

# PyroPure Pure Steam Generators

## The Mueller PyroPure P7000 Series Advantage

Mueller PyroPure pure steam generators are capable of producing pyrogen-free pure steam that, when condensed, meets all U.S. Pharmacopoeia (USP) requirements for use in autoclaves, critical area humidification, and routine steam-in-place (SIP) sterilization.

Feedwater enters the system and flows through two level control valves and then into the tube side of the blowdown cooler. In the blowdown cooler, heat is transferred between the feedwater on the tube side and the blowdown exiting the system through the shell side. Correspondingly, the blowdown exits the system at a lower, safer temperature, and the feedwater enters the system at a higher, more efficient temperature.

The heated feedwater flows into the steam separator while filling the lower part of the steam separator, the tube side of the evaporator, and the level indicator assembly to a factory-determined range controlled by level indicator switches. At the same time, utility steam enters the shell side of the evaporator. Latent heat from steam is rejected to the feedwater through the walls of the evaporator tubes. The feedwater is evaporated, and the resulting vapor is propelled from the evaporator into the steam separator where any impurities are removed from the steam by centrifugal force. Pyrogen-free steam exits from the top center of the separator and feeds the pure steam distribution system.

## Simple Design, Reliable Operation

- An external evaporator provides improved access for inspection and preventative maintenance on critical o-rings and gaskets.
- The separation column contains no internal components that require inspection or periodic maintenance.
- All maintenance (including replacement of critical components) can be performed with only 24" of space on all sides (including the top) of the equipment.
- Minimal instrumentation is required for equipment operation. Only one control loop is needed which minimizes the calibration required, as well as the potential for downtime.
- All components are fully drainable, including the feedwater pump.
- All elastomers in contact with feedwater and product are provided with USP Class VI certifications.
- ASME BPE certified fittings are used throughout the design.
- All product contact surfaces are polished to 20 Ra maximum and electropolished. Surfaces in contact with feedwater are polished to 25 Ra maximum. All surfaces in contact with feedwater and product are manufactured from 316/316L stainless steel.



## System Components

**Evaporator.** The natural circulation design of the PyroPure double-tubesheet evaporator ensures maximum surface wetting, eliminating the hot, dry areas that lead to the stress cracking associated with other designs. The tube bundle creates a large heat transfer surface that vaporizes feedwater almost instantly to allow the unit to respond to large loads. Mueller PyroPure pure steam generators have a fully drainable external evaporator, eliminating the need for the excess headroom required for evaporator removal with other designs. All surfaces that come into contact with pure vapor or distillate are made of type 316L stainless steel, including the sanitary clamp-type connections and seamless tubes.

**Blowdown Cooler Assembly.** The blowdown cooler assembly serves two functions in making the PyroPure pure steam generator as reliable and efficient as possible: pre-heating the feedwater and cooling blowdown. By transferring heat from blowdown to incoming feedwater, the blowdown cooler serves to preheat the feedwater while cooling wastewater and preventing it from flashing into steam as it exits the high-pressure separator. Blowdown temperatures are consistently less than 140°F (60°C) when constantly fed with ambient temperature feedwater.

**Steam Separator.** As the mixture of water and vapor leaves the evaporator at high velocity and enters the steam separator through a tangential port, a natural vortex is formed. The centrifugal force of the vortex separates water droplets and contaminants out of the spiraling vapor. Pure vapor rises up through the steam separator and out of the pure steam outlet at the top of the generator. Because the separator has no baffles or demister, there are no auxiliary surfaces for condensation to accumulate and stagnate. Consequently, concerns over potential bacterial growth are eliminated.

**Controls.** The standard control system is an Allen Bradley PLC with an Allen Bradley operator interface mounted in a NEMA rated panel. Ethernet is provided on the standard control system to facilitate communications with adjacent equipment or data archiving systems. Mueller can also provide other Allen Bradley control components, as well as control systems from Siemens and Mitsubishi. Control and electrical panels are supplied with a UL 508a label.

## Options

**Feedwater Pump System.** The feedwater pump system enhances feedwater pressure and should be installed if feedwater supply pressure does not exceed the desired pure steam operating pressure by 15–30 psig (1–2 bar). When furnished, the feedwater pump system will be installed on the pure steam generator framework.

**Pure Steam Condensate Sampling System.** Regular product testing for regulatory compliance. The sampling system will simplify your sampling methods and enable you to draw samples for testing. The sample valve is located near the control box for easy access.

**Pure Steam Analyzer.** This option works mutually with the pure steam condensate sampling system to measure and record the temperature and conductivity of the condensed pure steam. If the conductivity rises above the user-selected setpoint, the analyzer will signal an alarm on the operator interface.

