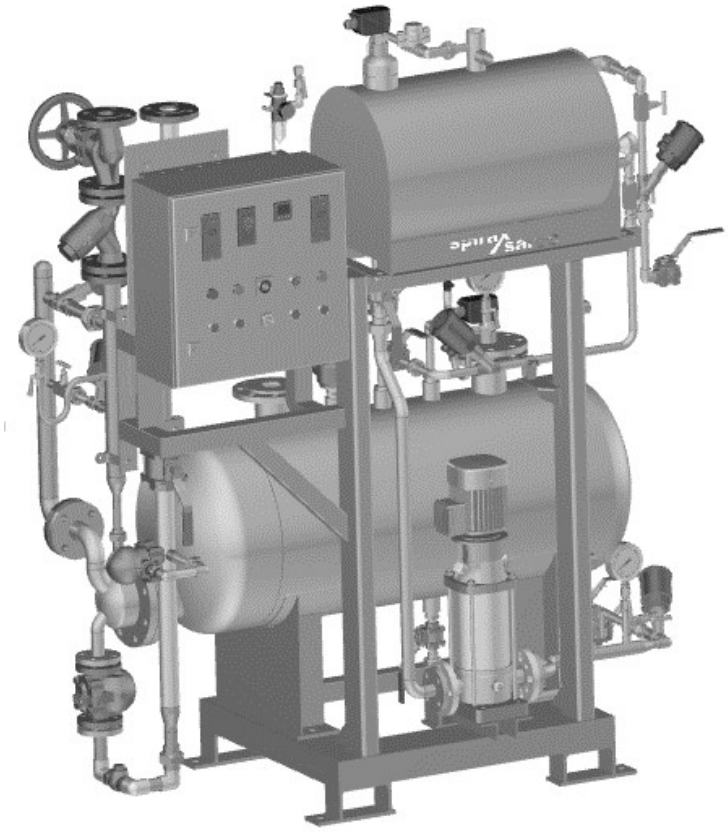
AH-CSG
Clean Steam Generator



Description

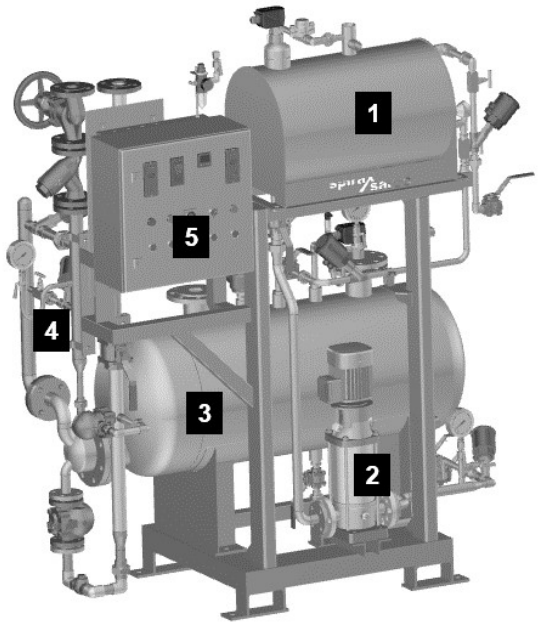
The "AH-CSG" clean steam generator consists of a complete, safe and functional system package, ready for installation and able to produce flows of up to 300 kg/h of clean steam* using industrial plant steam as a primary energy source. It is specifically designed to meet the needs of clean steam supply for steam sterilisation as required by AS/NZS 4187, however it may also be used for any other application or process that requires clean steam.

It incorporates a feedtank for pre-heating and degassing the cold feedwater before it is fed to the steam generator. The feedwater is heated by direct steam injection from the generator itself (i.e. clean steam is used), while the generator vessel uses indirect heat exchange, ensuring no contact between the primary steam and the 'clean' steam produced.

A compact design ensures the AH-CSG is well disposed to installation into existing plant rooms, or to minimise the space required in new installations.

***** Maximum peak steam production at reference operating conditions: primary steam at 900 to 1000 kPa g, clean steam production at 300 kPa g, feedwater at 20°C.

The AH-CSG comprises of the following main sections:



1. Feedtank with associated instrumentation, control valves and accessories.
2. Feedwater control.
3. Steam generator with associated instrumentation, accessories and safety devices.
4. Plant steam and condensate with associated control valves, traps and accessories.
5. Electrical control cabinet.

