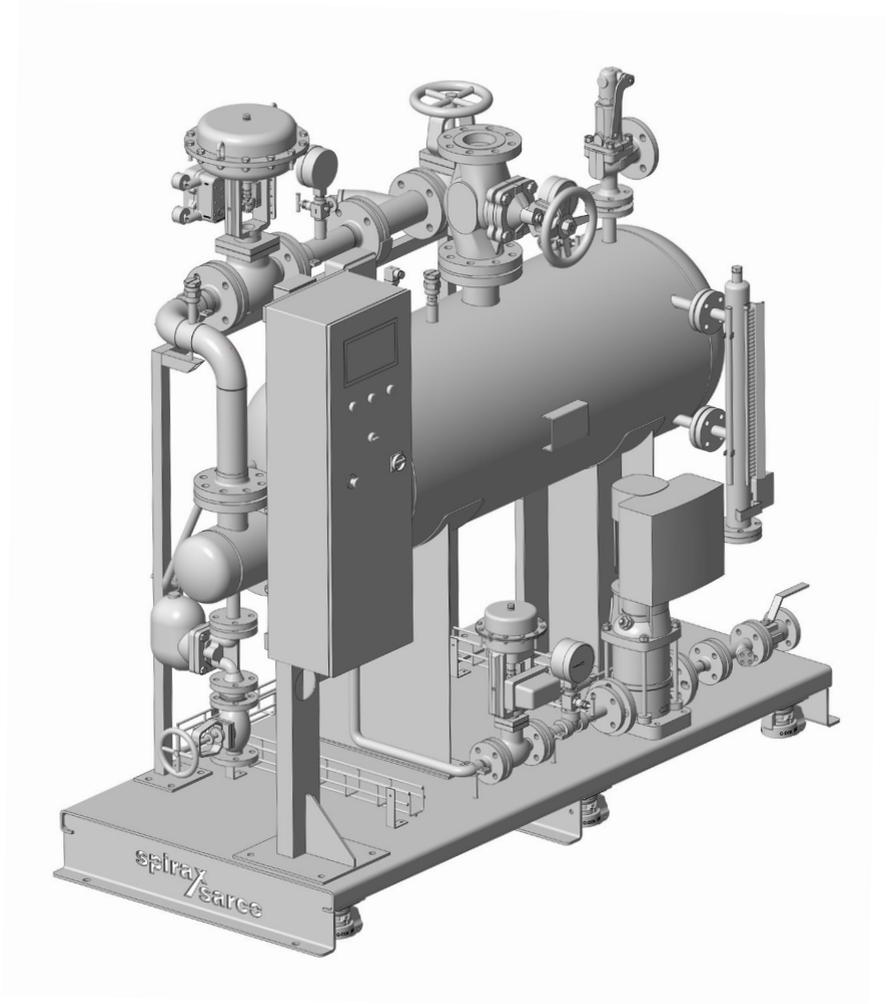


spirax sarco

mCSG

Ultra-compact Clean Steam Generation System

Installation and Maintenance Instructions



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1. Safety information

Safe operation of these products can be guaranteed only if they are properly installed, commissioned and maintained by a qualified person (see Section 1.11) in compliance with the related operating instructions. General installation and safety instructions for pipeline and plant construction and also the proper use of tools and safety equipment must also be complied with.

General safety notes

This manual is intended to cover the installation, start-up and maintenance procedures of the "m-CSG" ultra-compact steam generator and must be read in conjunction with the installation and maintenance manuals (IM) of the single components of the unit and related additional safety notes.

Precautions when lifting the unit

The "m-CSG" ultra-compact steam generator must be lifted from the base using a suitable forklift or transpallet. Once positioned correctly, it must be bolted securely to the floor.

| | |
|--|---|
|  <p>Caution or Warning</p> | <p>Do not lift the "m-CSG" ultra-compact steam generator by any other part or in any other manner except with a forklift from the base.</p> <p>Note: always leave sufficient space around the system for future maintenance operations.</p> |
|--|---|

Warnings

1. The unit is designed and constructed to withstand the intensity of work in ordinary use.
2. Use of the product for any other purpose, or failure to install the product in compliance with these Installation and Maintenance Instructions, may damage the product and also cause serious injuries to operating personnel.
3. Before carrying out any installation and maintenance procedure, always check that all primary steam, condensate and water return lines on the secondary have been isolated.
4. Make sure that residual pressure in the system and in pipework has been vented to atmospheric level.
5. To avoid the risk of burns, allow parts to cool before carrying out any type of operation.
6. Always wear suitable protective clothing before carrying out any installation or maintenance activity.
7. This product is intended to be connected into a system that can operate an EC1935 compliant process.
To minimise the risk of non-intentionally added substances in the system, it is essential that an appropriate CIP (cleaning in place) cycle is carried out by the end user prior to first use in a food contact application.
A list of the materials that could come directly or indirectly into contact with foodstuffs can be found in the Declaration of Conformity supplied with this product.

1.1 Intended use

Referring to the installation and maintenance instructions and the nameplate of the unit and the Technical Specifications, check that the product is suitable for intended use/application. The "m-CSG" ultra-compact steam generator complies with the requirements of the Pressure Equipment Directive (PED) and is  marked.

- i) The product has been specifically designed for use on steam and water belonging to Group 2 of the above-mentioned Pressure Equipment Directive.
- ii) Check suitability of material, pressure and temperature and related maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it to be inserted, or if malfunction of the product could generate dangerous overpressure or overtemperature, always insert a safety device in the system to prevent exceeding of such limits.
- iii) Determine the correct installation position and direction of flow of fluids.
- iv) The product is not designed to withstand external stresses induced by the system in which it is fitted. The installer is responsible for taking into account such stresses and for adopting adequate precautions to reduce these to a minimum.
- v) Prior to installation, remove protective covers from all connections and also protective film and packaging elements.

The 'F' version of the unit, dedicated to food and beverage industry, is compliant with regulation EC1935/2004, concerning the materials in contact with food, marked up with .

1.2 Pressure Equipment Directive (PED) classification

The clean steam generators "m-CSG" series are classified as assembly according the Pressure Equipment Directive (PED):

| Product | Fluid Group | Category |
|-----------|-------------|----------|
| m-CSG 300 | 2 | III |
| m-CSG 600 | 2 | III |

For the category of bespoke units (mCSG ...-S), refer to the "EC Declaration of Conformity" supplied with the product.

Other component parts of the assembly comply with the relevant European Directives, where necessary. Please refer to specific component literature for further details.

1.3 Access

Ensure safe access and, if necessary, a safe working platform (suitably guarded) before attempting any work on the product. Arrange suitable lifting gear if required.

1.4 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.5 Hazardous liquids or gases in the pipeline

Take into account what is currently in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extreme temperatures.

1.6 Hazardous environment around the product

Consider: areas with a risk of explosion, lack of oxygen (e.g. tanks, pits), dangerous gases, extreme temperatures, hot surfaces, fire hazards (e.g. during welding), excessive noise, moving machinery.

1.7 The system

Consider the effect of the work to be carried out on the entire system. Consider whether the action proposed (e.g. closing of isolating valves, electrical isolation) may put any other part of the system or personnel at risk.

Hazards may include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolating valves are opened and closed gradually to avoid shocks to the system.



1.8 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure.

Consider double isolation (double block and bleed) and locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.9 Temperature

Allow time for temperature to normalise after isolation to avoid the risk of burns and consider whether protective clothing (including safety glasses) is required.

1.10 Tools and consumables

Before starting work, make sure you have suitable tools and/or consumables on hand. Use only genuine Spirax Sarco replacement parts.

1.11 Protective clothing

Consider whether you and/or others require protective clothing to protect against hazards, such as chemicals, high/low temperatures, radiation, noise, falling objects and danger to eyes and face.

1.12 Permits to work

All work must be carried out or supervised by a suitably competent person. Installation and operating personnel should be trained in correct use of the product according to the Installation and Maintenance Instructions. Any formal work permit system adopted must be complied with. Where no such system is applied, a person responsible should be informed of progress of the work and, where necessary, an assistant with primary responsibility for safety should be appointed. Post "warning signs" if necessary.

1.13 Handling

Manual handling of large and /or heavy products may involve a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force may cause injury, particularly to the back. You are advised to assess the risks, taking into account the task, the individual, the load and the working environment and use appropriate handling methods according to the circumstances of the work to be carried out.

Note: if it is necessary to use slings for lifting, it is good practice to fit these around the plate of the base unit to avoid damage to the unit.

1.14 Freezing

Precautions must be taken to protect products that are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

As the product may contain PTFE and Viton, particular precautions must be adopted to avoid potential risks for health caused by decomposition or combustion of such materials. Unless otherwise indicated in the installation and maintenance instructions with regard to the materials of the seals, this product can be recycled and it is considered that no environmental risk exists deriving from disposal thereof provided that suitable precautions are adopted. However, its components can be checked to verify the possibility of safe disposal.

Please visit the Spirax Sarco product compliance web pages:

<https://www.spiraxsarco.com/product-compliance>

for up to date information on any substances of concern that may be contained within this product. Where no additional information is provided on the Spirax Sarco product compliance web page, this product may be safely recycled and/or disposed providing due care is taken. Always check your local recycling and disposal regulations.

PTFE :

- This material can be disposed of only using approved systems and never in incinerators.
- PTFE waste to be disposed of must be stocked in separate containers, must never be mixed with other waste and must be sent directly to a landfill.

Viton :

- VITON waste can be sent directly to landfills when permitted and accepted by local and national regulations.
- VITON components may also be incinerated but a scrubber must be used to remove the hydrogen fluoride developed by the product, carrying out this procedure in accordance with local and national regulations.

The components are insoluble in aquatic media.

