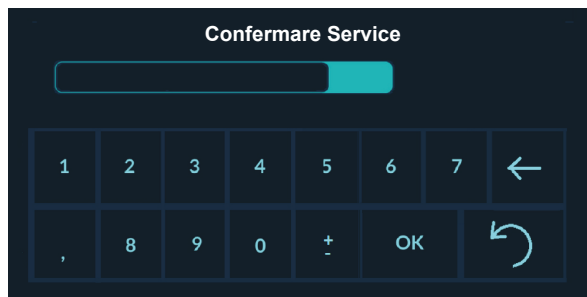
- touch icon  corresponding to the desired access level
- press **“YES”** on the displayed page to confirm the selection or press **“NO”** to go back to the previous page.



IMPORTANT

“OEM level” can be EXCLUSIVELY selected by **ICI SpA**.

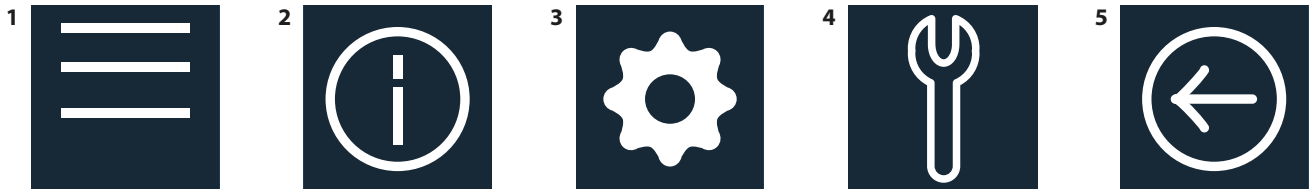
When Level **SERVICE** is selected and confirmed, the following page will be displayed:



- type in the code/password, provided by **ICI SpA**, using the keyboard and press **“OK”** to confirm.
- In case of error, touch key  to cancel the last entered number or touch key  to go back to previous page.

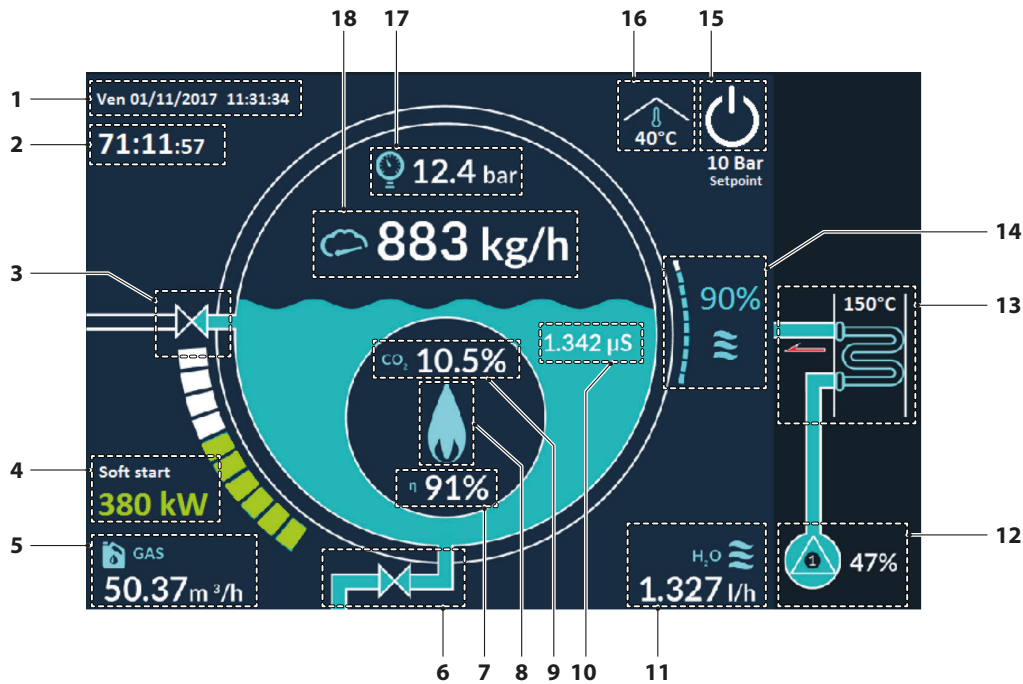
Menu access keys

There are five available access levels, represented by the following icons.



- 1 GENERAL PARAMETERS.** It can be used with any Access Level. It allows accessing the specific items/parameters of the selected Access Level
- 2 INFORMATION.** It provides the information in READ-ONLY mode
- 3 GENERATOR PARAMETERS.** It allows setting the parameters indicated in the different displayed pages
- 4 SERVICE.** It allows displaying all the activities to be carried out by the Technical Service. Each performed activity must be confirmed with **“OK”**, then the following activity will be displayed
- 5 BACK.** Back to previous page

Displaying area



- 1 **CURRENT DATE AND TIME** (in display-only mode) to set or edit them, select "user level / general parameters / display-date-time"
- 2 **TIME LEFT TO PERIODICAL CHECK (ECS 24 HOURS or ECS72 HOURS)**; The message flashes when there are less than two hours left to the periodical check. Touch this area to display the messages relating to the checks to be carried out by the SERVICE (Technical Service). Press "OK" to shift to next message and, once finished, the time to next check will be automatically set (ECS 24 hours or ECS 72 hours)
- 3 **TDS VALVE (Salinity Control Device)**; The valve opening is indicated by an animation. Touch this area to access the configuration menu of the TDS system. When the TDS is disabled, below the valve, a red indication appears.
- 4 **ESTIMATED OPERATING POWER**; thermal power estimated on the basis of the burner testing data. SOFT START will be shown steady on if set in the parameters or flashing if active. Touch this area to access the configuration menu of the burner
- 5 **GAS FLOW RATE** (if the meter is installed)
- 6 **BLOWDOWN VALVE**; the valve opening is indicated by an animation. Touch this area to access the configuration menu of the valve. When the automatic drain is disabled, below the valve, a red indication appears
- 7 **ESTIMATED COMBUSTION EFFICIENCY**
- 8 **FLAME PRESENCE**
- 9 **MEASURED CO₂**
- 10 **TDS VALUE** (Salinity Control Device). Touch this area to access the configuration menu of the TDS system. When the TDS is disabled, below this value, a red indication appears
- 11 **WATER DELIVERY FLOW RATE** (if the meter is installed)
- 12 **PUMPS OFF / PUMPS 1 and 2 ON with relevant modulation percentage**. Touch this area to access the configuration menu of the water feed pumps. When a pump is on, the animation indicates the water flow towards the generator
- 13 **FLUE GAS RECOVERY UNIT**; the temperature indicated is detected at the energy saver flue gas outlet
- 14 **WATER LEVEL**; touch this area to access the configuration menu of the water feed pumps
- 15 **GENERATOR START-UP - GENERATOR STATUS**; the icon is white when the safety circuits are open (boiler not ready). To close them and preset the generator for start-up, press the electromechanical button "I". The icon is flashing green when the safety circuits are closed (boiler ready). To open them and stop the generator, press the electromechanical button "O". The button turns steady green if it is pressed while flashing, thus operating the burner (steam production start) and, when pressed again, the burner stops. The setpoint pressure value is indicated under this key
- 16 **AMBIENT TEMPERATURE** (in display-only mode). It indicates the ambient temperature allowing to check that it is within the design values (+ 5°C minimum + 50 °C maximum)
- 17 **GENERATOR PRESSURE**; touch this area to access the pressure configuration menu
- 18 **STEAM FLOW RATE** (if the meter is installed)

OPERATING MODES

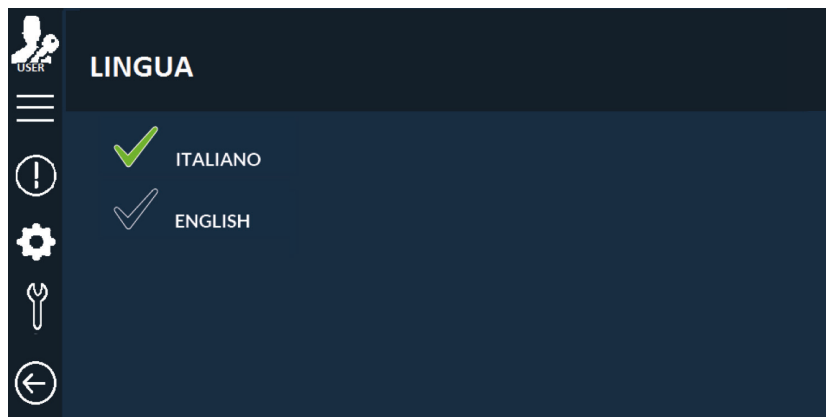
Hereinafter are some pages relating to the operating modes for the displaying and entering or editing of data and parameters. Then there are the tables with the complete list of the available parameters.

To edit generator settings, proceed as follows:

- select **USER** Level
- touch key  (**GENERAL PARAMETERS**) to display the page



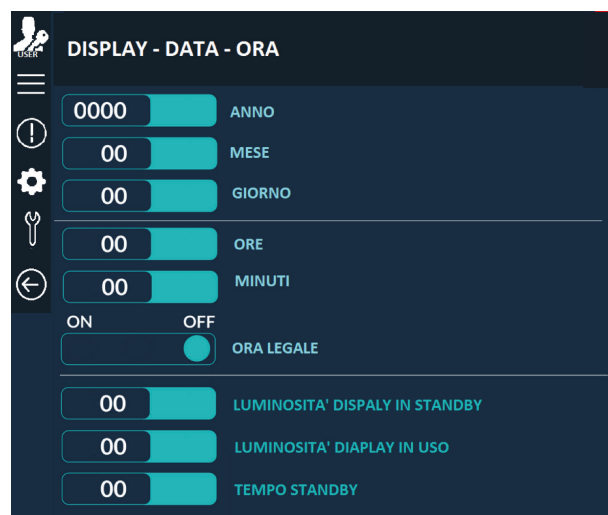
- touch the desired item (i.e. **"Language"**) to display the page



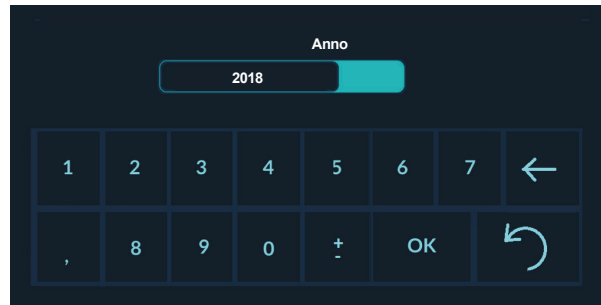
- select the desired LANGUAGE (i.e. **"ITALIAN"**) by touching the corresponding icon .

If an alarm is in progress while operations or displaying activities are in progress, the following icon appears on all the pages .

- Touch key  to go back to the previous page and select another item to check or edit (i.e. **"DISPLAY - DATE - TIME"**). The page will be displayed.



- to scroll the page, keep a finger on the screen and move it up or down
- to edit one item (i.e. “**Year**”) touch the Light Blue Area and set the new value using the displayed keyboard



- touch key **OK** to confirm, store the change and go back to the previous page (in this case “**DISPLAY - DATE - TIME**”) to select another item to be edited
 - to edit a non-numerical item (i.e. “**Daylight saving time**”) simply touch under the preferred setting (i.e. “**ON**” or “**OFF**”).
- In case of error, touch key to cancel the last entered number or touch key to go back to previous page.

When all the necessary changes have been made, touch key to go back to the starting page and select another item (i.e.: “**MODBUS**”). Refer to the **ModBus** parameter list available in paragraph “**3.5 Modbus/slave interface parameters**” on page 41.



ACTIVE ALARMS

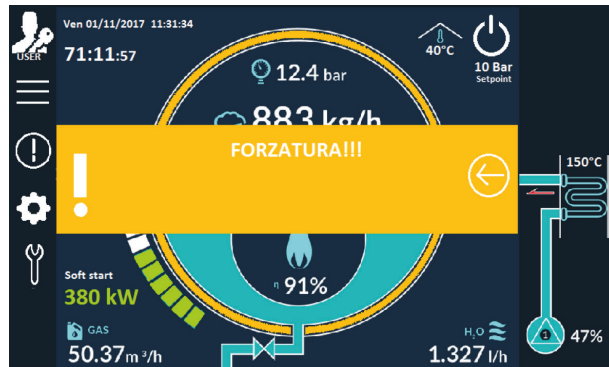
In case an alarm is present in the main page, the following message with the description of the active alarms will be displayed:



- touch the message red area to hide or display the alarm description.

ACTIVE FORCING

In case of active forcing in the main page, the following message will be displayed:



- touch the message yellow area to directly access the **“FORCING MENU”** (at **SERVICE** level only)
- touch the arrow  to hide the alarm description.

COMPLETE LIST OF MENUS AND PARAMETERS

MAIN PARAMETER MENU

ACCESS PATH:  → LANGUAGE

ACCESS PATH:  → DISPLAY - DATE - TIME

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
01.02	Year	USER	USER	ALWAYS
01.03	Month	USER	USER	ALWAYS
01.04	Day of the month	USER	USER	ALWAYS
01.05	Hours	USER	USER	ALWAYS
01.06	Minutes	USER	USER	ALWAYS
01.08	Daylight saving time	USER	USER	ALWAYS
	Stand-by time	USER	USER	ALWAYS
	Touch delay	USER	USER	ALWAYS

ACCESS PATH:  → GENERAL CONFIGURATION

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
15.01	Expansion 2 enabling	OEM	OEM	Always
15.02	Flue gas sensor enabling	SERVICE	SERVICE	Always
15.03	Ambient sensor enabling	SERVICE	SERVICE	Always
15.04	Level transducer enabling	OEM	OEM	Always
15.05	Blowdown valve enabling	OEM	OEM	Always
15.06	TDS enabling	OEM	OEM	Always
15.07	Second pump enabling	OEM	OEM	Always
15.08	Modulating feed valve enabling	OEM	OEM	If the level transducer is enabled
15.09	Maximum level alarm enabling	SERVICE	SERVICE	Always
15.10	IC1E1 inlet configuration	SERVICE	SERVICE	Always
15.11	EGR valve enabling	OEM	OEM	Always
15.12	Steam control valve enabling	OEM	OEM	If expansion 2 is enabled
15.13	Cascade enabling	OEM	OEM	If expansion 2 is enabled
15.14	ECO 1 inlet water temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.15	ECO 1 outlet water temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.16	ECO 1 water meter enabling	OEM	OEM	If expansion 2 is enabled
15.17	ECO 2 inlet water temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.18	ECO 2 outlet water temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.19	ECO 2 water meter enabling	OEM	OEM	If expansion 2 is enabled
15.20	ECO 1 inlet flue gas temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.21	ECO 2 outlet flue gas temperature probe enabling	OEM	OEM	If expansion 2 is enabled
15.22	Water delivery meter enabling	OEM	OEM	If expansion 2 is enabled
15.23	Gas meter enabling	OEM	OEM	If expansion 2 is enabled

ACCESS PATH:  → ModBus

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
15.24	Fan Inverter ModBus enabling	SERVICE	SERVICE	Always
15.25	Electric energy meter ModBus enabling	SERVICE	SERVICE	Always
15.26	Pump 1 ModBus enabling	SERVICE	SERVICE	Always
15.27	Pump 2 ModBus enabling	SERVICE	SERVICE	Always
15.28	Steam meter ModBus enabling	SERVICE	SERVICE	Always
15.29	ECO 1 heat meter ModBus enabling	SERVICE	SERVICE	Always
15.30	ECO 2 heat meter ModBus enabling	SERVICE	SERVICE	Always
15.31	ModBus Slave Address setting (1 ...250)	USER	USER	Always
15.32	ModBus Slave Baud rate setting (2400 – 4800 – 9600 – 19200 – 38400 – 57600 – 115200)	USER	USER	Always
15.33	ModBus Slave Data bit setting (7 – 8)	USER	USER	Always
15.34	ModBus Slave Parity setting (No – Even – Odd – Mark – Space)	USER	USER	Always
15.35	ModBus Slave Stop bit setting (1 – 2)	USER	USER	Always

