

CLEANSTREAM 550 - H1500

Wide Range Temperature Control for R+D Chemical Baths



Product Manual

EC Declaration of Conformity

We Solid State Cooling Systems
 167 Myers Corners Road
 Wappingers Falls, NY 12592
 USA

declare under sole responsibility that the

Cleanstream 550/H1500 (with Hummel electrical connectors)

complies with the essential requirements, Annex 1, of Low Voltage Directive 2006/95/EC.
 Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

EN 61010-1 +A1+A2: 1995	Low Voltage Directive safety requirements for electrical equipment for measurement, control, and laboratory use.
IEC 61010-1:2010 (Third Edition) / EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use

Equipment Description: Process heating and cooling equipment with no moving parts.

Lloyd F Wright CTO	
Date	August 12, 2016

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SYMBOLS USED ON THE CLEANSTREAM 550/H1500



To avoid electric shock, disconnect all power prior to servicing. The power supply DC output is not isolated from the AC input. Input power must be disconnected to prevent hazardous potentials (approximately 145 volts) from appearing on the output, even when voltage between output terminals is zero.



Burn Hazard -- Hot Surface. Outer surface temperatures of the Cleanstream 550/H1500 may reach 120 °C during normal operation.



Low Temperature -- Cold Surface. Surface temperatures may reach -15 °C during normal operation.

Do Not Touch. Low temperatures could cause skin to freeze to the surface, causing injury.



CAUTION

The red CAUTION equilateral triangle symbol appears throughout the manual. Please follow the important instructions accompanying this symbol to avoid significant damage to the chiller.



WARNING

The red WARNING equilateral triangle symbol appears throughout the manual accompanying certain maintenance and repair activities. Please follow the important instructions accompanying this symbol to avoid situations that could cause injury to the operator or other personnel.



DANGER

The red DANGER equilateral triangle symbol appears throughout the manual accompanying certain maintenance and repair activities. Please follow the important instructions accompanying this symbol to avoid injury to the operator. Only trained personnel should undertake any activity marked by the red DANGER triangle.

CAUTION!

- The process side of the Cleanstream 550/H1500 unit may reach temperatures of 120°C during heating and -15°C during cooling. Insulate this side prior to operation.
- Never remove the bolts clamping the Cleanstream unit together as irreparable damage may occur.
- Never operate the heat exchanger process fluid over 90°C or below 10°C.
- Never operate the Switchback Power Supply/Temperature Controller (associated with this Cleanstream 550/H1500) over 12.5 amps or 144 volts.
- Never ship the Cleanstream unit with water inside the liquid cold plate as freezing temperatures may be encountered which would damage the unit.



PRODUCT MANUAL

Cleanstream 550/H1500

Thermoelectric Heat Exchanger

1.0 INTRODUCTION

The Cleanstream 550/H1500 is a 550 Watt liquid-cooled thermoelectric heat exchanger combined with a 1500 Watt heater with all process fluid wetted parts fabricated from high density PFA Teflon. It does not use Freon or any other replacement gas. From conception, this cooler has been designed for long life and ease of use. The internal thermoelectric modules have lifetimes greater than 200,000 hours.

