

GrandStand System Instructional Manual

GrandStand Modular Membrane Systems



Important user information

Users must read this entire manual to fully understand the safe use of GrandStand™ modular membrane systems.

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System Documentation and Safety

About this user guide

This user guide describes how to use GE Healthcare GrandStand™ membrane systems safely. The systems described in this guide include GrandStand Modular systems (models 450 and 550). Hereafter, this user guide refers to these systems as the *membrane system*.

Audience

This user guide addresses the needs of scientists, process engineers, and technicians who operate pilot-scale and production-scale cross flow systems. The level of information in this guide assumes the user possesses basic laboratory and technical skills. The user should have the knowledge and documentation to operate safely any user-supplied equipment connected to the membrane system. If you need assistance with the instructions in this guide, contact GE Healthcare for more information.

Where to find more information

In the USA, you can contact our customer and technical support teams by calling 1-800-526-3593. Outside of the USA, you can contact your local GE Healthcare representative using the telephone numbers listed at the back of this user guide. You can also receive customer and technical support by emailing us at these addresses:

Technical Support: ts-usa@ge.com

System documentation

In addition to this user guide, you receive binders containing specific documentation for the membrane system such as: general specification, equipment list, P&ID, spare parts list, inspection and test plan, inspection reports, functional test report, installation test report, calibration and performance certificates, panel layout, electrical schematics, I/O list and material specifications.

Material compliance

The system documentation describes the design and materials of construction of the membrane system. The wetted materials of construction in the membrane system are recognized as safe for use in food and drug-handling equipment as described for Good Manufacturing Practice by the U.S. Food and Drug Administration. You should review the system documentation to ensure the system is suitable for your needs and specific application.

Safety compliance and design standards

GE Healthcare designed the system for electrical installation in accordance with the prevailing standards in the country of destination. CE marked membrane systems (standard and custom systems) comply with EU directives and standards described in the system documentation. The compliance with the directive is valid under the condition that you install, operate and maintain the membrane system according to the system documentation and this user guide. To maintain compliance, use only spare parts approved or supplied by your local GE Healthcare representative.

Safety

Anyone who works with the membrane system should read, understand, and follow the instructions in this user guide before using the system. If any operator does not understand an instruction, they should stop working with the membrane system and contact GE Healthcare for guidance. You should save these instructions and make them available to all users of the membrane system.

GE Healthcare designed the membrane system for pilot- and production-scale filtration of biological solutions under the conditions stated in this user guide. If you use the membrane system in a manner not specified by GE Healthcare, you may impair the protection provided by the unit.

When using cross flow equipment, the potential exists for personal injury unless you follow established safety procedures. When using GE Healthcare products, you should follow OSHA¹, federal, state, and/or local safety regulations for equipment installation and operation. You should follow your company's safety regulations. You should follow the specific safety instructions provided in this user guide and any original equipment manufacturer user guides provided with your system.

Only qualified personnel with training, who understand the operating instructions, should install, operate, maintain, and inspect the membrane system.

¹ In the United States, OSHA is the Occupational, Safety, and Health Administration.

Risk assessment

GE Healthcare designed and manufactured this system to provide a high level of personal safety. The level of risk, however, is dependent on the application and environment in which the membrane system operates. To ensure safe use, you should perform a risk assessment. The risk assessment should examine your specific application and use environment. The assessment should result in user-generated safety instructions—over and above those provided by GE Healthcare—for installation, operation, and maintenance.

Warning flags

This user guide uses a warning symbol and blocks of text to provide safety warnings:

► Safety

WARNING: A safety warning flag describes conditions or actions that can cause bodily harm and describes how to avoid the risk. You must follow the warning statement for safe operation of the membrane system.

Warning symbols

The membrane hardware uses warning symbols to warn operators of potentially harmful conditions or actions. The appendix includes examples and descriptions of the equipment warning symbols used on the membrane system.

Safety warnings

WARNING

The maximum operating pressure of the system's process equipment and process lines is 4.1 barg (60 psig). If this pressure is exceeded during integrity testing, equipment failure and bodily injury can result. To ensure proper operation, and to prevent equipment failure and bodily injury, do not exceed an air inlet pressure 6 barg (90 psig) to the process lines during integrity testing.

For the membrane system, the maximum operating pressure is 4.1 barg (60 psig). Wear the appropriate personal protection devices when testing the system.

If a cross flow system leaks, it can release potentially hazardous process fluids or cleaning fluids, causing bodily harm. To prevent leaks and the release of potentially hazardous fluids, limit feed pressure to 4.1 barg (60 psig) for membrane systems. Isolate and depressurize the system before disassembling it. Periodically inspect the system's gaskets, seals, and connections for wear and damage. Wear the appropriate personal protection devices and clothing when operating and cleaning the system.

WARNING

Membrane systems accept membrane cassettes or hollow fiber cartridges depending on the model. Using cassettes or cartridges without opening the packing properly can expose you to potentially hazardous solutions. Read the safety instructions provided with your membrane cassette or hollow fiber cartridge and follow the instructions when opening the package.

WARNING

Using tap water to flush or rinse your membrane system can plug the pores of the membrane with the relatively large particulates (rust, dirt, minerals, bacteria, etc.) found in tap water. To prevent plugging the pores of the membrane, always use 0.2- μ m filtered or water-for-injection (WFI) when rinsing or flushing the membrane system, or when making up cleaning solutions or adding dilution water to process fluids. In this user guide, the term clean water means 0.2- μ m filtered water or WFI.

WARNING

Data Logging accessories do not offer automatic process control. Hence many users normally establish pump curves for the system configuration they plan to use. By establishing a pump curve, they can quickly and accurately set the pump speed to achieve the recommended flow rate during processing. To determine the flow rate without a pump curve, you would have to disconnect the retentate line and measure the flow rate using a graduated cylinder and stopwatch. If you need help in developing a pump curve, contact GE Healthcare technical support team.

WARNING

Placing objects or fingers into valves, rotating pumps, fans or other moving parts, can damage the equipment and cause bodily harm. Do not place objects or fingers into valves, rotating pumps, fans or other moving parts. See the original equipment user guide if you must work on or adjust these components.

WARNING

Moving a system without observing safety procedures can result in the system tipping over and causing bodily injury and death. Before moving the system, clean it, shut it down, and disconnect all process and utility lines. If present on the system, observe the warning labels concerning system moving and stability. See the appendix for examples and descriptions of the warning labels used on the membrane system.

WARNING

If you are exposed to infectious liquids originating from the system, bodily harm can result. To prevent illness or any other effect from infectious liquids, always maintain a safe distance from the system during drainage or other activities that may involve splashing. Also use appropriate personal protective equipment as described in your company's safety procedures.

WARNING

Some membrane systems outfitted with the SIP accessory module can be steam sterilized. If you touch piping and other system components during steaming, burns can result. Do not touch the system until you are sure that it can be done without risk, when all components in the system have reached the normal working temperature range. Special attention should be given to the parts that are marked as hot or cold with signs described in the appendix.