ACCESS PATH: → OFFSET AND SCALES

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
08.01	Pressure value at 4 mA	SERVICE	SERVICE	Always
08.02	Pressure value at 20 mA	SERVICE	SERVICE	Always
08.03	Pressure offset	SERVICE	SERVICE	Always
08.04	TDS value at 4 mA	SERVICE	SERVICE	If the TDS sensor is enabled
08.05	TDS value at 20 mA	SERVICE	SERVICE	If the TDS sensor is enabled
08.06	TDS offset	SERVICE	SERVICE	If the TDS sensor is enabled
08.07	Level Offset	SERVICE	SERVICE	If the level sensor is enabled
08.08	Flue gas temperature offset	SERVICE	SERVICE	If the flue gas temperature probe is enabled
08.09	Ambient temperature offset	SERVICE	SERVICE	If the ambient temperature probe is enabled
08.12	Steam flow pressure value at 4 mA	SERVICE	SERVICE	If the steam control valve is enabled
08.13	Steam flow pressure value at 20 mA	SERVICE	SERVICE	If the steam control valve is enabled
08.14	Steam delivery pressure offset	SERVICE	SERVICE	If the steam control valve is enabled
08.15	Cascade manifold pressure value at 4 mA	SERVICE	SERVICE	If the cascade control is enabled
08.16	Cascade manifold pressure value at 20 mA	SERVICE	SERVICE	If the cascade control is enabled
08.17	Cascade manifold pressure offset	SERVICE	SERVICE	If the cascade control is enabled
08.18	Pump flow pressure value at 4 mA	SERVICE	SERVICE	If the pump flow pressure probe is enabled
08.19	Pump flow pressure value at 20 mA	SERVICE	SERVICE	If the pump flow pressure probe is enabled
08.20	Pump flow pressure offset	SERVICE	SERVICE	If the pump flow pressure probe is enabled
08.21	ECX 1 water inlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.22	ECX 1 water outlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.23	ECX 1 water meter pulse value (water delivery)	SERVICE	SERVICE	If the meter is enabled
08.24	ECX 2 water inlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.25	ECX 2 water outlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.26	ECX 2 water meter pulse value	SERVICE	SERVICE	If the meter is enabled
08.27	ECX 1 flue gas inlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.28	ECX 2 flue gas outlet temperature offset	SERVICE	SERVICE	If the probe is enabled
08.29	Make-up water meter pulse value	SERVICE	SERVICE	If the meter is enabled
08.30	Gas meter pulse value	SERVICE	SERVICE	If the meter is enabled
08.31	Burner maximum power (kW) Power is estimated based on the output modulation signal, unless the feedback on IC1 input expansion 1 is present. In this case, the feedback will be considered.	SERVICE	SERVICE	Always
08.32	First stage burner power (kW)	SERVICE	SERVICE	Always
08.34	Estimated CO ₂ (%)	SERVICE	SERVICE	Always
08.35	% O ₂ at 4 mA	SERVICE	SERVICE	If the oxygen sensor is enabled
08.36	% O ₂ at 20 mA	SERVICE	SERVICE	If the oxygen sensor is enabled
08.37	CO ₂ offset %	SERVICE	SERVICE	If the oxygen sensor is enabled

INFORMATION MENU

ACCESS PATH:  → INLET STATUS

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
11.01	Ambient temperature in °C (PT4 input) The parameter is displayed if the probe is enabled.	USER	-	If the sensor is enabled
11.02	Boiler pressure sensor value in % (IC1 input)	SERVICE	-	Always
11.03	Boiler pressure in Bar (IC1 input)	USER	-	Always
11.04	Supplied burner (F1 input)	USER	-	Always
11.05	Burner flame presence (F2 input)	USER	-	Always
11.06	Burner modulation feedback value in % (IC1E1 input) If the feedback is enabled the read value will be displayed as real modulation power. If not enabled the displayed modulation power will be the calculated one.	USER	-	Always
11.07	Level value in % (IC2E1 input)	USER	-	Always
11.08	TDS value in % (IC3E1 input)	SERVICE	-	If the TDS sensor is enabled
11.09	TDS value in µS (IC3E1 input)	USER	-	If the TDS sensor is enabled
11.10	Pump enabling (PT1E1 input)	USER	-	Always
11.11	Steam production enabling Contact is system start. When this contact is open, burner, TDS valve and drain valve will not be enabled. Only water feed system is active. The system activates when the PT2E1 contact is closed by the safety circuits.	USER	-	Always
11.12	Alarm reset button (PT8E1 input) The contact will be normally open and its 1-second closing will be always necessary to mute the siren and to delete alarm displaying. Alarm displaying will be always active even if the alarm conditions disappear. Some alarms require to be reset also to restore operation. If the contact is already closed when the alarm occurs, to activate the next closing again, it will have to be opened.	USER	-	Always
11.13	Flue gas temperature in °C (PT9E1 input)	USER	-	Always
11.14	Steam flow pressure in % (IC1E2 input)	SERVICE	-	If the steam control valve is enabled
11.15	Steam flow pressure in Bar (IC1E2 input)	USER	-	If the steam control valve is enabled
11.16	Cascade pressure value in % (IC2E2 input)	SERVICE	-	If the cascade is enabled
11.17	Cascade pressure in Bar (IC2E2 input)	USER	-	If the cascade is enabled
11.18	Pump flow pressure in % (IC3E2 input)	SERVICE	-	If the flow pressure sensor is enabled
11.19	Pump flow pressure in Bar (IC3E2 input)	USER	-	If the flow pressure sensor is enabled
11.20	ECX 1 water inlet temperature (PT1E2 input)	USER	-	If the sensor is enabled
11.21	ECX 1 water outlet temperature (PT2E2 input)	USER	-	If the sensor is enabled
11.22	ECX 2 water inlet temperature (PT4E2 input)	USER	-	If the sensor is enabled
11.23	ECX 2 water outlet temperature (PT5E2 input)	USER	-	If the sensor is enabled
11.24	ECX 1 flue gas inlet temperature (PT7E2 input)	USER	-	If the sensor is enabled
11.25	ECX 2 flue gas outlet temperature (PT5E2 input)	USER	-	If the sensor is enabled
11.26	0--10 Volt analogue input % value (IT1 input)			
11.27	O02 value in % (IC1E1 input)	USER	-	If the oxygen sensor is enabled
11.28	Value CO ₂ in % (actual value, calculated based on the oxygen percentage or estimated)	USER	-	If the oxygen sensor is enabled
11.29	Boiler pressure instant value	USER	-	If the sensor is enabled

ACCESS PATH:  → OUTLET STATUS

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
13.01	Burner modulation percentage	USER	-	Always
13.02	Pump 1 modulation percentage	USER	-	Always
13.03	Pump 2 modulation percentage	USER	-	Only with level sensor and pump 2 enabled
13.04	Feed valve modulation percentage	USER	-	Only with feed valve enabled
13.05	Burner enabling (T1-2)	USER	-	Always
13.08	Cumulative alarm signal system	USER	-	Always
13.09	Blowdown valve	USER	-	If the valve is enabled
13.10	Pump 1	USER	-	Always
13.11	Pump 2	USER	-	If the second pump is enabled
13.12	TDS valve	USER	-	If the valve is enabled
13.13	Acoustic signal	USER	-	Always
13.14	Time without continuous supervision expired	USER	-	Always
13.15	Energy saver pump	USER	-	If the pump is enabled
13.17	Dosing pump enabling	USER	-	If the pump is enabled
13.23	Steam flow valve modulation percentage	USER	-	If the valve is enabled

ACCESS PATH: → **ALARMS**

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
12.01	Cumulative alarm signal system	USER	-	Always
12.02	Expansion board communication alarm CANBUS communication alarm among PLC modules. This alarm generates: - alarm signalling on the panel - siren triggering - burner enabling opening - pump stop - valve closing This effect remains until key (R - Reset) is pressed even if the alarm conditions disappear.	USER	-	Always
12.03	Minimum level 1 alarm	USER	-	Always
12.04	Minimum level 2 alarm	USER	-	Always
12.05	Maximum level alarm	USER	-	Always
12.06	Safety pressure gauge alarm	USER	-	Always
12.07	Burner shut-off	USER	-	Always
12.08	Wrong supply	USER	-	Always
12.09	Burner fan alarm	USER	-	Always
12.10	Pump 1 alarm	USER	-	Always
12.11	Pump 2 alarm	USER	-	If the second pump is enabled
12.12	Deaerator / water treatment alarm	USER	-	Always
12.13	Emergency button activated	USER	-	Always
12.14	Pressure sensor alarm	USER	-	Always
12.15	Ambient temperature probe alarm	USER	-	If the sensor is enabled
12.16	Burner modulation feedback signal alarm	USER	-	If the feedback is enabled
12.17	Level sensor alarm	USER	-	If the level sensor is enabled
12.18	TDS sensor alarm	USER	-	If the TDS sensor is enabled
12.19	TDS limit alarm	USER	-	If the TDS sensor is enabled
12.20	Flue gas temperature sensor alarm	USER	-	If the sensor is enabled
12.21	Flue gas high temperature: alarm	USER	-	If the sensor is enabled
12.22	Flue gas high temperature: burner stop	USER	-	If the sensor is enabled
12.23	Fan inverter failure alarm	USER	-	If the device ModBus management is enabled
12.24	Fan inverter high temperature alarm	USER	-	If the device ModBus management is enabled
12.25	Fan inverter wrong supply alarm	USER	-	If the device ModBus management is enabled
12.26	Fan inverter excessive current alarm	USER	-	If the device ModBus management is enabled
12.27	Time without continuous supervision expired	USER	-	Always
12.28	EGR valve alarm	USER	-	If the valve is enabled
12.29	Oxygen sensor alarm	USER	-	If the oxygen sensor is enabled
12.30	Oxygen % limit alarm	USER	-	If the oxygen sensor is enabled

ACCESS PATH: → **DATA AND METERS**

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
14.01	Number of burner starts It represents the progressive number of the flame presence signal rising edges	USER	-	Always
14.02	Burner hours of operation It represent the total time of flame presence	USER	-	Always
14.05	Burner power output estimation	USER	-	Always
14.06	Burner total energy output estimation	USER	-	Always
14.07	Combustion efficiency estimation	USER	-	Only if ambient and flue gas probes are present
14.08	Number of openings of the drain valve	USER	-	Only if the valve is enabled
14.09	Opening hours of the drain valve	USER	-	Only if the valve is enabled
14.10	Number of openings of the TDS valve	USER	-	Only if the valve is enabled

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
14.11	Opening hours of the TDS valve	USER	-	Only if the valve is enabled
14.12	Number of starts of pump 1	USER	-	Always
14.13	Pump 1 hours of operation	USER	-	Always
14.14	Number of starts of pump 2	USER	-	Only if the second pump is enabled
14.15	Pump 2 hours of operation	USER	-	Only if the second pump is enabled
14.18	Number of electrical power F1 rising edges	USER	-	Service
14.19	Electrical power hours F1	USER	-	Service
14.20	Number of electrical power F3 rising edges	USER	-	Service
14.21	Electrical power hours F3	USER	-	Service
14.22	Make-up water total flow rate	USER	-	Only if the meter is enabled (PT9 E2 inlet)
14.23	Make-up water instant flow rate	USER	-	Only if the meter is enabled (PT9 E2 inlet)
14.24	Gas total flow rate	USER	-	Only if the meter is enabled (PT1 E1 or PT10E2 inlet)
14.25	Gas instant flow rate	USER	-	Only if the meter is enabled (PT1 E1 or PT10E2 inlet)
14.26	ECX1 water total flow rate (delivery)	USER	-	Only if the ModBus meter or the PT3E2 inlet is enabled
14.27	ECX1 water instant flow rate (delivery)	USER	-	Only if the ModBus meter or the PT3E2 inlet is enabled
14.28	ECX1 energy	USER	-	Only if the ModBus meter or the PT3E2 - PT1E2 - PT2E2 inlets are enabled
14.29	ECX1 power	USER	-	Only if the ModBus meter or the PT3E2 - PT1E2 - PT2E2 inlets are enabled
14.30	ECX2 water total flow rate	USER	-	Only if the ModBus meter or the PT6E2 inlet is enabled
14.31	ECX2 water instant flow rate	USER	-	Only if the ModBus meter or the PT6E2 inlet is enabled
14.32	ECX2 energy	USER	-	Only if the ModBus meter or the PT6E2 - PT4E2 - PT5E2 inlets are enabled
14.33	ECX2 power	USER	-	Only if the ModBus meter or the PT6E2 - PT4E2 - PT5E2 inlets are enabled
17.01	Total absorbed electrical energy (kWh)	USER	-	Only if the relevant ModBus meter is enabled
17.02	Total absorbed current (A)	USER	-	Only if the relevant ModBus meter is enabled
17.03	Total absorbed power (W)	USER	-	Only if the relevant ModBus meter is enabled
18.02	Pump 1 speed (RPM)	USER	-	Only if the Pump 1 ModBus is enabled
18.03	Pump 1 motor supply frequency (Hz)	USER	-	Only if the Pump 1 ModBus is enabled
18.04	Status of pump 1 run digital enabling (On-Off)	USER	-	Only if the Pump 1 ModBus is enabled
18.05	Pump 1 absorption (A)	USER	-	Only if the Pump 1 ModBus is enabled
18.06	Pump 1 absorbed power (W)	USER	-	Only if the Pump 1 ModBus is enabled
18.07	Pump 1 total absorbed energy (kWh)	USER	-	Only if the Pump 1 ModBus is enabled
18.08	Pump 1 inverter temperature (°C)	USER	-	Only if the Pump 1 ModBus is enabled
18.10	Pump 1 pre-alarm signal	USER	-	Only if the Pump 1 ModBus is enabled
19.02	Pump 2 speed (RPM)	USER	-	Only if the Pump 2 ModBus is enabled
19.03	Pump 2 motor supply frequency (Hz)	USER	-	Only if the Pump 2 ModBus is enabled
19.04	Status of pump 2 run digital enabling (On-Off)	USER	-	Only if the Pump 2 ModBus is enabled
19.05	Pump 2 absorption (A)	USER	-	Only if the Pump 2 ModBus is enabled
19.06	Pump 2 absorbed power (W)	USER	-	Only if the Pump 2 ModBus is enabled
19.07	Pump 2 total absorbed energy (kWh)	USER	-	Only if the Pump 2 ModBus is enabled
19.08	Pump 2 inverter temperature (°C)	USER	-	Only if the Pump 2 ModBus is enabled
19.10	Pump 2 pre-alarm signal	USER	-	Only if the Pump 2 ModBus is enabled
20.01	Steam total flow rate (kg)	USER	-	Only if the relevant ModBus meter is enabled
20.02	Steam instant flow rate (kg/h)	USER	-	Only if the relevant ModBus meter is enabled
20.03	Steam pressure (Bar)	USER	-	Only if the relevant ModBus meter is enabled
20.04	Steam temperature (°C)	USER	-	Only if the relevant ModBus meter is enabled
20.05	Water equivalent flow rate (l/h)	USER	-	Only if the relevant ModBus meter is enabled
20.06	Steam power (kW)	USER	-	Only if the relevant ModBus meter is enabled
20.07	Steam energy (kWh)	USER	-	Only if the relevant ModBus meter is enabled
11.27	Value O ₂ in %	USER	-	If the oxygen sensor is enabled
11.28	Value CO ₂ in %	USER	-	If the oxygen sensor is enabled

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
02.31	Boiler pressure setpoint in Bar	USER	-	Always
11.03	Boiler pressure in Bar	USER	-	Always
11.15	Steam flow pressure in Bar	USER	-	If the steam control valve is enabled
13.23	Steam flow valve modulation percentage	USER	-	If the valve is enabled
11.17	Cascade pressure value in Bar	USER	-	If the cascade is enabled
11.01	Ambient temperature in °C	USER	-	If the sensor is enabled
11.13	Flue gas temperature in °C	USER	-	Always
11.27	Value O ₂ in %	USER	-	If the oxygen sensor is enabled
11.28	Value CO ₂ in %	USER	-	If the oxygen sensor is enabled
11.09	TDS value in µS	USER	-	If the TDS sensor is enabled
11.04	Burner fed	USER	-	Always
11.05	Burner flame presence	USER	-	Always
13.01	Burner modulation percentage	USER	-	Always
14.01	Number of burner starts	USER	-	Always
14.02	Burner hours of operation	USER	-	Always
14.05	Burner power output estimation	USER	-	Always
14.06	Burner total energy output estimation It is the integral of power by time, calculated with the same PID sampling interval.	USER	-	Always
14.07	Combustion efficiency estimation Efficiency = $100 - (0.86 + 36.6 / \text{CO}_2) * (\text{TF} - \text{TA}) / 100$. Efficiency is not calculated if the flue gas probe is not present. If the ambient probe is not present, an air temperature of 25 °C is estimated	USER	-	Always
14.08	Number of openings of the drain valve	USER	-	Only if the valve is enabled
14.09	Opening hours of the drain valve	USER	-	Only if the valve is enabled
14.10	Number of openings of the TDS valve	USER	-	Only if the valve is enabled
14.11	Opening hours of the TDS valve	USER	-	Only if the valve is enabled
04.05	Level setpoint	SERVICE	SERVICE	If the level probe is enabled
11.07	Level value in %	USER	-	Always
14.12	Number of starts of pump 1	USER	-	Always
14.13	Pump 1 hours of operation	USER	-	Always
13.02	Pump 1 modulation percentage	USER	-	Always
14.14	Number of starts of pump 2	USER	-	Only if the second pump is enabled
14.15	Pump 2 hours of operation	USER	-	Only if the second pump is enabled
13.03	Pump 2 modulation percentage	USER	-	Only with level sensor and pump 2 enabled
13.04	Feed valve modulation percentage	USER	-	Only with feed valve enabled
11.19	Pump flow pressure in Bar	USER	-	If the flow pressure sensor is enabled
14.18	Number of electrical power F1 rising edges	SERVICE	-	Always
14.19	Electrical power hours F1	SERVICE	-	Always
14.20	Number of electrical power F3 rising edges	SERVICE	-	Always
14.21	Electrical power hours F3	SERVICE	-	Always
14.22	Make-up water total flow rate	USER	-	Only if the meter is enabled (PT9 E2 inlet)
14.23	Make-up water instant flow rate	USER	-	Only if the meter is enabled (PT9 E2 inlet)
14.24	Gas total flow rate	USER	-	Only if the meter is enabled (PT1 E1 or PT10E2 inlet)
14.25	Gas instant flow rate	USER	-	Only if the meter is enabled (PT1 E1 or PT10E2 inlet)
14.26	ECX1 water total flow rate (delivery)	USER	-	Only if the ModBus meter or the PT3E2 inlet is enabled
14.27	ECX1 water instant flow rate (delivery)	USER	-	Only if the ModBus meter or the PT3E2 inlet is enabled
14.28	ECX1 energy	USER	-	Only if the ModBus meter or the PT3E2 - PT1E2 - PT2E2 inlets are enabled
14.29	ECX1 power	USER	-	Only if the ModBus meter or the PT3E2 - PT1E2 - PT2E2 inlets are enabled
14.32	ECX2 energy	USER	-	Only if the ModBus meter or the PT6E2 - PT4E2 - PT5E2 inlets are enabled
14.33	ECX2 power	USER	-	Only if the ModBus meter or the PT6E2 - PT4E2 - PT5E2 inlets are enabled
17.01	Total absorbed electrical energy (kWh)	USER	-	Only if the relevant ModBus meter is enabled
17.03	Total absorbed power (W)	USER	-	Only if the relevant ModBus meter is enabled