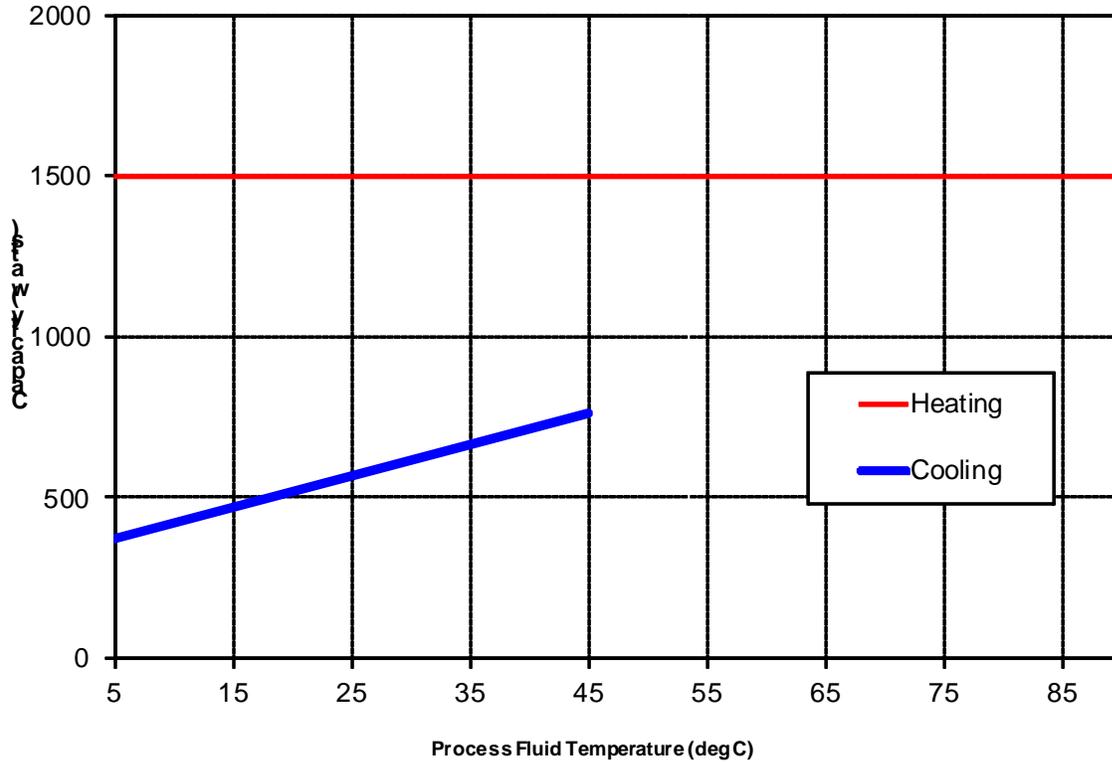
A complete system includes the Switchback 6600 CE Power Supply or Power Supply/Temperature Controller (see separate manual), which when interfaced to a PID temperature controller, can control process fluid temperatures to within ± 0.05 °C.

2.0 SPECIFICATIONS

Operating Range (Set Point):	10°C to 90°C
Ambient Temperature Range:	10°C to 40°C non-condensing
Stability / Repeatability:	±0.05°C with constant load (even near ambient)
Cooling Capacity (typical ¹):	550 Watts @ 25°C with 20°C facility water
Heating Capacity (typical ¹):	1,500 Watts @ 25°C with 20°C facility water
Process Fluid:	Up to 50% HF solution, organic solvents, other PFA Teflon compatible fluid
Process Fluid Fittings:	(see options)
Process Fluid Flow Rate:	4-10 gpm (15-38 lpm) with parallel flow (4:1 fittings) 2-4 gpm (8-15 lpm) contact SSCS 0.5-2 gpm (2-8 lpm) with series flow (Low flow Option)
Required Facility Water:	2-4 gpm (8-15 lpm) @ 10-35°C filtered, treated recirculating facility cooling water with pH: 6.5 to 8.2
Facility Water Fittings:	3/8" Female NPT
Maximum Pressure:	Process: 90 psig @ 40°C, 55 psig @ 90°C Facility: 100 psig
Wetted Materials:	Process: HDPFA Teflon Facility: Teflon impregnated anodized aluminum
Dimensions (L x W x H):	17.5" x 11.25" x 4.93" (44.4 cm x 28.6 cm x 12.5 cm) with insulation 16" x 9.75" x 3.43" (40.6 cm x 24.8 cm x 8.7 cm) without insulation
Weight:	38 lbs (17 kg)
Power Requirements:	Switchback 6600 set to 0-144 VDC, 0-12.5 Amps
Standards	Semi S2-0200, F47 compliant, CE