WARNING

If you are exposed to excessively high noise levels, bodily harm can result. Check for warning signs in your work area, and warning symbols on the membrane system indicating you need to wear hearing protection. Wear hearing protection if required to avoid bodily harm.

WARNING

If cabinet doors, equipment covers, and safety guards are not closed during operation, equipment damage and bodily harm can result. To prevent equipment damage and bodily harm, properly close cabinet doors, equipment covers, and safety guards before starting the membrane system.

System Description

Introduction

GE Healthcare manufactures standard GrandStand Modular systems. Standard GrandStand systems include these:

Ordering information

Code number	Catalog number	Description
Base System		
28-4005-31	GSMRLP550SYS ¹	GrandStand 550 Mod Sys 220VAC
28-4005-32	GSMRLP450SYS ¹	GrandStand 450 Mod Sys 220VAC
28-4004-48	GSMRLP550380V ¹	GrandStand 550 Mod Sys 380VAC
28-4004-49	GSMRLP450380V ¹	GrandStand 450 Mod Sys 380VAC
28-4004-53	GSMRLP550440V ¹	GrandStand 550 Mod Sys 440VAC
28-4004-54	GSMRLP450440V ¹	GrandStand 450 Mod Sys 440VAC

¹Includes one set of documentation. Additional sets of documents can be supplied at an additional cost.

These systems include membrane cassette and hollow fiber cartridge versions.

The membrane systems enable users to separate, concentrate, and/or diafilter biological solutions with precision.

These systems come configured for membrane cassettes or hollow fiber cartridges. By using conversion kits and rearranging components, GE Healthcare representatives can convert some standard membrane systems from a cassette system to a hollow fiber system or vice versa.

System types

The data acquisition accessories do not automatically monitor and regulate the membrane process control equipment. The operator must manually operate the pumps and valves and monitor the process conditions. The data acquisition accessories do collect process data for later analysis and display when exported to a computer with Microsoft® Excel.

Electrical system

Main power supply

The system label on the membrane system provides the power requirements and consumption information. The power consumption on the system label states the maximum amperage consumption during full load of the equipment. The system documentation also provides additional power requirement information for proper operation of the system.

When replacing a damaged power cable, use a replacement cable of the same type and dimensions.

► Safety

WARNING: If the power supply you use is not grounded to earth, equipment damage and bodily injury can result. To avoid equipment damage and bodily injury, always connect the system to a grounded (protected earth) power supply. Review local electrical code details to ensure that the type of power cable and other features are compliant.

Fuses

The membrane system main power supply is equipped with a circuit breaker inside the cabinet. The system documentation and the original equipment user guides supply information on internal power supply and instrument fuses.

Power failure and back-up

If the control system loses electrical power, the membrane system pumps stop. But the system may remain pressurized. The data collected during the run is saved up to the last autosave, which by default occurs every five minutes.

You should use an uninterruptible power supply (UPS) for the computer system used to log data to avoid the loss of data during a power failure.

► Safety

WARNING: During a power failure, or if the emergency stop button is pressed, the system may remain pressurized. Opening a line or vessel at this point could result in the release of potential hazardous process or cleaning fluid, and cause bodily harm. When recovering from a power failure or emergency shutdown, ensure all lines and vessels are depressurized before opening them up.

Emergency stop

The membrane systems are equipped with one red emergency stop button. Pushing the red emergency stop button cuts power to all electrically-powered equipment and stops the system. You can also use the main switch, to quickly stop the system. If there is no risk of personal injury, use the normal shut down procedure to shut the system down.

Chemical compatibility

All wetted parts have specific chemical resistances. See the system documentation for additional information. You must ensure the suitability of the process chemicals you use. You must consider the compatibility of the wetted parts and your process chemicals so that no negative interaction takes place, and so that your process chemicals do not damage the system components, compromising the safety of the system. Contact your local GE Healthcare representative if you are not sure of the compatibility of your chemicals.

► Safety

WARNING: If you use chemicals that are not compatible with the wetted parts of your system, equipment and product damage can result. Equipment failure leading to leaks and bodily injury can result. To avoid equipment damage and bodily injury, do not use incompatible chemicals in the membrane system. All wetted parts have specific chemical resistances. See the system documentation for additional information.

Hardware high pressure shut-off system

► Safety

WARNING: If you disconnect the system's hardware-driven, high-pressure shut-off safety system, overpressurization can lead to equipment damage, or the unexpected release of pressure or process and cleaning fluids, leading to bodily injury. To avoid equipment damage or bodily injury, do not disconnect the system's hardware high pressure shut-off system.

When the pressure exceeds the limit of the system, the hardware safety device will shut down the pumps and valves directly (not via the control system.) Factory setting is 45 psig (3.06 barg).

Before restarting the system, determine the cause of overpressurization. This is usually a result of a flow restriction in the retentate line or an increase in the recirculation pump speed. Make an appropriate adjustment in the system controls to avoid overpressurization.

Filter matrix/spool combinations

Use of a broad range of HF filters is enabled through a combination of swing elbows and piping spools. See filter housing/pipe spools table and HF filters/piping spools drawing for elbow orientation and spool piece/filter combination for the HF filter selected.

GrandStand™ 450 system specifications

Base system	GrandStand 450
Weight (approximate)	1576 lbs (715 kg)
Materials of Construction	
Frame	304 stainless steel
Fluid path	316 L stainless steel
Fluid path surface finish	< 20 Ra μ in. (0.5 Ra μm)
Kvick Flow holder surface finish Front and back plate	< 25 Ra μ in. (0.6 Ra μm)
Feed, retentate, permeate ports	< 20 Ra μ in. (0.5 Ra μm)
CIP tank	15 gal. Polypropylene (56.7 L)
Pump Type	Rotary lobe
Max Pump Flow rate	120 L/min@ 30 psig (2.07 bar)
O-rings, gaskets, valve diaphragms	EPDM
System dead volume*	9.5 L (2.5 gal)
Power requirements	GSMRLP450 SYS 220 VAC 3 Phase 50/60 Hz GSMRLP450 380V 380 VAC 3 Phase 50/60 Hz GSMRLP450 440V 440 VAC 3 Phase 50/60 Hz