No.	Parameter Description	Reading level	Writing level	Visibility Conditions
18.06	Pump 1 absorbed power (W)	USER	-	Only if the Pump 1 ModBus is enabled
18.07	Pump 1 total absorbed energy (kWh)	USER	-	Only if the Pump 1 ModBus is enabled
19.06	Pump 2 absorbed power (W)	USER	-	Only if the Pump 2 ModBus is enabled
19.07	Pump 2 total absorbed energy (kWh)	USER	-	Only if the Pump 2 ModBus is enabled
20.01	Steam total flow rate (kg)	USER	-	Only if the relevant ModBus meter is enabled
20.02	Steam instant flow rate (kg/h)	USER	-	Only if the relevant ModBus meter is enabled
20.04	Steam temperature (°C)	USER	-	Only if the relevant ModBus meter is enabled
11.27	Value O ₂ in %	USER	-	If the oxygen sensor is enabled
11.28	Value CO ₂ in %	USER	-	If the oxygen sensor is enabled

GENERATOR PARAMETER MENU

ACCESS PATH:  → PRESSURE SETTINGS

No.	Description	Range	unit of measurement	Default	Reading	Writing	Visibility
02.01	Soft start. With the control enabled, burner stays at the minimum power until reaching the "Soft start threshold".	Enabled / Disabled	-	Enabled	USER	USER	ALWAYS
02.02	Soft start threshold. With the soft start enabled, burner stays at the value set in parameter 2.22 until reaching this threshold.	0.0 – 12.0	Bar	1,0	USER	USER	ALWAYS
02.22	Soft start power				USER	USER	ALWAYS
02.10	Pressure setpoint.	0.1 – 20.0	Bar	0,0	USER	USER	ALWAYS
02.21	Boiler maximum pressure Maximum limit at which the OFF can be set.	0.0 – 20.0	Bar	12	USER	OEM	ALWAYS
02.23	Turning off differential. When the measured pressure reaches the setpoint (parameter 02.10) plus this differential, the burner stops	0.1 – 2.0	Bar	0,5	USER	USER	ALWAYS
02.24	Ignition differential. When the measured pressure reaches the setpoint (parameter 02.10) less this differential, the burner starts again	0.1 – 2.0	Bar	0,5	USER	USER	ALWAYS

ACCESS PATH:  → BURNER SETTINGS

No.	Parameter Description	Range	unit of measurement	Default	Reading	Writing	Visibility
02.03	Type of burner						
02.11	Low modulation range. Pressure range, above the setpoint, inside which the PID system is active.	0.1 – 10.0	Bar	2,0	SERVICE	SERVICE	ALWAYS
02.12	High modulation range Pressure range, under the setpoint, inside which the PID system is active.	0.1 – 10.0	Bar	1,0	SERVICE	SERVICE	ALWAYS
02.13	Stabilisation time. Time, since burner start (flame presence), during which power is kept at the minimum value.	0 – 300	s	90	SERVICE	SERVICE	ALWAYS
02.14	Sampling period. Time interval taken as a reference by burner PID system.	1 – 60	s	20	SERVICE	SERVICE	ALWAYS
02.15	Sampling time adaptation. Within the range between setpoint and modulation field limits, the frequency progressively increases until reaching the percentage indicated by this parameter.	0 – 1000	%	0	SERVICE	SERVICE	ALWAYS
02.16	Burner PID proportional factor. Weight of the proportional factor taken as a reference by the burner PID system. The proportional length is used to accelerate / decelerate the approaching speed to the setpoint. The definition of the correct speed stabilises the system since it prevents a too quick approach to the setpoint that could result in overshoots due to inertia. The proportional length also increases control responsiveness.	0 – 20	-	10	SERVICE	SERVICE	ALWAYS
02.17	Burner PID integral factor	SERVICE	SERVICE	Always			
02.18	Burner PID derivative factor	SERVICE	SERVICE	Always			
02.19	Time from minimum power to maximum power						

ACCESS PATH: → FLUE GAS PROBE

No.	Parameter Description	Range	unit of measurement	Default	Reading	Writing	Visibility
03.01	Flue gas probe alarm threshold If other than OFF, an alarm is signalled above the set threshold. Alarm is reset if the value goes below the threshold minus the hysteresis set in parameter 03.03.	Off – 0/300	-	Off	USER	SERVICE	With flue gas probe
03.02	Burner switching off threshold If other than OFF, the burner will be switched off above the set threshold and alarm will be signalled. Alarm is reset if the value goes below the threshold minus the hysteresis set in parameter 03.03.	Off – 0/300	-	Off	USER	SERVICE	With flue gas probe
03.03	Flue gas probe hysteresis Hysteresis used by parameters 03.02 and 03.03.	1/300 K	-	10	USER	SERVICE	With flue gas probe
03.04	EGR Flue gas temperature limit						
03.05	EGR Flue gas temperature limit hysteresis						
03.06	EGR Valve opening time						
03.07	O2 maximum limit						
03.08	O2 minimum limit						
03.09	O2 limit hysteresis						
03.10	O2 probe fluxing time						
03.11	O2 probe fluxing stand-by						
03.12	O2 probe reading delay						

ACCESS PATH: → FEED PUMPS

No.	Description	Range	unit of measurement	Default	Reading	Writing	Visibility
04.01	Pump switching. The pump that has to operate can be selected. By selecting this pump, this latter will always work. By selecting "AutoSwitch", the operation will be alternate based on the time set in next parameter. Switching will nevertheless be automatic in case a thermal switch triggers. Parameter available only if two pumps are present.	Pump 1 / Pump 2 / Automatic Switching	-	Pump 1	USER	USER	With second pump
04.02	Switching time. This parameter is active if pump automatic switching has been selected in the previous parameter. After a pump has operated for the time set, the other pump will be activated. The reversal occurs when there is no feeding request.	1-999	Hours	24	USER	USER	With second pump
04.03	Level Off When the level is above the setpoint plus this differential, the pump stops. Parameter present if the level sensor is enabled.	0-100	%	40	SERVICE	SERVICE	ALWAYS
04.04	Level On When the level is under the setpoint minus this differential the pump starts. Parameter present if level sensor is enabled.	0-100	%	10	SERVICE	SERVICE	ALWAYS
04.05	Level Setpoint xValue of the level that the modulation system has to maintain.	0-100	%	50	SERVICE	SERVICE	ALWAYS
04.06	Sampling period Time interval taken as a reference by modulating feed system PID system.	1-60	s	2	SERVICE	SERVICE	ALWAYS
04.07	Sampling time adaptation Within the range between setpoint and modulation field limits, the frequency progressively increases until reaching the percentage indicated by this parameter.	0-1000	%	0	SERVICE	SERVICE	ALWAYS
04.08	Burner PID proportional factor Weight of the proportional factor taken as a reference by the PID system. The proportional length is used to accelerate / decelerate the approaching speed to the setpoint. The definition of the correct speed stabilises the system since it prevents a too quick approach to the setpoint that could result in overshoots due to inertia. The proportional length also increases control responsiveness.	0-20	-	10	SERVICE	SERVICE	ALWAYS

No.	Description	Range	unit of measurement	Default	Reading	Writing	Visibility
04.09	Burner PID integral factor. Weight of the integral factor taken as a reference by the PID system. The integral length is necessary to ensure accuracy at full operation. Nevertheless, if this value is too high, it can cause excessive overshoots before reaching the setpoint. It can also cause fluctuations around the setpoint.	0-20	-	2,5	SERVICE	SERVICE	ALWAYS
04.10	Burner PID derivative factor. Value of the derivative factor taken as a reference by the PID system. The derivative length, duly sized, favours stability (i.e. a protection against excessive overshoots), but it does not contribute to ensure accuracy at full operation. The derivative component tends to mitigate the harsh direction changes of temperature trend, which are due to a possible excessive action of the integral and proportional components. It also increases control responsiveness to sudden load variations.	0-20	-	5	SERVICE	SERVICE	ALWAYS
04.11	Variation maximum speed It represents the maximum speed to increase and decrease speed modulation.	0-20	%/second	10	SERVICE	SERVICE	ALWAYS
04.12	Level probe filter. Number of transducer readings used to calculate the average value. Readings take place every 100 milliseconds.	0-100	-	10	SERVICE	SERVICE	ALWAYS
04.13	Pump manual operation. By activating this function, the selected pump is activated until boiler maximum level. The modulating pump is forced to the maximum.	On/Off	-	Off	USER	USER	ALWAYS

ACCESS PATH: → TDS

No.	Description	Range	unit of measurement	Default	Reading	Writing	Visibility
07.03	TDS alarm threshold. TDS level above which burner is stopped and the relevant alarm is triggered.	0 – 6000	µS	6000	USER	USER	If the TDS sensor is enabled
07.04	TDS alarm hysteresis. When the TDS value drops under the alarm threshold minus this hysteresis, the alarm will be reset and the burner will be restarted.	0 – 1000	µS	100	USER	USER	If the TDS sensor is enabled
07.05	TDS valve opening threshold. TDS level above which the TDS valve is opened intermittently. The valve is opened and closed intermittently based on parameters 07.07 and 07.08. For TDS2: When the intermittent opening is active, the TDS value is read during openings, parameters 06.02 and 06.03 are not active.	2000 – 6000	µS	4000	USER	USER	If the TDS sensor is enabled
07.06	TDS valve opening hysteresis. When the TDS value drops under the opening threshold minus this hysteresis, the valve stays closed.	1 – 1000	µS	100	USER	USER	If the TDS sensor is enabled
07.07	TDS drain valve opening time. TDS valve opening time for drainage (washing) and consequent dilution (for TDS lowering).	1 – 99	s	15	USER	USER	If the TDS sensor is enabled
07.08	TDS drain valve pause time. Duration of TDS pause time during drainage (washing).	1 – 999	s	30	USER	USER	If the TDS sensor is enabled
07.09	TDS enabling. Off: Valve always closed, no alarm is triggered when threshold is exceeded and burner is not stopped. The read TDS value flashes to indicate that the TDS control is disabled. No alarm is triggered even in case of faulty TDS probe. Four dashes "µS ----" will flash instead if the read value On: The valve opens according to the programmed automatisms, when the threshold is exceeded, the alarm will be signalled and the burner turned off.	Off/On	-	Off	USER	USER	If the TDS sensor is enabled

ACCESS PATH: → **BLOWDOWN VALVE**

No.	Description	Range	unit of measurement	Default	Reading	Writing	Visibility
06.01	Opening time of the blowdown valve. Duration of the programmed opening of the blowdown valve. When the value is 0, the valve does not open. The valve symbol flashes on the display.	0 - 99	s	10	USER	USER	If the blowdown valve is enabled
06.02	Pause time of the blowdown valve. Time between one opening and the following one of the blowdown valve.	1 - 999	min	60	USER	USER	If the blowdown valve is enabled

SERVICE PARAMETER MENU

ACCESS PATH: → **FORCING**

No.	Description	Reading Level	Writing Level	Visibility Conditions
10.01	Burner enabling	OEM	OEM	Always
10.07	Blowdown valve	OEM	OEM	Only if enabled
10.08	Pump 1 Modulation	SERVICE	SERVICE	Only if the level transducer is enabled
10.09	Pump 2 Modulation	SERVICE	SERVICE	Only if the second pump and the level transducer are enabled
10.11	Pump 1 Enabling	OEM	OEM	Always
10.12	Pump 2 Enabling	OEM	OEM	Only if the second pump is enabled
10.13	TDS Valve Enabling	OEM	OEM	Only if enabled
10.14	Acoustic alarm	SERVICE	SERVICE	Always
10.15	Alarm for operation without continuous supervision expired	SERVICE	SERVICE	Always
10.06	Cumulative alarm signal	SERVICE	SERVICE	Always
10.16	Energy saver pump	OEM	OEM	If enabled
10.17	Feed valve modulation (OC1)	SERVICE	SERVICE	Only if expansion 2 and relevant function are enabled
10.18	Steam valve modulation (OC2)	SERVICE	SERVICE	Only if expansion 2 and relevant function are enabled
10.20	Dosing pump (V1A outlet)	OEM	OEM	Only if expansion 2 and relevant function are enabled
10.26	Enabling duration	SERVICE	SERVICE	Always
10.27	Enable forcing	SERVICE	SERVICE	Always

Notes

- By accessing the forcing parameter, all the available outlets will be displayed. The desired status of each outlet can be set.
- Forcing is interrupted by quitting the menu, unless an additional duration is entered whose countdown starts upon quitting the menu.
- Outlets can be forced also for an unlimited time (HOLD).
- Whenever accessing the forcing menu, the default parameters will be available, except for the unlimited time forcing. Forcing will be disabled upon PLC rebooting and after any level change.

MODBUS/SLAVE INTERFACE PARAMETERS

Once the ModBus communication parameters have been set, the following parameters will be available:

WORD PARAMETERS

Reading: Read Output Registers (03) or Read Input Registers (04).

ModBus PARAMETER	REF.	Parameter Description	Scale	Scale
300007 or 400007	02.10	Pressure setpoint	Bar	10
300008 or 400008	02.10	Turning off differential	Bar	10
300009 or 400009	02.10	Ignition differential	Bar	10
Inlets				
300011 or 400011	11.01	Ambient temperature	°C	10
300012 or 400012	11.03	Boiler pressure	Bar	10
300013 or 400013	11.07	Water level	%	1
300014 or 400014	11.09	TDS value	µS	1
300015 or 400015	11.13	Flue gas temperature	°C	10
Outputs				
300031 or 400031	13.01	Burner modulation	%	1
300032 or 400032	13.02	Pump 1 modulation	%	1
300033 or 400033	13.03	Pump 1 modulation	%	1
Data and meters				
300041 or 400041	14.01	Number of burner starts	-	1
300042 or 400042	14.02	Burner hours of operation	-	1
300043 or 400043	14.05	Burner estimated power	kW	1
300044 or 400044	14.06	Burner estimated energy	MWh	1
300045 or 400045	14.07	Estimated combustion efficiency	%	1
300046 or 400046	14.08	Number of openings of the blowdown valve	-	1
300047 or 400047	14.09	Hours of operation of the blowdown valve	-	1
300048 or 400048	14.10	Number of openings of the TDS valve	-	1
300049 or 400049	14.11	Hours of operation of the TDS valve	-	1
300050 or 400050	14.12	Number of starts of pump 1	-	1
300051 or 400051	14.13	Hours of operation of pump 1	-	1
300052 or 400052	14.14	Number of starts of pump 2	-	1
300053 or 400053	14.15	Hours of operation of pump 2	-	1
300054 or 400054	14.16	Hours left to the expiration of time for operation without continuous supervision	hh	1
300055 or 400055	14.17	Minutes left to the expiration of time for operation without continuous supervision	mm	1
Parameter Description				
300056 or 400056	14.24	Water delivery total flow rate	cu.m	1
300057 or 400057	14.25	Water delivery instant flow rate	l/h	1
300058 or 400058	14.26	Gas total flow rate	cu.m	1
300059 or 400059	14.27	Gas instant flow rate	cu.m/h	1
FAN INVERTER				
300071 or 400071	16.01	Fan absorbed power	W	1
300072 or 400072	16.02	Fan absorbed current	A	10
300073 or 400073	16.04	Fan supply frequency	Hz	1
300074 or 400074	16.09	Fan absorbed energy	kWh	1
ELECTRICAL ENERGY METER				
300081 or 400081	17.01	Total absorbed electrical energy	kWh	1
300082 or 400082	17.02	Total absorbed current	A	10
300083 or 400083	17.03	Total absorbed power	W	1
Pump 1				
300091 or 400091	18.01	Modulation percentage (with Bus control)	%	1
300092 or 400092	18.02	Pump rotating speed	RPM	1
Pump 2				
300101 or 400101	19.01	Modulation percentage (with Bus control)	%	1
300102 or 400102	19.02	Pump rotating speed	RPM	1
STEAM METER				
300111 or 400111	20.01	Steam total flow rate	t.	1
300112 or 400112	20.02	Steam instant flow rate	Kg/h	1
300113 or 400113	20.03	Steam pressure at the meter	Bar	10
300114 or 400114	20.04	Steam temperature at the meter	°C	10

Bit Parameters

Read: Read Output Status (01) or Read Input Status (02).