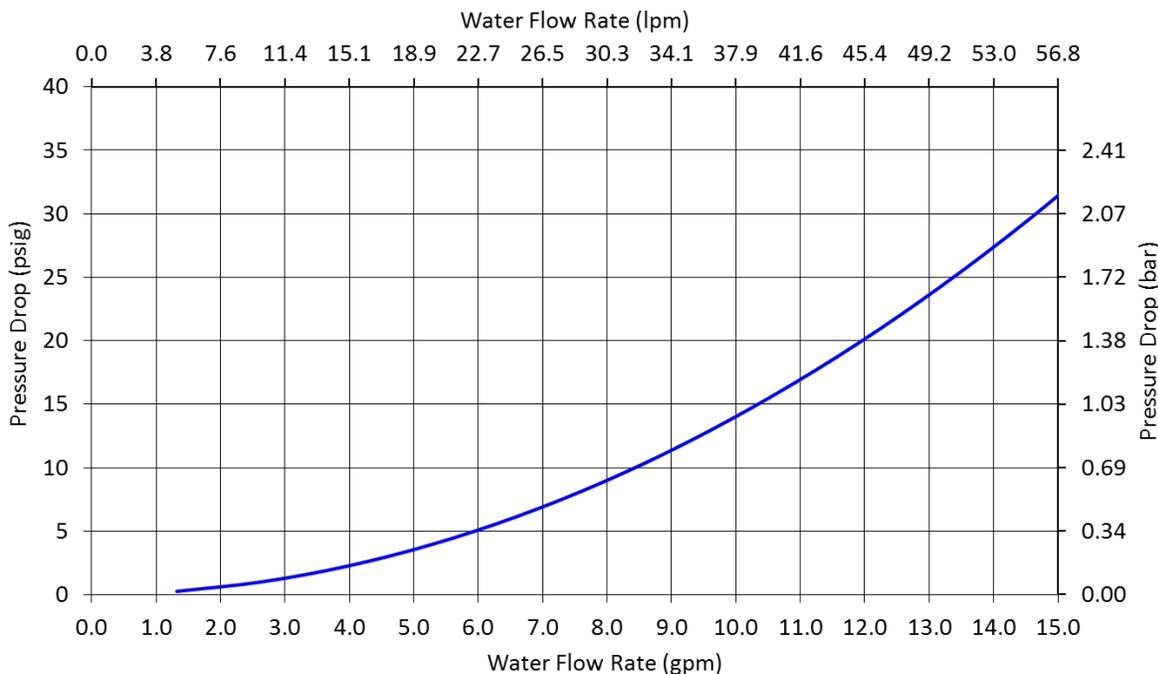
Note 1: See Figure 1 for cooling and heating capacity as measured at SSCS. Conditions at SSCS were 4 gpm process flow rate and 6 gpm facility water flow rate. Higher process or facility water flow rates will improve cooling capacity.

Figure 1: Cleanstream 550/H1500 Cooling and Heating Capacity



Teflon Manifold Options:	
-0	No manifold
-1	4x1 Fitting, 1" Weld Stub PN 32-11315-1 (set of 2)
-2	4x1 Fitting, 3/4" Flaretek PN 32-11315-2 (set of 2)
-3	4x1 Fitting, 1" Flaretek PN 32-11315-3 (set of 2)
-8	Low Flow Option w/U-tubes PN 30-22840-1 (x3) and PN 30-22841-1 (x3)
Insulation Options:	
-ICH	Insulation for Cleanstream 550/H1500

Figure 2 Cleanstream 550/H1500 Pressure Drop vs Flow Rate (water @ 20 deg C)



3.0 INSTALLATION



WARNING

SSCS recommends choosing the insulation option to protect the user from potentially hot or cold surfaces

Proper installation requires:

- 1) Mounting the Cleanstream either vertically (electrical connections at the top) or with its large flat surface horizontal per section 3.3.
- 2) Properly connecting the thermostat interlocks to the Switchback power supply per section 3.1 and figure 5.
- 3) SSCS recommends purchasing the insulation option to protect operators from hot or cold surfaces.
- 4) SSCS also recommends the user place a leak detector under the Cleanstream process and house fluid connections to shut down the circulating fluids in the event of a leak.
- 5) Reviewing all process chemical hazards (flammability and toxicity) and insuring in the event of a leak, toxic fumes cannot come in contact with operators and, when flammable chemicals are used, no surfaces exceed the chemical’s flash point and exhaust flow prevents vapor concentrations from reaching their lower explosive limits.

3.1 Electrical Connections

All electrical connections to the Cleanstream 550/H1500 come through a Hummel connector PN 7.621.000.000. A single 5m (16ft) cable is provided (SSCS PN 16-13253-XY) to connect the Cleanstream to a Switchback 6600 CE power supply or Switchback 6600 CE power supply/temperature controller. The mating connector on this cable is a Hummel right-angle receptacle PN 7.576.500.000. This cable is described in Figure 3 and Table 1.