1.16 Return of products

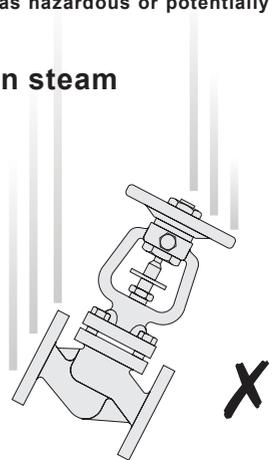
Customers and stockists are reminded that, under EC Health, Safety and Environment Law, when returning products to Spirax Sarco, they must provide information regarding any hazards and precautions to be taken due to contamination residues or mechanical damage which may represent a risk to health, safety or the environmental. This information must be provided in writing, including Health and Safety datasheets relating to any substances identified as hazardous or potentially hazardous.

1.17 Working safely with cast iron products on steam

Cast iron products are commonly found on steam and condensate systems. If installed correctly using good steam engineering practices, it is perfectly safe. However, because of its mechanical properties, it is less forgiving compared to other materials such as SG iron or carbon steel. The following are the good engineering practices required to prevent waterhammer and ensure safe working conditions on a steam system.

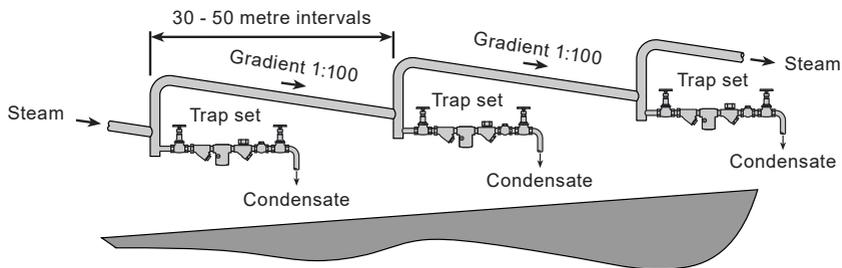
Safe Handling

Cast Iron is a brittle material. If the product is dropped during installation and there is any risk of damage the product should not be used unless it is fully inspected and pressure tested by the manufacturer.

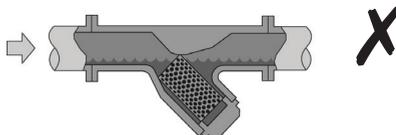
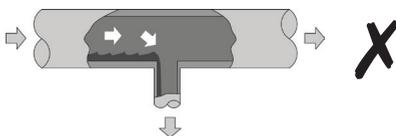
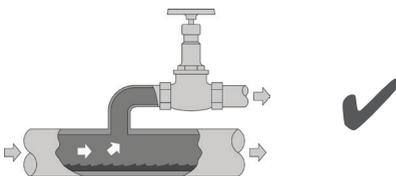
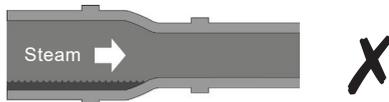
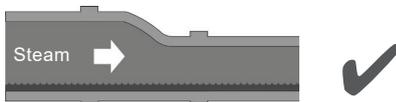
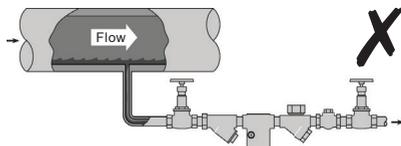
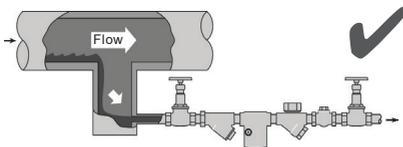


Prevention of waterhammer

Steam trapping on steam mains:



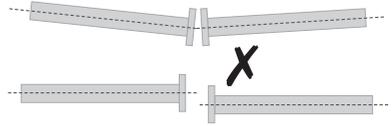
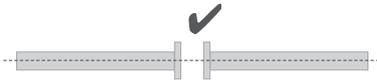
Steam Mains - Do's and Don'ts:



mCSG Ultra-compact Clean Steam Generation System

Prevention of tensile stressing

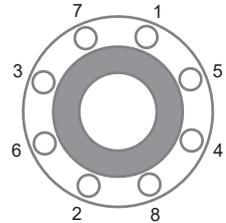
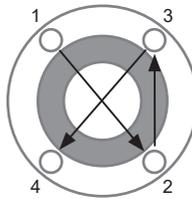
Pipe misalignment:



Installing products or re-assembling after maintenance:

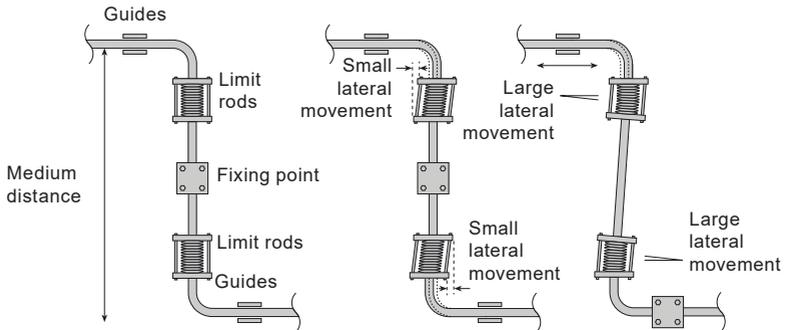
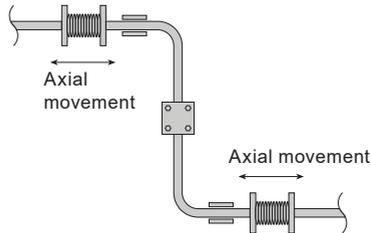
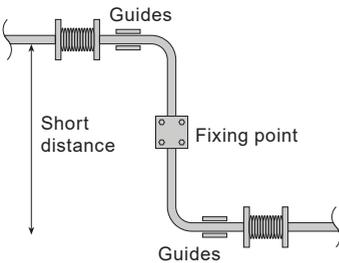


Do not over tighten.
Use correct torque figures.



Flange bolts should be gradually tightened across diameters to ensure even load and alignment.

Thermal expansion:



mCSG Ultra-compact Clean Steam Generation System

2. General product information

2.1 Description

The "m-CSG" ultra-compact clean steam generator consists of a complete, safe and functional system package, ready for installation and able to produce up to 300/600 kg/h of clean steam (at normal operating conditions) using industrial steam as a primary energy source.

The heat exchange is indirect, for which there is no contamination between the primary steam and the 'clean' steam produced.

Models and applications

Size **300** CSG for a nominal production of 300 kg/h *

600 CSG for a nominal production of 600 kg/h *

H **Humidification:** humidification (AHU), sterilisation of containers, generic use of clean steam.

Applications

Food & Beverage - EC 1935/2004 Directive compliant:
F Steam injection into food products, sterilisation of containers in contact with food or other applications where it is required, the compliance with the EC directives is products intended to come in contact with food.

CSG design/construction code: EN 13445

* Max steam production at reference operating conditions: primary steam at 9-10 bar g, production at 3 bar g, feedwater at 20 °C

The "m-CSG" unit, (Figure 1), comprises the following main parts:

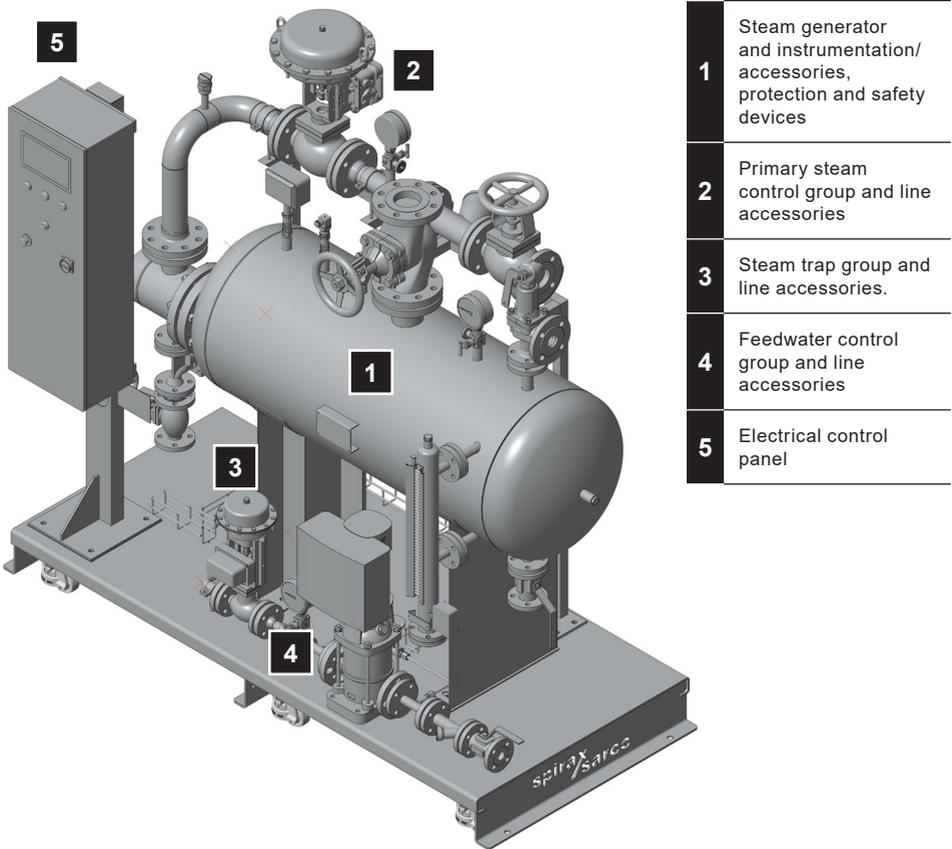


Fig. 1

For a detailed list of equipment and specifications, refer to the P&ID and documentation provided.

Notes:

1. For further information concerning each equipment of the system, refer to the specific technical documentation of each product.
2. Further technical information regarding the "m-CSG" ultra-compact steam generator can be found in Specification TI-P486-20.

2.2 Identification of the product

The product is identified by the nameplate fastened to the frame.