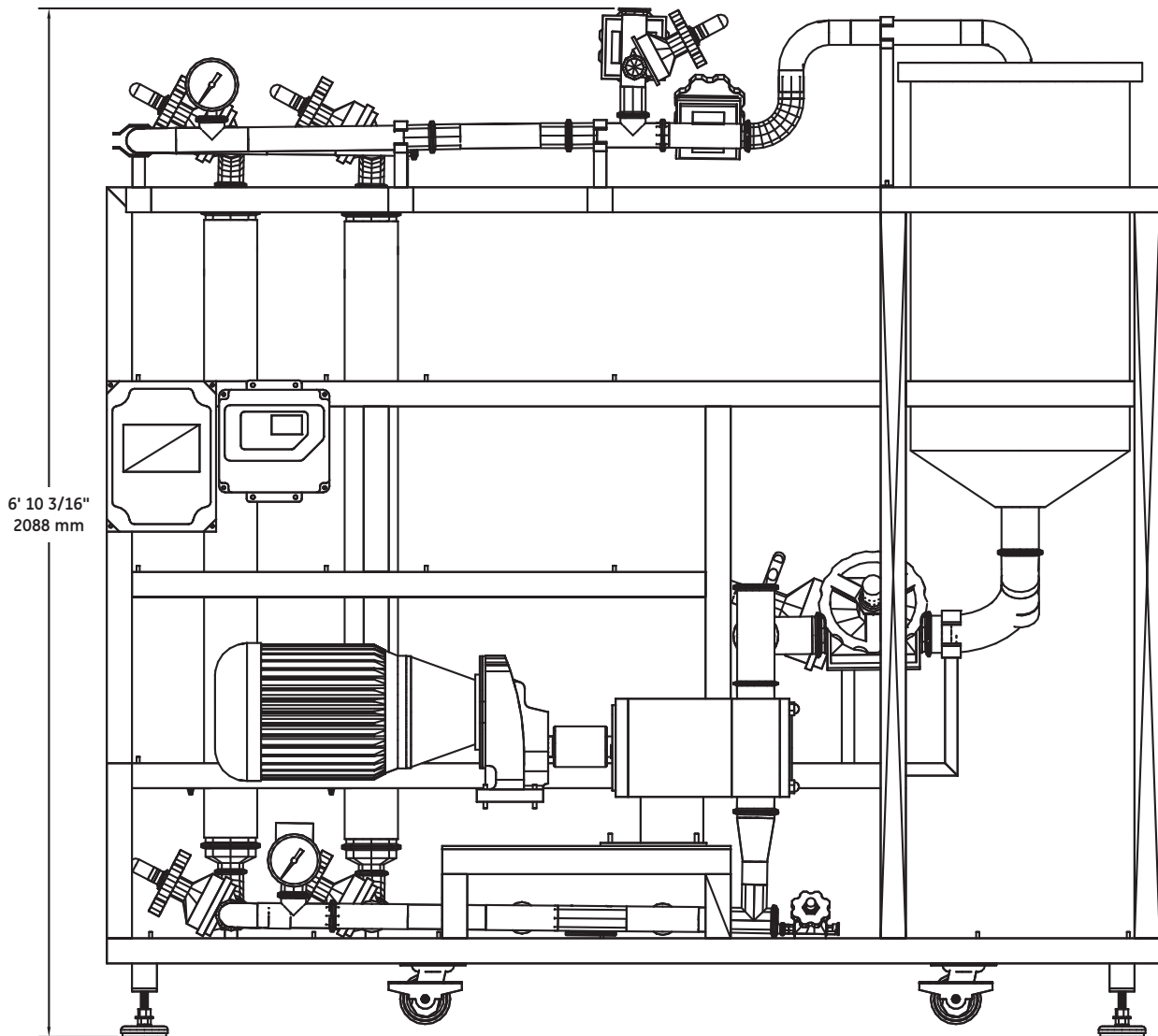
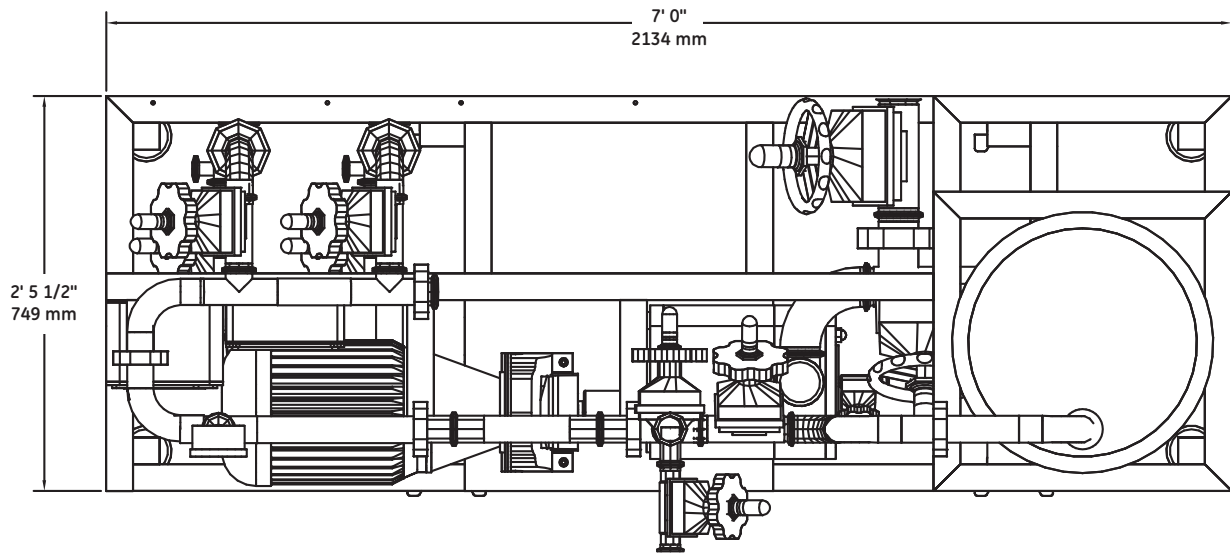
GrandStand™ 550 system specifications

