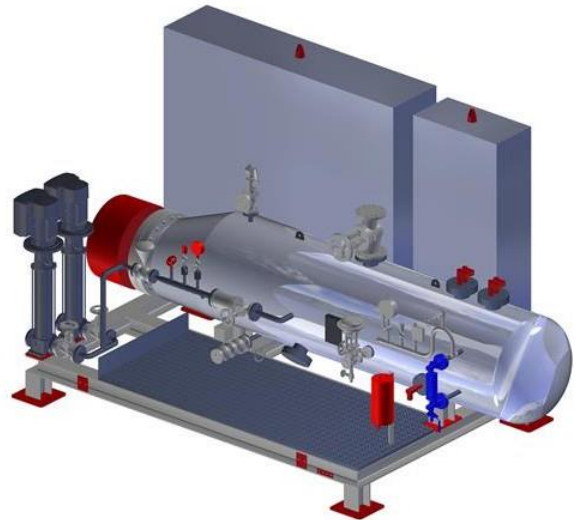




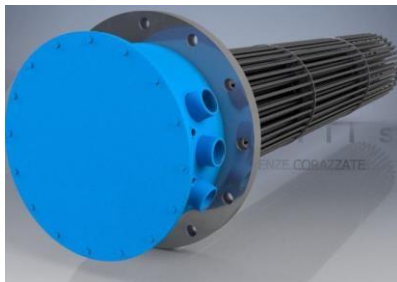
**Electric Steam Boiler – e-SG model
n.1 x 0,7 t/h @10 barg**

INTRODUCTION TO ELECTRIC STEAM GENERATOR: E-SG SERIES

The ideal solution for companies facing energy transition or that, due to their location, must comply with stringent emissions limits imposed by the regulations enforced in that specific area. Unlike traditional flame boilers, industrial electric boilers do not work with combustion but use a system of resistors or electrodes to efficiently generate energy needed for the production process.



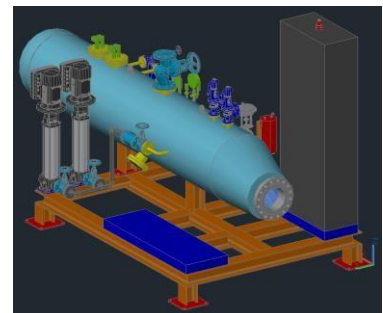
RESISTANCE



POWER CONTROL PANEL



PRESSURIZED BODY ACCESSORIES AND CONTROL PANEL



Steam capacity: up to 20 t/h



Design pressure: up to 100 barg



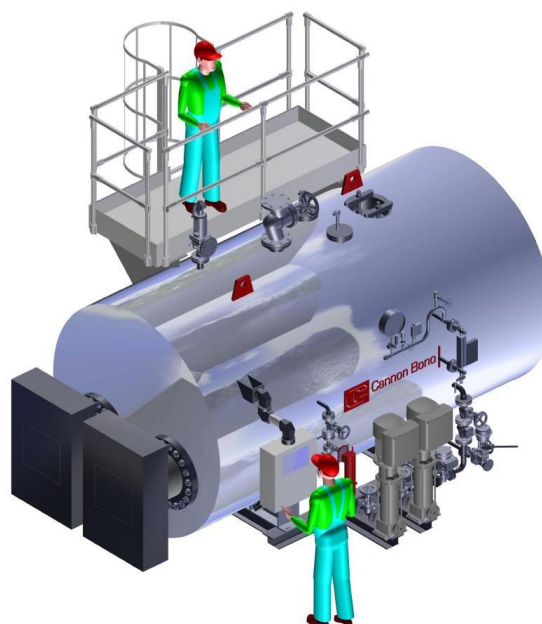
Thermal efficiency: close to 100%



NOx Emissions: 0 (zero) mg/Nm³



Technology	Advantages
Depending on process requirements, industrial electric boilers can be designed with resistances, electrodes, or hybrid (traditional fuels + electric) technology. <u>Resistance:</u> Current 360 – 640 V. Ideal for power below 6 MW, and for all industrial utilities and processes. Consolidated technology, simple design, and easy to use. <u>Electrodes:</u> Current 5000 – 15000 V. Conceived for higher powers and heavy-duty applications, over 4 MW power. <u>Hybrid:</u> Ideal for energy transition and can be used with traditional fuels (also hydrogen) or electric power. Based on instant energy costs or even simultaneously for peak needs. 	The absence of combustion prevents the emission of any pollutants into the atmosphere, such as nitrogen oxide (NOx), sulfur oxide (SOx), and carbon dioxide. Precise steam pressure and temperature control Fast start-up and fast load variation High turn-down ratio All electrical energy input is fully converted into thermal energy, guaranteeing nearly 100% efficiency Easy and reduced maintenance