Figure 3 Cleanstream Electrical Interface Cable

**Table 1**

Pin#	Wire Color	Wire Size	Description
1	RED	12 AWG	DC(+) to TEC's or Heaters
3	BLK	12 AWG	DC(-) to TEC's or Heaters
↓	GRN/YEL	12 AWG	Earth Ground
A	YEL	26 AWG	Over Temperature Thermostat
D	WHT	26 AWG	Over Temperature Thermostat

The Switchback Power Supply/Temperature controller maximum current dipswitch is preset to 12.5A and the maximum voltage dip switch is preset to 144 VDC.

Thermostats: The yellow and white 26 AWG wires connect to four thermostats for shutting down the thermoelectric system in the event of a temperature excursion on either the house or process plates. All four thermostats are wired in series and trip as follows:

- One 120 °C normally closed, reset at 100 °C thermostat on each process plate
- One 55 °C normally closed, reset at 35 °C thermostat on the house water plate
- One 4 °C normally open, reset at 14 °C thermostat on the house water plate

Important: When using the Cleanstream unit in conjunction with the Switchback 6600 CE power supply, wire the thermostats in series with the LOCAL ON/OFF signal (even if running in remote mode).

See Figure 4 for the typical electrical hook-up from these thermostats to a Switchback 6600 power supply or power supply/temperature controller.

Important: Older Cleanstream systems may have different style electrical connectors for Switchback hookup (16 pin or 4 pin Fisher connectors). Please contact Solid State Cooling Systems for information on these older style connectors.

**WARNING**

Failure to connect the Cleanstream thermostat wires to the Switchback Local On/Off signal will cause the Cleanstream surfaces to become excessively hot or cold when process fluid flow or PCW flow is lost. This will create a burn hazard and lead to premature failure of the Cleanstream.

3.2 Plumbing Connections



CAUTION

The Cleanstream Facility Water (PCW) cold plate contains a gasket that must stay wet to seal properly. If a Cleanstream sits unused in a dry area for an extended period of time, this gasket can dry out. SSCS recommends wetting the gasket prior to use. See section 3.3 for details.

See Drawing Number 19-11424-1. Facility water connections are 3/8" FNPT. Clean water is very important for long life of the Cleanstream 550/H1500 heat exchanger. Water must be filtered (≤ 20 micron filter) treated recirculated industrial water, pH 6.5 – 8.2. Tap or city water will deposit calcium inside the heat exchanger, substantially reducing the heat exchanger's efficiency.

Process fluid connections are eight 3/8" x 0.030" PFA tubes, four inlet and four outlet. Two 4 x 1 PFA/PTFE reducer fittings (3/8" x 3/4") are also included to facilitate hook-up.

NOTE: The maximum process pressure is 2.75 bar (40 psig).

Never operate the process fluid below 5 °C as the water could freeze inside the heat exchanger, causing it to burst.

3.3 Wetting the PCW Gasket Prior to Installation

The Cleanstream Facility Water (PCW) cold plate contains a gasket that must stay wet to seal properly. SSCS recommends wetting the gasket prior to use. Stand the Cleanstream up on the end opposite the electrical connections. Pour ~50ml of water into the facility water (PCW) cold plate at the top and let the Cleanstream sit for an hour. The gasket will now be wetted.

3.4 Mechanical Layout/Mounting

Heater Side Up
Yellow Insulation
Toward Top



The Cleanstream 550/H1500 may be mounted in any orientation for operation, though mounting the unit with the PFA Teflon tubes exiting the top will make draining the unit for servicing very difficult. The preferred orientation is horizontal or vertical with the PFA tubes exiting the side. (See Drawing # 19-11424-2.) The Cleanstream 550/H1500 comes with eight (8) 10-32 mounting holes located on the end opposite the electrical connections. Alternatively, the Cleanstream 550/H1500 may be placed inside an enclosure made of PVDF or other fire-retardant plastic resistant to the process chemicals or may be clamped or strapped to any thermally insulated frame that can support 40 lbs. (18 kg).



