

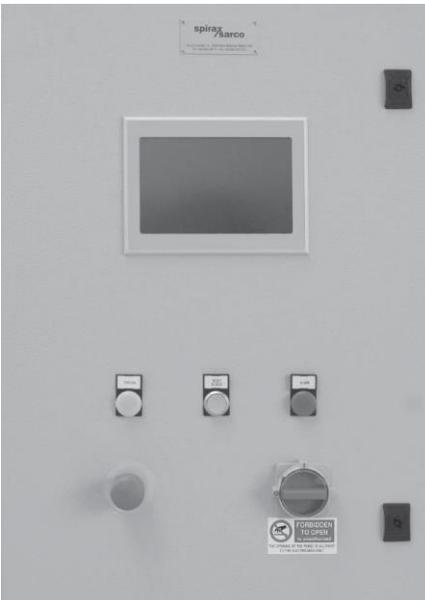


## PLC Control Unit for a CSM-C Steam Compact Clean Steam Generator

Installation, Start-up and Operation Manual

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1. Safety information
2. General product information
3. Installation
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5. Maintenance
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# 1. Safety information

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## 1.1 General safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.2) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction (see IM-P486-05-US supplied with the unit), as well as the proper use of tools and safety equipment must also be complied with.

## 1.2 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation, Start-up and Operation Manual. Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety. Post 'warning notices' if necessary.

## 1.3 Limits of responsibility

This Installation, Start-up and Operation manual is intended to be as complete and up to date as possible. It describes installation, start-up and operating procedures for the PLC control unit for Spirax Sarco indirect clean steam generators. Spirax Sarco reserves the right to update this manual and other product information regarding installation, start-up and operation, at any time and without having to notify owners of the product. Spirax Sarco is not responsible for any inaccuracies in the specifications, procedures and/or content of other product documents provided by other manufacturers of components used on Spirax Sarco steam generators.

Spirax Sarco uses only top-quality components in the construction and control of its steam generators. Spirax Sarco accepts responsibility for complete systems only when it supplies all the components of the system. Otherwise Spirax Sarco accepts responsibility only for those parts that it has supplied, since it has no direct control over other manufacturers or their quality standards.

Note: the symbol  indicates 'warnings'.

 Spirax Sarco is not responsible for any injuries or damage caused by incorrect installation, commissioning or maintenance of the unit (see Section 1.1).

Only trained, authorized personnel must carry out installation, start-up and operating procedures. The personnel who carry out these procedures must read carefully and completely, and understand, all relevant product manuals before beginning any of the activities described in the procedures. Personnel must pay great attention to any Notes, Precautions and Warnings contained in the procedures described in this manual.

 When Spirax Sarco provides only the steam generator without any control accessories, then this manual applies only to the generator. In this case, responsibility for the additional components, their respective manuals, and for the entire system, rests with the provider of the accessories for the generation system.

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## 1.4 Notices

This Installation, Start-up and Operation manual is intended as a procedural guide for the control unit for Spirax Sarco clean steam generators. Since each unit is manufactured according to the customer's specifications, the instructions contained in the manual may sometimes appear rather general. Where procedures differ greatly from those described in the manual, specific notes are provided.

Should this manual not answer all possible questions, or should the procedures described in it not be clearly understood, please contact Spirax Sarco for further clarification.

## 1.5 Warnings

Listed below are specific warnings pertaining to the unit. In addition, in the manual, 'warnings' are repeated when the procedures concerned refer to potentially hazardous areas. All warnings must be carefully read and understood. All precautions contained in the warnings must be carefully followed to reduce the risk of injury. They must be carefully studied before beginning any installation, start-up or maintenance operation.

 Every product or system that uses steam, diathermic oil or superheated water under pressure, or electricity, presents a potential hazard of serious injury to persons if the relevant installation, start-up and operating procedures are not followed attentively.

 The simultaneous presence of water and electrical energy can create potentially hazardous conditions.

 Potentially hazardous areas:

1. All electrical connections and cables.
2. All steam lines, valves and pressure regulators.
3. All steam, diathermic oil and superheated water lines, joints, valves and pressure regulators.