**Stainless Steel Sheathing and Frame.** Sheathing made entirely of Type 304 stainless steel enhances the general appearance of your unit and adds value to any facility. The sturdy Type 304 stainless steel frame enhances the generator's overall appearance, as well as improves the resistance to corrosion. Standard equipment includes a painted carbon steel frame and embossed aluminum insulation sheathing.

**Feedwater Analyzer.** The feedwater analyzer option continuously measures and records the conductivity of the feedwater. If the conductivity rises above the user-selected setpoint, the analyzer will signal the operator interface.

**Degasser.** To ensure compliance with regulations limiting the non-condensable gas content in pure steam the degasser may be desired. The degasser uses steam from the steam separator to heat the feedwater. As the feedwater is heated the non-condensable gases are expelled and vented from the equipment.

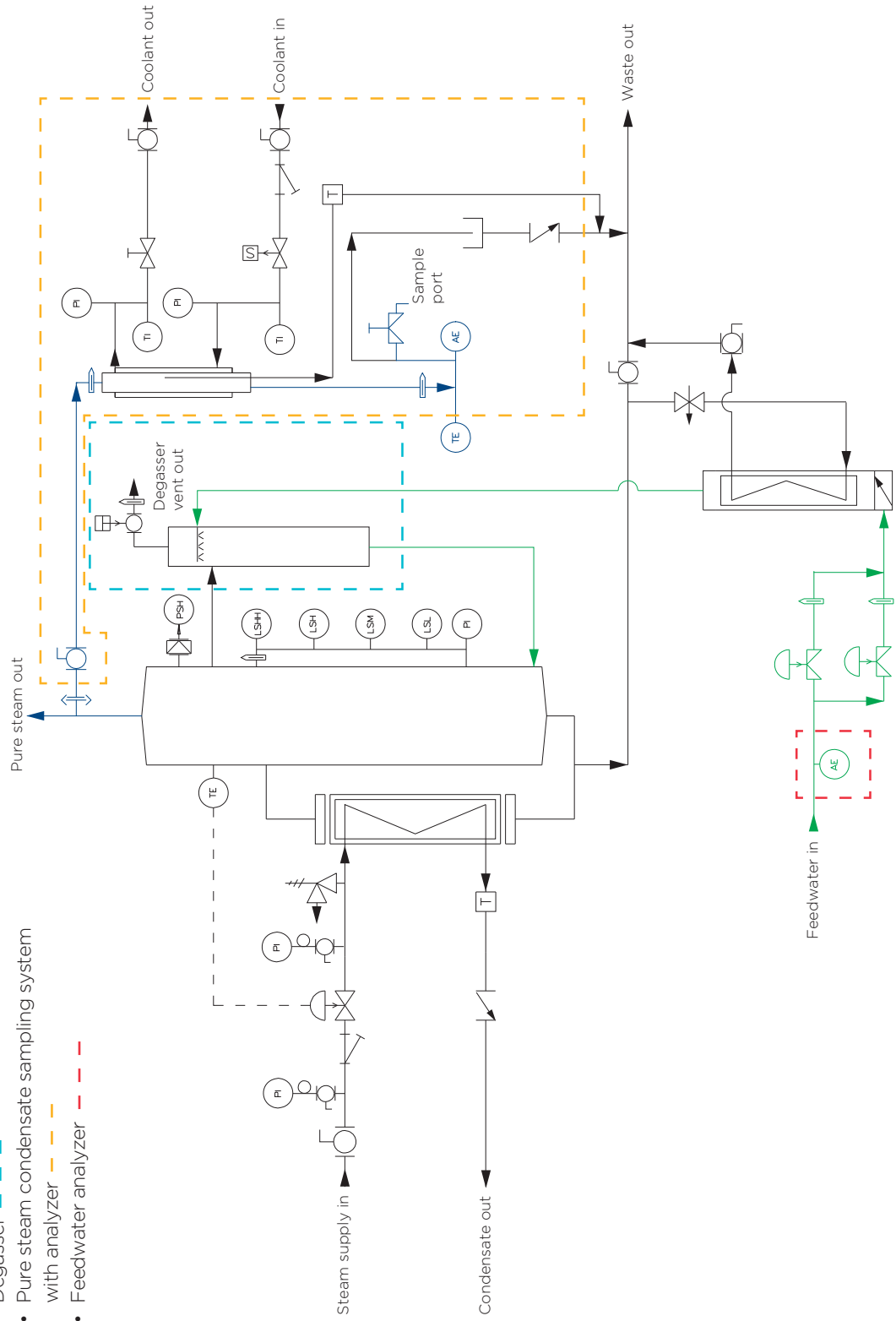
**WFI Production.** A pure steam condenser may be included with the pure steam generator to produce up to 150 gallons per hour (568 LPH) of WFI. The condenser may be provided integral to the pure steam generator skid or as a separate skid.