CAUTION

IMPORTANT: If the Cleanstream 550/H1500 is not placed in a purged enclosure free from moisture, SSCS strongly recommends selecting the insulation option. If the Cleanstream is not installed in a moisture free environment and the insulation option is not chosen, then you must orient the Cleanstream vertically (with the electrical connector on top) or horizontally with heater side facing up (the side opposite the label – see picture). Failure to orient the Cleanstream 550/H1500 in this manner can lead to condensation from the cooling side running down the edges of the Cleanstream and shorting out the heater.



CAUTION

Note: If mounted vertically, the house water must enter from the bottom.

Orienting the Cleanstream with the facility water out connection on the bottom will cause air to be trapped in the Cleanstream cold plate, causing it to not properly cool the internal thermoelectric modules, leading to premature failure

3.5 Recommended Safety Precautions



DANGER

Failure to provide leak detection or sufficient exhaust air can lead to hazardous toxic and flammable conditions in the event of a leak.

When flammable process fluids are used, failure to prevent leaks from contacting surfaces at or above the flash point of the chemical can lead to fires in the event of a leak.

The user must review the combustible and toxic properties of all process fluids and take all precautions necessary to protect operators against leak. This includes meeting all governmental regulations and industry standards.

3.5.1 Leak Detection

Solid State Cooling Systems (SSCS) recommends installing liquid and, when highly toxic or flammable process chemicals are used, gas leak detectors in the enclosure where the Cleanstream is mounted. In the event of a leak, the leak detector should automatically shut down the process fluid flow and issue an alarm to the operators.

3.5.2 Combustible Fluids

The user must review the combustible properties of all process fluids. The user is responsible for providing sufficient cabinet exhausting to ensure any process fluid leaks cannot cause explosive gas mixtures to occur. In addition, the enclosure housing the Cleanstream should not have any surfaces at temperatures above the flash point of the process fluid.

3.5.3 Exhaust Recommendations

SSCS recommends placing the Cleanstream inside an enclosure with a chemically scrubbed exhaust with a flow rate that conforms to Semi S2 requirements and secondary containment of the process chemicals should a leak occur. The Cleanstream contains continuous pieces of PFA Teflon tubes, so internal leaks are very rare. The most likely source of leaks is improperly tightened plumbing fittings.

3.5.4 Seismic Recommendations

If the Cleanstream 550/H1500 is to be operated in a seismically active area, SSCS recommends mechanically clamping the it to a rigid structure with metal bars or fastening it to a rigid structure via the eight (8) 10-32 mounting screws. Using the top left view of 19-11347-2 (next page), the Cleanstream 550/H1500's center of mass is located 6.75" from the right edge (opposite the electrical connector), at the midpoint of the 9.73" dimension, and halfway down into the 3.15" thickness.