Design conditions

Primary side	Design pressure	1000 kPa g
	Design temperature	195 °C
	Maximum cold hydrostatic test pressure (tube bundle §)	1750 kPa g
Secondary side	Design pressure	1000 kPa g
	Design temperature	195 °C
	Safety valve set pressure	600 kPa g
	Maximum cold hydrostatic test pressure (vessel §)	1980 kPa g
Feedtank	Atmospheric design	<50 kPa g
	Design temperature	100 °C

§ refer to data sheets of individual equipment items for their maximum test pressure

Operating limits

Plant steam (primary side)	Pressure	700 kPa g Min ‡	1000 kPa g Max
	Temperature	Saturated steam	
Clean steam (secondary side)	Pressure	300 kPa g Min ‡	500 kPa g Max
	Temperature	Saturated steam	
Feedwater (feedtank supply)	Pressure	120 kPa g Min	400 kPa g Max
	Temperature	>0 °C Min	90 °C Max

‡ a lower steam pressure may be possible – consult Spirax Sarco

Utilities and Services

The Utilities and Services required are listed below, however also refer to IM-P486-02A.

Plant steam supply

Plant steam supply of between 700 kPa g and 1000 kPa g is required. The higher the plant steam pressure the greater the output possible from the generator. For plant steam pressure below 700 kPa g consult Spirax Sarco.
Plant steam consumption is approximately 1.3 to 1.4 times the clean steam generation rate, with a maximum instantaneous plant steam flow rate of up to 500 kg/h under operating conditions (actual values will depend on operating pressures of plant steam and clean steam, as well as feedwater supply temperature).

Feedwater

The level of contaminants in the feedwater will influence the clean steam purity as well as corrosion (particularly the level of Chloride). The level of contaminants in the feedwater supply will depend on the pre-treatment used (usually Reverse Osmosis or Demineralised).

The maximum recommended levels of contaminants in feedwater are outlined in EN285 Sterilization – Steam sterilizers – Large sterilizers; Table B.1.

The details below, may be used as a guide, however always refer to EN285 for the definitive values.

Cadmium	≤ 0.005 mg/l
Iron	≤ 0.2 mg/l
Lead	≤ 0.05 mg/l
Silicate	≤ 1 mg/l
Rest of heavy metals except cadmium, iron & lead	≤ 0.1 mg/l
Chloride	≤ 0.5 mg/l
Phosphate	≤ 0.5 mg/l
Conductivity (at 20°C)	≤ 5 µS/cm †
pH (at 20°C)	5 to 7.5
Hardness (∑ Ions of alkaline earth)	≤ 0.02 mmol/l
† minimum conductivity of 1.5 µS/cm is required for level probe operation	

Feedwater consumption will be approximately 1.1 times the clean steam generation rate, with a typical flow rate of 550 to 650 kg/h required while filling the feedtank (allow for an instantaneous peak flow of to 800 kg/h).

Electrical supply

Electrical supply required is 3 phase 400 V 50 Hz (maximum 10 A per phase) with Neutral and Earth.
Installed load – maximum 1 kW (instantaneous).

Compressed air supply

Compressed air is required to operate the actuated valves. The compressed air must be clean, dry and oil free.

Supply pressure required: 500 kPa g Minimum, 900 kPa g Maximum.
Maximum instantaneous flow: 13 Nm^3/h.
Maximum consumption: Less than 1 Nm^3/h.

Cooling water supply

Cooling water will be required for cooling blowdown. This may be through a blowdown vessel, or the unit may have the blowdown cooling option, which mixes cooling water with the blowdown to cool it before discharge to drain.
Cold water supply: 200 kPa Minimum pressure, 800 kPa Maximum pressure.
Consumption of cooling water will depend on the amount of blowdown required.
Some cooling water will also be required to a sample cooler.