ModBus PARAMETER	REF.	Parameter Description	0	1
Inlets				
000001 or 100001	11.04	Burner supply presence	NO	YES
000002 or 100002	11.05	Flame presence	NO	YES
Outputs				
000011 or 100011	13.05	Burner enabling from PLC	NO	YES
000014 or 100014	13.09	Blowdown valve opening control	NO	YES
000015 or 100015	13.10	Pump 1 ignition digital control	NO	YES
000016 or 100016	13.11	Pump 2 ignition digital control	NO	YES
000017 or 100017	13.12	Opening control of the TDS valve	NO	YES
000018 or 100018	13.13	Acoustic signal active	NO	YES
BUS SIGNALS				
000021 or 100021	16.10	Fan ON	NO	YES
000022 or 100022	18.09	Pump 1 enabling	NO	YES
000023 or 100023	19.09	Pump 2 enabling	NO	YES
Alarms				
000031 or 100031	12.01	General alarm	OK	ALARM
000032 or 100032	12.02	Bus communication alarm	OK	ALARM
000033 or 100033	12.03	Minimum level 1	OK	ALARM
000034 or 100034	12.04	Minimum level 2	OK	ALARM
000035 or 100035	12.05	Maximum level	OK	ALARM
000037 or 100037	12.07	Burner shut-off	OK	ALARM
000038 or 100038	12.08	Wrong power supply	OK	ALARM
000039 or 100039	12.09	Safety circuit fault	OK	ALARM
000040 or 100040	12.10	Pump 1 failure	OK	ALARM
000041 or 100041	12.11	Pump 2 failure	OK	ALARM
000042 or 100042	12.12	Deaerator alarm	OK	ALARM
000043 or 100043	12.13	Emergency button pressed	OK	ALARM
000044 or 100044	12.14	Level sensor failure	OK	ALARM
000045 or 100045	12.15	Ambient temperature probe failure	OK	ALARM
000046 or 100046	12.16	Burner modulation feedback failure	OK	ALARM
000047 or 100047	12.17	Level sensor failure	OK	ALARM
000048 or 100048	12.18	TDS sensor failure	OK	ALARM
000049 or 100049	12.19	TDS high value	OK	ALARM
000050 or 100050	12.20	Flue gas temperature probe failure	OK	ALARM
000051 or 100051	12.21	High flue gas temperature 1	OK	ALARM
000052 or 100052	12.22	High flue gas temperature 2 + burner stop	OK	ALARM
000053 or 100053	12.23	Fan inverter fault	OK	ALARM
000054 or 100054	12.24	Fan inverter high temperature	OK	ALARM
000055 or 100055	12.25	Wrong fan supply	OK	ALARM
000056 or 100056	12.26	Fan excessive absorption	OK	ALARM

4 Installation

The installation must be performed in compliance with the local standards by **Qualified Personnel**, namely by personnel with specific technical skills in the field of the steam production system components. An incorrect installation may cause damage to persons or property for which the manufacturer will not be liable.

PRODUCT RECEIPT



IMPORTANT

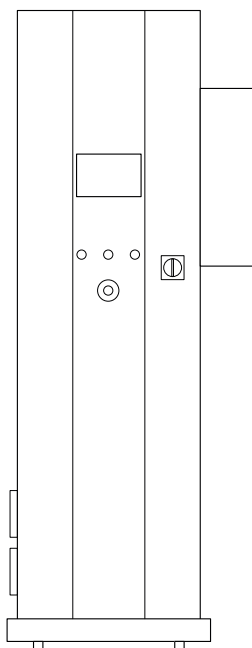
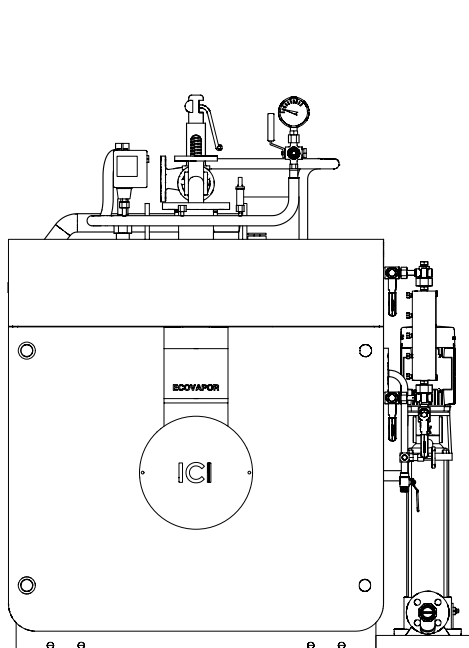
Upon receipt of the steam generating system, make sure that the supply is intact and undamaged and promptly contact **ICI CALDAIE S.p.A.** if it does not correspond to the order

The **ECOVAPOR** systems consist of:

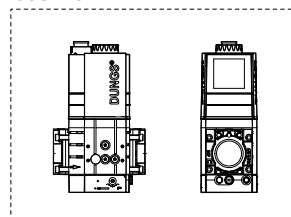
- steam generating system complete with all its parts, any requested component included (assembled and tested).
- turbulators present inside the combustion chamber, to be inserted inside the flue gas tubes upon installation
- control panel made based on the generator to be managed
- gas train, to be assembled on the system upon installation
- pipe, vibration-damping joint and shutter.

The following documents are located inside the control panel:

- declaration of conformity
- use and maintenance manual
- safety valve(s) certificate, with declaration of conformity and use and maintenance manual
- feed pump(s) characteristic curve
- electrical diagram
- Instructions for:
 - safety pressure switch,,
 - pressure transducer,
 - pre-amplifier,
 - probe(s),
 - gas valve.



Gas Train



IMPORTANT

All the supplied documentation is an integral part of the appliance and it **MUST** be carefully read before installing and commissioning the generator, carefully stored for further consultations and it **MUST** always accompany the appliance.

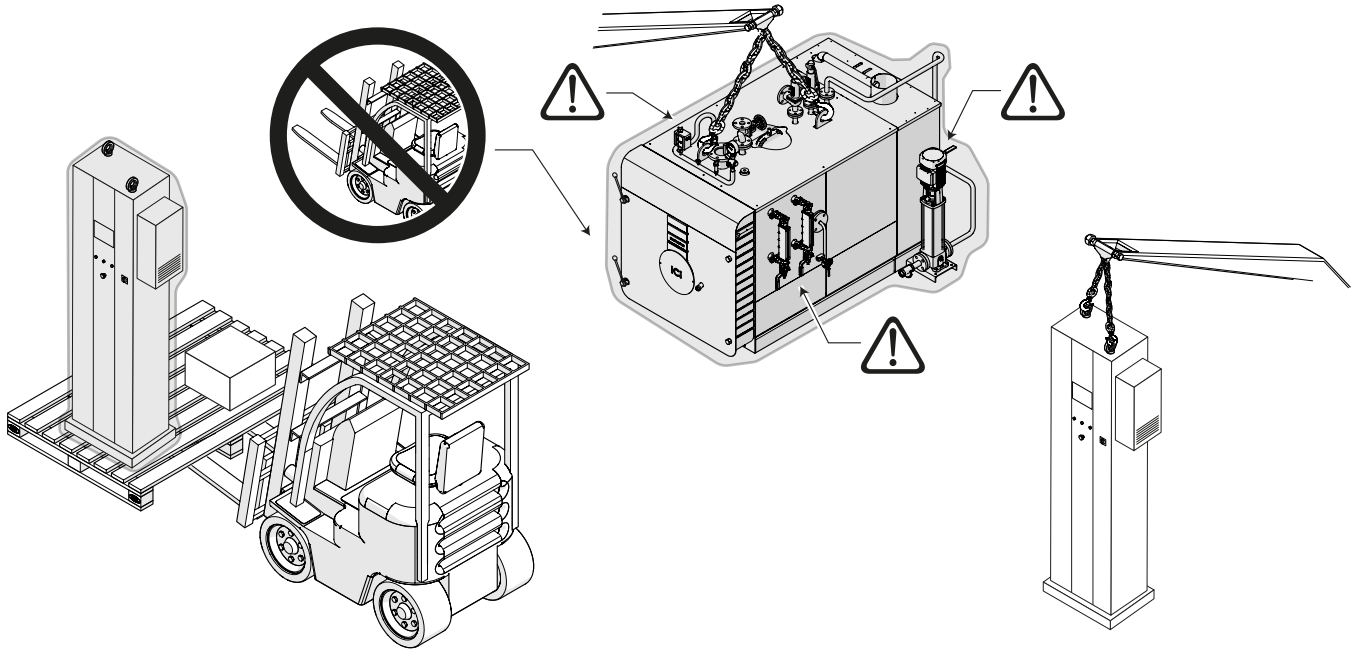
HANDLING



ATTENTION

Pay the utmost care during handling and use the Personal Protective Equipment requested by the prevailing regulations.

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

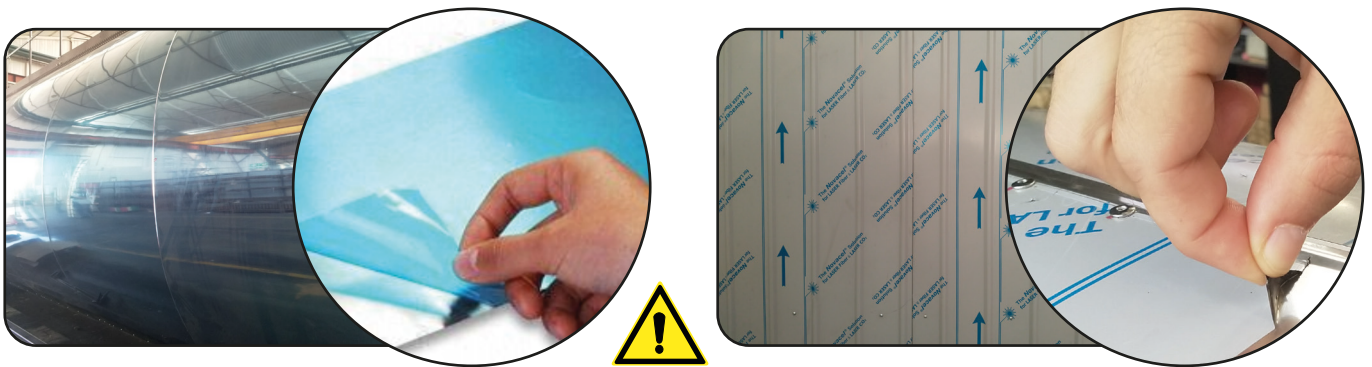


ATTENTION

– Do not expose the packed product to direct sunlight.

FILM REMOVAL

The boilers can feature the following types of protective films:



ATTENTION

Remove the **PROTECTIVE FILM**, if any:

- After handling and after having installed all components.
- **BEFORE STARTING THE BOILER**. The generated heat makes it impossible to remove the film.
- The film exposure to direct sunlight makes it impossible to remove it.

INSTALLATION ROOM

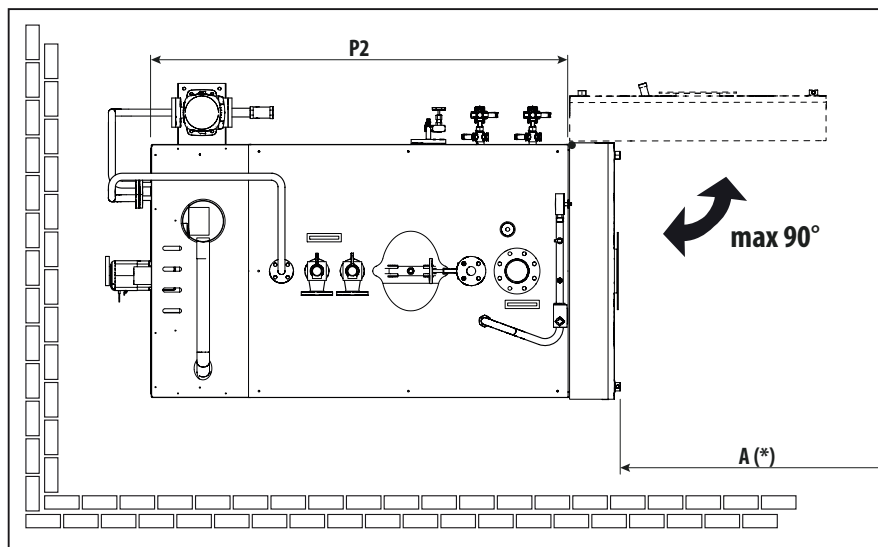
POSITIONING

The room where **ECOVAPOR** boilers are to be installed must be exclusively used for them, compliant with the Technical Standards and the Law in force and equipped with adequately dimensioned vents for generator power.

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 have a main entrance for the passage of the boiler and two doors with panic push-bars for the passage of the personnel. It must also feature a suitable fire protection 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 room must be exclusively used by the personnel in charge of the activities on the generating system. **The access prohibition to unauthorised people must be duly signalled**
- consider the possible the need to replace components that fail over time
- special buffer zones, duly sized in order to allow the operators to carry out the operating, check and maintenance operations of all the installed components in full safety and in compliance with the **Legislation in force in the place of installation**, must be arranged around the boiler
- the boiler can be installed inside an outdoor prefabricated heating plant room, compatibly with the dimensions of the supplied boiler model, and in compliance with the Legislation in force in the place of installation. **COMPULSORY request upon order placing.**



(*) $A \geq P2$ (see "Size and fittings")



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.

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.

As an indication, in case gases lighter than air (natural gas) are used, the air vents must be positioned in the highest point of the room.

SYSTEM CLEANING

All system pipes, in particular those already installed, must be thoroughly cleaned and/or washed, to eliminate any machining residues and possible sludge. The gaskets positioned between joints shall not reduce pipe sections.

HYDRAULIC CONNECTIONS

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

- **Water;** from the condensate tank (if present, otherwise purified water tank) to the feed pump suction.
- **Steam;** from steam main outlet valve to the users (distribution header or others), from the safety valve outlet outside the room in safety position.
- **Drains;** from the level indicator drain, from the boiler drain to the drain line.
- **Fuels;** burner connection for natural gas, LPG, diesel fuel and naphtha.
- **Compressed air;** air pressure must range between 4 and 10 bar. The air must be filtered with a 25 µm mesh.



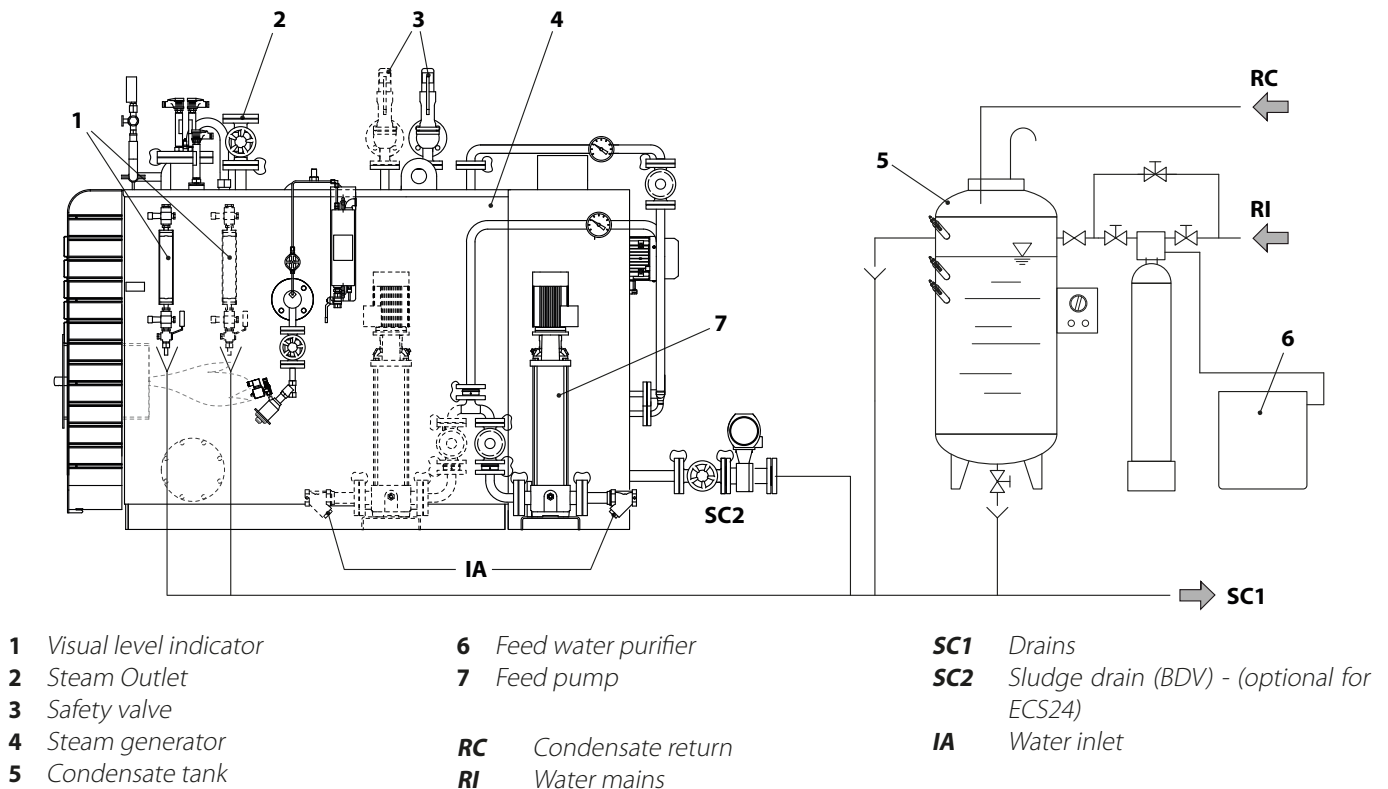
IMPORTANT

- It is recommended to insulate system pipes to avoid heat losses and a higher fuel consumption. All generator, safety valve, etc. drains must be duly conveyed to collection points that can be inspected.
- Make sure that the water and heating system pipes are not used as earthing point of the electrical system.
- It is good practice to allow for expansion joints and suitable supports for the generator connecting pipes.



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.



FLUE EXHAUST

Chimney main specifications, such as height, section type of outlet to the atmosphere, check points, flue gas mass, must be defined by a company specialised in this field that will operate in compliance with the prevailing Standards and Legislation. The connection between chimney and generator (flue gas channel) must be made based on the specific system needs.