Figure 4: Mechanical Layout

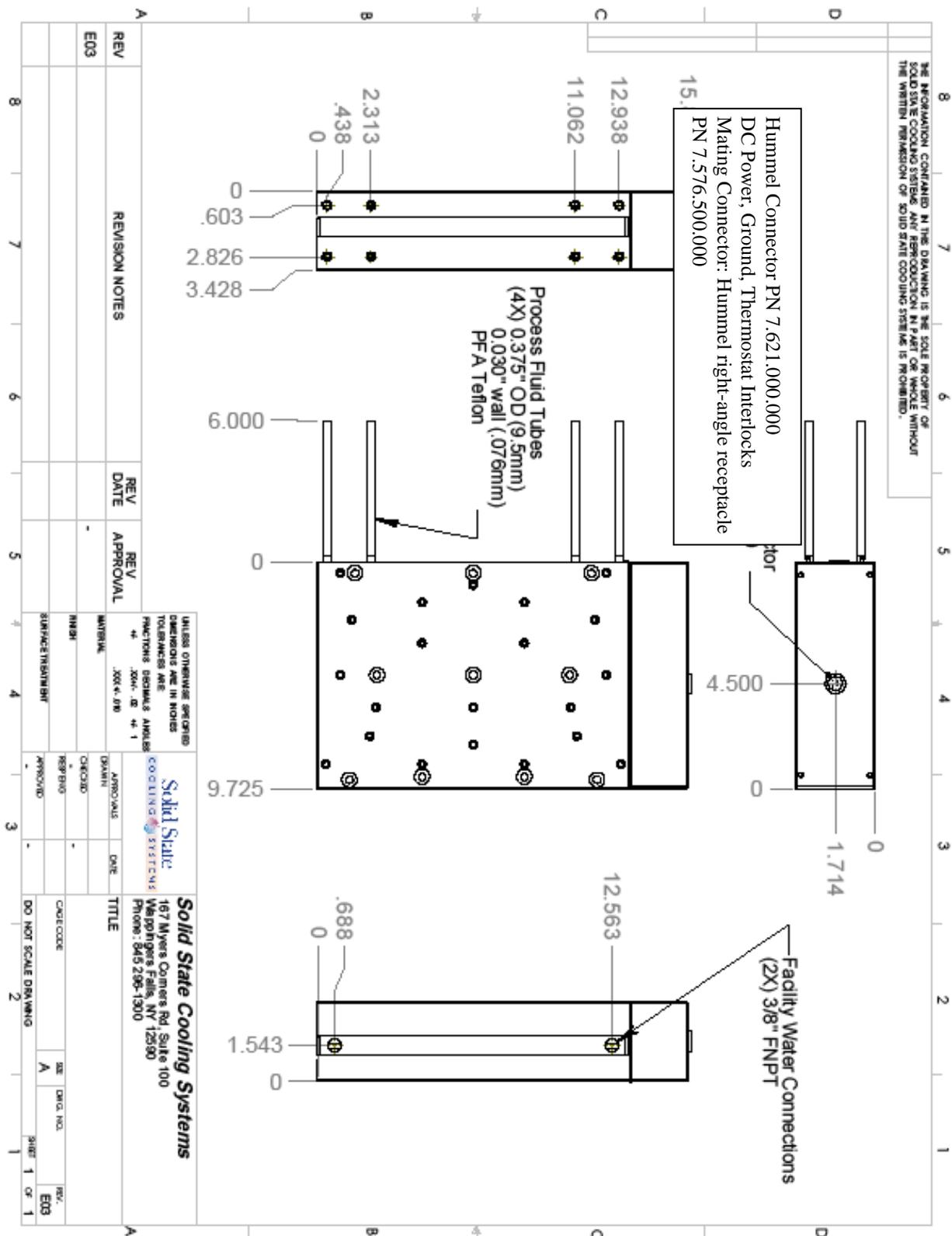
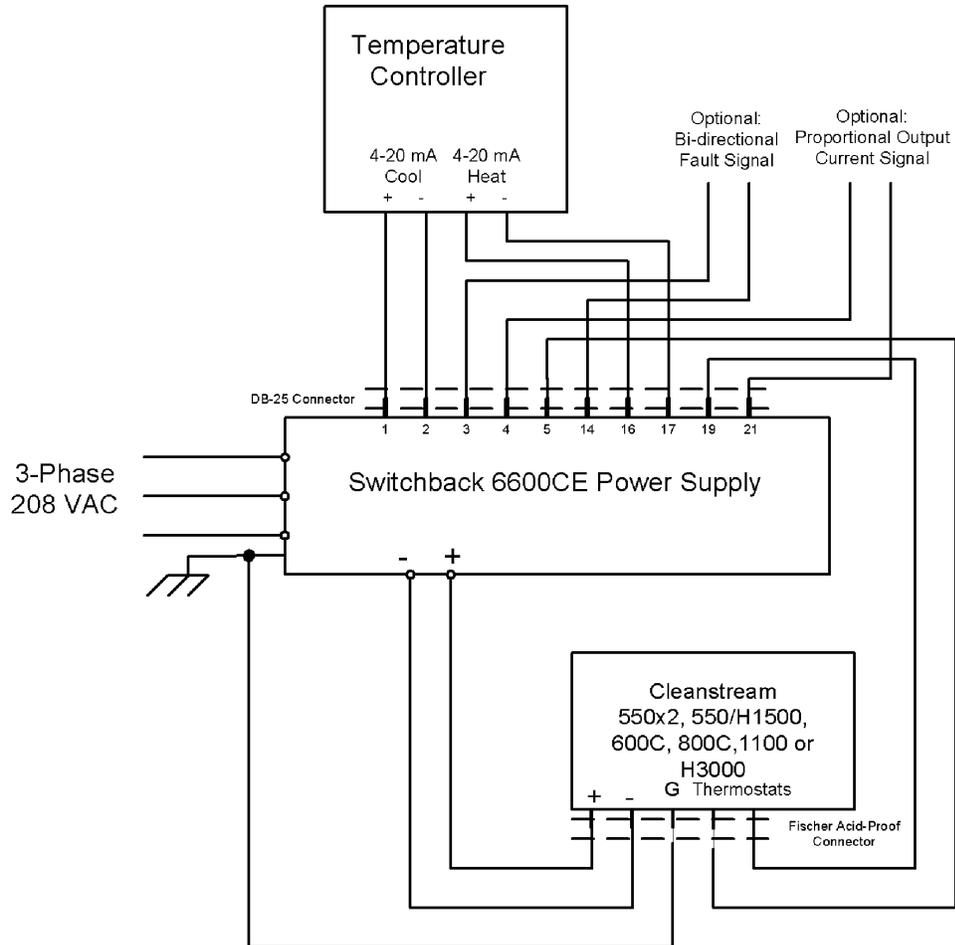