## 1.6 Connection of power lines

Only experienced, trained and qualified personnel must carry out electrical installation. Control units for Spirax Sarco clean steam generators are designed for indoor installation only, unless otherwise specified by the customer.

 Always ensure that the power supply is switched off before beginning any installation or maintenance operation.

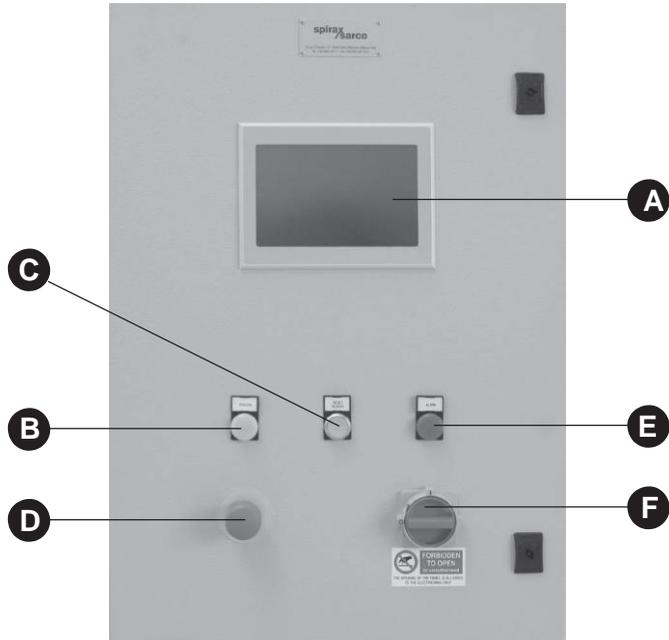
## 2. General product information

### 2.1 Control unit

The PLC smart control and safety unit is intelligent equipment designed to start-up, control and operate the generator, either in local mode or by means of a remote system (DCS - Distribution Control System or BMS - Business Management System).

#### Location and identification of components

##### Front panel



**A** PLC  
PLC control unit (touch screen).

**B** Power Indicator (L1)  
When lit (white light) indicates that the unit is powered (110 VAC).

**C** Manual Alarm Reset (PRB)  
Push button.

**D** Emergency Stop (PE)  
Latching push button.

**E** Alarm Indicator (L2)  
When lit (red light) indicates that the system is stopped due to the intervention of one or more alarms.

**F** Main power switch (IG)  
This is a two-pole switch with a door locking handle that switches off the mains current and allows the door to be opened only when it is in the 'OFF' position.

**⚠** Warning: the user must install an external circuit for interrupting the electricity supply. This circuit must be able to cut off the electrical power supply in the event of incorrect operation or to allow maintenance to be carried out on the unit. Failure to cut off the electricity supply could lead to hazardous conditions for personnel.



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## 2.2 Control features

The PLC control unit is designed for the regulation of pressure, water level, and the management of the blowdown function and alarm limits for Spirax Sarco indirect steam and electrical generators. The unit can be supplied with a video interface for the generator, or parts of it, with a graphic display of error messages, test functions, etc. Set-point values can be displayed and changed during operation, using the function keys.

As well as automation of individual generators, the system also enables computer structures to be created, such as networks of PCs, PLCs and microprocessor systems, thus allowing a high degree of integration between the automation systems for the various parts of the system. The supervisor system can be seen in terms of a display of machine, configuration and production control data. The unit has a main switch and is mounted in an NEMA 4 metal enclosure, measuring approximately 27<sup>1</sup>/<sub>2</sub>" x 19<sup>1</sup>/<sub>2</sub>" x 9<sup>3</sup>/<sub>4</sub>.

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# 3. Installation

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## 3.1 External connections

Trained and qualified electricians must carry out all electrical connections. Ensure that the on/off switch is in the **off** position before connecting to the mains. The installer must connect the power cables to the terminals on the mains switch mounted on the panel, and to the earth wire leading to the ground.

**For the power supply, please see the wiring diagram inside the control panel.**



**Warning:** Before making a hole in the removable baseplate of the panel to connect the power cables, very carefully open the door and check that there are no obstacles inside the panel. Ensure that there is no contact with residues from the drilling or with metal pieces on the base or on the transformer or switch.