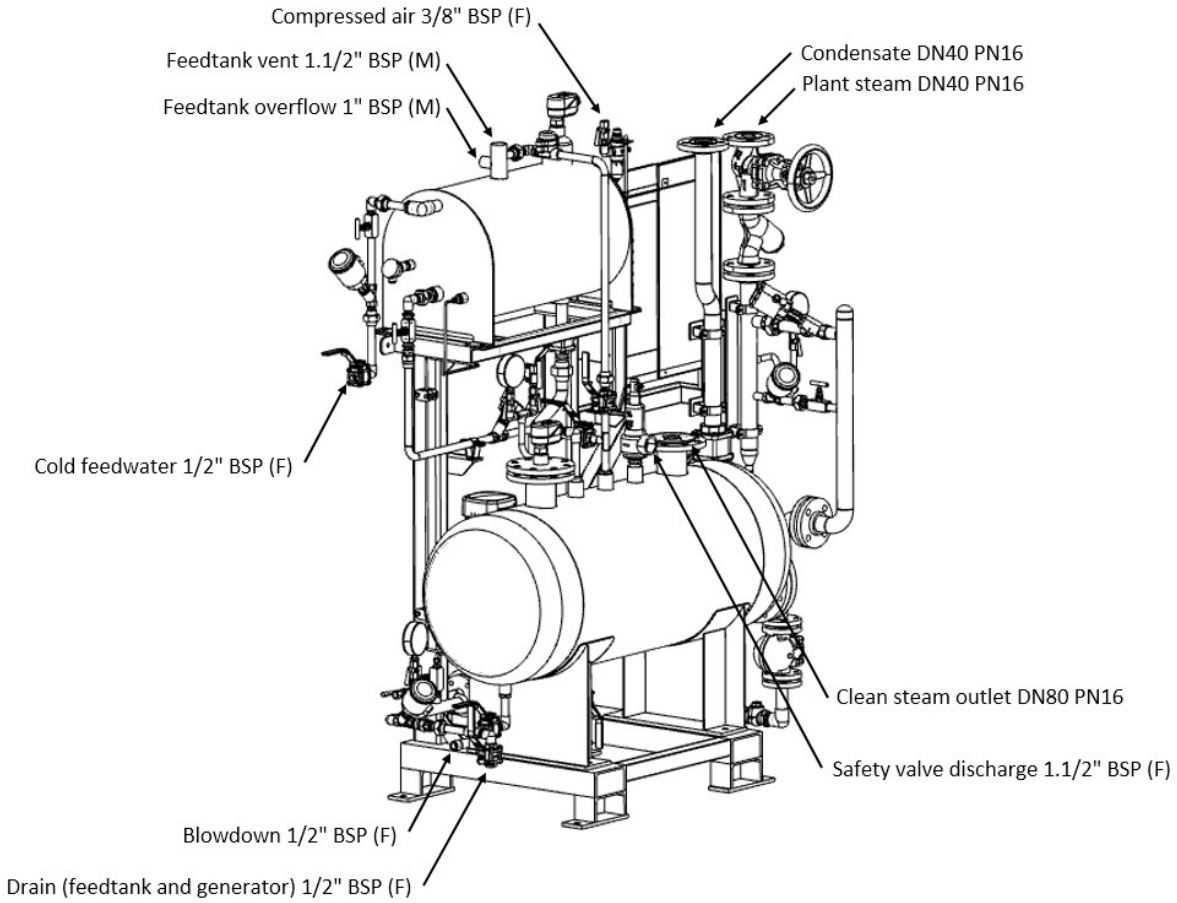
Drains and vents

Water discharged from the unit when being drained, or from blowdown during normal operation, will be hot and as such needs to be discharged through drains capable of handling high temperature water (drains rated to 100°C are recommended).

Potential steam discharge and vapour from the generator safety valve and the feedtank vent must be directed to a suitable and safe area.

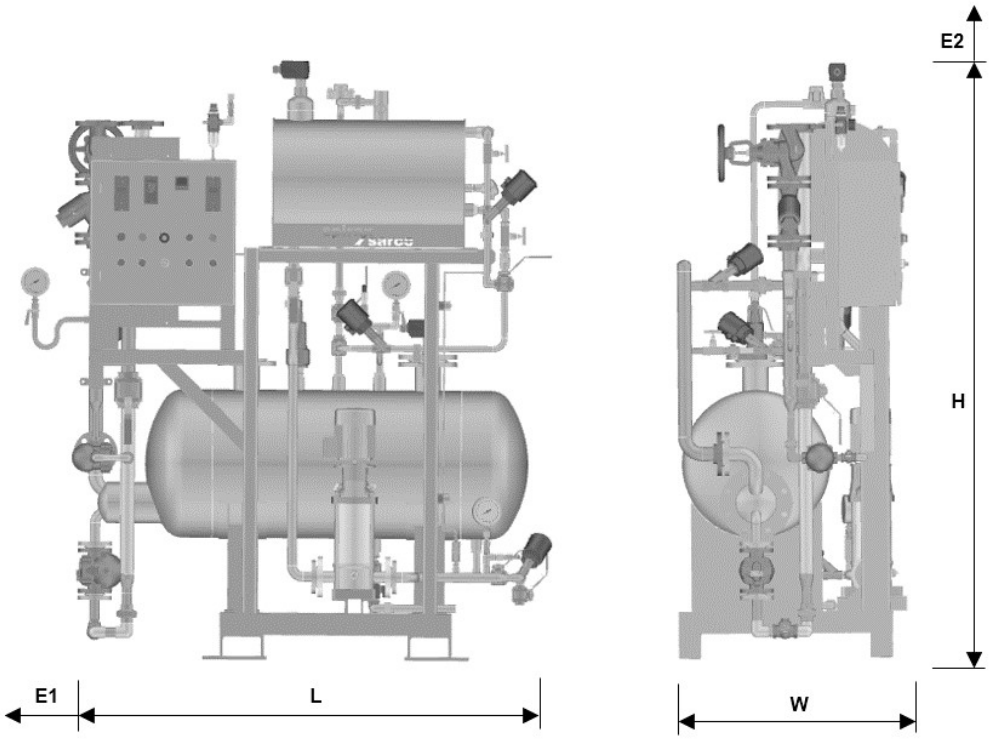
A blowdown vessel will be required to handle blowdown (unless the unit has the blowdown cooling option). Such a vessel will have both a hot water discharge as well as a vent that will discharge flash steam.