Figure 5: Electrical Hook-up

APPLICATION		REVISIONS			
NEXT ASSY.	USED ON	REV.	DESCRIPTION	DATE	APPROVED
		E2	Add Cleanstream 550-800 models Add Notes 2 & 3	09/03/08	LFW



- Notes:**
- 1) 4-20mA Cool signals not required for H3000
 - 2) When hooking up to the Switchback 6600 CE Power Supply/Temperature Controller no external Temperature Controller is used
 - 3) When hooking up to the Switchback 6600R or Power Supply/Temperature Controller all DC power and thermostat connections are included in the interconnect cable, no external connections to the Switchback are required.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± X/X XX ± XX ± X ° XXX ± XXX	DO NOT SCALE DRAWING		Solid State Cooling Systems 167 Myers Corners Road Wappingers Falls, NY 12590 Phone: (845) 296-1300		
	APPROVALS				
MATERIAL	DRAWN	Lloyd Wright	05/01/02		TITLE Electrical Schematic, Cleanstream 1100/H3000 to Switchback 6600CE
N/A	CHECKED	J Gaspar	05/01/02		
FINISH	ENGR.	Lloyd Wright	05/01/02		DWG. NO.
none	APPROVED	Lloyd Wright	05/01/02		17-11504-1
SURFACE TREATMENT					REV.
none					E2
					SHEET
					1 of 1

4.0 OPERATION

Install the Cleanstream 550/H1500 heat exchanger by following the steps below:

- 1) Connect the house water fittings to the two 3/8" FNPT connections using thread sealant on the male pipe threads.
- 2) Leak check the house water fittings.
- 3) Connect the 4:1 PFA reducer fittings to the two sets of PFA process fluid tubes.
- 4) Leak check the PFA fittings.
- 5) Connect the power/thermostat cable 16-13253-XY to the Switchback 6600 power supply or power supply/temperature controller as shown in Figure 5.
- 6) Plug female electrical connector (Hummel right-angle receptacle PN 7.576.500.000) into the male connector on the Cleanstream; this connected is keyed and will only plug in if correctly aligned. Rotate the latching collar while applying light pressure on the plug until the collar latches in place.
- 7) Turn on the facility water flow.
- 8) Turn on the process water flow.
- 9) Turn on power supply circuit breaker.
- 10) Begin operation.



Perform leak checking with water, not process chemicals.



Important: Observe the following warning symbols on the Cleanstream 550/H1500:

Burn Hazard -- Hot Surface. Top surface temperatures of the Cleanstream 550/H1500 may reach 120 °C during normal operation.

Do Not Touch. Severe burns may occur due to hot surfaces. See above.

Low Temperature -- Cold Surface. Surface temperatures may reach -15 °C during normal operation.

5.0 THERMOELECTRIC MODULE RELIABILITY



CAUTION

Using ON/OFF or PWM control will lead to premature failure of the Cleanstream. Always use a controller with 4-20mA or 0-5VDC output with full PID control.

Thermoelectric modules are extremely reliable (>200,000 hours MTBF) when operated properly. The primary failure modes for thermoelectric modules are:

- 1) Overheating,
- 2) Ramping power too quickly,
- 3) Frequent power cycling back and forth from heating to cooling.

The thermostats mounted on the Cleanstream unit are designed to prevent overheating of the modules (Failure Mode #1).