## 3.2 Mains power supply

**Display:** 5.7" Touch-screen with high resolution color graphics

**Input voltage:** 110 VAC, 50-60 Hz, single phase (**always refer to wiring diagram**)

Connect input power cables to the power supply terminal block: Live to terminal L3, Neutral to terminal L1 and the Ground to the Ground screw connection

**Input contacts:** 3 A – 110 V for inductive loads

**Output contacts:** 6 A – 110 V for resistive loads

**Operational ambient temperature:** Minimum 32°F, Maximum 122°F (inside the control enclosure)\*

**Relative Humidity (RH):** from 5% to 95% non-condensing

\* **Note:** If the environmental conditions raise the temperature inside the enclosure to over 122°F, conditioning devices should be fitted.

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## 4. Operation

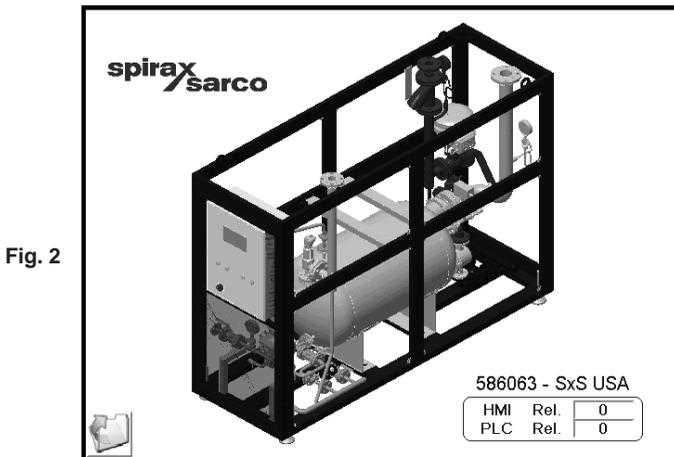
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### 4.1 Initial screens

The control unit is fitted with a touch-screen display. To interact with the control screen, simply press with bare fingertips on the screen surface. When the unit is first switched on, the screen displays the following image:



Press the key  to view the screen that displays the version of the installed program (Fig.2):



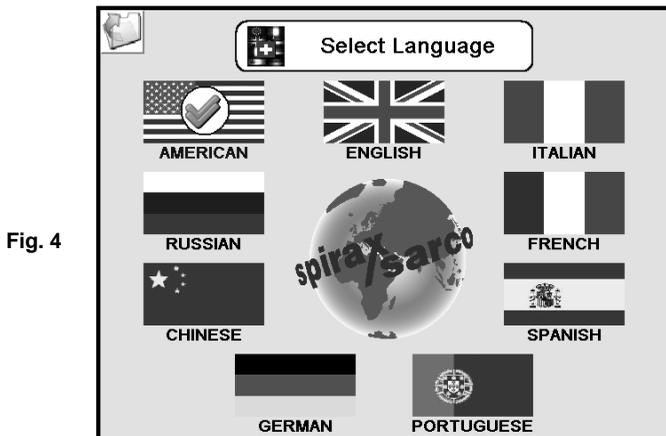
Press the  key again to view the “Welcome” screen shown in Fig.3, where a start-up menu offers three alternatives:

1. **Spirax Sarco address:** contact details for Spirax Sarco Operating Company.
2. **Status:** machine manual/automatic cycling and information about generator operation.
3. **Protected parameters:** Generator configuration parameters that were configured during the initial commissioning procedure performed by the Spirax Sarco Service Engineer.

To return to Fig.2 press the  key.



Touching the flag in the top right hand corner brings up the “Select Language” screen (Fig.4)



To select preferred language (and associated engineering units), touch the corresponding flag key. The  symbol will be displayed on the selected flag key to confirm the selection. Touch the  key to return to the “Welcome” screen shown in Fig.3.

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By touching the  key on the “Welcome” screen, the password input keypad is displayed (Fig.5). Use of this keypad (when accessed from the “Welcome” screen) is only for use by the Spirax Sarco Service Engineer or Factory appointed and authorized service technician during the initial commissioning procedure.

Fig. 5



To exit the password input keypad, touch the ESC button which will return you to the “Welcome” screen (Fig.3).