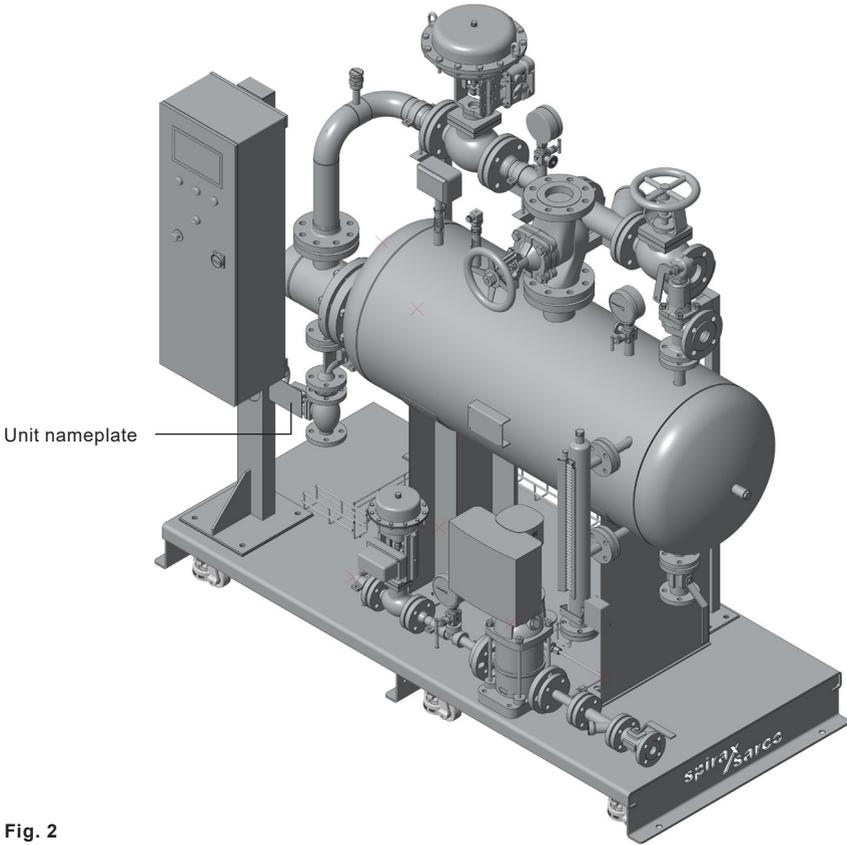


Fig. 2

Example of nameplate:

1. "CE" marking and Id. of Notified Body

Unit PED category

2. Unit model:

- series
- size
- configuration
- options

3. Article number (only for standard unit)

4. Unit serial No.:

- YY : year
- XXXXXX: identification number (6 or 9 digits)
- ZZ : unit progressive number
- Year of construction

5. Electric and air supply specifications (where required)

6. Fluid group (PED), design conditions and circuit hydro test pressure

The 'F' version of the unit (for the food and beverage industry) will have  on the nameplate.



Note: the pressure values in the nameplate are expressed in 'bar g'.

Fig. 3

2.4 Design conditions

| | | | |
|-----------------------|---------------------------|------------|---|
| Primary side | Design pressure | 12.8 bar g | The complete condition of the design of the supplied units are reported on the P&ID |
| | Design temperature | 194.4 °C | |
| Secondary side | Design pressure | 8 bar g | |
| | Design temperature | 194.4 °C | |
| | Safety valve set pressure | 6 bar g | |
| Feedwater | Design pressure | 8 bar g | |
| | Design temperature | 110 °C | |

2.5 Operating limits

| | Without pump | With pump |
|---------------------|---|--|
| Production | Clean saturated steam, up to 5 bar g/159.0 °C | |
| Primary side | Plant steam, up to 12 bar g/191.7 °C | |
| Feedwater | P min. \geq P clean steam + 0.5 bar g | Net positive suction head required (see below) |
| | P max 8 bar g/T max 110 °C | |

Minimum pressure of the feedwater at the inlet flange of the units equipped with pump, to avoid cavitation (NPSHR) = P' min. + dP

dP: pressure drop along the water feed pipework, at maximum flow-rate.

P' min. depending on the water temperature:

| | | | | | | | |
|-----------------|-----------|------|------|------|------|------|----------------------|
| T (°C) | \leq 85 | 90 | 95 | 100 | 105 | 110 | (*) Under water head |
| P' min. (bar g) | 0 * | 0.05 | 0.20 | 0.35 | 0.50 | 0.70 | |

Minimum ambient temperature: 0 °C

Unit designed for indoor installation, protect from freezing.

To ensure the correct operation of the clean steam generator, the inlet feed water should have the following characteristics. An excess on these values can compromise the lifetime, maintenance and efficiency of the steam generator.

pH $5.5 + 7.5$ (at 20 °C)

Chloride ≤ 5 mg/l

Hardness ≤ 0.02 mmol/l

Conductivity ≤ 20 μ S/cm

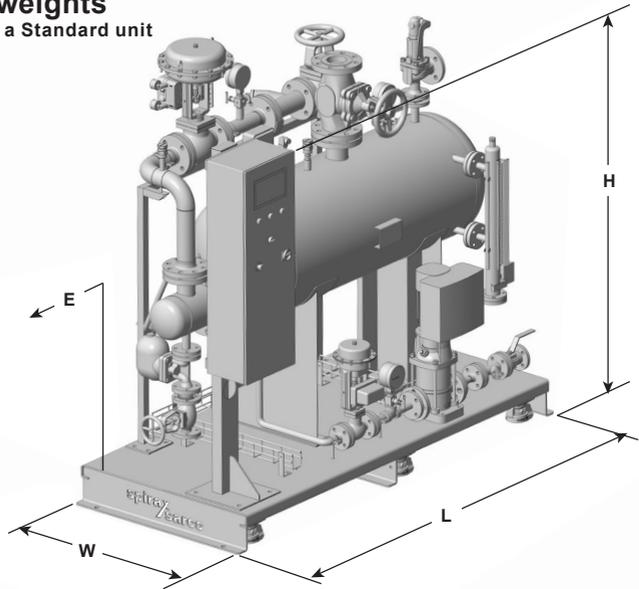
All the other characteristics and values of feed water are up to end user of the plant.

2.6 Utilities

| | Without pump | With fixed speed pump 50 Hz | With fixed speed pump 60 Hz | With variable speed pump |
|--|---|--------------------------------------|--------------------------------------|---|
| Electrical supply: (to electrical cabinet) | 1x230V + N 50/60Hz 0,4 kW (inst.) | 3x400V + N 50Hz 0,8 kW (inst.) | 3x380V + N 60Hz 0,8 kW (inst.) | 3x380-500V + N 50/60Hz 0,8 kW (inst.) |
| Air supply: (to filters) | min. 3 bar - max 15 bar (only for the units with pneumatics actuators) | | | |

2.7 Dimensions and weights

(approximate in mm and kg) of a Standard unit



| | Dimensions (mm) | | | | Weights (kg) | | |
|--|-----------------|---------|--------------|--|--------------|--------------|----------|
| | L Length | W Width | H Height | E Clearance for tube bundle extraction | Empty | In operation | Maximum |
| 300 | 1472 | 860 | 1615 | 950 | 350-400* | 430-480* | 520-570* |
| 600 | 1945 | 905 | 1800 - 1950* | 1050 | 450-500* | 600-650* | 700-750* |
| *Depending on what configuration is chosen | | | | | | | |

For detailed dimensions of the unit, size and position of the connections, clearance for the tube bundle extraction, weights and other constructive information, refer to the specific general arrangement drawing of the product.

3. Installation

3.1 Installation site

The "m-CSG" unit is designed for installation indoors with a minimum ambient temperature of 0 °C. Installation outdoors is permitted provided that the unit is suitably protected against adverse weather conditions and freezing.

The unit is not suitable for installation in potentially hazardous zones classified as ATEX. Specific solutions can be provided on request.

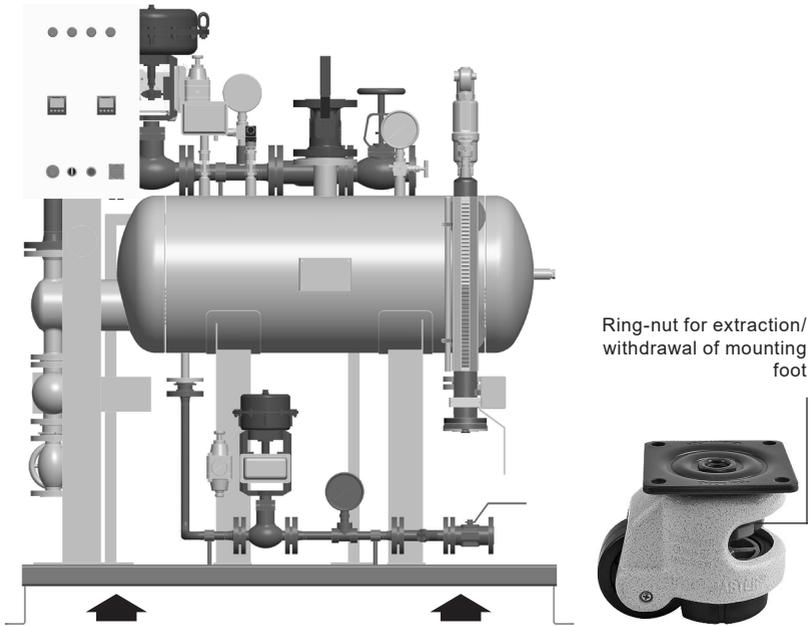
The m-CSG unit, version "F", is compliant with EC 1935/2004 Regulation. For the fully compliance of the plant to this Regulation is necessary that all the parts in contact with the feed water and the clean steam, upstream and downstream the unit, are certified EC 1935/2004 as well.