To prevent Failure Mode #2, the Switchback 6600 power supply or power supply temperature controller limits the rate of change of power to the thermoelectric modules to ensure long thermoelectric module life.

To prevent Failure Mode #3, tune your temperature controller for the actual set-point to ensure smooth temperature control.

6.0 MAINTENANCE



DANGER

Read the SDS's for all process chemicals and take all recommended precautions prior to decontaminating a Cleanstream 550/H1500C or 550/H1500.

The Cleanstream 550/H1500 does not require any routine maintenance. Before removing the Cleanstream from a system that contains corrosive or toxic chemicals, disconnect power via the lockout/tag-out procedure below, then use the following decontamination procedure:

- 1) Flush all tool plumbing lines with DI water until all toxic or corrosive chemicals have been removed.
- 2) Disconnect the Cleanstream 4x1 fittings from the tool.
- 3) Connect the Cleanstream 4x1 Fittings to DI water. Flush the Cleanstream for 30 minutes at a flow rate of at least 2 gpm (8 lpm).
- 4) Using a clean-room wipe soaked in DI water, wipe all exterior surfaces of the Cleanstream to remove any chemical residue.
- 5) Dry the exterior surfaces with clean-room wipes. Isopropyl alcohol may be used to speed the drying process.

7.0 LOCKOUT/TAG-OUT

Lock Out

Lock out the DC power to the Cleanstream via the following procedure:

- 1) Disconnect AC power from the Switchback 6600 by turning off the customer supplied electrical disconnect.
- 2) Unlatch the DC power plug from the Cleanstream.
- 3) Place a safety padlock through the main AC power connector to the Switchback 6600 so AC power cannot be plugged into the Switchback with the padlock in place.

Tag Out

When locking out the main AC power receptacle, place a lockout tag through the main AC power connector latch to identify contact person/phone number. Never attach a lockout tag without first locking out the connector latch with a padlock.

8.0 TECHNICAL SUPPORT

Delighting our customers is our highest priority. Please contact us immediately for technical assistance whenever you have questions or concerns. We can be reached in New York State by telephone at (845) 296-1300, by fax at (845) 296-1303 or via e-mail at: info1@sscooling.com.

WARRANTY POLICY

Solid State Cooling Systems offers a full parts and labor warranty on its products. The length of a warranty is product-specific, depending on the type and planned usage of the product, but will be specified in the quotation upon which a purchase order is made. Prototypes are not warranted, but will be repaired/adjusted after original shipment until they meet the agreed-upon specifications. Malfunctioning products should be returned to Solid State Cooling Systems by the method described below. Solid State Cooling Systems will provide a Failure Analysis Report to the customer and will determine if the problem is covered under the warranty.

Warranty Coverage:

Products with defects in components or manufacturing which are reported to Solid State Cooling Systems before the end of the warranty period will be repaired or replaced at no cost (see below for reporting requirements). The warranty period begins on the date the product was initially shipped from Solid State Cooling System's factory.

Excluded from Warranty:

Excluded from warranty is any damage caused to the product occurring during, but not limited to, such events as shipment, installation, storage, or usage occurring during a situation specifically cautioned against or noted in the product manual.

Specific situations, which invalidate the warranty, include (but are not limited to):

- Removing the serial number label.
- Any disassembly (partial or complete) of a heat exchanger, which includes removing the tape on the sides, loosening or removing the bolts, or separating the heat sinks.
- Subjecting a heat exchanger to temperatures below the freezing point of the heat transfer fluid contained inside the unit.
- Subjecting a heat exchanger to unfiltered water.
- Subjecting any product to temperature, voltage, current, or pressure (internal or external) greater than that specified in the product manual.
- Employing pulse-width-modulated control at less than 1000 Hz.
- Any actions prohibited in the "Caution" section of the product manual.

Returned Goods Procedure and Reporting Requirements

Before a failed product is returned to the factory, a Returned Materials Authorization (RMA) number must be obtained from Customer Service at (845) 296-1300. The date the RMA is requested will be the reporting date noted and relevant to the warranty. Products, which have received an RMA, must be received at Solid State Cooling System's factory within 30 days or the reporting date will be moved ahead 30 days and a new 30-day waiting period will begin.