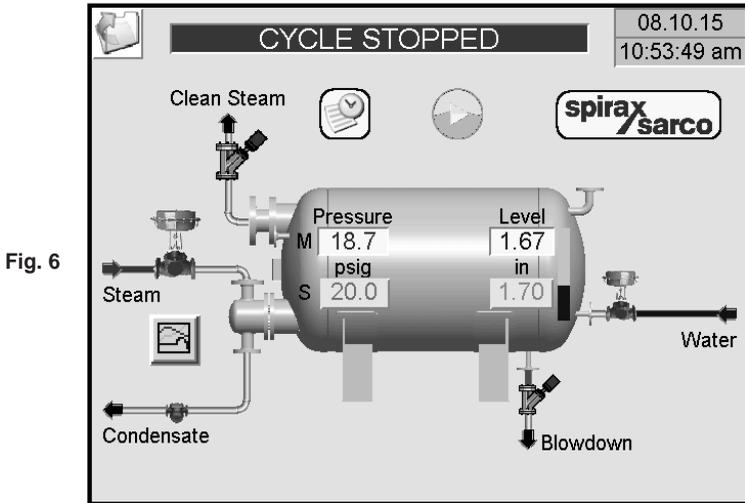
## 4.2 Operators screens

From the “Welcome” screen (Fig.3), touch the  key to view the “Operators” screen (Figs. 6 & 7).

There are 2 “Operators” screens that display the generator’s operating parameters. Which screen is shown is dependent on whether the Generator is Off-Line (“Cycle Stopped” - Fig.6), or On-Line (“Cycle Running” – Fig.7).

From these screens you can start the generator by pressing the green  which turns red  once the generator is running. The clean steam pressure and generator water level can also be changed through this screen (password protected). It is strongly recommended that these two procedures are only performed by Spirax Sarco Service Engineers or trained technicians. Note if the steam set pressure or water level settings are adjusted then the alarm settings (high steam pressure and low & high water levels) must be also be changed. As access to Alarm settings is not available at Operator level, please contact Spirax Sarco for assistance.

## 4.2.1 Generator Off-Line – Cycle Stopped Screen



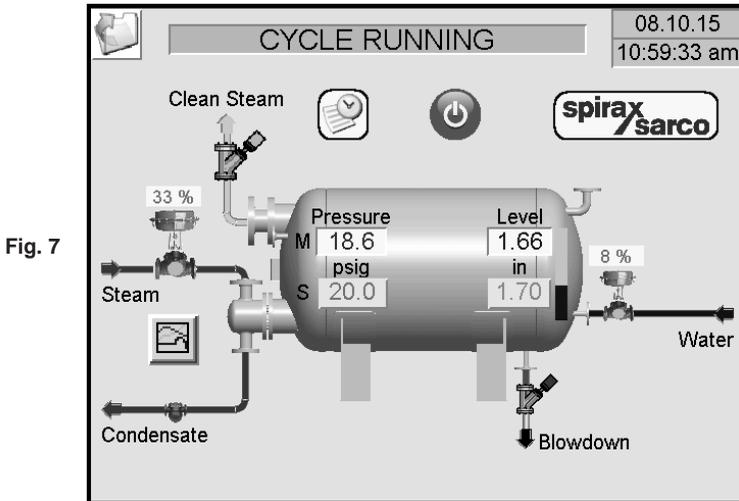
This screen displays the following operating parameters:

- Clean Steam Pressure – Measured pressure (M) and Set pressure (S)
- Water Level – Measured level (M) and Set level (S)
- Plant steam inlet valve condition – closed (red) or open (green)
- Feedwater inlet valve condition – closed (red) or open (green)
- Blowdown valve condition – closed (red) or open (green)
- Clean steam outlet valve condition (if installed) – closed (red) or open (green)

Additionally there are three buttons:

-  On/Off button (will be showing green)
-  Diagnostics button
-  Alarms History button

## 4.2.2 Generator On-Line – Cycle Running Screen



This screen displays the following operating parameters:

- Clean Steam Pressure – Measured pressure (M) and Set pressure (S)
- Water Level – Measured level (M) and Set level (S)
- Plant steam inlet valve condition – closed (red) or open (green) and % open
- Feedwater inlet valve condition – closed (red) or open (green) and % open
- Blowdown valve condition – closed (red) or open (green)
- Clean steam outlet valve condition (if installed) – closed (red) or open (green)

Additionally there are three buttons:

-  On/Off button (will be showing red)
-  Diagnostics button
-  Alarms History button

## 4.2.2 Operators screens buttons

The buttons shown on the Operators screens have the following functions:

-  Shuts down or  starts up the Generator
-  Displays the Diagnostics screen
-  Displays the Alarms History screen

During normal operation the generator can be taken off-line by touching the  button. When the generator is off-line, it can be started up (following the procedure detailed in section 4.3 “Startup operating procedure”) by touching the  button

Touching the Diagnostics button  will display the Diagnostics screen (Fig.8) showing plant operating information in graphical format: clean steam pressure versus set pressure and plant steam inlet valve condition (% open) against time.

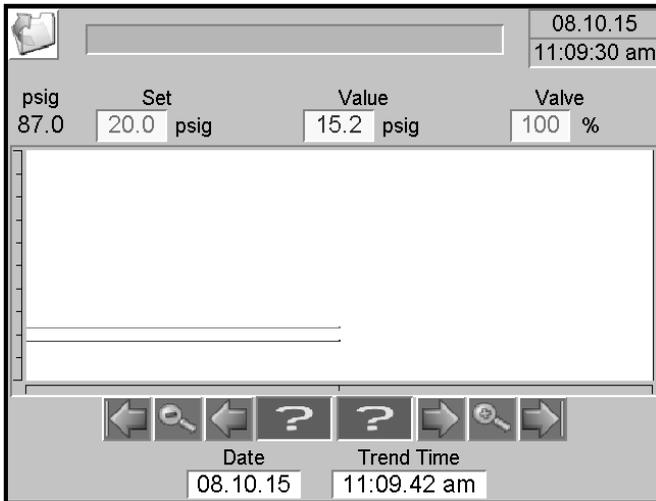
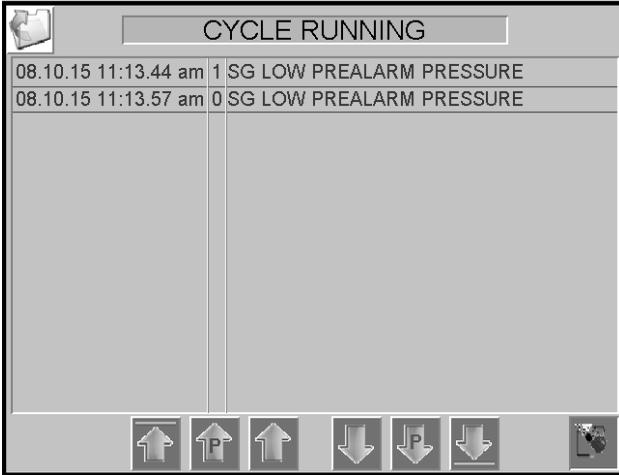


Fig. 8

Using the keys at the bottom of the screen allows the user to maneuver around the graphical display and enlarge specific areas for more detailed viewing if required. If an alarm interrupts the automatic cycle or the cycle ends, the chart recorded during the Touch the  key to return to the “Operators” screen (Figs.6 & 7).

Touching the Alarms History button  will display the Alarms History screen (Fig.9).



CYCLE RUNNING	
08.10.15 11:13.44 am	1 SG LOW PREALARM PRESSURE
08.10.15 11:13.57 am	0 SG LOW PREALARM PRESSURE

Fig. 9

For each alarm, the start (1) and end (0) date and time is displayed.

By selecting the  key, the first stored alarm will be displayed. Selecting  the key displays the last alarm.

By selecting the  and  keys, it is possible to individually scroll through the alarm list.

By selecting the  and  keys, it is possible to navigate from one alarm menu screen to another.

By selecting the  button located in the bottom right corner of the screen, all history of alarms stored in the database will be erased.

Touch the  key to return to the “Operators” screen (Figs.6 & 7).