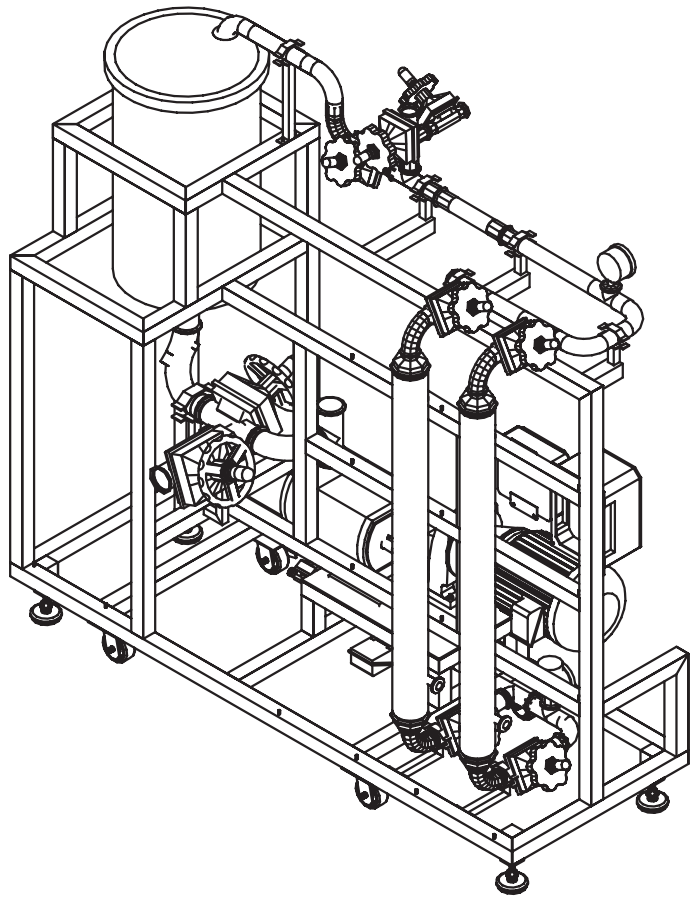
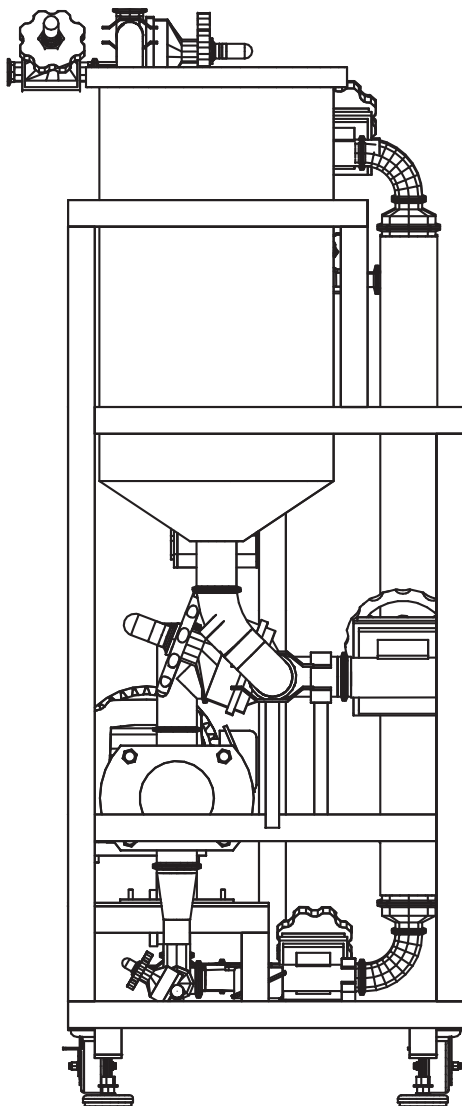
Base system	GrandStand 550
Weight (approximate)	1876 lbs (851 kg)
Materials of Construction	
Frame	304 stainless steel
Fluid path	316 L stainless steel
Fluid path surface finish	< 20 Ra μ in. (0.5 Ra μm)
Kvick Flow holder surface finish Front and back plate	< 25 Ra μ in. (0.6 Ra μm)
Feed, retentate, permeate ports	< 20 Ra μ in. (0.5 Ra μm)
CIP tank	30 gal. Polypropylene (113.5 L)
Pump Type	Rotary lobe
Max Pump Flow rate	400 L/min@ 30 psig (2.07 bar)
O-rings, gaskets, valve diaphragms	EPDM
System dead volume*	18.9 L (5 gal)
Power requirements	GSMRLP550 SYS 220 VAC 3 Phase 50/60 Hz GSMRLP550 380V 380 VAC 3 Phase 50/60 Hz GSMRLP550 440V 440 VAC 3 Phase 50/60 Hz

*Approximate base system without tank or filter cartridge

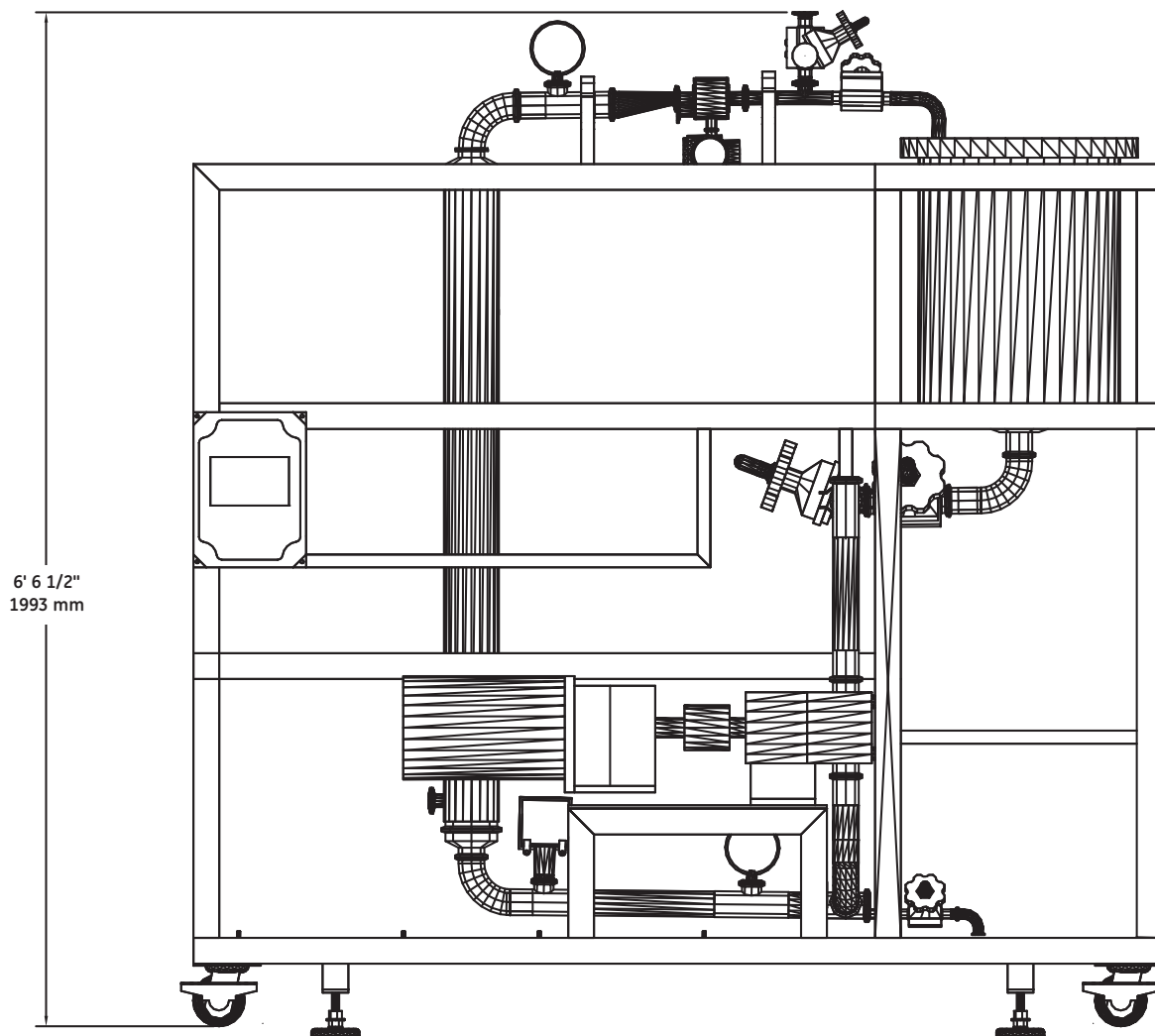
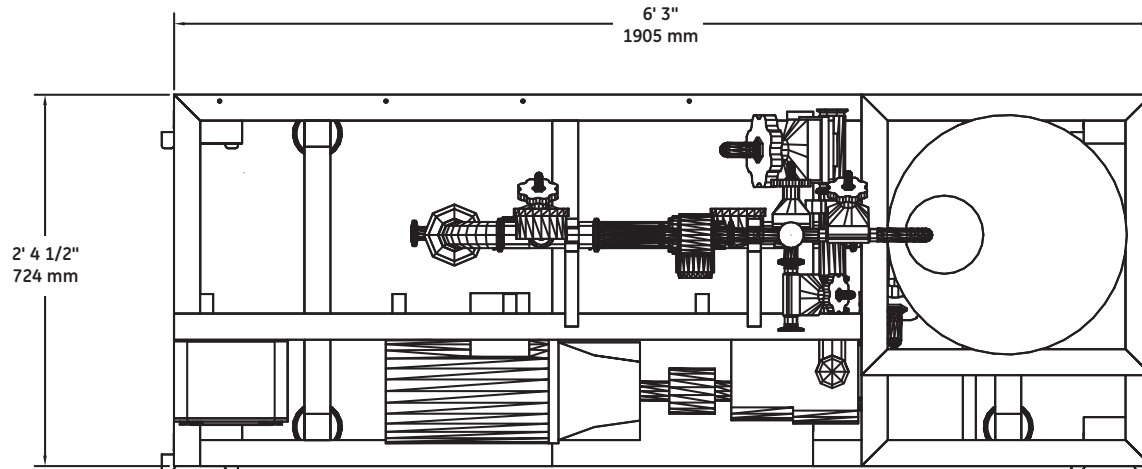
Note: To determine minimum working volume, add volume of filter holder, tank working volume to system dead volume.