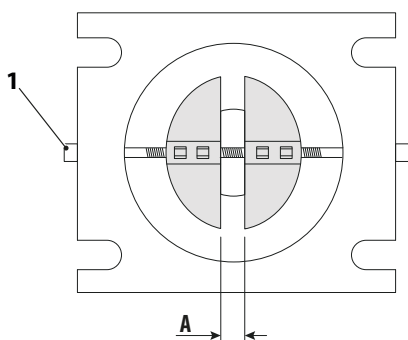


IMPORTANT

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).

GAS TRAIN ASSEMBLING

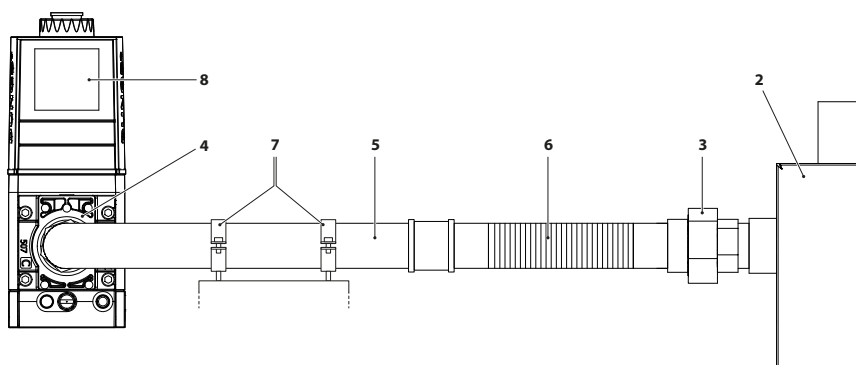
Make sure that the "shutter" opening corresponds to the value specified in the table. Should this not be the case, turn screw (1) until measuring the requested opening.



ECOVAPOR MODEL	u.m.	ECOVAPOR									
		350	500	650	800	1000	1350	1700	2000	2500	3000
Shutter size	(Inch)	1"	1"			1" 1/2	1" 1/2	1" 1/2	1" 1/2	1" 1/2	1" 1/2
Shutter opening	(A - mm)	8					10,5		21,7		
From totally closed shutter	(number of turns)	4					4" 1/2		9" 1/2		
From totally open shutter	(number of turns)	5" 1/2					9		4		
Total	(number of turns)	9" 1/2					13" 1/2		13" 1/2		

To assemble the gas train and connect it to the **ECOVAPOR** steam generating system, use the components supplied and proceed as follows:

- connect nipple male side (3) to the air/gas channel (2),
- connect pipe (5), vibration damper (6) and nipple female part (3) to the shutter (4), thus assembling the gas pipe unit. Duly tighten all joints. lay the gas pipe unit on the hose clamp supports (7) and connect nipple (3). connect gas valve (8) to shutter (4) by duly tightening the four screws
- duly tighten the hose clamp supports (7) and the nipple (3).



IMPORTANT

Apply a suitable product to every joint to ensure proper tightness.

A pressure controller suitable to the gas grid pressure and to generator **ECOVAPOR** performance specifications must be installed upstream the gas train.

Before generator commissioning, the GAS LINE LEAK TEST must be carried out, as required by the current Legislation.

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.

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.

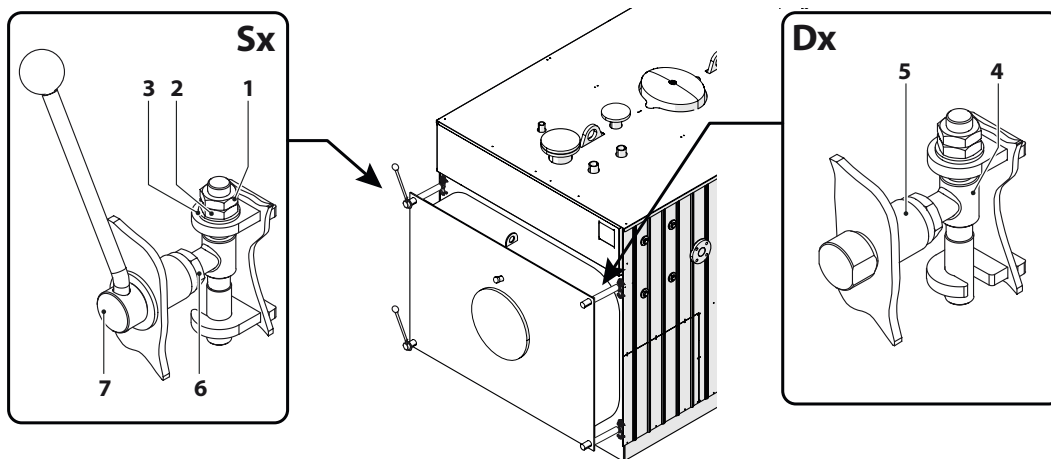
FRONT DOOR ADJUSTMENT



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.



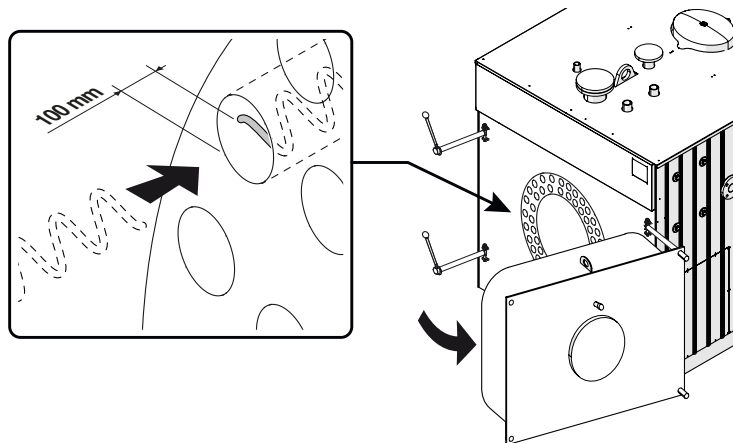
DANGER

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.



The dimensions, diameter and length ($\varnothing \times P$) and the quantities (no.) of the turbulators (Tb) for the various models, are specified in the **"Hydraulic fittings"** table in paragraph **"Dimensions and fittings"**

ELECTRICAL CONNECTIONS

The **ECOVAPOR** feature a control panel (IP 55 insulation class) to be completed by fitting the two factory equipped connectors to the various generator components. Panel model depends on the version of the ordered generator and the specific and detailed wiring diagram is present inside the panel. The connections outside the generator must be carried out by **Qualified Personnel** in compliance with the Technical Standards and with the local National Legislation in force in the country of use.



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.
- 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.



PROHIBITION

- Do not use the water and heating system pipes for the **earthing connections**.
- Do not step on or damage the protective sheath of the cable with any other mean.

5 *First commissioning*

PRELIMINARY ACTIVITIES TO BE CARRIED OUT BEFORE THE "FIRST" COMMISSIONING



IMPORTANT

Before feeding the steam generating system, it is recommended to perform a "Boiling out" with consequent passivation, in order to remove any machining residues. Taking into account the high risk resulting from wrong chemical treatments, the operation must be carried out by **Qualified Personnel**.

The **ECOVAPOR/system** is fed by means of a multi-stage centrifugal pump. Water must reach pump suction with quite a high head in order to avoid possible cavitation phenomena.

The minimum temperature of sucked water must be higher than 60 °C in order to favour oxygen elimination that, in any case, must be completely eliminated with suitable chemical agents. In addition, if water temperature is >60°C the risk of thermal shock inside the generator will be reduced.

The height of installation of the feed reservoir depends on the water temperature inside deaerator/feed reservoir, on the structure of the connecting pipe between deaerator/reservoir and pump and on the characteristics of the pump (refer to the pump manual).



ATTENTION

The oxygen dissolved in water causes corrosion inside boiler. Refer to the maximum allowed values specified in the specific section of this manual.

Follow the table below to avoid pump cavitation problems.

DEGASSER TYPE	Water supply temperature (°C)	Head (H) on suction (metres)
Atmospheric degasser	60	1
	70	2
	80	3
	90	4,5
0.5 bar pressurised thermo-physical degasser	105	6
Pressurised thermophysical deaerator (3 bar)	120 ⁽¹⁾	7

⁽¹⁾ Maximum pump suction temperature is 120 °C.

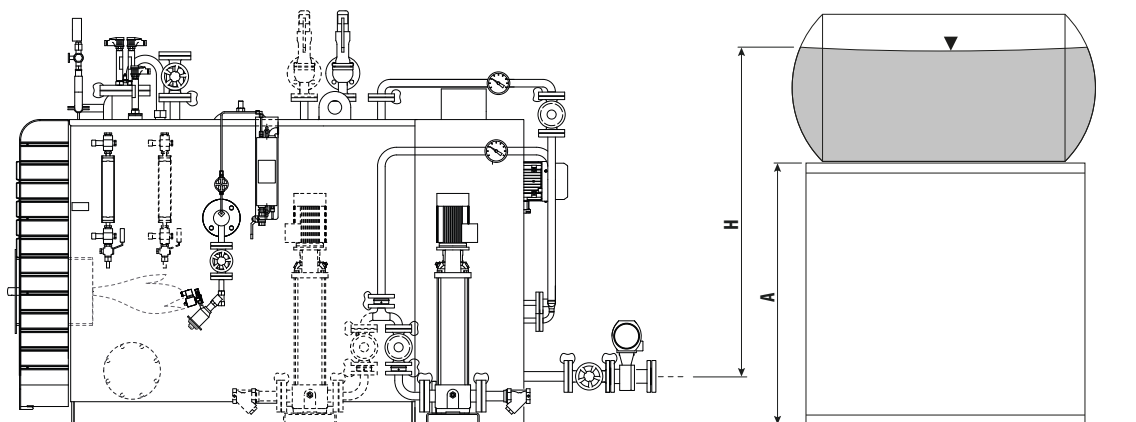


ATTENTION

- Avoid using feed water at a temperature below 60°C because rich of dissolved oxygen, thus such to cause corrosion.
- Before starting the feed pump(s), operate the bleed valve and eliminate all the air present inside the pipe.

HYDROSTATIC HEAD DIAGRAM

Below is an example of hydrostatic head diagram.



A = value variable based on the type of system.

WATER CHARACTERISTICS

The values in the following tables are taken from tables 5.1 and 5.2 of EN 12953-10 (requirements for water delivery and water inside generator).

Even for the generators not included in the mentioned standard, it is nevertheless necessary to adopt at least the indicated limits and consult specialised companies to select the type of treatment to be carried out based on a comprehensive analysis of the available water.

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 apply supposing the presence of a thermal deaerator. If no deaerator is present, the temperature of the water contained inside the reservoir must be increased to at least 80 °C in order to reduce the content of dissolved gases (O₂ and CO₂). In any case, it is recommended to use chemical conditioners to completely deoxygenate the water delivery and to minimise the corrosive effects of CO₂.

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 (SiO2)	mg/l	See the previous table "Maximum acceptable silica content in the boiler generator water up to 20 bar pressures"		
Phosphates (PO4) ^[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 NaPO_4 , further injection of NaOH only if the pH value is < 10 .
- [c] If the acid conductivity of the generator feed water is $< 0.2 \mu\text{S/cm}$, and its concentration of $\text{Na} + \text{K}$ is $< 0.01 \text{ mg/l}$, the injection of phosphate is not required. It can be applied under AVT conditions (treatment with volatile chemicals, feed water $\text{pH} \geq 9.2$ and generator water $\text{pH} \geq 8$), in this case the conductivity of the generator water is $< 5 \mu\text{S/cm}$.
- [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 PO_4 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.

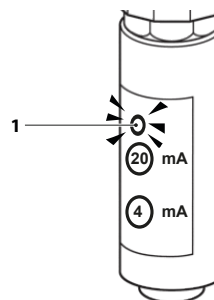
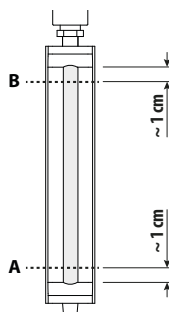
FREQUENCY OF ANALYSIS

The analyses have to be carried out at the frequency specified in the table present inside the periodical checks paragraph. It is nevertheless recommended to check the pH, total hardness and alkalinity values of the water delivery and of the operating water. It is good practice, mainly under variable operating conditions, to make a monthly complete analysis of a significant sample of water delivery and operating water. In addition, it is good practice to visually inspect the possible presence of highly polluting oily substances inside condensate return lines (reduction of the evaporation on the water surface inside generator due to a layer of oil).

WATER FEEDING PROCEDURE

For generator **ECOVAPOR** water feeding, proceed as follows:

- open the water delivery shut-off valves.
- completely bleed the water delivery pipe to the feed pump by operating on the bleed valve
- power the system by setting the plant room panel main switch and the Control Panel main switch to **"ON"**.
- set feed pump operation to **"MAN"** by following path  → **FEED PUMP** → **PUMP MANUAL OPERATION** → **ON**
- press key  and then icon  to start the feed pump
- check that pump rotor turns in the direction indicated on motor rear side and feed until the water level reaches at least **point (A)**, visible on the level indicator
- press icon  to stop the pump
- press and hold key **"4 mA"** of the pre-amplifier (for ~3 sec.) until the **GREEN** LED (1) flashes, then release it
- start pump again by pressing icon  and continue filling until the level indicator reaches approx. **point (B)**, visible on level indicator
- press icon  to stop the pump
- press and hold key **"20 mA"** of the pre-amplifier (for ~3 sec.) until the **GREEN** LED (1) flashes, then release it
- open the sludge drain or **SC2** and forcedly drain the generator until the water level is **approximately 65 mm above the minimum level indicated on the level indicator plate**
- close the sludge drain.
- set feed pump operation to **"AUT"** by following path  → **FEED PUMP** → **PUMP MANUAL OPERATION** → **OFF**





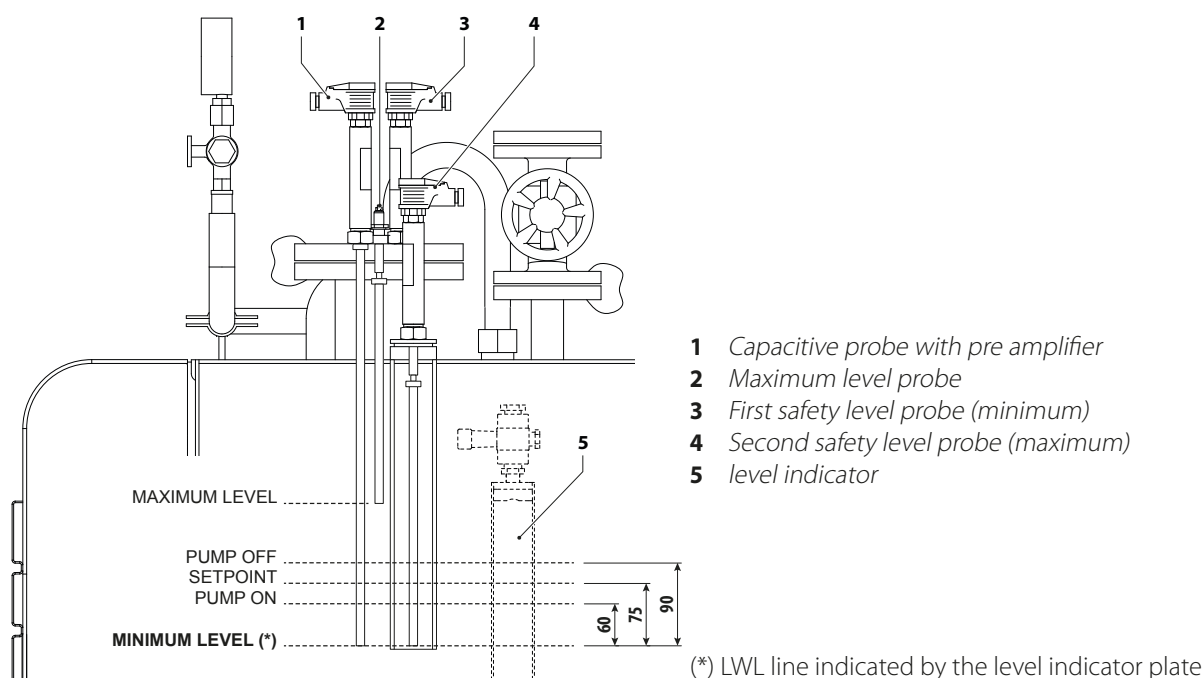
IMPORTANT

If, after key **4 mA** or **20 mA** is pressed, the pre-amplifier LED is **RED**, it means that the operation has **NOT** been carried out correctly. Repeat the operation until the LED flashes green.

LEVEL PROBE POSITIONING

The generator **ECOVAPOR** is supplied with a pre-calibration (positioning) of the probe pack according to the diagram shown. Pump must be started (ON) when the water level is 60 mm above the minimum level, which can be seen on the level indicator, while pump will turn off (OFF) when the level is 90 mm above the minimum level.

The optimal operating level is thus approx. 75 mm above the minimum level (centred between pump ON and OFF).



The commissioning of generator **ECOVAPOR** MUST be carried out by an **Authorised Technical Service Centre** after the following preliminary checks:

- check for the presence and interconnection of all the components described in the manual
- check that the electric, hydraulic and pneumatic connections have been correctly carried out and in compliance with this manual's provisions
- check that all fittings are fully tightened
- check that water filling has been carried out
- close drain valves, steam outlet and level indicator drain
- open the level shut-off and feed valves (upstream and downstream the water pump)
- check that turbulators have been correctly inserted inside the flue gas pipes and properly close the door
- check that fuel supply to burner gas train can ensure a constant pressure inside the flame modulation range and that, in any case, ranges between 20 and 50 mbar. A vibration-damping joint must be positioned between the fuel supply network and the gas train.