### 4.2.3 Alarms and Shut-downs

Interruption of the feed water control cycle when one of the following alarms occurs:

- Level transmitter fault
- Maximum water level
- High steam pressure
- Pressure transmitter fault

Interruption of the pressure control cycle when one of the following alarms occurs:

- Pressure transmitter fault
- Minimum water level
- Maximum water level
- High steam pressure

Interruption of the blowdown control cycle when the following alarm occurs:

- Blowdown closed

If a problem or fault is observed during automatic operation, press the emergency stop button on the front of the control panel and the unit will shut-down (cycle interrupted), clearing all active functions and activating the relevant alarm signal(s) which will be displayed on the control panel screen.

In order to resume automatic operation and restart the cycle following an interruption, ensure that the emergency stop button is in the stand-by position and then press the green start button 

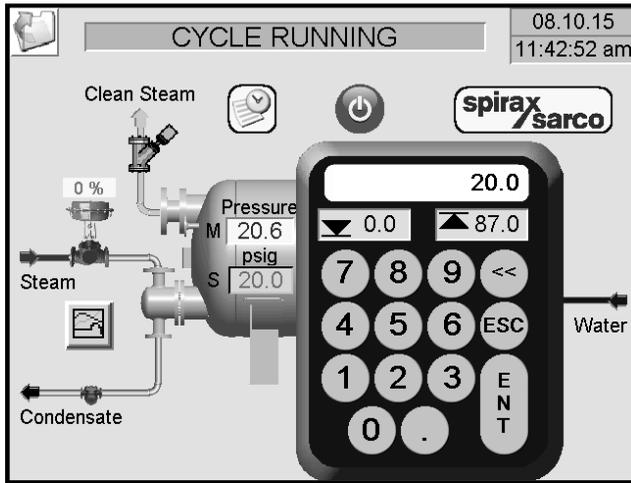
## 4.2.4 Operators screens – adjusting set points

At the operator level, the clean steam operating pressure set point and the water level set point can be adjusted. **Warning this should only be attempted by competent and trained personnel. Note if significant changes are made to the clean steam pressure and/or water level set points this may require changes to the relevant alarm set points. This would require access to the protected Service Menu which is not accessible at Operator level. Please contact Spirax Sarco at (866) 460-6804 for assistance.**

## 4.2.5 Adjusting Clean Steam Pressure set point

On the Operator screens, the upper window displays the Measured (actual) clean steam pressure in psig and the lower window displays the Set point pressure in psig. To adjust the clean steam pressure set point, touch the lower (Set point pressure) window which will reveal the password key pad (Fig.5). Enter the default password (3) and touch the ENTER key. Touch the lower (Set point pressure) window a second time which will reveal the square numerical pad (Fig. 10). Enter the new desired set point value (in psig) and touch the ENT button.

Fig. 10



Operating pressure will now be continuously controlled and maintained at this value by modulating the steam supply through the control valve to the heating coils.

If the pressure reaches the programmed high pressure alarm set point value, the control valve will close automatically, shutting off the steam supply to the heating coils and sending an alarm signal which will be displayed on the screen.

**Note:** The control valve cannot be re-opened until the operating pressure of the generator has fallen to within the programmed set value (below the high pressure alarm set point value and the manual alarm reset button on the front of the control panel has been pushed.

## 4.2.6 Adjusting Water Level set point

To adjust the water level set point, follow the same procedure as for adjusting the clean steam pressure set point.

During the commissioning process by the Spirax Sarco Service Engineer, the optimum water level has been configured for the generator and should not be changed by an unqualified person.

If the water in the generator vessel falls below the minimum level to provide adequate coverage of the heating coils, the steam inlet control valve will close automatically shutting off the steam supply to the heating coils and sending an alarm (low level) which will be displayed on the screen and the generator will shut down.

Once the water level in the generator has been re-established above the low level alarm set point, the alarm will clear automatically and the generator will resume running. Once the water

in the generator reaches the normal level set point the plant steam valve will reopen and the clean steam valve (if present) will also open.

If the water in the vessel reaches the programmed maximum level, the feed water inlet valve will close and a high level alarm will be displayed on the screen. The plant steam inlet valve and the clean steam outlet valve (if present) will also close.