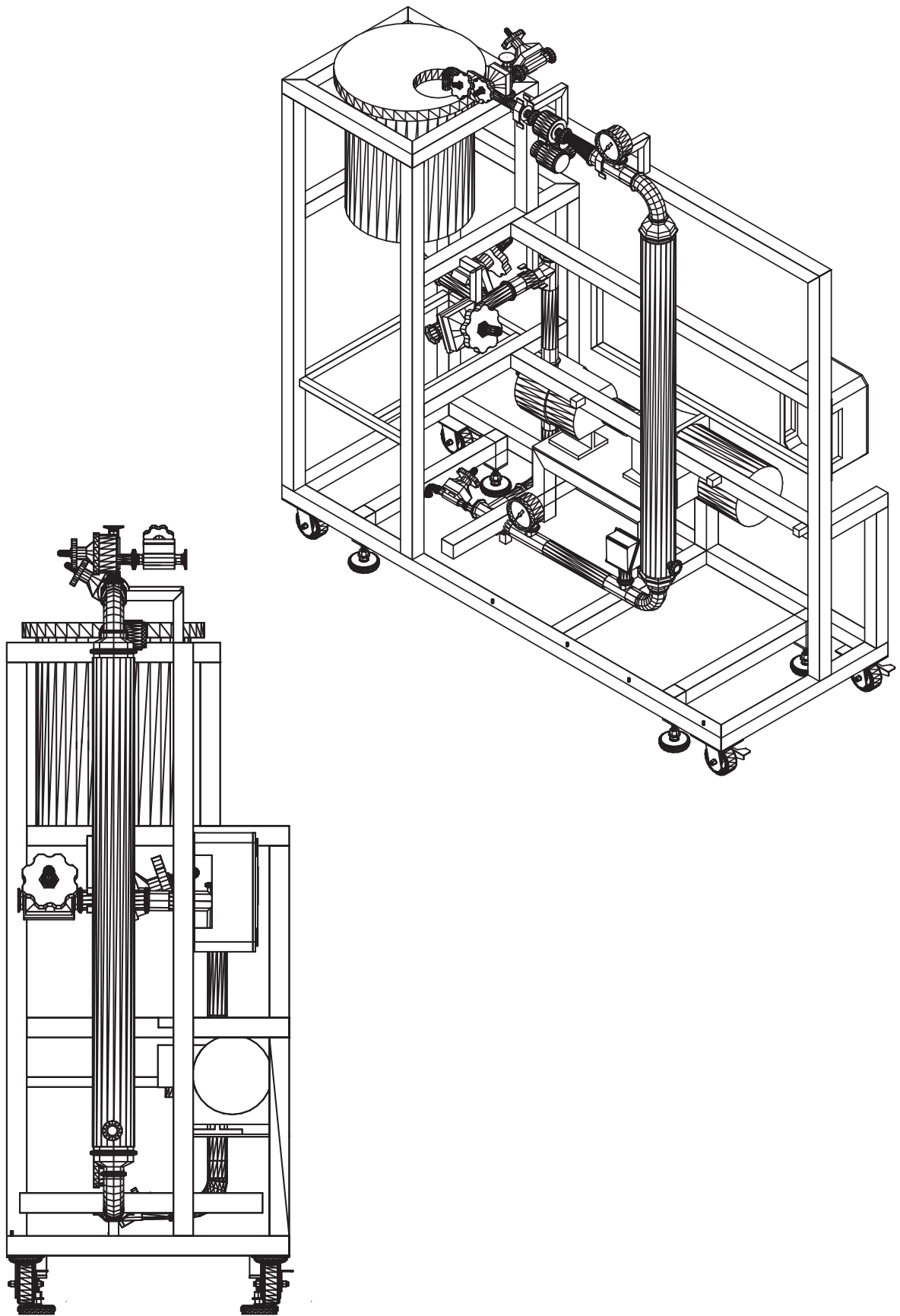
GrandStand 550 System



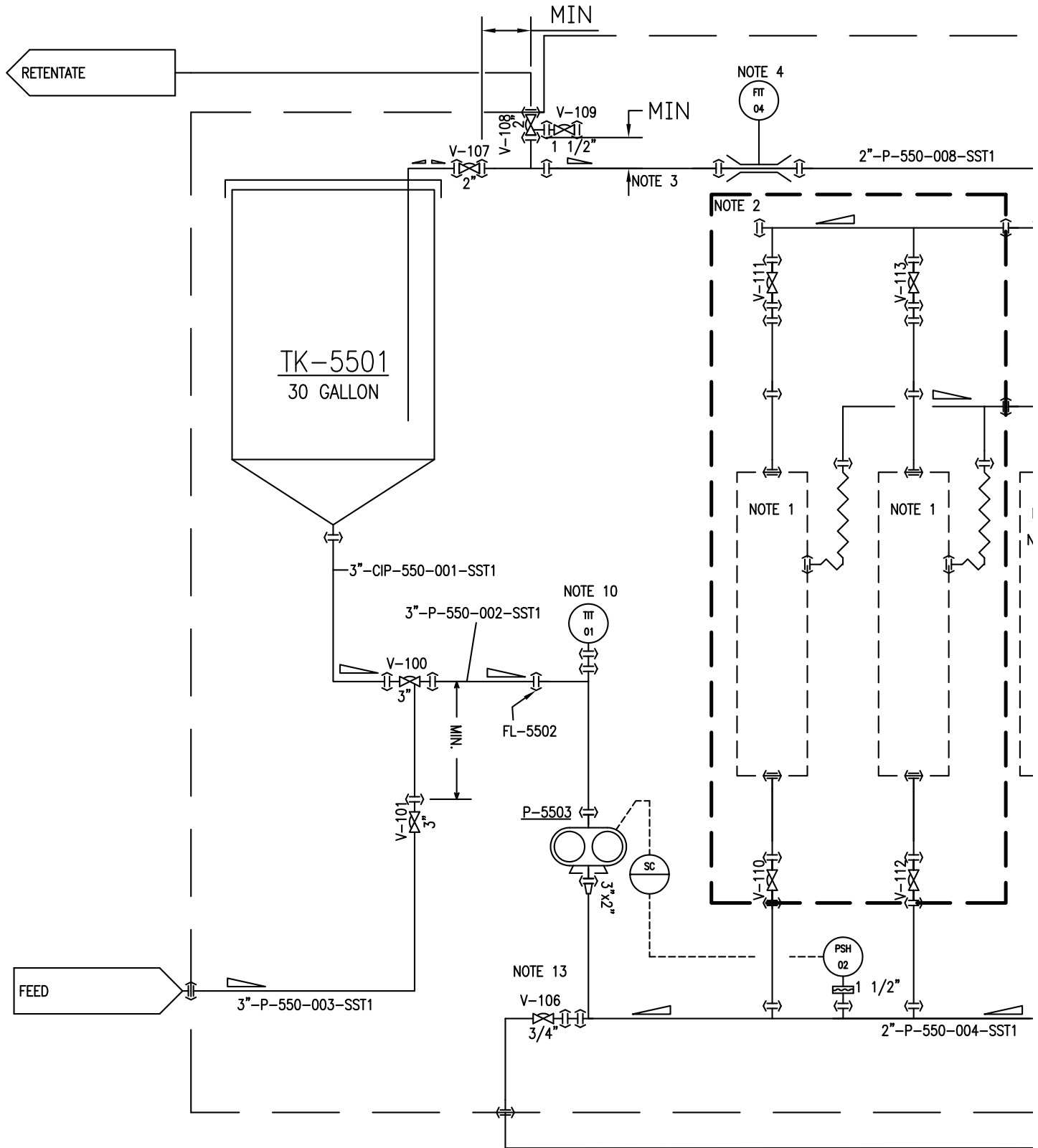


GrandStand 450 System





GrandStand 550 System

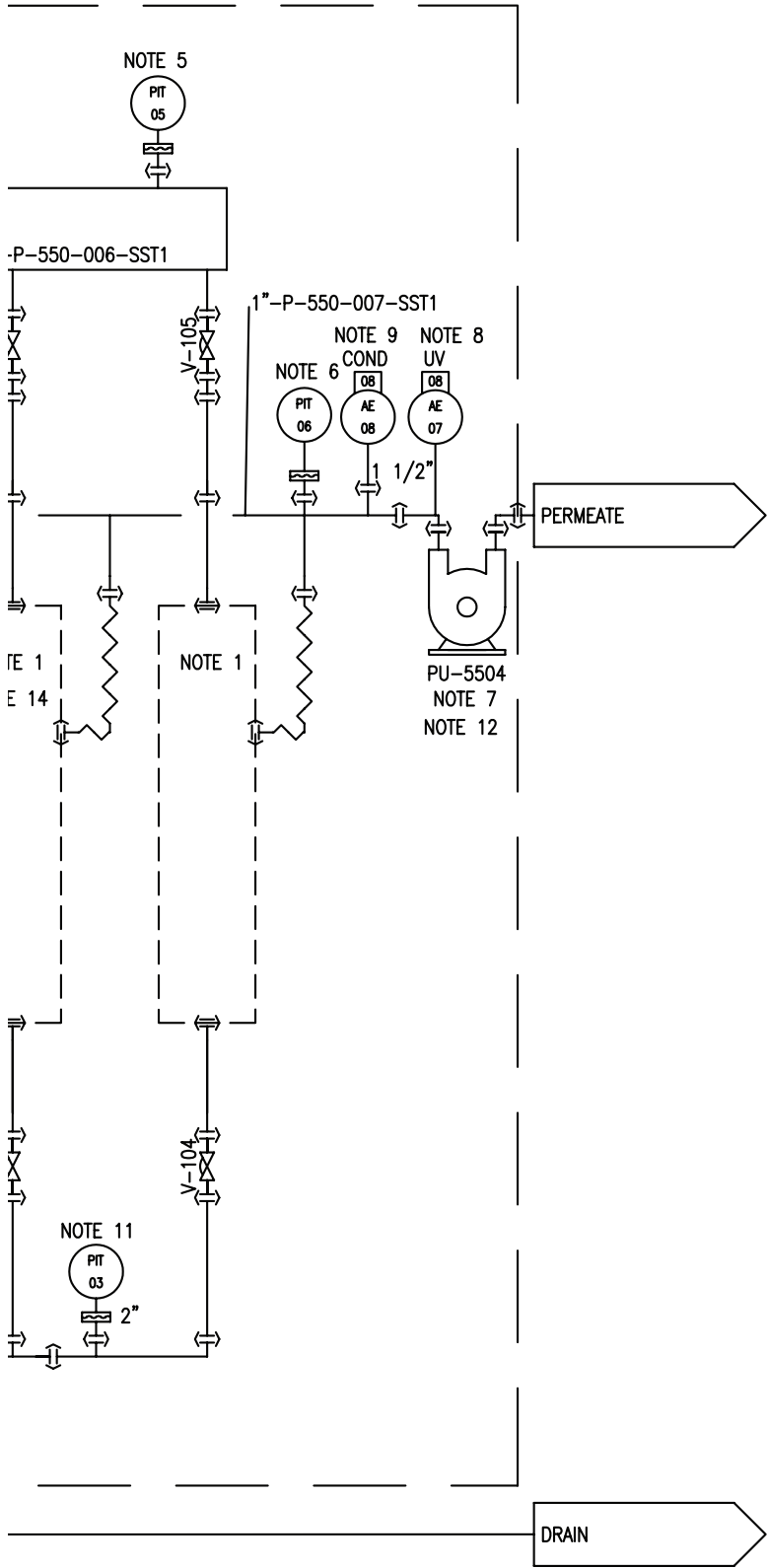


TK-5501
CIP TANK
PP-CONE BOTTOM
30 GALLONS

FL-5502
SCREEN GASKET
30 MESH

PU-5503
RECIRCULATION PUMP
UNIBLOC-PD 550
60 LPM @ 45 PSID
230/460VAC/3PH/7.5 HP

WATSON-1



NOTES:

1. SEE P&ID# DTL-001 CARTRIDGE DETAILS
2. OPTION. ADD 2 POSITIONS ON GRANDSTAND 550
3. OPTION. VALVE (1/2") FOR STORAGE SOLUTION FLUSHING ON RETENTATE LINE
4. OPTION. FLOWMETER ON RETENTATE LINE
5. OPTION. PRESSURE INDICATING TRANSMITTER ON RETENTANTE LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
6. OPTION. PRESSURE INDICATING TRANSMITTER ON PERMEATE LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
7. OPTION. PERISTALTIC PUMP ON PERMEATE LINE
8. OPTION. UV ON PERMEATE LINE
9. OPTION. CONDUCTIVITY ON PERMEATE LINE
10. OPTION. TEMPERATURE INDICATING TRANSMITTER ON FEED LINE
11. OPTION. PRESSURE INDICATING TRANSMITTER ON FEED LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
12. FOR GRANDSTAND 550 WITH 4 POSITIONS. THE PUMP INCLUDE DOUBLE HEAD WITH MAX FLOW RATE: 66.6 liter/min
13. OPTION. FOR SIP ADD STEAM TRAP TO DRAIN VALVE