FIRST START-UP

The following devices of generator **ECOVAPOR** are pre-set and pre-calibrated:

- inverter (the device is present inside the control panel and is supplied already set)
- burner managing board (pre-calibrated, the minimum (P1), start (P0) and maximum (P9) speeds can be edited)
- control panel, set upon testing as for:
 - number of pumps
 - presence of sludge blowdown

- language
- date and time
- burner management setup
- steam safety pressure switch
- air pressure switch (1 mbar)
- gas valve pressure switch for leak check (10 mbar)
- gas valve pressure switch for grid gas minimum pressure (10 mbar)
- steam safety valve(s) already calibrated and sealed at the maximum boiler pressure (12 barg)
- capacitive level probe
- minimum safety level probes
- gas valve minimum flow rate (mechanical calibration)
- gas valve maximum flow rate (mechanical calibration)
- recirculation flue gas by-pass gate (mechanical calibration).



IMPORTANT

- For further information, refer to the manual of the devices supplied with the generator.
- Upon first start-up, check the efficiency of all the adjustment and control devices present on the control panel.
- Warranty validity is subject to the compliance of the provisions set forth in this manual.

Start-up procedure

To start the steam generator:

- power the control panel by setting the central and main switch to **"ON"**
- press key
- touch the flashing icon to start the generator, with the water at minimum temperature (approx. at ambient temperature).

Wait for the appliance to have completed the start-up phases until reaching the maximum power.

When the generator has reached the maximum power, let it stabilise, without waiting for the pressure to rise and carry out the following measurements/checks:

- check that the grid gas and the gas valve pressure values match with those specified for the installed generator. Should this not be the case, operate on the pressure controller
- make sure that fan frequency (Hz) and combustion data (CO₂ - NO_x) match with those specified in the table
- Through the flame inspection windows (4) check that the colour of the flame and of the metal mesh is light blue. Should this not be the case, turn the Shutter adjustment screw (+/-) (1), or operate on the flue gas recirculation gate (2).

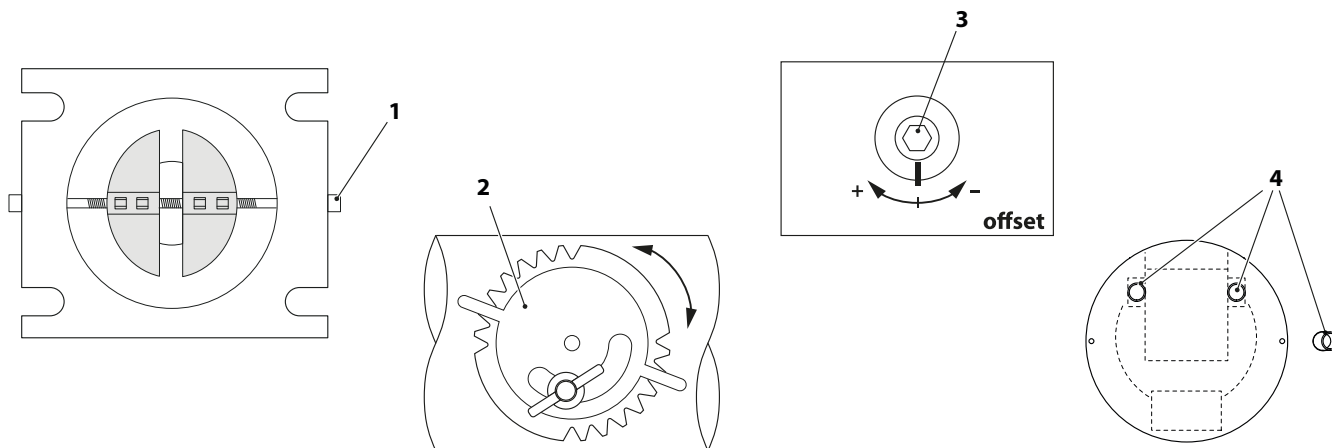
Operate the appliance at its minimum power and carry out the following measurements/checks:

- make sure that fan frequency (Hz) and combustion data (CO₂ - NO_x) match with those specified in the table.
- through the flame inspection windows (4) check that the colour of the flame and of the metal mesh is light blue. Should this not be the case, operate on the "OFFSET" screw pre-calibrated with centreline index (+/-) (3).



IMPORTANT

- It is of the utmost importance to avoid that burner mesh is red since it indicates a "combustion air defect" and can irreparably damage the material.



COMBUSTION SYSTEM CALIBRATION

The following equipment is necessary for the calibration of the combustion system:

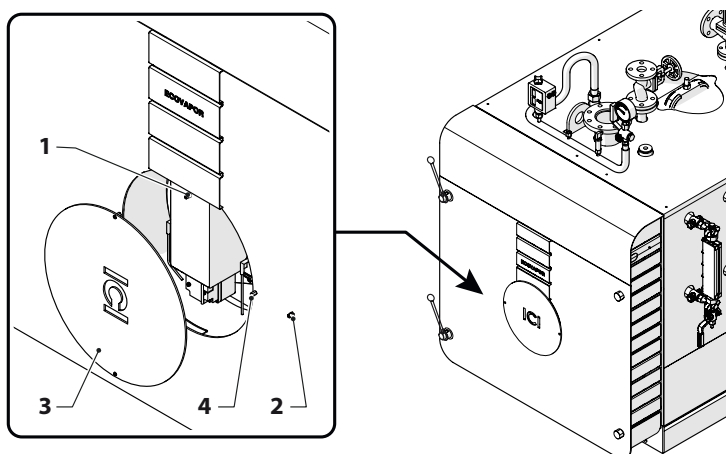
- combustion flue gas analyser (%O₂ , ppm CO, ppm NO_x)
- digital manometer.

The table shows the reference values with the steam generating system set at 10 bar.

The steam generating system is delivered already calibrated (gas valve setting, inverter setting, managing board setting) but, during start-up, some adjustments may be required on the gas valve.

DESCRIPTION		u.m.	ECOVAPOR									
			350	500	650	800	1000	1350	1700	2000	2500	3000
Fan Frequency	MIN	Hz	11,5 ÷ 15	12 ÷ 15				14 ÷ 16		12 ÷ 15		
	START	Hz	14 ÷ 20	20 ÷ 23				23 ÷ 26		14 ÷ 19		
	MAX	Hz	50 ÷ 56	65 ÷ 70				70 ÷ 75		60 ÷ 66		
CO ₂	MIN	%	7,8 ÷ 8,3	7,8 ÷ 8,3				8,5 ÷ 9,0		8,5 ÷ 9,0		
	START	%	9,0 ÷ 9,5	9,0 ÷ 9,5				9,0 ÷ 9,5		9,0 ÷ 9,5		
	MAX	%	9,3 ÷ 9,8	9,3 ÷ 9,8				9,5 ÷ 10		9,5 ÷ 10		
NO _x	MIN	mg/kWh	< 40	< 40				< 50		< 50		
	MAX	mg/kWh	< 60	< 60				< 70		< 70		
Gas Train Pressure	MAX	mbar	20 ÷ 25	20 ÷ 25				30 ÷ 60		30 ÷ 70		
Pilot Flame Pressure	START	mbar								15 ÷ 35		
Combustion Head Δp*	MAX	mbar	9	8,4				17,5		23,7		

* The pressure difference between points A and B indicated in the fig. and detected by the generator set at 10 bar indicates that the MAX flow thermal has been reached



- 1 Pressure test connection A
- 2 Pressure test connection B
- 3 Protective plate
- 4 Fastening screw

The pressure test connection (1) is positioned under the burner protective plate, hence a fastening screw has to be removed to turn the plate as shown in the figure.



IMPORTANT

- **With the steam generator running at the Max Power and at a steam pressure of 10 bar, the NO_x value must be < 70 mg/kwh.**
- On the generators equipped with manhole, during the first start-up, it is essential to progressively tighten the two nuts of the hatch while pressure increases. Otherwise, the installation area may become dangerous for the operators in charge, due to steam seeping through and deteriorating gasket rapidly.
- Check the intervention of all safety and adjustment accessories described in the relevant chapter.

CHECKS AFTER COMMISSIONING

With cold start, check that:

- the water level is 60 mm above the minimum level (LWL) indicated on the level indicator; the water volume increase due to heating (water thermal expansion) should not be excessive in order to avoid having to drain water at regular intervals to bring the level back to half scale on the glass indicator
- once the set pressure has been reached, the steam outlet valve must be opened gradually in order to heat the delivery pipe by eliminating any condensate present inside ducts
- the manhole gasket seals.

STOP PERIODS

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

The operations to be carried out to ensure a correct storage of the generator mainly depend on the duration of the stop time. When the generator has to remain unused **for long periods** a **dry storage** is recommended. When the stop times are **for short periods** or when the generator has a backup function and must be able to become operational in a short time, a **wet storage** is recommended.

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

The wet storage, whenever possible, reduces the interval necessary to reach the operating conditions.

Dry storage

Empty and thoroughly dry the generator, then inject a dessicant (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.

Make sure that there are no leaks from connections or junctions and take some water samples at regular intervals in order to check that the alkalinity value has not been altered.

6 Maintenance

Periodic maintenance is prescribed by Law and must be performed only by a **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
- in case of backfire inside the combustion chamber, before a new ignition, check for any damage of the system, mainly close to the combustion head.

FILTER CLEANING

To maintain the proper functioning of the generator it is necessary to clean the filter periodically (about every 3 months) with the appropriate KIT (not supplied).



ATTENTION

Carefully read the cleaning instructions in the FILTER CLEANING KIT.

The filter must be completely dry before feeding the oil included in the KIT. The filter may take several hours to dry, so it is advisable to purchase a second filter to replace the disassembled one.

Air Filter Cleaning Kit Code: 99-5003EU AIR FILTER MAINTEN. SPRAY

PERIODIC VERIFICATIONS

WATER MONITORING

The system operator present inside the installation room must frequently check the glass indicator in order to avoid that the water level inside the generator remains above the minimum value indicated by the glass level. Any lowering under the minimum value shall trigger 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.

Check intervals are specified in the table. They **MUST be thoroughly respected**.

Version 24 h operation without continuous supervision

Observation and tests	1 day	1 month	3 months	6 months	12 months
Safety valves	O			T(7)	
Level indicators	T(1)				
"TDS-BWD" drain devices (If present)	T(2)				
Shut-off valves	O			T(8)	
Water load control devices	O				
Low level protection devices					

Observation and tests	1 day	1 month	3 months	6 months	12 months
High level protection devices	O	T(4)			T(13)
Temperature and pressure indicators	O				
High pressure protection devices	O	T(4)			T(13)
Protection devices, water delivery quality (if present)	O	T (5)		T (9)	
Safety systems	O			T (10)	
Pressurised parts, piping, flanges, joints		O			
Temperature, pressure control devices	O			T(11)	
Load system, pumps/valves	O		T(6)		
Analysis of the water quality	T(3)				
Burner control (combustion)	O				T(12)
Water quality automatic protection device (if any)		T(14)			
Burner check (filter, gas valve, air pressure switch, fan, cone, electrodes, combustion head and control unit, phase sequence check)	O				T(12)

Version 72 h operation without continuous supervision

Observation and tests	3 days	1 month	3 months	6 months	12 months
Safety valves	O			T(7)	
Level indicators	T(1)				
"TDS-BWD" drain devices (if present)	T(2)				
Shut-off valves	O			T(8)	
Water load control devices	O				
Low level protection devices	O				
High level protection devices	O	T(4)			T(13)
Temperature and pressure indicators	O				
High pressure protection devices	O	T(4)			T(13)
Protection devices, water delivery quality (if present)	O	T (5)		T (9)	
Safety systems	O			T (10)	
Pressurised parts, piping, flanges, joints		O			
Temperature, pressure control devices	O			T(11)	
Load system, pumps/valves	O		T(6)		
Analysis of the water quality	T (3)				
Burner control (combustion)	O				T(12)
Water quality automatic protection device (if any)		T(14)			
Burner check (filter, gas valve, air pressure switch, fan, cone, electrodes, combustion head and control unit, phase sequence check)	O				T(12)

- 0 Observe generator correct operation in all its parts.
 There shall be no leaks from the safety valves.
 There shall be no leaks from the shut-off valves, pipes, flanges, joints, and pressurised parts in general.
 Visually check, through the glass indicators, water correct level.
 Check pump(s), modulating valve (if present).
 Check the correct displaying and adjustment of temperature/pressure values.
 Check for the presence of alarms originated by the protection devices.
 Check burner correct operation.
- T(1) Purge the level indicators
- T(2) Manually check, through the switches present on panel front side, that valves (if any) are open.
- T(3) Perform generator water analysis (refer to the specific paragraph).
- T(4) "Physically" check the triggering of devices (refer to the specific paragraph).
- T(5) Analyse water quality by taking a sample from the feed system; check whether it complies with EN12953-10 specifications (refer to paragraph "water quality" of the generator manual)
- T(6) Thoroughly check the feed system, matching of the level on the glass indicators with the parameters entered in the check device, controller (if any).
- T(7) Check safety valves by applying a master manometer to the generator, as a reference of the exact activation pressure.
Checks must be carried out by qualified personnel.
- T(8) Check correct sealing; grease, lubricate where necessary.
- T(9) Check and new calibration of the analysis system. **Checks must be carried out by qualified personnel.**
- T(10) Check the correct operation of all safety, electric and electronic devices. **Checks must be carried out by qualified personnel.**
- T(11) Check, using master thermometers/manometers, the correct indications provided by the instruments. **Checks must be carried out by qualified personnel.**
- T(12) Burner check, combustion check, safety device check. **Checks must be carried out by qualified personnel.**
- T(13) Bench testing of safety devices. **Checks must be carried out by qualified personnel.**
- T(14) Check and new calibration of the analysis system.

GAS LEAK MONITORING AND AIR FILTER CLEANING (STANDARD)

In addition, it is strongly recommended to carry out periodical tests to check any gas leak and air filter cleanliness.

Monitoring	Modes	Max. frequency
Gas leak detection		12 months
Air filter cleaning	Check of the load loss extent at the filter	12 months

LIFECYCLE OF MAIN COMPONENTS

The lifetime of system components is shown in the table below.

These devices must be replaced once their useful lifetime expires:

COMPONENTS	LIFETIME (years)
Level switch	8
Pressure switch	10
Safety modules	20
Combustion control unit	10
Gas valve	10
Gas pressure switch	20
Air pressure switch	20



ATTENTION

The electronic level relays present inside the control panel must be replaced after 8 years of operation since their useful lifetime has expired.

METHODS FOR CHECKING THE SAFETY DEVICES

CHECKING OF THE MINIMUM LEVEL SAFETY LEVEL SWITCHES

Position yourself in front of the control panel, leave the steam outlet valve open with standard withdrawal, turn off the pump by setting switch to "0", wait for the natural lowering of the generator water level. To accelerate this operation, operate on the sludge drain valve.



IMPORTANT

The two safety devices must trigger when the water level reaches the "minimum" mark indicated on the side of the glass indicators. Should this not be the case, check the whole level switch, which consists of:

- electronic level regulator; check it is intact and, if not, proceed with replacement
- connection cable between control 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 scale build-ups preventing the probe-water current passage or possible dipstick detachment.

If check outcome is positive, set pump control to "AUT".

CHECK THE MAXIMUM LEVEL SWITCH (IF ANY)

Set the pump switch on the control panel to MAN and wait for the water level to increase inside the generator. Check that the pump stops when the maximum point visible in the glass indicator has been reached.

CHECK OF THE SAFETY PRESSURE SWITCH

The safety pressure switch must be calibrated at a pressure lower than that of the safety valve.

To check the correct activation of the safety pressure switch, increase the calibration of the regulation pressure switch(es) and check burner turning off and shut-off alarm activation from the control panel (visually follow the indication provided by the manometer).

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 if there are dust deposits inside the control panel, suck and/or blow to remove any deposit.
- 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 pump and burner control circuits still meet the original conditions (refer to 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 generator body for inspection and 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.

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
		Check thermal calibration
Block pressure switch intervention	Blocked pump shaft	Electric pump maintenance
	Calibrated limit pressure switch too high	Limit pressure switch calibration
	Faulty limit pressure switch	Limit pressure switch replacement
	Clogged pressure switch coil	Coil cleaning or replacement
Level 1 or 2 safety intervention	Block pressure switch failure	Pressure switch replacement
	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
Wrong wiring of control panel probe power cable	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		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

The protection and the respect of the environment are a fundamental principle for **ICI CALDAIE S.p.A**.

Product quality, energy saving and protection of the environment are equally important objectives for the company. **ICI CALDAIE S.p.A**, also through the ISO 14001 certification, strictly adheres to the European laws and standards on environmental protection. 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.

Thermal insulators are special waste and must therefore be disposed of in compliance with the applicable legislation.

DECOMMISSIONING AND DISPOSAL

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

SYSTEM FOR 24 OR 72 H OPERATION WITHOUT CONTINUOUS SUPERVISION

ECOVAPOR is a system certified as assembly under **PED Directive 2014/68/EU** allowing its operation without continuous supervision of an authorised operator in compliance with the provisions in force in the country of installation up to 24 hours for **ECOVAPOR 24** or up to 72 hours for **ECOVAPOR 72**.