DESIGN DATA

This quotation is based on the following data:

Country of destination	Greece
Electrical data	230/400 V – 50 Hz – 3 phase
Area of installation	Indoors, boiler room, free of frost, dust, and sand.
Area classification	Safe area, NO ATEX classification
Elevation	< 600 m.a.s.l.
Type of fluid	Saturated steam
Max capacity	700 kg/h 500 kW
Design pressure	12,0 bar _g
Max Operating pressure	10,5 bar _g
Feed water temperature	80°C <i>*to be confirmed</i>
Feed water quality	According to EN 12953:10

CODES AND STANDARDS

Boiler design, calculation and construction	EN 13445
Pressure parts certification	CE-PED (2014/68/EU)
Mechanical equipment	ISO
Electrical equipment	CEI – IEC
Ladders, walkways, supporting structure	EN 14122
Electrical protection degree	IP 54 – IP 55
Alarms sequence	ISA
Electrical protection	Standard, Non-hazardous area

PRODUCT DATASHEET

DIMENSIONAL DATA

		e-SG 500
Length (boiler + control/power cabinet + accessories)	mm	4.300
Width (boiler + control/power cabinet + accessories + pumps)	mm	2.400
Height (boiler + control/power cabinet + accessories)	mm	2.500
Length (power cabinet)	mm	3.000
Width (power cabinet)	mm	500
Height (power cabinet)	mm	2.100

**boiler and power cabinet on the same skid*

FUNCTIONAL DATA

Design pressure	bar _g	12,0
Maximum operating pressure	bar _g	10,5
Steam quality	%	> 99,5
Boiler Feed water temperature (± 5°C) (mix condensate + make-up water)	°C	80
Steam production capacity	kg/h	700
Heat transferred to steam	kW	500
Thermal Efficiency	%	99,5 ± 0,5
Pump flow rate (each)	m ³ /h	1,0
Pump static pressure (each)	mcl	140
Pump installed power	kW	2,0

FEED WATER QUALITY SPECIFICATION

A proper feed water treatment system is mandatory for the issuing and validity of the manufacturer's guarantee. Therefore, it is necessary to carry out a complete analysis of the raw feed water, to select the correct water treatment system. Equally important is the periodic analysis of feed water and boiler water.

If the water treatment is not carried out properly, elements dissolved in the water such as calcium, magnesium or silica can deposit on the iron surfaces of the coil at higher temperatures, causing incrustations and blocking the pipes. In addition, if the feed water is rich in oxygen, the iron in contact with the water will suffer corrosion, leading to holes in the coil. The table below shows the limits values for boiler feed water according to EN 12952-12 and EN 12953-10. In order to maintain the values shown, it is necessary to use water conditioners in addition to water treatment units.

Table 1-1

Parameter	Unit	Feedwater for steam boilers		Make-up water for hot water boilers
Operating pressure	bar (= 0,1 MPa)	> 0,5 to 20	> 20	total range
Appearance	—	clear, free from suspended solids		
Direct conductivity at 25 °C	µS/cm	not specified, only guide values relevant for boiler water see table 5-2		
pH value at 25 °C ^a	—	> 9,2 ^b	> 9,2 ^b	> 7,0
Total hardness (Ca + Mg)	mmol/l	< 0,01 ^c	< 0,01	< 0,05
Iron (Fe) concentration	mg/l	< 0,3	< 0,1	< 0,2
Copper (Cu) concentration	mg/l	< 0,05	< 0,03	< 0,1
Silica (SiO ₂) concentration	mg/l	not specified, only guide values for boiler water relevant, see table 5-2		—
Oxygen (O ₂) concentration	mg/l	< 0,05 ^d	< 0,02	—
Oil/grease concentration (see EN 12953-6)	mg/l	< 1	< 1	< 1
Organic substances (as TOC) concentration	—	see footnote ^e		

^a With copper alloys in the system the pH value shall be maintained in the range 8,7 to 9,2.