The location, size and type of the main mechanical connections are shown below



Connections for services, outlets, drains and vents

Dimensions and weights

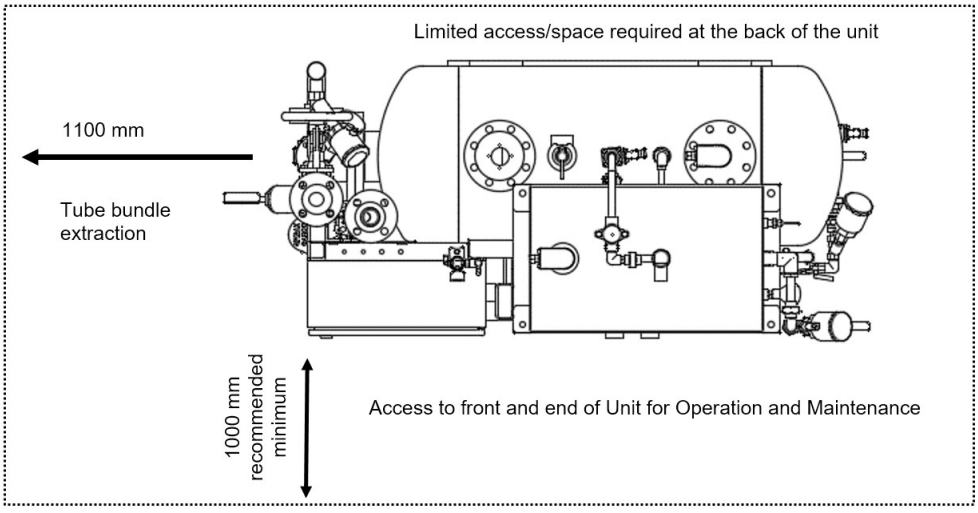


Dimensions (approximate in mm for standard unit)				
L Length	**W** Width	**H** Height	**E1** Coil removal	**E2** Level probe removal
1710	**810**	**2075**	**1100**	**400**

Dimensions (approximate) of AH-CSG

Approximate weights	Empty	525 kg
	Full (hydraulic test)	875 kg
	Operating	800 kg

An indication of the installation requirements for access is given in the diagram below (refer to IM-P486-02A for full installation details)



It may be possible to make a “mirror” configuration of the standard unit shown if this allows a better fit into a particular location, or perhaps where more than one unit is to be installed.

Consult Spirax Sarco with regard to this possibility.

Control, Alarms and Remote Monitoring

The AH-CSG uses simple, reliable but effective on-off control. Levels in the feedtank and generator vessel are provided by pre-set conductivity level probes and plant steam and water flows (make-up water and feedwater to generator) are controlled by piston actuated valves. Standard process controllers and timers are used to control the unit, making it simple to understand, diagnose and maintain.

Control outputs to the valves and feedpump have hard wired interlocks, via alarm outputs, to provide safe operation. In addition to providing interlocks, an alarm condition will also shut down the unit if it is running.

	Pump Not Running	Feedtank				Generator			
		Level		Temperature		Level		Pressure	
		Low	High	Low	High	Low	High	Low	High
FT Fill			I						
FT Heat		I			I			I	
Gen Fill	I	P			P		P		
Gen Heat (small valve)	I	P			P	I	P		I
Gen Heat (large valve)	I	P			P	I	P	I	I
Pump Run		I			I		I		

FT = Feedtank, Gen = Generator, **I** = Interlock, **P** = Pump interlock prevents operation

Hard wired interlocks (via alarm relays)

Volt free contacts are provided for the CSG running status and the status of the alarms. Terminal connection points for these volt free contacts are provided and can be used to provide feedback to a BMS (Building Management System) or similar.
In addition the feedtank temperature controller and the generator pressure controller are set-up to retransmit a 4-20 mA signal of the process variable. This signal can also be used to feedback to the BMS.

Description	Type
Feedtank Low Temperature	Volt free contact
Feedtank High Temperature	
Feedtank Low Level	
Feedtank High Level	
Generator Low Pressure	
Generator High Pressure	
Generator Low Level	
Generator High Level	
CSG Running	
Feedtank Temperature Process variable Retransmit	4-20 mA
Generator Pressure Process variable Retransmit	4-20 mA

Control feedback available from the AH-CSG

Refer to the Installation and Maintenance Instructions (IM-P486-02A) for further details on the installation and operation of the AH-CSG.