The generator supplied (CE certified by the Notified Body as a whole assembly in compliance with the **European Directive 2014/68/EU**) consists of an equipment set, assembled and electrically and hydraulically factory tested at **ICI CALDAIE S.p.A**

Control panel, insulation class IP 55 400V/3 +N/ 50Hz, certified for safety chain management, complete with board and operator panel able to monitor, display and transmit the status signals and alarms. Suitable for operation inside Heating Plant Room under critical environmental conditions (T min. +5°C, T max. +50°C).

Equipped with:

- 7" touch screen HMI operator's panel
- expandable control and monitoring HW board
- control system connectivity via LAN, WiFi, Modbus, Modem
- main disconnecting switch
- low level 1st alarm relay with manual reset
- low level 2nd alarm relay with manual reset
- air-conditioning system
- special safety circuits.

The main functions are:

- water level continuous adjustment through capacitive probe and delivery with inverter-controlled pumps
- inverter controlled motor rpm adjustment of combustion system fan
- burner modulation adjustment, for the management of any power between the minimum and maximum limits, for an optimal adaptation to the feed instant request
- adjustment of automatic sludge blowdown frequency and duration (only for **ECOVAPOR 72**)
- adjustment of salinity control unit thresholds **TDS** (only for **ECOVAPOR 72**)
- self-adaptation based on system actual needs

Accessory unit on steam side, including:

- steam outlet globe valve
- spring safety valve
- level indicator with direct reflection
- interception valve and drain indicator unit.

Pressure control instrumentation containing:

- large dial 3 way test valve manometer
- fail safe manual reset safety pressure switch
- analogue pressure transducer.

Feed water unit mounted on system support, containing:

- 1 vertical multi-stage centrifugal pump suitable for 120° C water with integrated inverter
- 1 shut-off globe valve
- pump suction filter
- 1 non-return valve.

Conductivity probe automatic level controller, containing:

- capacitive probe for level control and management.

Auto-controlled safety level unit, containing:

- 2 low-level safety probes, mechanically and electrically independent, mounted directly on the system, with manual reset and self-test, complete with burner shut off relay
- connections and electrical controls in generator control panel
- mechanical and electric assembling.

This system, supplied as an alternative to the standard low level probes, is designed to ensure that the water level in the generator does not fall below the allowed value. It consists of two independent "fail safe" probes connected to two separated electronic level relays with self-checking feature, capable of indicating:

- the lack of water below the set level

- the lack of water below the set level
- the lack of insulation inside the probe
- faults inside the device (self-check)
- interruption of the connection between the probe and the device in compliance with **EN 12953-9 point 5.4.8.**

When it trips, the control panel triggers a visual and an acoustic alarm and stops the generator (permanently). The generator operation is resumed only after the elimination of the fault and the manual reset by the operator. The control panel is supplied fully assembled on the generator and already tested.

It complies with the following European Directives:

- **Low Voltage Directive 2014/35/EU**
- **EMC Directive 2014/30/EU**
- **PED Directive 2014/68/EU**

Salinity control unit (TDS - only for ECOVAPOR 72) consisting of:

- conductivity probe
- salinity regulation and control unit
- electric or pneumatic blowdown system complete with shut-off valves
- electrical controls in generator control panel
- mechanical and electric assembling.

The **TDS** control system limits the salt and mineral levels dissolved in system water within permitted manufacturer values, thus avoiding any risk of entrainment due to high salinity levels and minimising the amount of blowdown required and associated costs. The system continually measures the electrical conductivity value of the system water, just below the evaporation surface. Its value is related to the concentration of dissolved salts. The detected value is compared with the set one. If it is higher, the blowdown valve opens until the value returns below the set-point.

Automatic sludge drain unit (only for **ECOVAPOR 72**), to prevent sludge build-up inside generator, it consists of:

- 2-way pneumatic valve made of steel, with lever for manual operation
- adjustment of opening frequency and duration
- compressed air solenoid valve
- connections and electrical controls in generator control panel
- mechanical and electric assembling.

The automatic sludge drain unit prevents unnecessary blowdown duplication or verifiable omission with the manual system. This system allows sludge accumulated at the bottom of the boiler to be regularly and automatically removed through a cyclical opening in the blowdown valve. The blowdown frequency and duration are set by the user according to the characteristics of the generator water, as indicated in this technical manual. The system requires compressed air availability.

High level safety probe, mounted directly in the generator body.

Kit designed to prevent an excessive increase of water level inside the generator. Once the set level is reached, the control panel stops the feed pump and triggers an acoustic alarm. Alarm resetting and pump restart automatically occur once normal level in the generator is restored.

Cooler for samples, directly fitted inside the generator, consisting of:

- AISI 304 barrel with an internal water-cooling coil
- cooling water injection ball valve
- handwheel valve for sample picking.

Make sure that the boiler is operating within the desired conductivity parameters by taking and testing water samples. To safely obtain samples, it is essential that a proper cooling is carried out in order to condensate any rising steam before the withdrawal point. The cooler reduces the water temperature to 25° C so that it is ready for an immediate sampling.

Integrated energy saver consisting of:

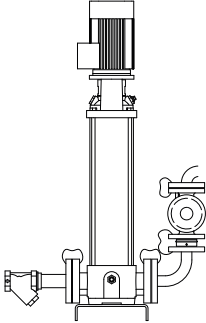
- 2 check thermometers
- 1 pressure gauge with three-way test valve
- safety valve.

Temperature monitoring:

- ambient temperature
- flue gas temperature.

7 *Optional components*

BACKUP SUPPLY PUMP



To ensure a continuous operation of the generator by avoiding any production downtime in case of a supply pump failure, a second backup supply pump is supplied and installed in parallel with the service one. In case of failure of the operating pump, duly signalled by the flashing light on the control panel, the exchange is carried out by the operator - after having eliminated the cause of the malfunction - through the switch present on the control panel.

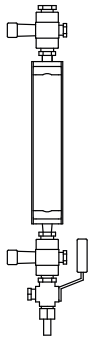
This switch is located between the level relay (or controller) and the power and protection branches of the pumps, which are completely split and independent.

The backup supply pump is thus controlled in the same way as the service pump. Both pumps, hydraulically connected to the same feed pipe, are equipped with a non-return valve and a shut-off valve dedicated to each pump to avoid the water flow towards the pump in stand-by conditions.

The kit comes with:

- no.1 backup supply pump with characteristics similar to service pump
- no.1 pump suction filter
- no.1 non-return valve on pump downstream
- no.1 shut-off valve on pump downstream

SECOND LEVEL INDICATOR

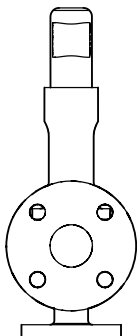


It is supplied as an optional and/or when the prevailing Regulation in the country of destination of **ECOVAPOR** requires the second level indicator.

The kit is assembled and tested in our factory and comes with:

- level indicator with direct reflection
- interception valve and drain indicator unit.

SECOND SAFETY VALVE



It is supplied as an optional and/or when the prevailing Regulation in the country of destination of **ECOVAPOR** requires the spring double safety valve.

STEAM OUTLET ELECTRIC VALVES



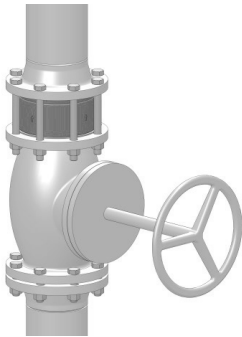
The butterfly valve is a safety valve with a disc-shaped shutter turning around a standard axis of the pipe thus stopping the flow. It can be used as control valve or simply as shut-off valve. It has proven its worth in recent years as an alternative, with allocation range up to 16 bar, to ball valves or gate valves.

The main advantages offered by the butterfly valve are:

- compact dimensions with consequent less space required
- possibility to be assembled in any position
- reduced weight with easy transport and maintenance
- negligible load losses
- long duration over time

Butterfly valve is adjusted through the electric actuator remotely controlled by the boiler control panel.

STEAM NON-RETURN VALVES



The check valve, or non-return valve, is a valve allowing a single flow direction.

The disc check valves are used for the "sandwich" assembling between flanges; they are suitable for use with a wide range of fluids for applications on process lines, cold, hot and superheated water systems, thermal oils, compressed air, etc.

STEAM FLOW METER



Flowmeter for saturated steam, in sandwich design, i.e. in-between two flanges, equipped with built-in electronics providing an output with density compensation.

The electronic head is equipped with an LCD. Instant flow rate signal is transmitted through a 4÷20 mA output.

ELECTRICAL ENERGY METER



- Electrical energy electronic meter.
- Connection and insertion with TA.
- Number of poles: 3 poles + neutral.
- Measure of power, active and reactive energy.
- Communication port protocol: ModBus, RS485.
- Insulation class: IP20, IP40.

MID THERMAL ENERGY METER



The heat meter kits are used for heating and cooling flow metering.

The range includes kits up to DN200 in order to meter the supply energy to risers or heat exchangers.

The kits consist of a calculating unit where two PT500 temperature probes (flow and return) and the pulse output head of a suitable sized volumetric meter must be connected.

The calculating unit features a Meter Bus output and can communicate with devices provided with this input such as, for example, CB 1013 interface of MBUS CB78 centraliser.

The data communicated by the calculating unit to the interface board (CB1013) can be read also by a e-kronos unit that can be connected up to 90 metres away with 3x0.35 shielded cable.

The calculating unit can meter also the pulses coming from 3 possible volumetric meters.

TURBINE GAS METER



The turbine flow meters and quantometers are meters showing the passed volume in cubic meters at the operating conditions.

The running gas is accelerated and conveyed on impeller blades.

The movement of the impeller is transferred to a eight-digit meter through reduction gears and a magnetic coupling.

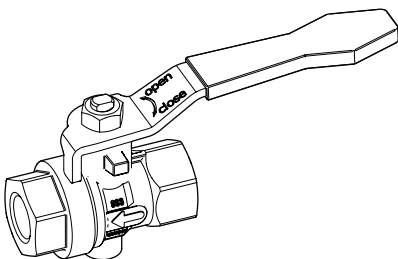
The turbine flow meters are approved for the fiscal measurements of natural gas.

All turbine flow meters are compliant with the international directives and standards on pressure equipment (PED).

The turbine gas meters are fiscal flow meters detecting gas operating volume.

Meters comply with **Directive MID 2004/22/EC**.

GAS MANUAL SHUT-OFF VALVE



Female/female ball valve with total passage for the fuel gas and yellow aluminium lever, galvanised.

GAS PRESSURE CONTROLLER



Gas pressure controller with direct action compensated shutter.

Controllers comply with standard **EN 88-2 - EN 334**

In compliance with directives:

- **PED 2014/68/EU**
- **Gas 2009/142/EC**
- **ATEX 2014/34/EU**

8

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.

EV01n			
ICI CALDAIE S.p.A. Via G.Pascoli, 38 - 37059 ZEVIÒ (VR) - ITALIA -			
		Tipo - Type ECOVAPOR 500	
Codice - Code 86440504	Data - Date 07.12.2017	Numero di Serie - S. N. 200031736	
PORTATA TERMICA - HEAT INPUT		379 kW	325.600 Kcal/h
POTENZA UTILE - HEAT OUTPUT		341 kW	293.000 Kcal/h
TS min: -10 °C PS: 12 BAR TS max: 191,7 °C	RIF. DISEGNO - DRAWING REF. CORPO - BODY: SIXEN5001200 INSIEME - ASSEMBLY: ECOVAPOR_P-ID_01		
BRUCIATORE - BURNER			
COMBUSTIBILE - FUEL METANO - NATURAL GAS		GAS TYPE: G20 (34,02 MJ/mc) GAS CAT.: I2H	
PRESSIONE - PRESSURE 17 - 25 mbar		PORTATA COMBUSTIBILE - FLOW FUEL 38 Smc/h	
DESTINAZIONE - DESTINATION AT, CH, CZ, DK, EE, ES, FI, GB, GR, RO, IE, IT, LT, LV, NO, PT, SE, SI, SK		ALIM.ELETT.-VOLTAGE-ALIM.ELECT. V. 3/N~ 400 - Hz. 50	
		CLASSE PROTEZIONE - PROTECTION CLASS IP55	
GENERATORE EQUIPAGGIATO PER ESSERE ESERCITO SENZA LA SUPERVISIONE CONTINUA FINO A 72 ORE DI FUNZIONAMENTO.			
STEAM GENERATOR FOR WORKING WITHOUT CONTINUOUS SUPERVISION UNTIL 72 HOURS.		 1370	
S.N. Body 1: 100030216			
DATI CARATTERISTICI: VEDI DICHIARAZ.CONFORMITA' SEE THE DECLARATION OF CONFORMITY FOR TECHNICAL DATES			

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.
www.icaldaie.com - info@icaldaie.com

9

Appendixes for Technical Personnel

The tables below have to be used by the **Technical Personnel** to easily identify the components that could have generated any fault / alarm.

TABLES 1 and 2 indicate the operating phase and the input and output statuses during this phase.

TABLES 3 list the error codes, the diagnosis codes, the causes and the operating phase during which the fault occurred, thus simplifying the identification of the cause that could have generated it

When a malfunction of one generator component occurs or in case of abnormal situation, the control panel generates a visual and acoustic alarm. Press button **(R)** to mute the siren, but the visual indications remain present both on the operator display and on the burner control unit (1)display present inside the control panel.

In order to display the **number of the operating phase** during which the fault occurred or the **fault error code** on the control unit display, the control panel door has to be opened; this operation can be performed only by **Authorised Technical Personnel**.

Examples:



Table 1 and 2 - Operating phase 22:

- General safety circuit ON
- Operation request ON
- Fan motor ON

The other inputs and outputs of phase 22 are negligible or not significant.



Table 3

Loc.c: 12 relates to the LEAK CHECK phase.

Loc.d: 83 indicates that gas valve V2 leaks.



Note

The indications **"Loc.c"** e **"Loc.d"** are alternatively shown on the display.

Table 1; Version without pilot flame[illegible]

	Input / output signal 0 (OFF)
	Permitted input signal 1 (ON) or 0 (OFF)
	Input / output signal 1 (ON)
	Cannot be modified
	Factory setting
	Can be modified on site

70

	Input / output signal 0 (OFF)
	Permitted input signal 1 (ON) or 0 (OFF)
	Input / output signal 1 (ON)
5 s	Cannot be modified
6 s	Factory setting
7 s	Can be modified on site