3.2 Handling

The "m-CSG" unit must be lifted from the base using a suitable forklift or transpallet.

| | |
|---|--|
|  | <p>Do not lift the unit by other parts or in any manner other than from the base using a forklift.</p> <p>During lifting, take into account the high centre of gravity of the unit and adopt all the necessary precautions to avoid accidental tipping over of the unit.</p> |
|---|--|

Fig. 4



Do not use any eye-bolts of equipment on board the unit.

If fitted with wheels for handling (option), the unit must be moved in safe conditions and then secured in position using the integrated mounting feet.

3.3 Positioning and fastening

The unit must be positioned on a completely flat, horizontal surface able to support its entire weight at full load. To secure the unit, use the 4 holes provided in the mounting feet of the base. For access to the unit, provide at least one metre of clearance around, and 0.5 m above. A space for tube bundle removal has to be considered.

3.4 Process pipework and vents

Each unit is provided complete with drawings indicating the position and specifications of connections to be made according to configuration and options ordered.

The main connections of the unit are as follows:

UNI-EN 1092-1 PN16/40 connection flanges

For other pipework, according to options installed, refer to the dimensional (or G.A.) drawing of the unit provided.

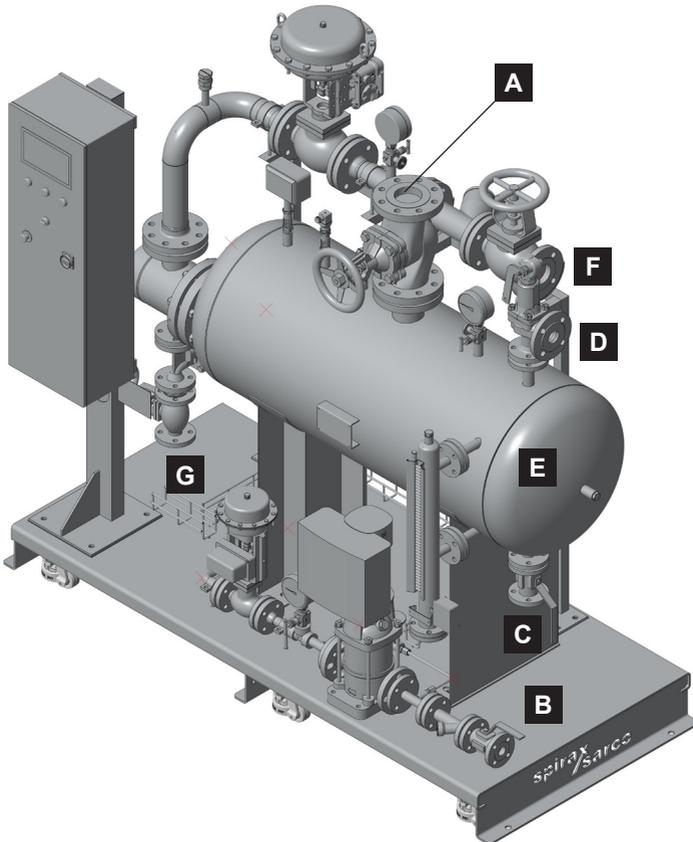


Fig. 5

| | | 300 | 600 |
|----------|--|---------------|--|
| A | Clean steam outlet: | DN50 PN16 | DN80 PN40 |
| B | Feedwater inlet: | DN15 PN16 | DN20 PN16 |
| C | Generator drain: | DN25 PN16 | DN25 PN16 |
| D | Safety valve discharge: | 1" G-F | vers."H": DN40 PN16 vers."F": DN50 PN16 |
| E | (spare) | ½"G-F | ½"G-F |
| F | Plant steam inlet (primary): | DN32 PN16 | DN50 PN16 |
| G | Condensate outlet: | DN25 PN16 | DN25 PN16 |
| H | Primary steam condensate drain: (*) | DN15 PN40 | DN15 PN40 |
| I | TDS discharge: (*) | DN15 PN40 | DN15 PN40 |
| J | Sample cooler: (*) (cooling water inlet/outlet – sample outlet) | ½" BSP - 6 mm | ½" BSP - 6 mm |

UNI-EN 1092-1 PN16/40 flanged connections

(*) options

The steam supplied to the m-CSG unit must be as dry and clean as possible in accordance with the guidelines of sound steam engineering practices. It is also necessary to verify that all pipes are suitably supported without any excessive loads or stress.

| | |
|---|--|
|  | <p>Before making any connection, check that all pipework is clean and free of foreign material or scale that may adversely affect functioning and/or the performance of the unit.</p> <p>The steam supplied must always be maintained within design operating pressure and temperature limits. The unit shall not work above the design pressures and temperatures indicated on the name plate on the package.</p> <p>The drawings provided in this manual are for guidance purposes only. For connections of the unit, always consult the attached drawings.</p> |
|---|--|

3.4.1 Feedwater inlet

The first step of the installation procedure consists in connecting the unit to the cold feedwater line. The manual isolating valve on the feedwater control line of the unit must remain closed until installation has been completed. The precise position of the feedwater inlet connections, the pipe diameter and size of the attachment flange can be deduced from the drawings provided with the unit.

3.4.2 Clean steam outlet

The next step in the installation procedure is to connect the clean steam outlet of the generator to the clean steam distribution network of the plant. The precise position of the clean steam outlet, the pipe diameter and size of the attachment flange can be deduced from the drawings provided with the unit. A manual isolating valve (supply option) should be installed downstream of the unit on the clean steam line to permit isolation of the generator. This valve must remain closed until installation has been completed.

Note: In the case of units installed in parallel with another generator(s) (common clean steam distribution line), a check valve must be installed on the steam intake of each generator.

3.4.3 Primary energy source (industrial steam)

Connect the inlet of the primary fluid of the unit to the technological steam distribution network of the plant. The manual isolating valve installed on the primary fluid control line must be closed and remain closed during installation. The precise position of the primary fluid connection, the pipe diameter and size of the attachment flange can be deduced from the drawings provided with the unit.



3.4.4 Condensate blowdown

Transfer of heat from the primary steam to the produced (clean steam) generates condensate. The condensate blowdown from the unit must therefore be connected to the condensate return line of the plant. The manual isolating valve installed on the condensate blowdown line of the unit must be closed and remain closed during installation. The precise position of the condensate blowdown connection, the pipe diameter and size of the attachment flange can be deduced from the drawings provided with the unit.

3.4.5 Piping the pressure relief valve to vent and drain

As required by current regulations, "m-CSG" unit generators are equipped with a pressure relief valve to protect against the risk of overpressure. Venting of the pressure relief valve (steam) shall be directed towards a safe area to avoid injuries or damage. In most applications, the pressure safety valves should be vented to atmosphere (generally through the roof). The piping used in the vent system shall be of adequate size to handle the capacity of the pressure safety valve. The vent piping system shall be suitable drained to prevent formation of condensate inside this. **The vent pipe of the pressure relief valve shall not be intercepted in any way or even partially obstructed.** For further information and prescriptions regarding connection of the vent piping of the pressure safety valve, refer to the related use and maintenance manual. Venting of the pressure relief valve shall comply with current legislation. The purchaser/installer is responsible for such conformity.

The precise position of the discharge of the safety valve and also pipe diameter and size of the attachment flange can be taken from the drawings provided with the unit.

3.4.6 Drainage of the generator

The "m-CSG" steam generators are equipped with a drain/bottom blowdown line with manual valve installed on the lower part of the vessel. The blowdown from this valve is at the same pressure and temperature of the generated steam and can cause severe injury or death if not properly piped. In accordance with local regulations or standards, it is recommended that the blowdown lines be connected to a blowdown vessel or condensate cooler before being discharged to drain.

The precise position of the drainage of the generator connection and also pipe diameter and size of the attachment flange can be taken from the drawings supplied with the unit.

The drains of the generator cannot be placed back in the circuit return condensate or feedwater.

3.4.7 Other blowdown, venting, drainage facilities (where required)

The "m-CSG" can be equipped with optional systems for blowdown, drainage and venting, such as for example a TDS control system, primary steam drainage line. In accordance with current legislation, blowdown from the TDS control system should be connected to a blowdown vessel or condensate cooler before being discharged to drain. TDS blowdown shall not be connected to the condensate return line. Primary steam blowdown can be connected to the condensate return line of the plant.

Any purge/drain should not be recovered reintegrating the line/water storage tank of feedwater.

3.5 Connection of the power supply

For power voltage, consult the wiring diagram provided with the unit.

| | |
|---|--|
|  | <p>Possible injury or death Before connecting the power supply, check that the main power switch and system start selector are off (0 position).</p> |
|---|--|

Unless otherwise indicated in the documentation provided with the unit, the power supply must be connected directly to the main power switch (IG) of the control panel (lifting the protection) and to the main ground terminal.

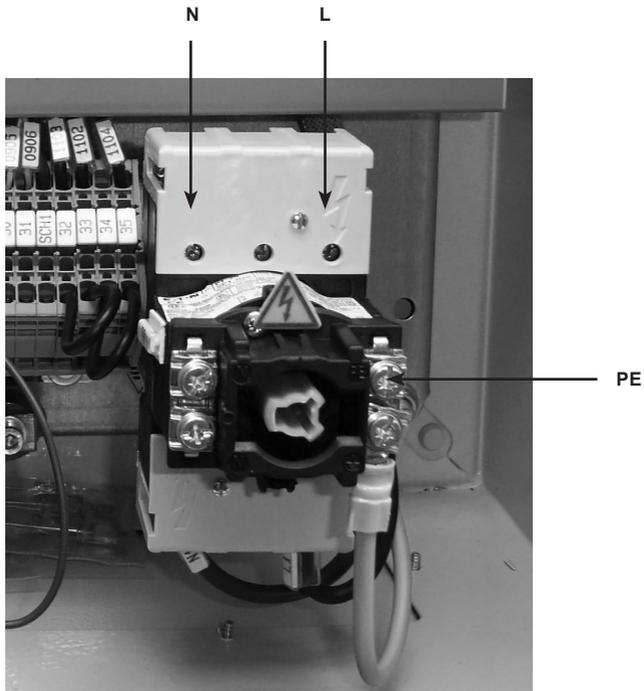


Fig. 6
Version with single-phase power supply
(mod. "mCSG x00-xx1-...")