Once the water level has dropped below the high level alarm set point, the alarm can be cleared manually by pressing the alarm reset button on the front panel and the generator will resume normal operation.

## 4.3 Startup operating procedure

### 4.3.1 Cold Startup

**The following procedure must be followed when bringing the clean steam generator into operation from an isolated and empty condition:**

- Ensure that all manual isolation valves are in a fully closed position.
- Turn on the electrical power supply.
- Turn on the compressed air supply.
- Open the manual isolation valve for the treated feedwater supply.
- Press the generator green start button  on the control panel touch Operators screen.
- Observe the rise in the displayed water level on the control panel Operators screen.
- Check that the generator stops filling when the set point level is reached.
- Open the condensate return manual isolation valve.
- Slowly open the plant steam supply manual isolation valve.
- Observe that the generator reaches the programmed set point pressure on the Operators screen.
- Leave the generator in operation for sufficient time to allow any non-condensable gases to dissipate.
- Slowly open the clean steam outlet manual isolation valve.
- The unit is now ready for operation.

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## 4.3.2 Cycle Interrupted Startup

The following procedure must be followed when bringing the generator back on line following an alarm condition lockout or temporary shutdown:

- Check that the generator pressure is above 1.5 psig via the generator Operators screen.
- If this is not the case then the cold start-up procedure must be followed - Section 4.3.1.
- Check that the 'Emergency Stop' button on the front of the control panel has been released.
- Also check that all remote stops have been released.
- Press the manual reset button on the front of the control panel.
- Check that all manual isolation valves are in an open position.
- The generator will come back on line and the clean steam outlet valve (if installed) will open when approaching the programmed operating pressure set point.

## 4.3.3 Shutdown Procedure

The following procedure must be followed when shutting down the unit for extended periods such as over weekend or for maintenance purposes:

- Close the plant steam supply manual isolation valve.
- Close the manual isolation valve for the treated feedwater supply.
- Close the condensate return manual isolation valve.
- Allow the generator pressure to fall to atmospheric.
- Close the clean steam outlet manual isolation valve.
- Press the **MAIN STOP** key on the control panel touch (Operators) screen.
- Open the manual drain valve and leave it open until the generator vessel is empty.
- Close all other manual isolation valves and lock out.
- Turn off the electrical power supply.

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### 4.3.4 Emergency Shutdown Procedure

The following procedure must be followed in the event that an emergency shutdown is required. The emergency shutdown procedure must only be used in the event of an unusual occurrence that requires the rapid isolation of the clean steam supply or in the unlikely event of a malfunction within the clean steam generator.

- Press the 'Emergency Stop' button either on the front of the control panel or at the remote location.
- Close the plant steam supply manual isolation valve.
- Close the clean steam outlet manual isolation valve.
- Close all other manual isolation valves and lock out.
- Turn off the electrical power supply.

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## 5. Maintenance

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### Repairs

To request a site service or return components for replacement, please contact your nearest Hub Office or directly at:

Spirax Sarco, Inc.  
1150 Northpoint Boulevard,  
Blythewood, SC 29016  
Tel: 800 833 3246  
Fax: 803 714 2221

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## 6. Warranty

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Spirax Sarco, Inc. warrants to the original user, that the CSM-C 600 Clean Steam Generator, being used in the service and the manner for which it was intended, shall be free from defects in material and workmanship for a period of 12 months from date of commissioning and no longer than 18 months from the date of shipment from the factory. The validity of this warranty is subject to the completion of the mandatory commissioning and start-up service performed by a Spirax Sarco Service Technician. This warranty does not extend to any product that has been subject to misuse, neglect or alteration after shipment from the Spirax Sarco factory, except as may be expressly provided in a written agreement between Spirax Sarco, Inc. and the user and which is signed by both parties. The use of the CSM-C 600 Clean Steam Generator with poor quality feed water that does not meet the minimum feed water quality requirements as published by Spirax Sarco will be considered misuse and neglect and will void the warranty. Defective components or assemblies found during the warranty period may be repaired or replaced at the discretion of Spirax Sarco and must be completed by a Spirax Sarco service technician or qualified representative; otherwise the warranty will be terminated. The partial or total failure to follow the instructions given in this manual completely invalidates the warranty.