^b With softened water pH value > 7,0 the pH value of boiler water according to table 5-2 should be considered.

^c At operating pressure < 1 bar total hardness max. 0,05 mmol/l shall be acceptable.

^d Instead of observing this value at intermittent operation or operation without deaerator if film forming agents and/or excess of oxygen scavenger shall be used.

^e Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behaviour of their individual components under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.

Table 1-2

Parameter	Unit	Boiler water for steam boilers using			Boiler water for hot water boilers
		Feedwater direct conductivity > 30 $\mu\text{S/cm}$		Feedwater direct conductivity $\leq 30 \mu\text{S/cm}$	
Operating pressure	bar (= 0,1MPa)	> 0,5 to 20	> 20	> 0,5	total range
Appearance	—	clear, no stable foam			
Direct conductivity at 25 °C	$\mu\text{S/cm}$	< 6 000 ^a	see Figure 5-1 ^a	< 1 500	< 1 500
pH value at 25 °C	—	10,5 to 12,0	10,5 to 11,8	10,0 to 11,0 ^{b, c}	9,0 to 11,5 ^d
Composite alkalinity	mmol/l	1 to 15 ^a	1 to 10 ^a	0,1 to 1,0 ^c	< 5
Silica (SiO ₂) concentration	mg/l	pressure dependent, according to figure 5-2			—
Phosphate (PO ₄) ^e	mg/l	10 to 30	10 to 30	6 to 15	—
Organic substances	—	see footnote ^f			—

^a With superheater consider 50 % of the indicated upper value as maximum value,

^b Basic pH adjustment by injecting Na₃PO₄, additional NaOH injection only if the pH value is < 10.

^c If the acid conductivity of the boiler feedwater is < 0,2 $\mu\text{S/cm}$, and its Na + K concentration is < 0,010 mg/l, phosphate injection is not necessary. Under the conditions AVT (all volatile treatment, feedwater pH $\geq 9,2$ and boiler water pH $\geq 8,0$) can be applied, in this case the acid conductivity of the boiler water is < 5 $\mu\text{S/cm}$.

^d If non-ferrous materials are present in the system, e. g. aluminium, they may require lower pH value and direct conductivity, however, the protection of the boiler has priority.

^e If coordinated phosphate treatment is used; considering all other values higher PO₄-concentrations are acceptable (see also clause 4),

^f See ^e in table 5-1.

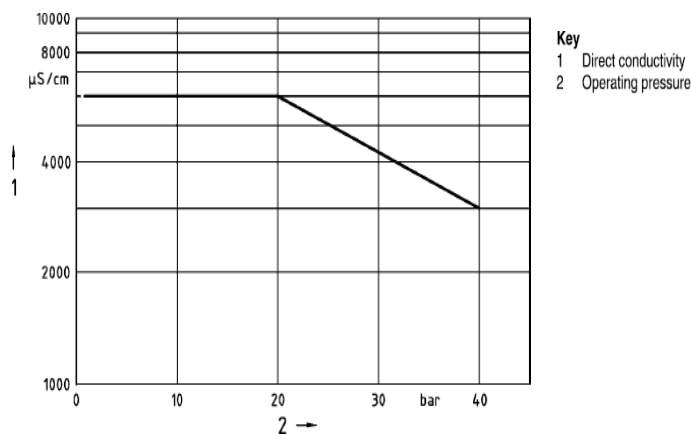


Figure 1-1: Maximum acceptable direct conductivity of the boiler water depending on pressure; feed water direct conductivity >

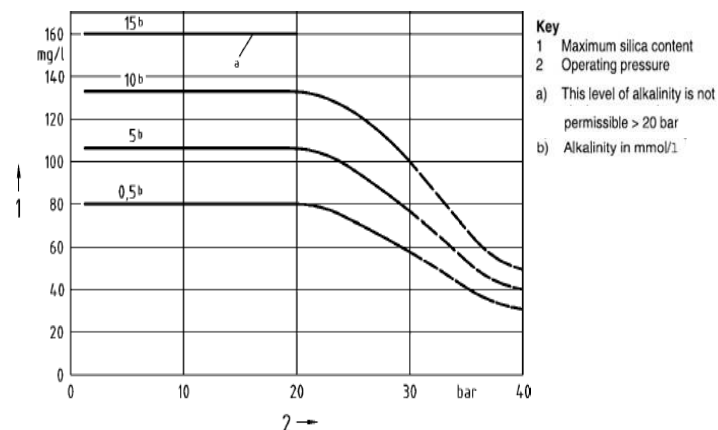


Figure 1-2: Maximum acceptable silica content (SiO₂) of the boiler water depending on pressure.