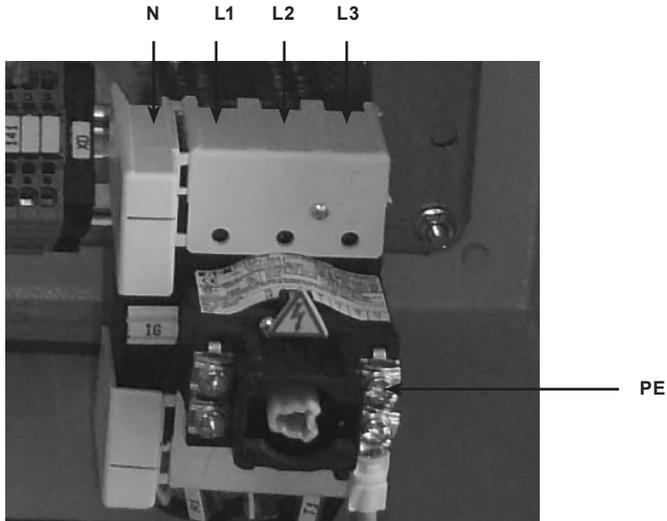


Fig. 7
Version with three-phase + N power supply
 (mod. "mCSG x00-xx2-...", "mCSG x00-xx3..." and "mCSG x00-xx4...")

| | |
|--|--|
|  | <p>All electrical connections must be made by qualified electricians.</p> <p>The user is responsible for the suitability of electrical connections outside the unit and for their conformity with current legislation.</p> <p>Before drilling holes in the cabinet of the control panel to connect the power cables and any interface with an external system, open the door very carefully and check that there are no obstacles inside the cabinet. Ensure that there is no contact between electrical cables inside the panel with drilling residues or with metal.</p> <p>Signal cables must not be laid together with power cables outside the unit to avoid disturbances and interference during operation. Failure to comply may cause also irreparable damage to the equipment.</p> <p>The user must install a device between the power supply and control panel able to cut off the power if necessary. It is important to check compatibility of the mains supply with that required by the control panel, verifying correspondence with voltage and frequency data indicated on the nameplate.</p> <p>Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages.</p> <p>The user is responsible for power connections outside the unit and their compliance with current legislation.</p> |
|--|--|

3.6 Connection of air supply (where necessary)

If pneumatic drive is selected, the compressed air must be as dry and clean as possible in accordance with the guidelines of sound engineering practice.

Connect the compressed air supply (minimum 3 bar g - maximum 15 bar g) to the pressure regulators fitted on the valves (CV1 and CV2).

So, before starting, adjust the downstream pressure reducers at least 1 bar g above the spring range of pneumatic actuators (if any):

- Control valve CV1 with electro-pneumatic positioner (primary steam control): actuator spring range 1-2 bar g
- Control valve CV2 with I/P converter (feedwater control valve): 0.4-1.2 bar g actuator spring range

3.7 Electrical specifications

For electrical data, consult the wiring diagram provided with the unit.

Generic electrical data are indicated below which may not, however, comply fully with the specific data of the unit provided.

3.7.1 Power supply of the control panel

| Unit type | Power supply | Total power (installed) | Auxiliary circuit protection | Power circuit protection |
|--|-------------------------------------|-------------------------|------------------------------|----------------------------|
| Versions without pump (mod. "mCSG x00-xx1-...") | Single-phase + N 230V/50/60Hz | 0,4 kW | 4 A automatic switch | / |
| Versions with fixed speed pump 50 Hz (mod. "mCSG x00-xx2-...") | Three-phase + N 400V/50Hz | 0,8 kW | | 1.2 A breaker (pump) |
| Versions with fixed speed pump 60 Hz (mod. "mCSG x00-xx3-...") | Three-phase + N 380V/60Hz | 0,8 kW | | 1.1 A breaker (pump) |
| Versions with variable speed pump 50/60 Hz (mod. "mCSG x00-xx4-...") | Three-phase + N 380-500V/50/60Hz | 0,8 kW | | Included in VFD |

Voltage tolerance: ±5%

3.7.2 Electrical specifications of unit components

(powered by electric cabinet)

Unit electrical components are provided wired to the electrical cabinet.

For electrical specifications, see the list of components in the P&ID, wiring diagram, specifications (TI) of the single components.

3.8 Digital Inputs/Outputs (on all versions)

For wiring, consult the wiring diagram provided with the unit.

The electric control cabinet of "m-CSG" units is pre-engineered to permit basic interfacing with any external control/supervision system by means of digital inputs/outputs.

These permit remote activation, if required, of the unit and also provide the enable signal (e.g. non-functioning downstream service points) or activate any alarm for blocking of functioning (e.g. no water from network). They also provide power on (control panel on), system operating, cumulative alarm feedback.

3.8.1 Digital Inputs (DI) - volt-free contacts

| Description | Terminal strip | Terminals | Type of contact |
|---|----------------|---------------|--|
| Remote Start/stop of system (with 1-0-REM selector set to REM) | XA | 38,39 (*) | Stable, NO closed = start open = stop |
| Enable/block system from external alarm | XA | 40,41 (*) | Stable, NO closed = ok open = block |
| External emergency button | XA | 16,17 (*) | closed = ok open = block |

* terminals are supplied jumpered by default

3.8.2 Digital outputs (DO) - volt-free contacts

| Description | Relay | Terminal strip | Terminals | Type of contact |
|---------------------------|-------|----------------|--------------------------------|-----------------|
| System running feedback | RC | XA | 42 (NC), 43 (NO), 44 (C) | SPDT |
| Power feedback | RO | XA | 45 (NC), 46 (NO), 47 (C) | SPDT |
| Cumulative alarm feedback | RA | XA | 48 (NC), 49 (NO), 50 (C) | SPDT |

3.9 Analog inputs/outputs

(only on versions with SX90 or SX1650 regulators or PLC type control)

For wiring, consult the wiring diagram provided with the unit.

3.9.1 Analog inputs (possible)

| Description | Terminals | Signal |
|-----------------------|----------------------|------------------|
| External SP: pressure | 32 (+), 33 (-), Sch. | 4-20 mA (active) |
| External SP: level | 22 (+), 23 (-), Sch. | 4-20 mA (active) |

3.9.2 Analog outputs (possible)

| Description | Terminals | Signal |
|-----------------------------|----------------------|------------------|
| PV retransmission: pressure | 30 (+), 31 (-), Sch. | 4-20 mA (active) |
| PV retransmission: level | 20 (+), 21 (-), Sch. | 4-20 mA (active) |

3.10 Serial-bus (where present, only on versions with PLC-based control)

The "m-CSG" units equipped with PLC-based control panel can be pre-engineered for communication with the supervision/control system via serial bus.

For interfacing and address register, consult the additional documentation supplied with the unit.

The communication protocols that can be supplied on "m-CSG" units equipped with PLC are as follows:

| Unit mod. | Communication protocol | |
|------------------------|------------------------|--------------------------|
| mCSG x00-xxx-xxxx0xxxx | / | |
| mCSG x00-xxx-xxxx1xxxx | Modbus RTU | Native for ABB and Eaton |
| mCSG x00-xxx-xxxx2xxxx | BACnet MS/TP | |
| mCSG x00-xxx-xxxx3xxxx | Modbus TCP/IP | Native for ABB and Eaton |
| mCSG x00-xxx-xxxx4xxxx | Devicenet | |
| mCSG x00-xxx-xxxx5xxxx | CANopen | |
| mCSGx00-xxx-xxxx6xxxx | BACnet IP | |
| mCSG x00-xxx-xxxx7xxxx | Profibus DP | Native for Siemens |
| mCSG x00-xxx-xxxx8xxxx | Profinet | Native for Siemens |

Other PLC solutions can be provided on request, as well as other communication protocols (if feasible).

4. Commissioning

For correct commissioning, we recommend the service and support of a Spirax Sarco Engineer. Contact Spirax Sarco for details of this service.

4.1 Cleaning before first use

This product is intended to be connected into a system that can operate an EC1935 compliant process. To minimise the risk of non-intentionally added substances in the system, it is essential that an appropriate CIP (cleaning in place) cycle is carried out by the end user prior to first use in a food contact application. A list of the materials that could come directly or indirectly into contact with foodstuffs can be found in the declaration of conformity supplied with this product.

4.1.1 Pre-commissioning inspection (initial start-up)

In most new installations, dirt collects in the steam line during construction of piping systems. It is essential to flush this out prior to commissioning

- Most of the new installations during the construction of pipelines and the installation of the system, may inadvertently collect dirt particles inside the pipes. It is essential to carefully remove any residual impurities and dirt in them before starting the commissioning.
- Check that all the manual isolating valves (on primary stream, on condensate blowdown, on clean steam intake and on feedwater) are closed.
- Clean the filters upstream of the regulation valves.
- Check that the blowdown valve (drainage) of the unit is closed.
- Make sure that the unit power supply is disconnected or shut-off upstream of the unit.
- Check that primary steam and feedwater design conditions do not exceed the rated values of the unit.
- Check that the design conditions of the downstream system, clean steam side, are not lower than the rated data of the unit or in any case not lower than the calibration pressure of the safety valve installed on the unit, secondary side.
- Check that the feedwater line is properly pressurised and has been vented.
- Check that the technological steam (primary) line is properly pressurised and has been drained/ vented.
- Check that the clean steam line has been drained/vented.
- Check that the air supply line, if any, complies with system requirements.
- Check that the power supply complies with the system requirements.
- Make a double check to verify that all connections to steam, condensate and water lines have been made correctly.
- Check that the bolts of the flanged attachments are correctly torqued.
- Check that all the electrical connections outside and inside the unit, are verifying compliance with the wiring diagram (see wiring diagram supplied with the unit).
- Check the air supply of the filters/reducers of the valves (actuated pneumatically where established) and that it complies with the system requirements.