Table 3

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
no Comm	#	No communication between LMV37.4 and AZL2	Check the wiring to exclude interruptions / contact loosening.
2	#	No flame at the end of the safety interval	
	1	No flame at the end of the safety interval 1	
	2	No flame at the end of the safety interval 2	
	4	No flame at the end of the safety interval 1 (software version £ V02.00)	
3	#	Air pressure error	
	0	Air pressure OFF	
	1	Air pressure ON	
	2	Air pressure evaluation	Correct the setting of parameters 235 and 335. (Disabling of the air pressure control during operation allowed only with pneumatic operation!)
	4	Air pressure ON - Start lock	
	20	Air pressure, combustion pressure - Start lock	
	68	Air pressure, POC - Start lock	
	84	Air pressure, combustion pressure, POC - Start lock	
7	#	Flame loss	
	0	Flame loss	
	3	Flame loss (software version £ V02.00)	
	3...255	Flame loss with TÜV test (flame loss test)	The diagnosis corresponds to the time between fuel valve disabling and flame loss acknowledgement (0.2 second resolution * Value 5 = 1 second).
12	#	Leak check	
	0	The fuel valve 1 leaks (fuel valve 2 with leak check through X5-01)	Through the leak check X5-01 (minimum pressure switch) -Check if the burner side valve leaks -Check if the pressure switch for leak check is closed when there is gas pressure -Check the wiring to exclude short circuits
	1	The fuel valve 2 leaks (fuel valve 1 with leak check through X5-01)	Through the leak check X5-01 (minimum pressure switch) -Check if the burner side valve leaks -Check the wiring to exclude short circuits
	2	The leak check cannot be performed	The leak check is active, but the minimum pressure switch is selected as input function for X9-04 (check parameters 238 and 241).
	3	The leak check cannot be performed	The leak check is active, but it is not assigned to any input (check parameters 236 and 237).
	4	The leak check cannot be performed	The leak check is active, but 2 inputs are assigned (set parameter 237 on max. pressure switch or POC).
	5	The leak check cannot be performed	The leak check is active, but 2 inputs are assigned (check parameters 236 and 237).
	81	V1 leaks	Check if the gas side valve leaks. Check the wiring to exclude interruptions.
	83	V2 leaks	Check if the burner side valve leaks. Check if the pressure switch for leak check is closed when there is gas pressure. Check the wiring to exclude short circuits.
20	#	Min gas pressure switch	
	0	No minimum gas pressure	Check the wiring to exclude interruptions.
	1	No gas - Start lock	Check the wiring to exclude interruptions.
22 OFF S	#	Safety circuit	
	0	Safety circuit	
23	#	Minimum pressure switch (Pmin) / fuel oil immediate start	
	0	No minimum gas pressure	Check the wiring to exclude interruptions (X5-01).
	1	No gas - Start lock	Check the wiring to exclude interruptions (X5-01).
	2	Fuel oil immediate start	Check wiring to exclude interruptions (X9-04). Check oil pre heating function.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
50	#	Internal error	Unlock, if it occurs again replace the appliance.
51	#	Internal error	Unlock, if it occurs again replace the appliance.
55	#	Internal error	Unlock, if it occurs again replace the appliance.
56	#	Internal error	Unlock, if it occurs again replace the appliance.
57	#	Internal error	Unlock, if it occurs again replace the appliance.
58	#	Internal error	Unlock, if it occurs again replace the appliance.
60	0	External error: no valid feeding source	Unlock, if it occurs again replace the appliance.
65	#	Internal error	Unlock, if it occurs again replace the appliance.
66	#	Internal error	Unlock, if it occurs again replace the appliance.
67	#	Internal error	Unlock, if it occurs again replace the appliance.
70	#	Ratio internal error: position calculation in modulation	
	23	Feeding not valid	No valid feeding.
	26	Curve points not defined	Set all curve points for all actuators.
71	#	Specific position not defined	
	0	Rest position	Parametrise the rest position for all the used actuators.
	1	Pre-ventilation position	Parametrise the pre-ventilation position for all the used actuators.
	2	Post-ventilation position	Parametrise the post-ventilation position for all the used actuators.
	3	Ignition position	Parametrise the ignition position for all the used actuators.
72	#	Ratio internal error	Unlock, if it occurs again replace the appliance.
73	#	Ratio internal error: position calculation in stages	
	23	Feeding not valid	No valid feeding.
	26	Curve points not defined	Set all curve points for all actuators.
75	#	Ratio internal error: data matching check	
	1	Current feeding not matching	
	2	Target feeding not matching	
	4	Target positions not matching	
	16	Different positions reached	It can be caused by different rpm values standardised with activated frequency converter (i.e. after a dataset restore). Repeat the standardisation and check ratio setting.
76	#	Ratio internal error	Unlock, if it occurs again replace the appliance.
80	#	Limitation of frequency converter adjustment range	The appliance could not adjust the rpm difference due to an adjustment limit. The appliance is not standardised for this motor. Repeat the standardisation. Warning! Check ratio setting . The gas train times of the frequency converter are not set with a duration lower than the gas trains of the appliance (parameter: 522, 523) or wrong setting of the operating gas train during modulation (parameter 544). Frequency converter characteristic is not linear. The input (voltage) configuration on the frequency converter must be equal to that of the appliance (parameter 645). The frequency converter does not follow appliance changes fast enough. Check frequency converter setting (inlet filter, sliding compensation, disabling of several rpms).
	1	Limitation of lower adjustment range	The rpm value of the frequency converter was too high.
	Bit 0 Significance 1	Line interruption	A line interruption on the actuator connections has been acknowledged. Check wiring (voltage X54 across pin 5 or 6 and pin 2 >0.5 V).
	Bit 3 Significance ≥ 8	Too steep curve compared to gas train speed	Check the position difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 s modulation. The slope of the curve must be max. 31° (15° with SQM33.6 or 9° with SQM33.7) of position change between 2 basic points in modulation operating mode. Operating gas train in 64 s modulation. The slope of the curve must be max. 62° (30° with SQM33.6 or 18° with SQM33.7) of position change between 2 basic points in modulation operating mode.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
	2	Limitation of upper adjustment range	The rpm value of the frequency converter was too low.
84	#	Actuator curve steepness	
	Bit 0 Significance 1	Frequency converter: curve too steep compared to gas train speed	Check the rpm difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 second modulation. Slope of the curve maximum 10% with gas train LMV37.4 of 20 seconds (20% with 10 seconds or 40% with 5 seconds). Operating gas train in 48 second modulation. Slope of the curve maximum 10% with gas train LMV37.4 of 30 seconds (20% with 15 seconds or 30% with 10 seconds). Operating gas train in 64 second modulation. Slope of the curve maximum 10% with gas train LMV37.4 of 40 seconds (20% with 20 seconds or 40% with 10 seconds). Between the ignition point (P0) and the low flame (P1), the variation of the rpm value in modulation can be 40%, independent of the LMV gas train. The gas train of the frequency converter must be set approx. 20% faster than the gas trains of the appliance (parameter: 522, 523).
	Bit 1 Significance 2-3	Fuel operation: too steep curve compared to gas train speed	Check the position difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 s modulation. The slope of the curve must be max. 31° (15° with SQM33.6 or 9° with SQM33.7) of position change between 2 basic points in modulation operating mode. Operating gas train in 64 s modulation. The slope of the curve must be max. 62° (30° with SQM33.6 or 18° with SQM33.7) of position change between 2 basic points in modulation operating mode.
	Bit 2 Significance 4-7	Air drive: too steep curve compared to gas train speed	Check the position difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 s modulation. The slope of the curve must be max. 31° (15° with SQM33.6 or 9° with SQM33.7) of position change between 2 basic points in modulation operating mode. Operating gas train in 64 s modulation. The slope of the curve must be max. 62° (30° with SQM33.6 or 18° with SQM33.7) of position change between 2 basic points in modulation operating mode.
85	#	Reference error of an actuator	
	0	Reference error of a fuel drive	Fuel drive referencing not successfully completed. The reference point could not be reached. -Check the setting of the type of drive (parameter 613.0 or 614) -Check if the actuator have been mixed up. -Check whether the actuator is stuck or overloaded.
	1	Reference error of the air drive	Air drive referencing not successfully completed. The reference point could not be reached. -Check the setting of the type of drive (parameter 613.1). -Check if the actuator have been mixed up. -Check whether the actuator is stuck or overloaded.
	Bit 7 Significance ≥ 128	Reference error for parameter editing	The parametrisation of an actuator (i.e. status of the reference position) has been edited. This error is generated to provoke a new referencing.
	#		
86	#	Fuel drive error	
	0	Position error	The requested position could not be reached within the defined tolerance. Check whether the actuator is stuck or overloaded.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
	Bit 0 Significance 1	Line interruption	A line interruption on the actuator connections has been acknowledged. Check wiring (voltage X54 across pin 5 or 6 and pin 2 >0.5 V).
	Bit 3 Significance ≥ 8	Too steep curve compared to gas train speed	Check the position difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 s modulation. The slope of the curve must be max. 31° (15° with SQM33.6 or 9° with SQM33.7) of position change between 2 basic points in modulation operating mode. Operating gas train in 64 s modulation. The slope of the curve must be max. 62° (30° with SQM33.6 or 18° with SQM33.7) of position change between 2 basic points in modulation operating mode.
	Bit 4 Significance ≤ 16	Discrepancy compared to the last referencing	The actuator has been overloaded or mechanically bent. Check the setting of the type of drive (parameter 613.0 or 614). Check if the actuator gets stuck in a point of the operating range. Check whether the torque for the application is enough.
87	#	Air drive error	
	0	Position error	The requested position could not be reached within the defined tolerance. Check whether the actuator is stuck or overloaded.
	Bit 0 Significance 1	Line interruption	A line interruption on the actuator connections has been acknowledged. Check wiring (voltage X53 across pin 5 or 6 and pin 2 >0.5 V).
	Bit 3 Significance ≥ 8	Too steep curve compared to gas train speed	Check the position difference between basic point and setting of the operating gas train in modulation (parameter 544). Operating gas train in 32 s modulation. The slope of the curve must be max. 31° (15° with SQM33.6 or 9° with SQM33.7) of position change between 2 basic points in modulation operating mode. Operating gas train in 64 s modulation. The slope of the curve must be max. 62° (30° with SQM33.6 or 18° with SQM33.7) of position change between 2 basic points in modulation operating mode.
	Bit 4 Significance ≥ 16	Discrepancy compared to the last referencing	The actuator has been overloaded or mechanically bent. Check the setting of the type of drive (parameter 613.1). Check if the actuator gets stuck in a point of the operating range. Check whether the torque for the application is enough.
90	#	Appliance internal error	
91	#	Appliance internal error	
93	#	Flame signal detection error	
	3	Detector short circuit	Short circuit on QRB Check wiring. Possible fault of the flame detector.
95	#	Relay monitoring error	
	3 = ignition transformer 4 = fuel valve 1 5 = fuel valve 2 6 = fuel valve 3	Operation contact external supply	Check wiring.
96	#	Relay monitoring error	
	3 = ignition transformer 4 = fuel valve 1 5 = fuel valve 2 6 = fuel valve 3	Welded relay	Measure contacts: Powered appliance: the fan output must not be powered. Disconnect the electrical power: disconnect the fan. No ohmic connection shall be present between fan output and N. If one of the two tests is not successfully completed, replace the appliance: contacts are welded and their safety can no longer be ensured.
97	#	Relay monitoring error	
	0	Welded safety relay or supply outside the safety relay	Measure contacts: Powered appliance: the fan output must not be powered. Disconnect the electrical power: disconnect the fan. No ohmic connection shall be present between fan output and N. If one of the two tests is not successfully completed, replace the appliance: contacts are welded and their safety can no longer be ensured.
98	#	Relay monitoring error	
	2 = safety valve 3 = ignition transformer 4 = fuel valve 1 5 = fuel valve 2 6 = fuel valve 3	The relay is not activated	Unlock, if it occurs again replace the appliance.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
99	#	Relay operation internal error	Unlock, if it occurs again replace the appliance.
	3	Relay operation internal error	Unlock, if it occurs again replace the appliance. Software version V03.10: with error C:99 D:3 during a standardisation of the frequency converter, temporarily disable the Alarm function in case of start lock (parameter 210 = 0, using an enabling contact) or interrupt the ON controller signal.
100	#	Relay operation internal error	Unlock, if it occurs again replace the appliance.
105	#	Contact inquiry internal error	
	0 = min. pressure switch 1 = max / POC pressure switch 2 = pressure switch sealing check 3 = air pressure 4 = feed controller OFF 5 = feed controller ON / OFF 6 = feed controller CLOSED 7 = safety circuit / burner flange 8 = safety valve 9 = fuel valve 1 ignition transformer 10 = 1 ignition transformer 11 = fuel valve 2 12 = fuel valve 3 13 = unlock	"Stuck At" error	It can be caused by a capacity load or by direct current supply on the mains voltage inputs. The inlet where the problem occurred is indicated in the diagnosis code.
106	#	Contact inquiry internal error	Unlock, if it occurs again replace the appliance.
107	#	Contact inquiry internal error	Unlock, if it occurs again replace the appliance.
108	#	Contact inquiry internal error	Unlock, if it occurs again replace the appliance.
110	#	Voltage switch test internal error	Unlock, if it occurs again replace the appliance.
	#		Mains voltage too low.
111	#	Mains undervoltage	Diagnosis code calculation factor; electrical power value (AC 230 V: 1.683; AC 120 V: 0.843).
112	0	Mains voltage restore	Error code to provoke a reset to resume mains voltage (no error).
113	#	Mains voltage monitoring internal error	Unlock, if it occurs again replace the appliance.
115	#	System meter internal error	
116	0	Designed lifetime exceeded (250,000 cycles)	The warning threshold has been reached. The appliance must be replaced.
117	0	Lifetime exceeded Operation no longer reliable	The turning off threshold has been reached.
120	0	Fuel meter input interruption limitation	Too many interference pulses at fuel meter inlet. Improve the EMF measures.
121	#	EEPROM access internal error	Unlock, repeat / check the last parametrisation, restore the dataset, if it occurs again replace the appliance.
122	#	EEPROM access internal error	Unlock, repeat / check the last parametrisation, restore the dataset, if it occurs again replace the appliance.
123	#	EEPROM access internal error	Unlock, repeat / check the last parametrisation, restore the dataset, if it occurs again replace the appliance.
124	#	EEPROM access internal error	Unlock, repeat / check the last parametrisation, restore the dataset, if it occurs again replace the appliance.
125	#	EEPROM reading access internal error	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
126	#	EEPROM writing access internal error	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
127	#	EEPROM access internal error	Unlock, repeat / check the last parametrisation, restore the dataset, if it occurs again replace the appliance.
128	0	EEPROM access internal error – Initialisation synchronisation	Unlock, if it occurs again replace the appliance.
129	#	EEPROM access internal error – Task synchronisation	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
130	#	EEPROM access internal error – Time-out	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
131	#	EEPROM access internal error – Page on Abort	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
132	#	EEPROM register initialisation internal error	Unlock, if it occurs again replace the appliance.
133	#	EEPROM access internal error – Task synchronisation	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
134	#	EEPROM access internal error – Task synchronisation	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
135	#	EEPROM access internal error – Task synchronisation	Unlock, repeat / check the last parametrisation, if it occurs again replace the appliance.
136	#	Restore	
	1	Restore started	A backup restore has been started (no error). In a new appliance, after the restore an unlock is requested!
	#	For other diagnosis codes on error code 136, refer to error code 137	For the measures, refer to error code 137.
137	#	Internal error – Backup / Restore	
	157 (-99)	Restore – OK, but the backup size is lower than the dataset of the current system	Restore successfully completed, but the backup dataset is smaller than that in the current system.
	239 (-17)	Backup – error in backup saving in AZL2	Unlock, repeat the backup.
	240 (-16)	Restore – no backup available in AZL2	No backup in AZL2.
	241 (-15)	Restore – cancellation for unsuitable ASN	The backup does not have a suitable ASN and must not be run on the appliance.
	242 (-14)	Backup – the generated backup is not consistent	The backup is wrong and cannot be restored.
	243 (-13)	Backup – data comparison between wrong µCs	Unlock, repeat the backup.
	244 (-12)	The backup data are incompatible	The backup data are not compatible with the current software version, the restore is not possible.
	245 (-11)	Access error to parameter Restore_Complete	Unlock, repeat the restore.
	246 (-10)	Restore – time-out during saving on EEPROM	Unlock, repeat the restore.
	247 (-9)	The received data are not consistent	The backup dataset is not valid, restore not possible.
	248 (-8)	The restore cannot be run at this moment	Unlock, repeat the restore.
	249 (-7)	Restore – cancellation for unsuitable burner identification	The backup does not have a suitable burner identification and must not be run on the appliance.
	250 (-6)	Backup – the CRC of a page does not match	The backup dataset is not valid, restore not possible.
	251 (-5)	Backup – the burner identification is not defined	Define a burner identification and repeat the backup.
	252 (-4)	After the restore, there are still pages on ABORT	Unlock, repeat the restore.
	253 (-3)	The restore cannot be run at this moment	Unlock, repeat the backup.
	254 (-2)	Cancellation for error transmission	Unlock, repeat the backup.
	255 (-1)	Cancellation for time-out during restore	Unlock, check the connections and repeat the backup.
146	#	Building automation interface time-out	See user's documents of Modbus A7541.
	1	Modbus time-out	
150	#	TÜV test	
	1 (-1)	Invalid phase	TÜV test can be started only in phase 60 (operation).
	2 (-2)	TÜV test default load too small	The default load of the TÜV test cannot be smaller than the lower load threshold.
	3 (-3)	TÜV test default load too big	The default load of the TÜV test cannot be bigger than the lower load threshold.
	4 (-4)	Manual cancellation	No error: manual cancellation of the TÜV test by the user.
	5 (-5)	TÜV test time-out	No flame loss after the disabling of fuel valves: -Check the extraneous light -Check the wiring to exclude short circuits -Check valve tightness
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.

(Loc. "c") Err.Code	(Loc. "d") Diagn. Code	Cause	Possible remedy
	5 (-5)	TÜV test time-out	No flame loss after the disabling of fuel valves: -Check the extraneous light -Check the wiring to exclude short circuits -Check valve tightness
165	#	Internal error	
166	0	Watchdog internal error-reset	
167	#	Manual lock	The appliance has been manually shut-off (no error).
	1	Manual shut-off through contact	
	2	Manual shut-off through AZL2	
	3	Manual shut-off through PC software	
	8	Manual shut-off through AZL2 time-out / communication interruption	During the setting of a curve with AZL2, menu use time-out (setting with parameter 127) or communication interrupted between LMV37.4 and AZL2.
	9	Manual shut-off through the interruption of the PC software communication	During the setting of a curve with ACS410, the communication between LMV37.4 and ACS410 has been interrupted for more than 30 seconds.
	33	Manual shut-off after the unlock attempt of the PC software	The PC software has attempted to unlock a system without errors.
168	#	Error management internal error	Unlock, if it occurs again replace the appliance.
169	#	Error management internal error	Unlock, if it occurs again replace the appliance.
170	#	Error management internal error	Unlock, if it occurs again replace the appliance.
171	#	Error management internal error	Unlock, if it occurs again replace the appliance.
200 OFF	#	System without errors	No error.
201 OFF Upr	#	Start lock	Start lock in an unparametrised. In case of turning off during the first curve setting, the original cause of the error must be detected through the error log, item 702.
	Bit 0 Significance 1	No selected operating mode	
	Bit 1 Significance 2-3	No defined fuel gas train	
	Bit 2 Significance 4-7	No defined curve	
	Bit 3 Significance 8-15	Standard rpm not defined	
	Bit 4 Significance 16-31	The backup / restore could not be run	
202	#	Internal error for operating mode setting	Re-define the operating mode (parameter 201).
203	#	Internal error	Re-define the operating mode (parameter 201). Unlock, if it occurs again replace the appliance.
204	Phase number	Programme stop	Active programme stop (no error).
205	#	Internal error	Unlock, if it occurs again replace the appliance.
	#		
206	0	Device combination not allowed (appliance AZL2)	
207	#	Appliance version compatibility – AZL2	
	0	The version of the appliance is too old	
	1	AZL2 version too old	
208	#	Internal error	Unlock, if it occurs again replace the appliance.
209	#	Internal error	Unlock, if it occurs again replace the appliance.
210	0	The selected operating mode is not enabled for the appliance	Select an operating mode enabled for the appliance.
240	#	Internal error	Unlock, if it occurs again replace the appliance.
245	#	Internal error	Unlock, if it occurs again replace the appliance.
250	#	Internal error	Unlock, if it occurs again replace the appliance.



ICI CALDAIE SpA

37059 Fraz. Campagnola di Zevio (Verona) Italy

Via G. Pascoli 38 Phone: +39 0458738511 Fax: +39 0458731148

info@icaldaie.com www.icaldaie.com