TECHNICAL SCOPE OF SUPPLY

ITEM 1: e-SG

BOILER BODY

Cylindrical boiler body in horizontal orientation. Shell equipped with manhole for cleaning and internal inspection, flanged service connections: steam valve, safety valve, drain, instrument and probe bottles, surface purging.

N°2 lifting lugs. Steam moisture separator. Dished bottom welded to the shell with full penetration process. Flanges for removable connection of heating resistors.

Materials:

- Shell and bottoms: P355 laminated steel EN10028 or equivalent
- Flanges: ASTM A105 Forged Steel
- Stub tubes: ASTM A 106 Gr.B seamless steel

All materials are supplied with certificate of conformity 3.1 according to EN10204.

Flanged connections to process according to EN1092-1

CE PED certification as equipment; Risk class IV, verification module B+F (EC type examination and product verification) or G.

Design and manufacture under the supervision of a Notified Body.

Metal plate riveted to the body according to the factory number with CE mark and characteristic data.

Boiler base frame consisting of: fixed front saddle, mobile rear saddle with sliding slots.

Stainless steel plate for the earthing connection.

Mineral wool shell insulation Thickness 100 mm Density 100 kg/m³; aluminium sheet or Aluzinc® finish with galvanized steel screws.

ACCESSORIES

- Manual steam output valve and discharge valves flanged according to EN1092-1.
 - o Steam delivery valve.
 - o N°2 boiler body drain valves (one of those is for quick discharge).
 - o Manual boiler water inlet valve.
 - o Check valve for water inlet in boiler.
 - o N°2 internal bottles for housing the level probes
- N° 1 direct-acting safety valve, spring locking. The valve is sized to discharge the maximum capacity of steam produced by the boiler with a maximum overpressure of 10% according to PED requirements. The maximum back pressure considered downstream of the valve is equal to 10% of the trip pressure. The valve is supplied with a PED certificate of conformity and a manufacturer's calibration certificate.
- Pressure gauge with stainless steel case for local boiler pressure indication.
- Safety pressure switch for high pressure.
The safety chain is SIL2 according to IEC61508-2.
- Steam pressure transmitter with 4-20 mA signal for boiler load control
- N°1 level indicator
- N°1 level transmitter with 4-20 mA signal for modulating boiler level control
- N° 2 SELF-CONTROLLED conductive safety probe for very low boiler level. Rear control panel relay for very low water level with manual reset boiler block. The safety chain is SIL3 according to IEC61508-2.

CONTROL PANEL

Electrical panel, compliant with EN 60204 and EN 61439, standards installed on the machine, IP54 metal cabinet powder-coated RAL 7035 (grey) with front door. CE identification plate. Start, stop, reset buttons. Emergency lock button in accordance with ISO 13850. Safety chains with SIL relays. Controllers/Indicators in front of the process variables. Visual status and alarm signals. Cumulative alarm and lockout signaling contacts available in terminal strip. 230V auxiliary section for the management of safety and controls. Signal wiring with 1.5 mm cables with numbering referred to electrical drawing. Earthing bar for equipotential bonding of field electrical consumers. Power section with devices for the control and protection of the water supply pumps (when provided for in the supply). Numbered terminal strip for field instruments connections. Remote locking contact preset. Single-line wiring diagram with multiple pages for immediate consultation. TN-S power supply system with ground cable. Power supply voltage 400V 3 phases + Frequency No. 50Hz. Environmental conditions: installation protected from bad weather and direct sunlight, Tmin 10°C, Tmax 40°C. Safety testing and CE electrical conformity certificate.

Boiler electrical connections (instruments and pumps) compliant with EN60204 standards with wiring carried out in flexible PVC conduit and watertight end fittings. Degree of protection of the electrical system + field instrumentation IP 54.

CE PED CERTIFICATION

CE PED boiler assembly certification including all equipment already certified with an independent procedure and all safety accessories supplied, risk class IV, module B+F or G. Test of safety accessories carried out in the workshop under the supervision of notified body. Metal plate riveted to the QE bearing the serial number with CE stamp and characteristic data.