4.1.2 Cleaning before start-up

The clean steam generator is supplied after a pickling and passivation cycle.

If the selected unit is compliant to EC1935/2004  , before the first use is suggested a washing cycle with a CIP (cleaning in place), or other procedure required by the process/plant directives.

4.2 Commissioning procedure

- Make sure all the isolating valves are closed.
- Make sure the main power switch and system start selector set to 0/OFF.
- Connect or restore the power supply to the unit control panel.
- Switch on the panel using main power switch (1/ON).
- Check the parameter set on the regulators and/or PLC. Set specific process parameters such as pressure SP.
- Check that all the regulators have been set to automatic regulation ("auto" mode).
- Open the isolating valve on the feedwater line.
- Open slightly the clean steam intake/line isolating valve (to permit venting of the air). Alternatively open the vent of the gauge-holder on the generator body.
- Start the system, setting the 1-0-REM selector to 1 (or to REM for remote starting).
- Ignore any low level alarm and, if necessary, reset other alarms using the alarm reset button.
- The water regulation valves (CV2) will start to operate and, where present, the pump is activated. Wait for automatic filling of the generator up to SP level (the low level alarm is reset automatically when the minimum threshold is exceeded; consequently, the steam regulation valve is activated).
- Completely close the valve on the clean steam intake/line or the vent of the gauge holder tap.
- Open the primary steam line drainage unit isolating valves (if option installed).
- Open the isolating valve on the condensate blowdown line.
- Slowly open the primary steam isolating valve.
- Wait for the end of heating run-up and until pressure SP has been reached at full modulation.
- Slightly open the clean steam intake/line isolating valve to bring the downstream circuit to temperature, then slowly fully open the valve.

At this point, the unit is inserted in the system and operational.

Note: during water filling and the generator and line heating/pressurisation phase, leakages may occur from flanged or threaded couplings. This is normal especially on the clean steam and the water side due to the characteristics of the seals used (PTFE). Therefore, the procedure is to let the seals settle and to tighten the couplings carefully.

4.3 Shut-down procedure

The following procedure must be adopted in the case in which the generator is de-activated for periods exceeding the weekend or for maintenance operations.

- Close the primary fluid isolating valve.
- Stop the unit: set the 1-0-REM selector to 0.
- Wait until the pressure drops to around 0 bar g.

To accelerate the process, with the system still running and primary steam shut off, slightly open the blowdown/drainage valve of the generator. The level will be topped up automatically with cold water, cooling the generator more rapidly. Then stop the system.

- Close the isolating valve on the condensate blowdown line.
- Close the isolating valve on the feedwater line.
- Close all the other isolating valves (steam line drainage system, TDS control system, etc.).
- Let the generator cool and then drain it completely via the drainage valve.
- Close the isolating valve on the clean steam intake/line (inside or outside the package).
- Switch off the control panel using the main power switch (ON/OFF) and cut off the upstream power supply.

After long shutdown of the system is recommended to empty the unit and to follow the shutdown procedure of end user plant.

4.4 Ambient conditions

When the unit is out of service in a low ambient temperature space, with a risk of freezing, it is necessary to completely empty the unit.

| | |
|---|---|
|  | <p>Ice inside the generator and inside primary steam line/condensate and feedwater can severely damage the equipment</p> |
|---|---|

5. Operation

5.1 Operation

The "m-CSG" ultra-compact indirect clean steam generator consists of a complete, safe and functional system package designed to produce clean steam using industrial steam as primary energy source. The generator is of the indirect type (no contamination of the clean steam generated with technological steam used for heating).

The unit is fully automatic and equipped with its own control cabinet.

The main controls of the unit are pressure of the steam generated and the level of the water inside the vessel of the generator. These controls are interlocked by the electromechanical protective devices of the unit which, in accordance with current legislation, are always active (both in automatic and manual regulation mode). Other controls are supplied by any optional systems that can be supplied with the unit, such as TDS control. Also, if feedwater pressure is lower than that of the steam generated, an optional filling pump can be provided, installed upstream of the water regulation valve.

| | |
|---|--|
|  | <p>If the loading pump is provided, the unit shall not be started when water is not present and /or if the pump is isolated</p> |
|---|--|

5.1.1 Clean steam pressure regulation

Clean steam pressure is maintained by the related pressure regulator (PIC-01) or PLC controller on the panel. This process variable is detected by the related pressure transmitter (PT-01) installed on the vessel of the generator which sends the 4-20 mA signal corresponding to a range of 0-10 bar g to the Regulator/ PLC.

The pressure regulator/PLC process the PV signal and transmit the 4-20 mA control signal to the technological primary steam regulation valve (CV1). Pressure control is modulating. The action of control is of the inverse type, i.e. as pressure increases, opening of the primary fluid valve is decreased, thus reducing heat contribution - and viceversa.

The control valve (CV1) is interlocked by high pressure (PSH-01) and low level (LSL-01) protection devices which if tripped, close the primary fluid regulation valve, interrupting heating.

The control valve (CV1) is "fail-safe" (NC) and closes in case of alarm, system off, no electrical or compressed air supply (where required).

"Soft Start Timer" function: this is a function set on the pressure regulator (or PLC controller) that gradually heats the unit in cold starts to prevent stress on materials. The control logic limits opening of the primary fluid regulation valve for a specific time or until a specific pressure value is reached. When starting with the system already hot, this function is partially or completely bypassed.

5.1.2 Water level regulation

The level of the water inside the generator is maintained by the related regulator (LIC-01) or PLC controller on the panel. This process variable is detected by the level transmitter (LT-01) fitted on the gauge installed on the vessel of the generator which sends the 4-20 mA signal corresponding to a range of 0-300 mm to the regulator/PLC.

The level regulator/PLC processes the PV signal and transmits the 4-20 mA control signal to the feedwater regulation valve (CV2). Level control is modulating. The action of control is of the inverse type, i.e. as level increases, opening of the feedwater fluid valve is decreased, thus reducing water load - and vice versa.

Water control valve (CV2) is interlocked by high pressure (PSH-01) and high level (LSH-01) protection devices which if tripped, close the water regulation valve, interrupting filling.

The control valve (CV2) is "fail-safe" (NC) and closes in case of alarm, system off, no electrical or compressed air supply (where required)

"Pump power-off function" (when pump is installed)

In case fixed speed pump is selected (50 or 60 Hz), this function is carried out by a dedicated device installed in the control cabinet (in case of electronic controllers SX90 or SX1650 are selected) or by a PLC dedicated logic (in case PLC is selected).

The dedicated device or logic supervises the control signal of the water regulation valve and stops the pump when filling is very low or nil, i.e. when the regulation valve is almost completely closed (settable threshold). The pump is re-started automatically when the regulation valve re-opens (settable threshold).

In case variable speed pump is selected (50/60 Hz), this function is directly performed by the pump on-board VFD.

In both cases, stop and start of the pump is delayed (settable time) to avoid frequent cycles that could damage the equipment.

5.1.3. Feedwater pressure control

The pressure of the feedwater is reached thanks to the integrated pump (VFD).

During commissioning phase, the set-point value is set; this value should be at least equal to the clean steam pressure value + 1 bar g.

The pump is then automatically able to feed the required head in order to reach the set-point.

5.1.4 TDS regulation (where option is provided)

With the production of steam, the concentration of TDS (total dissolved solids-salts) of the water inside the generator gradually increases as solids-salts do not evaporate together with the steam generated. To maintain TDS concentration within the values required, periodic flushing is required.

| | |
|--|---|
|  | <p>Maintain dissolved solids-salts concentration within the limits established for the application.</p> <p>High TDS levels affect the quality of the steam generated and have negative effects on generator performance and, in the long term, may cause serious damage to equipment.</p> |
|--|---|

On "m-CSG" units the concentration of solid-salts dissolved in the water inside the generator could be controlled via two optional systems:

TDS timed blow-down system (no control):

This option is available only if electronic controller SX1650 or PLC are selected.

This system does not rely on probes (no control) but relies on two timers to open and close the TDS valve. The TDS valve opens after the first time interval and then closes after the second time interval.

Both time intervals are settable via SX1650 electronic controller or PLC.

Discontinuous TDS control system with external probe (discontinuous control):

Thanks to this system, that relies on a CP10 probe fitted in the TDS blow-down line of the unit, the conductivity of water can only be monitored when the TDS valve is open. The interval and duration of the intervals are settable via dedicated BC3150 controller installed in the control panel. Their values must be set to allow a reliable TDS value to be read.

5.2 The control panel

The control panel of the "m-CSG" unit affords complete control of the clean steam generation system. All electrical components of the unit are suitably wired to the panel.

5.2.1 Front controls/pilot lights:

- Main power switch with door lock
- Emergency button
- Local/remote start selector (1-0-REM) with system running indicator light (only with regulators)
- Reset block button (high pressure, restart after black out)
- Power indicator light
- Alarm lights: high pressure, low and level, pump power breaker (if present)

5.2.2 Protection of auxiliary circuits and pump power (if present)

Auxiliary circuits are protected against overloads by a circuit breaker. Each solenoid valve or motorised valve is also protected by fused terminals.

Pump power is protected by a breaker for units equipped with fixed speed pump, by the VFD for units with variable speed pump.

5.2.3 Regulations:

Process variables (pressure and level) are controlled using SX90 or SX1650 electronic regulators or PLC controller according to unit configuration.

Where the option is installed, the TDS (Total Dissolved Solids-Salts) regulation is afforded by a dedicated BC3150 controller or timed logic.

5.2.4 Additional capabilities with PLC controller:

PLC control panels provide additional capabilities such as: synoptic panel with process data, user-friendly user interface, PV trend, alarms log, interfacing with external automation via serial bus. On units equipped with PLC control panel, the TDS regulator is rear-mounted and interfaced with the PLC for display of TDS concentration and related alarm.