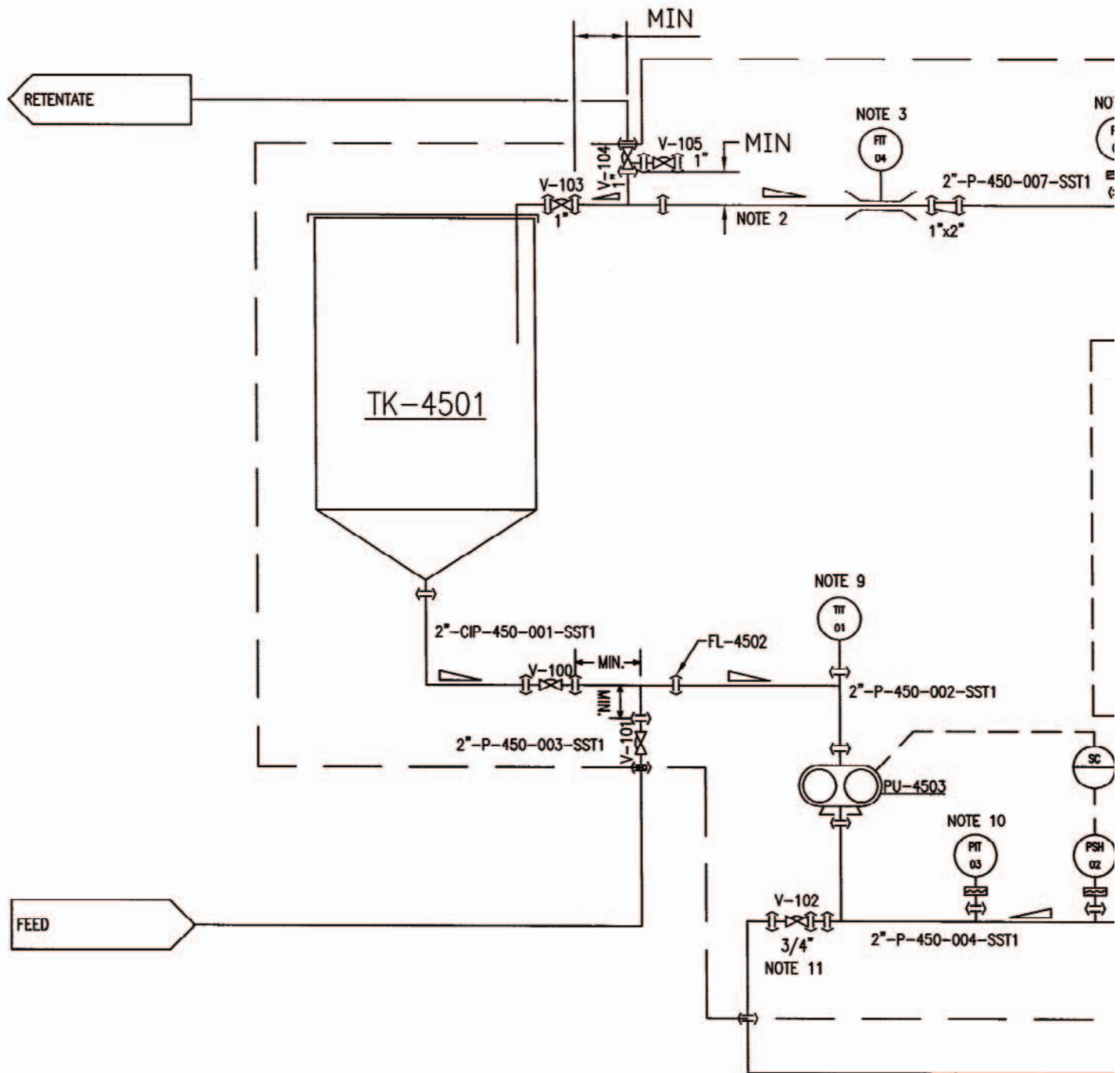
PU-5504

PERISTALTIC PUMP

ARLOW. Model: 720SN/RE or (720SN/RE/REX)
 Flow Rate: 8.8 l/min (17.6 l/min)