FIRST PUMP

Vertical centrifugal pump, multi-stage impeller, directly coupled to IEC3 electric motor. Base connected to boiler frame, check valve, connection piping. Start/stop indicators and buttons; control logics provided for QE and electrical wiring. Electrical protection with thermal-magnetic circuit breaker and start/stop contactor.

SECOND PUMP (option)

Vertical centrifugal pump BACKUP, multi-stage impeller, directly coupled to IEC3 electric motor. Base connected to the boiler frame, check valve, manual interception valves, connection piping. Start/stop indicators and buttons; control logics provided for QE and wiring. Electrical protection with thermal-magnetic circuit breaker and start/stop contactor.

72H KIT (option)

TDS salt concentration control system consisting of:

- conductivity probe mounted on discharge pipe for conductivity measurement
- front panel regulator/limiter with indication of process variables
- DN15 multi trim motorized surface purge valve with manual sampling connection

Automatic Blow Down sludge removal system consisting of:

- automatic bottom drain valve DN 25 with electropneumatic control
- timer for bottom drain valve control

Water sampling system in the boiler consisting of:

- sample intake bottle with stainless steel coil water-cooled; needle valve for sample collection
- safety chain for boiler interlock in the event of very high feed water conductivity.

POWER ELECTRICAL PANEL

Floor-mounted electrical panel compliant with EN 60204 and EN 61439 standards, supplied on boiler skid electrical and mechanical connected. Series of IP54 powder-coated modular cabinets with front door. CE identification data plate. Mushroom lock button in accordance with ISO 13850.

Single electrical power input and safety door locking main disconnect. Busbars.

Complete protection from accidental contacts achieved either with the protections of modular systems or with other systems on the various components; alternatively, transparent Plexiglas covers

Transformer for powering auxiliary circuits with secondary 230Vac.

Forced ventilation system calculated based on the dispersions of each component

SIL2 emergency relay with possible safe-guided contactors for auxiliary circuit management

Modular columns for feeding the individual sections into which the heating resistance is divided, each consisting of the following safety and control elements:

Protection system against the opening of panel doors with live cabinet by unauthorized personnel

Short-circuit protection automatic breakers

Safety devices consisting of a release contactor acting in case safety chains trip

Front panel manual switch for double contactor functional test

Differential currents (toroid) metering unit connected to its safety threshold for earth leakage alarm and interlock.

Multi-step solution.

HEATING ELEMENTS

Series of low heat load heating elements consisting of:

- metal conductor wound in coils
- Layer of electrical insulation material
- Connection terminals

MECHANICAL PART

Stainless steel heating element casing sheath, U-bent and pressure-tight welded to the end flange. "Cold" spacers for temperature reduction from heating section to the connection panel.

Flange according to EN 1092-1 for resistor connection to the boiler body made of carbon steel painted with high temperature cycle.

RESISTOR JUNCTION BOX

Electrical cabinet compliant with EN 60204 and EN 61439 standards mounted on the resistor.

The panel contains the electrical connection between the individual heating elements and the terminals strip for the power supply wiring.

ELECTRICAL TESTING AND CERTIFICATION

Electrical commissioning and testing:

- continuity
- Insulation resistance
- Functional verification at partial load

CE certification of electrical conformity to the applicable directives

TECHNICAL DOCUMENTATION

- ✓ Equipment drawing with foundation loads (ENGLISH – digital)
- ✓ Transport drawing with dimensions, weights and indications on handling (ENGLISH – digital)
- ✓ P&ID for water/steam (ENGLISH – digital)
- ✓ Electrical diagrams (ENGLISH – digital and paper)
- ✓ Boiler Instruction and maintenance manual (ENGLISH and GREEK – digital and paper)
Note: instruction manual of instruments and accessories in English only.
- ✓ Boiler management system “SMC” or “Optispark” manual (ENGLISH – digital)
- ✓ Boiler control panel HMI language: ENGLISH
- ✓ Boiler and Control Panel CE Certification (ENGLISH – digital)
- ✓ Boiler main components documentation and CE Certification (ENGLISH – digital)
- ✓ Signals serial list (ENGLISH – digital)

Standard of documentation: BONO STANDARD