5.2.5 Safety interlocks:

The electromechanically protective devices that permit partial/total interlocking of the system are as follows:

- **High pressure:** closes the primary steam and water regulation valves (CV1 and CV2), interrupting heating and filling (manual reset required);
- **Low level:** closes the primary steam regulation valve (CV1), interrupting heating;
- **High level:** closes the water regulation valve (CV2), interrupting filling;
- **Pump power breaker (if present):** isolates the power supply of the pump, activating tripping of low level protection alarms in cascade.
- **External Alarm or denied consent to operate:** closes both control valves, stopping the heating and the water filling sequences
- The system is also protected against the following events:
 - **Black-out (or sudden power-off of panel/pressing of emergency button):** the regulation valves (primary steam and feedwater), whether actuated pneumatically or electrically, are fail-safe (N.C.). Therefore, in the case of blackout, they return to safety position (closed) interrupting delivery of technological steam or feedwater.
In case of electrical blackout, the system shall be manually restarted (reset with the proper button is required).
For automatic restart of the system, a jumper between terminals 14 and 15 of the control cabinet is needed.
- **Interruption of air supply (or low pressure):** in the case of pneumatically-actuated regulation valves, interruption or low pressure of the air supply closes or restricts opening of the regulation valves, interrupting or limiting delivery of primary steam and Feedwater. Insufficient pressure of the air supply, even temporary may cause problems of stability on regulations and also activate alarms.
- **VFD failure alarm (when installed):** isolates the power supply of the pump, activating tripping of the low level protection alarms in cascade.

5.2.6 Digital-analog I/O:

For any basic interfacing with external automation, the following digital inputs/outputs are standard (all versions):

- DI: Remote system start (with mode selector set to REM): stable contact (closed = start)
- DI: external consent/block: stable contact (closed = ok, open = block)
- DO: system feedback active: SPDT contact
- DO: power on feedback active: SPDT contact
- DO: cumulative alarm feedback : SPDT contact

Units equipped with SX90 or SX1650 regulators or PLC control also feature the following analog I/O:

- AI: SP pressure (4-20 mA)
- AI: SP level (4-20 mA)
- AO: pressure measure retransmission (0-10 bar g // 4-20 mA)
- AO: level measure retransmission (0-300 mm // 4-20 mA)

Functioning of regulators via remote rather than local SP must be set on the instruments

5.2.7 Communication interface (serial bus):

Units equipped with PLC control can be arranged to be interfaced to an external supervision/ control system via serial bus. Available communication protocols are listed in the technical specifications of the product. For the specifications of the protocol supplied, interfacing instructions and address register, consult the additional documentation supplied with the unit.

5.2.8 Terminal board:

A terminal board for wiring of the following is housed in the panel:

- unit electronic components - pre-wired;
- electric pump (if any) - pre-wired;
- digital I/O;
- analog I/O (if any).

Unless otherwise indicated in the documentation supplied with the unit, the mains supply shall be connected directly to the terminals of the main power switch.

The communication link via serial bus (if present) shall be connected directly to the communication port of the PLC.

5.3 Settings

The units and related regulators /PLC controller are preset in the factory.

However, certain settings can be optimised to adapt unit operation more effectively to system conditions.

Factory settings are indicated below.

For units with PLC control, refer to the information provided in additional documentation.

For settings of SX1650/SX90 regulators, refer to the related manual.

5.3.1 Settings of pressure and level regulators:

| Description | Instr. Id | Range | Set |
|---|-----------|---------------------|-------------------------|
| SP pressure | PIC-01 | (1 ... 5 bar g) | 3 bar g |
| Transmitter input (from PT-01) | | 0-10 bar g//4-20 mA | = |
| Regulation signal output (to valve CV1) | | 0-100%//4-20 mA | = |
| Action control | | | reverse |
| Type control | | | proportional + integral |
| PB/Ti control | | | 5%/20 s |
| "soft-start timer" function | | | see below |
| SP level | LIC-01 | | 200 mm |
| Transmitter input (from LT-01) | | 0-300 mm//4-20 mA | = |
| Regulation signal output (to valve CV2) | | 0-100%//4-20 mA | = |
| Action control | | | reverse |
| Type control | | | proportional |
| PB control | | | 5% |
| High level threshold (LAH-01) | | 0-300 mm | 230 mm |
| TDS valve closing interval | | | 24 h |
| TDS blow-down duration | | 5 s | |

5.3.1.1 "Soft Start Timer" function (on SX1650 or SX90 pressure regulators):

Level 2 parameters:

- Timer Resolution (TM.RES) = MINUTES
- Soft Start Power Limit (SS.PWR) = 10%
- Soft Start Set Point (SS.SP) = 0.5 bar (as band below pressure SP of the generator)
- Set Time Duration (DWELL) = 5

Configuration parameters:

- Logic Input Function (L.D.IN) = 1

These parameters can be optimised during plant commissioning.

5.3.1.2 "Pump power-off" function (or units equipped with pump):

Here are listed dedicated electronic device configuration parameters (inside control panel) excluding units with PLC control logic for units equipped with fixed speed pump (without VFD):

- Input signal = mA
- Min-max input signal = 4-20 mA
- Pump stop threshold (alarm ON) = 4.5 mA
- Pump stop delay (delay ON) = 20 s
- Start pump threshold (alarm OFF) = 6 mA
- Pump start delay (delay OFF) = 10 s
- Alarm type = low
- Alarm action = relay off = contact open
- Output signal = mA
- Min-max output signal = 4-20 mA

These parameters can be optimised during system commissioning.

In case of units with variable speed pump, "Pump power-off function" is performed directly by the pump on board VFD.

Please refer to pump and VFD manual for configuration parameters.

5.3.2 Setting of TDS regulator (if option fitted)

For the settings of the TDS regulator TDS (BC3150), refer to the related manual.

Percentage blowdowns depend on feedwater TDS and generator TDS setting.

$$\% \text{ blowdowns} = \text{TDS water} / (\text{TDS set of SG} - \text{TDS water})$$

Generally, to limit blowdowns to max 5%, the ratio between feedwater TDS and TDS set of CSG must be 1:20 (max).

5.3.3 Settings of electromechanical protection devices:

| Description | Instr. Id | Range | Set |
|--|-----------|-------------|---------------|
| Pressure switch (high pressure) certified | PSH-01 | 0.5-9 bar g | 5.5 bar g (*) |
| Minimum level switch (limit switch on level gauge) | LSL-01 | 0-300 mm | 170 mm |
| Maximum level switch (threshold on LIC-01 regulator) | LSH-01 | 0-300 mm | 230 mm |

(*) The blocking pressure switch is certified in cat. IV PED. The setting cannot be modified.

5.3.4 Mechanical safety devices (clean steam side):

| Description | Instr. Id | Set |
|---|-----------|--------------|
| Pressure safety valve (high pressure) certified | PSV | 6 bar g (**) |

(**)The setting of the safety valve is shown in the documentation of PED test of the assembly and cannot be changed.

Its' tampering will invalidate the certification of PED test of the assembly and the relevant EC declaration of conformity.

5.3.5 VFD configuration parameters (for units with variable speed pump)

Please refer to pump and VFD manual for configuration parameters.

6. Troubleshooting

| Problem | Possible causes | Corrective action |
|--|---|---|
| The unit does not start | No power | Check the input power |
| | Auxiliary circuit protection on | Check the automatic switch of the auxiliary circuit protection in the control board. |
| Water level in generator very low. | Insufficient pressure of water supply (< P steam generated + 0.5 barg) | Check the conditions of the water supply. |
| | | Check that the water pressure is correct and there are no pressure losses when the generator load increases. |
| | | Clean the filter upstream the regulator valve. |
| | The generator is loading | Check the shut-off valve on the line is completely open. |
| | The generator is loading | Wait until loaded and the automatic alarm reset. |
| The water supply control valve (CV2) is not working correctly | | Check the solenoid valve mounted on the pneumatic regulation valve (CV2) and relative control panel protection fuse. Check the air pressure is correct. If necessary replace the solenoid valve or fuse |
| The generator is in alarm state. | Fault/malfunction of level controller (LIC-01) | Check the settings. |
| | | Check that the I/P converter or positioner of the control valve (CV2) reaches the control signal from the controller. |
| | | Switch to the regulator manual control to verify the operation of the signal. If necessary replace the controller. |
| Fault of level transmitter (LT-01) or damage to measuring instrument | Check the transmitter signal and that it corresponds to the measure of the level indicator. | Check that the level display does not remain stationary. |
| | | If necessary replace the instrument. |

| Problem | Possible causes | Corrective action |
|---|--|--|
| Water level in generator very high. The generator is in alarm state. | The water control valve (CV2) does not close correctly | Inspect the valve housing to identify any damage. If necessary repair the valve. |
| | Fault/malfunction of level regulator (LIC-01) | Check the settings. Check that the I/P converter or valve positioner reaches the regulating signal. Switch to the regulator manual command to check the working order of the regulating signal. If necessary replace the regulator. |
| | Fault of level transmitter (LT-01) or damage to level measuring instrument | Check the transmitter signal and that it corresponds to the measure of the level indicator. Check that the level display does not remain stationary. If necessary replace the instrument. |
| Generator pressure too high. The generator is in a state of alarm. | The primary steam control valve (CV1) does not close correctly | Inspect the valve housing to identify any damage. If necessary repair the valve. |
| | Fault/malfunctioning of pressure controller (PIC-01) | Check the settings. Check that the positioner of the control valve (CV1) reaches the control signal from the controller. Switch to the regulator manual control to verify the operation of the signal. If necessary replace the controller. |
| | Pressure transmitter fault (PT-01) | Check the transmitter signal and that is corresponds to the manometer measure. If necessary replace the transmitter. |