# The Mueller PyroPure P7000 Series Advantage

## Schematic of Operation

Optional equipment indicated:

- Degasser — — — — —
- Pure steam condensate sampling system with analyzer — — — — —
- Feedwater analyzer - - - - -



# Specifications

Model Nos.	P7060	P7140	P7145	P7310	P7315	P7500	P7505	P7990	P7995
<b>Capacity (lb/hr)<sup>1</sup></b>	600 (272 kg/hr)	1,300 (590)	1,850 (839)	2,300 (1043)	2,900 (1315)	4,000 (1,814)	5,700 (2,586)	7,300 (3,311)	10,500 (4,763)
<b>FW Inlet<sup>2,5</sup></b>	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC	1.5" TC	1.5" TC
<b>Plant Steam Inlet (150psig max.)<sup>3</sup></b>	1" Flange	1.5" Flange	1.5" Flange	2" Flange	2" Flange	3" Flange	3" Flange	4" Flange	4" Flange
<b>Pure Steam Outlet</b>	1.5" TC	2" TC	2" TC	3" TC	3" TC	4" TC	4" TC	6" TC	6" TC
<b>Condensate Outlet<sup>4</sup></b>	.75" FNPT	1" FNPT	1" FNPT	1.25" FNPT	1.25" FNPT	1.5" NPT	1.5" NPT	2" Flange	2" Flange
<b>Drain</b>	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC	1" TC
<b>Instrument Air</b>	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT	.25" FNPT
<b>FW Pressure/Quantity Req'd.<sup>5</sup></b>	Maximum of 150 psig/Maximum of 1 ppm silica or total hardness. No chlorine, chlorides, or amines.								
<b>Elec. Srv. (Std.)<sup>6</sup></b>	Without Pump: 115 VAC, 1 phase, 50/60 Hz.; With Pump: 460 VAC, 3 phase, 60 Hz. (Other voltages available upon request.)								
<b>Height<sup>7</sup></b>	94" (239 cm)	107" (272 cm)	107" (272 cm)	115" (292 cm)	115" (292 cm)	126" (320 cm)	126" (320 cm)	143" (363 cm)	167" (424 cm)
<b>Width<sup>7</sup></b>	48" (122 cm)	48" (122 cm)	48" (122 cm)	50" (127 cm)	50" (127 cm)	50" (127 cm)	50" (127 cm)	61" (155 cm)	61" (155 cm)
<b>Depth<sup>7</sup></b>	46.5" (118 cm)	46.5" (118 cm)	46.5" (118 cm)	54.5" (138 cm)	54.5" (138 cm)	61.5" (156 cm)	61.5" (156 cm)	63.5" (161 cm)	63" (161 cm)
<b>Operating/Shipping Wt.</b>	1500 lbs (680 kg)	2,150 lbs (980 kg)	2,350 lbs (1,070 kg)	2,700 lbs (1,230 kg)	2,800 lbs (1,270 kg)	5,100 lbs (2,313 kg)	5,700 lbs (2,580 kg)	8,190 lbs (3,710 kg)	9,200 lbs (4,170 kg)

<sup>1</sup> Capacity is based on a steam supply pressure of 120 psig, a pure steam header pressure of 50 psig, and a feedwater temperature of 70°F.

<sup>2</sup> Feedwater flow rate must be 5 to 10 percent greater than the pure steam volume produced to allow for blowdown (e.g., 100 lb/hr [12 gph] pure steam requires 110 lb/hr [13.8 gph] feedwater).

<sup>3</sup> If feedwater temperature is at least 160°F (71°C) then plant steam must be 20 percent greater than pure steam capacity (e.g., 100 lb/hr pure steam requires 120 lb/hr plant steam). If feedwater temperature is approximately 70°F, then plant steam must be 30 percent greater than pure steam capacity.

<sup>4</sup> Generator performance curves assume no back pressure on the condensate outlet. Any back pressure must be subtracted from the inlet supply steam pressure to figure the net effective inlet steam pressure and actual unit performance.

<sup>5</sup> If a feedwater pump is used, feedwater must be supplied at a minimum pressure of 10 psig and connection size may be larger than indicated.

<sup>6</sup> Other electrical services must be specified at time of order.

<sup>7</sup> Dimensions and weights do not include options. All specifications subject to change without notice.

# Pressure and Temperature Charts

## PyroPure Pure Steam Generator Capacity Curves

1. Select the chart(s) with pure steam capacities closest to the one you need.
2. Locate your supply steam pressure on the vertical axis.
3. Follow that line across to the point where it intersects with the curve representing your required pure steam pressure.
4. Drop down from this point to the horizontal axis to determine the model's pure steam capacity.
5. Select the model which most closely fits your capacity needs given your pressure requirements.

Note: Capacities shown are approximate and do not include an allowance for pure steam sampling.