| Problem | Possible causes | Corrective action |
|--|---|---|
| <p>The generator is not able to maintain the required pressure when it is working at maximum load conditions.</p> | <p>The pressure of the primary steam is too low</p> | <p>Check the primary steam pressure is correct and there are no pressure losses when the generator load increases.</p> <p>Clean the filter upstream the regulator valve.</p> <p>Check the shut-off valve on the line is completely open.</p> |
| | <p>Primary steam blocked for the low water level (even temporary).</p> | <p>See the part regarding the problem: water level low, generator in alarm.</p> |
| | <p>Insufficient condensate is removed from the tube bundle of the generator.</p> | <p>Make sure the condensate trap is working correctly.</p> <p>Check the integrated filter is clean.</p> <p>Check the shut-off valve of the steam trap is completely open.</p> <p>If necessary replace the steam trap.</p> |
| | <p>The tubes are fouled; therefore, their capacity to transfer heat is reduced.</p> | <p>Remove and examine the tube bundle of the generator.</p> <p>If necessary clean or replace the tube bundle.</p> |
| | <p>The generator load (clean steam intake) exceeds its capacity.</p> | <p>Verify that the instant clean steam intake does not exceed the capacity of the system, shown in the product specification.</p> <p>If necessary, reduce peak loads or optimize the instant withdrawals.</p> |
| <p>The generator remains cold when switching it on.</p> <p>When working, the pressure of the generator falls drastically (heating interruption).</p> | <p>Primary steam blocked for the low water level.</p> | <p>See the part regarding the problem: water level low, generator in alarm.</p> |
| | <p>The primary steam control valve (CV1) is not working correctly.</p> | <p>Check the solenoid valve mounted on the regulating pneumatic valve (CV1) and relative control panel protection fuse.</p> <p>Check the air pressure is correct.</p> <p>If necessary replace the solenoid valve or fuse.</p> |
| | <p>Fault/malfunctioning of pressure controller (PIC-01).</p> | <p>Check the settings.</p> <p>Check that the positioner of the control valve (CV1) reaches the control signal from the controller.</p> <p>Switch to the regulator manual control to verify the operation of the signal.</p> <p>If necessary replace the controller.</p> |
| | <p>Pressure transmitter (PT-01) fault</p> | <p>Check the transmitter signal and that it corresponds to the manometer measure.</p> <p>If necessary replace the transmitter.</p> |
| | <p>Block pressure switch (PSH-01) on</p> | <p>Reset the block, through the reset button on the control panel.</p> |

| Problem | Possible causes | Corrective action |
|---|--|--|
| The loading pump remains off (where the option is provided) even if the level of the generator is low. | Pump power breaker on | Check the power breaker condition on the panel and restore it if necessary. |
| | Pump fault | Replace the motor or the complete pump |
| | Pump-off management device fault | Check the settings. If the case may be, replace device for the "Pump power-off" function. |
| | Level controller (LIC-01) fault (the water regulator valve remains closed) | Check the settings. Check that the I/P converter or positioner of the control valve (CV2) reaches the control signal from the controller. Switch to regulator manual control to verify the operation of the signal. If necessary replace the regulator. |
| | VFD failure | Refer to VFD manual. |
| No TDS bleed-offs (where the option is provided) | Blowdown line intercepted/ obstructed. | Check the shut-off valves of the blowdown line are all completely open. Clean the filter upstream of the probe. |
| | Conductivity sensor (CE-01) fault | Check the conductivity measure on the controller. Check the measure of the probe with a sample solution. If necessary replace the sensor. |
| | Blowdown solenoid valve (EV3) fault | Check the solenoid mounted on the blowdown valve and relative control panel protection fuse. If necessary replace the solenoid valve or fuse. |
| | Fault/malfunctioning of TDS controller (CIC-01) | Check the working order of the controller. Check settings. Check the bleed-off solenoid valve command. If necessary replace the controller. |

7. Maintenance



Before starting any maintenance operation, carefully read the general safety information in Section 1 of this document.

Before starting any installation or maintenance operation, make sure that power has been shut-off.

To carry out many maintenance procedures, the unit shall be isolated from the system. The unit can be re-inserted in the system only after completing all the procedures.

It is recommended that maintenance personnel carry out the shut-down and start-up procedures described in this manual.

7.1 General information

The maintenance of single system components must be carried out as indicated in the single installation and maintenance manuals (IM).

7.2 Inspection/replacement of the tube bundle of the generator

The U-shaped tube bundle is the core of the steam generator.

It must be removed and inspected every two years or as established by the terms of the warranty. The plate of the tube bundle is secured between the flanges of the vessel of the generator and the primary steam head. It is fitted with two gaskets:

- 1 shell side of the generator, between the tube bundle plate and body/shell of the generator.
- 1 head side (2-passes), between the tube bundle plate and primary steam head.

7.2.1 Disassembly of the tube bundle:

- Check that primary steam, condensate return line, feedwater inlet and clean steam outlet are isolated; that both circuits (primary and secondary) are not pressurized; that the generator has been completely drained and all components and surfaces are cold.
- Carefully disconnect the piping between the head of the generator and the primary steam inlet and condensate blowdown lines, with the utmost care so that no part of the line has damage.
- Separate the head from the generator, removing the bolts that secure it to the body.
- Carefully pull the tube bundle.

7.2.2 Inspection of the tube bundle:

- Inspect the tube bundle for scale and/or leaks. In the absence of leaks, remove scale and carefully clean the tube bundle before preparing this for installation.
- If detected, even a leakage, repair or replace the tube bundle.

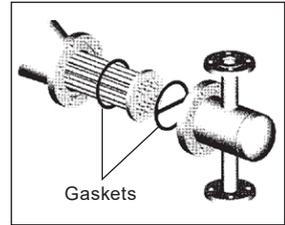
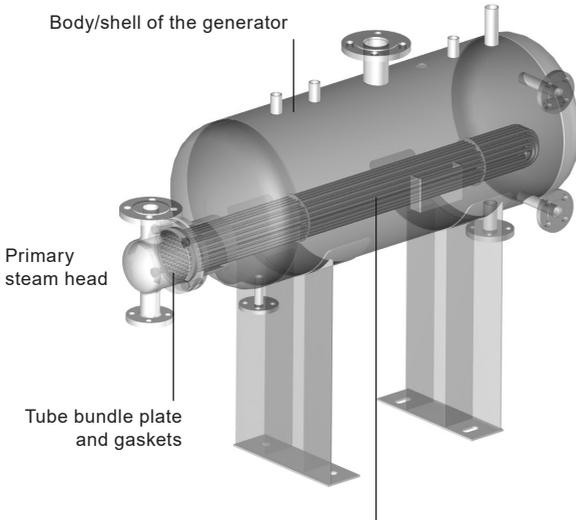


Fig. 8 "U" shaped tube bundle

7.2.3 Re-assembly of the tube bundle:

- Remove the old gaskets, thoroughly clean mating surfaces and install two new gaskets: one between the tube plate and generator (shell side), the other with the sector divider between the tube plate and the head (head side).
- Carefully insert the tube bundle in the generator body, so that the dividing line between the two passes of the tubes is perfectly parallel to the horizontal plane.
- After making sure that the tube is properly in place, assemble the primary steam head by aligning the divider at the dividing line between the two passes of the tubes (expected perfectly parallel to the horizontal plane), then tighten the bolts .
- Reconnect the inlet and outlet primary lines to the steam head. Check that these have been reconnected also where they may have been detached to facilitate extraction of the tube bundle.
- Carefully check all connections to detect any leaks during start-up.

7.3 Spare parts

For recommended spare parts for commissioning or maintenance, please contact our Service Department.

7.4 Recommend inspection

The following table indicate the suggested interval times for the inspection on the clean steam generator and of all the other components installed on the package.

| Inspection | Following related spec. | Daily | Weekly | Quarter |
|-------------------------------------|-------------------------|-------|--------|---------|
| Blowdown | | • | | |
| Control Valve | • | | | |
| Water level** | | • | | |
| Pressure level** | | | | • |
| Level control | • | | | |
| Inlet and outlet line | | | | • |
| Pneumatic connections | | | | • |
| Electrical connection | | | | • |
| Primary and secondary side pressure | | • | | |
| Safety valve | • | | | |
| Manual isolation valve | | | • | |
| Strainers | | | | • |

** To verify the difference between the measure of the transmittal against the indicator

7.5 Spirax Sarco Service maintenance

Spirax Sarco can provide on request of routine scheduled maintenance contracts with the following steps. The maintenance contract usually includes two visits per year.

| Inspection | Six Month visit | Year visit | 2 year visit |
|---|-----------------|------------|--------------|
| Dismantle control valve, clean and visually inspect valve internals | | • | |
| Visual inspection of controller, valve and actuator | • | • | |
| Visual inspection of all wiring and terminations | • | • | |
| Check all electrical connections for tightness | | | |
| Replace valve stem seals | | • | |
| Check valve/actuator/positioners, zero and stroke, adjust if necessary | • | • | |
| Ensure correct operation pump (if present) | | • | |
| Pressure transmittal and level transmittal control | | • | |
| Functional inspection of safety components and PLC | | | • |
| Visually inspect of heat exchanger for external leakage | • | • | |
| Tube bundle dismantled and inspection, gasket replacement | | | • |
| Functionally test line drainage traps with Ultrasonic Leak Detector to confirm correct operation (if present) | | • | |
| Check and clean all strainer screens, re-fit using new cap gaskets* | • | • | |
| TDS test and probe check | | • | |
| TDS re-calibration | • | • | |
| Fully functional test of the unit | | • | |

Service

For technical assistance contact our nearest Office or Agency or contact directly:

SPIRAX SARCO S.r.l. – Service
Via per Cinisello, 18 - 20834 Nova Milanese (MB) - Italy
Tel.: (+39) 0362 4917 257 - (+39) 0362 4917 211
Fax: (+39) 0362 4917 315
E-mail: support@it.spiraxsarco.com

Warranty

Ascertained partial or complete non-compliance with these regulations will result in forfeiture of the related warranty.