NOTE 12

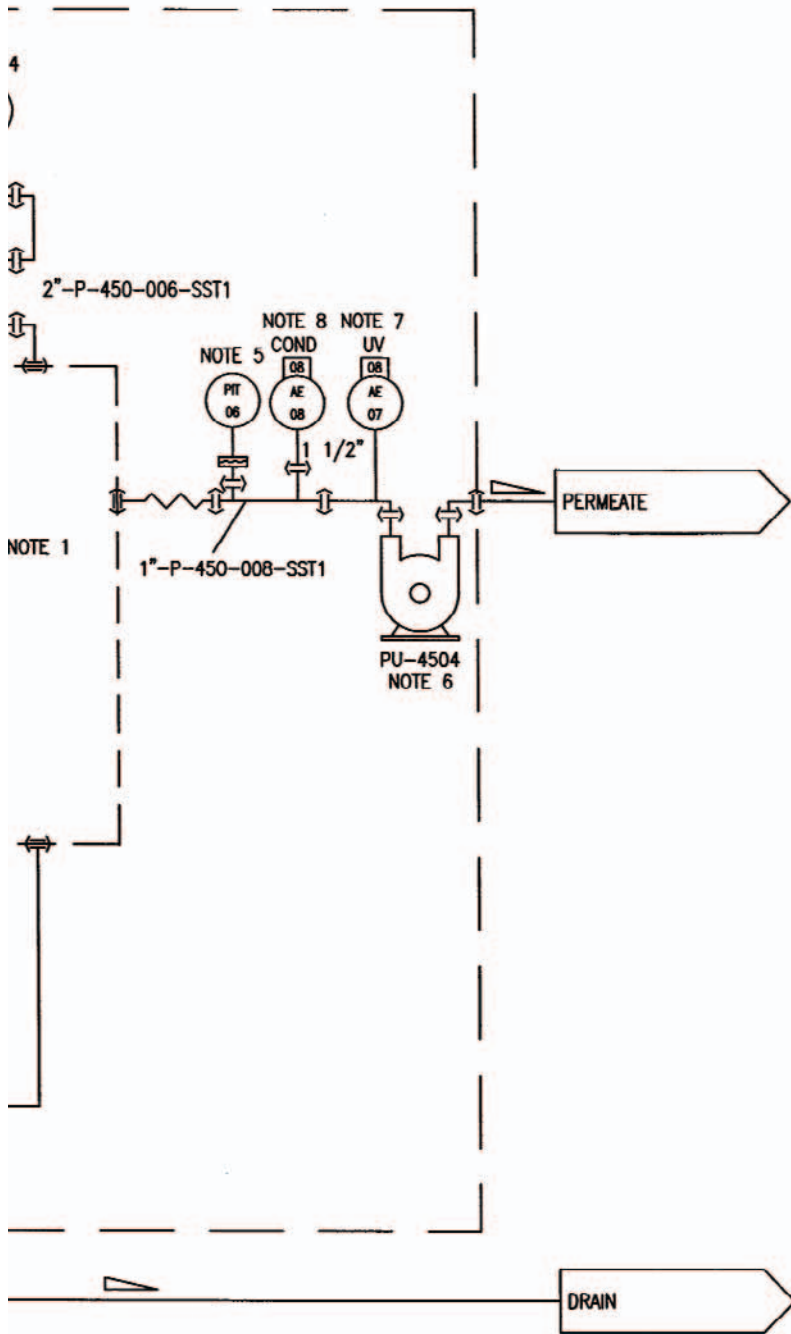
GrandStand 450 System



TK-4501
 CIP TANK
 PP-CONE BOTTOM
 15 GALLONS

FL-4502
 SCREEN GASKET
 30 MESH

PU-4503
 RECIRCULATION PUMP
 UNIBLOC-PD 450
 60 LPM @ 45 PSID
 230/460VAC/3PH/3HP



NOTES:

1. SEE P&ID# DTL-001 CARTRIDGE DETAILS
2. OPTION. VALVE (1/2") FOR STORAGE SOLUTION FLUSHING
3. OPTION. FLOWMETER ON RETENTATE LINE
4. OPTION. PRESSURE INDICATING TRANSMITER ON RETENTANTE LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
5. OPTION. PRESSURE INDICATING TRANSMITER ON PERMEATE LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
6. OPTION. PERISTALTIC PUMP ON PERMEATE LINE
7. OPTION. UV ON PERMEATE LINE
8. OPTION. CONDUCTIVITY ON PERMEATE LINE
9. OPTION. TEMPERATURE INDICATING TRANSMITER ON FEED LINE
10. OPTION. PRESSURE INDICATING TRANSMITER ON FEED LINE. THE STANDARD UNIT INCLUDE PRESSURE INDICATOR
11. OPTION. FOR SIP ADD STEAM TRAP TO DRAIN VALVE

PU-4504

PERISTALTIC PUMP
 N-MARLOW, Model: 620 SN/RE
 ax. flow rate: 18 liter/min

GrandStand 450 system housing and pipe spools dimensions

Dimensions housing	Length (in (cm))	Diameter (in (cm))	Permeate ports (in (cm))	Feed/Retentate ports (in (cm))	Drain port (SIP)	Vent port (SIP)	Cartridge size (in (cm))	2 2"x1 1/2" reducers	Total length with reducers
45	19.8 (50.3)	4.24 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	19.8 (50.3)	-	19.8 (50.3)
35	14.0 (35.6)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	14.0 (35.6)	6	14.0 (35.6)
35 SMO-DP	14.7 (37.3)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	14.7 (37.3)	6	14.7 (37.3)
45 SMO-DP	20.8 (52.8)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	20.8 (52.8)	-	20.8 (52.8)
35 STM	17.1 (43.4)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	17.1 (43.4)	6	17.1 (43.4)
65	28.8 (73.2)	4.25 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	28.8 (73.2)	-	28.8 (73.2)
65 MSM-DP	29.8 (75.7)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	29.8 (75.7)	-	29.8 (75.7)
152 M	32.0 (81.3)	6.63 (16.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	32.0 (81.3)	-	32.0 (81.3)
55	26.5 (67.3)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	26.5 (67.3)	6	26.5 (67.3)
55 SMO-DP	27.3 (69.3)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	27.3 (69.3)	6	27.3 (69.3)
35 (2 in series)	28.0 (71.1)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	28.0 (71.1)	6	28.0 (71.1)
35 SMO-DP	29.4 (74.7)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	29.4 (74.7)	6	29.4 (74.7)
(2 in series)									
55 STM	29.6 (75.2)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	29.6 (75.2)	6	29.6 (75.2)
45 (2 in series)	39.6 (100.6)	4.24 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	39.6 (100.6)	-	39.6 (100.6)
35 STM	34.2 (86.9)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	34.2 (86.9)	6	34.2 (86.9)
(2 in series)									
45 MSM-DP	41.6 (105.7)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	41.6 (105.7)	-	41.6 (105.7)
(2 in series)									
75	44.5 (113.0)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	44.5 (113.0)	6	44.5 (113.0)
85	51.5 (130.8)	4.25 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	51.5 (130.8)	-	51.5 (130.8)
85 MSM-DP	52.7 (133.9)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	52.7 (133.9)	-	52.7 (133.9)
154 m	54.8 (139.2)	6.63 (16.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	54.8 (139.2)	-	54.8 (139.2)

GrandStand 450 system housing and pipe spools dimensions continued

Dimensions housing	Not pipe spool required (in (cm))	Pipe spool 6.5" (in (cm))	Pipe spool 13.5" (in (cm))	Using both spools (in (cm))	Center to center swing elbows (in (cm))	Angle
45	-	-	-	39.8 (101.1)	15.0 (38.1)	20.36
35	-	-	-	40.0 (103.4)	14.8 (37.6)	22.33
35 SMO-DP	-	-	-	40.0 (103.4)	14.1 (35.8)	28.21
45 SMO-DP	-	-	-	40.8 (103.6)	14.0 (35.6)	28.96
35 STM	-	-	-	43.1 (109.5)	11.7 (29.7)	43.01
65	-	-	42.3 (107.4)	-	12.5 (31.8)	38.62
65 MSM-DP	-	-	43.3 (110.0)	-	11.5 (29.1)	44.05
152 M	-	-	45.5 (115.6)	-	9.3 (23.6)	54.46
55	-	-	46.0 (116.8)	-	8.8 (22.4)	56.63
55 SMO-DP	-	-	46.8 (118.9)	-	8.0 (20.3)	60.00
35 (2 in series)	-	40.5 (102.9)	-	-	14.3 (36.3)	28.65
35 SMO-DP	-	41.9 (106.4)	-	-	12.9 (32.8)	36.27
(2 in series)						
55 STM	-	42.1 (106.9)	-	-	12.7 (32.3)	37.46
45 (2 in series)	-	46.1 (117.1)	-	-	8.7 (22.1)	57.06
35 STM	-	46.7 (118.6)	-	-	8.1 (20.6)	59.59
(2 in series)						
45 MSM-DP	41.6 (105.7)	-	-	-	13.2 (33.5)	34.41
(2 in series)						
75	44.5 (128.3)	-	-	-	4.3 (10.9)	74.41
85	51.5 (130.8)	-	-	-	3.3 (8.4)	78.10
85 MSM-DP	52.7 (133.9)	-	-	-	2.1 (5.3)	Don't use swing elbows
154 m	54.8 (139.2)	-	-	-	0	Don't use swing elbows

GrandStand 550 system housing and pipe spools dimensions

Dimensions housing	Length (in (cm))	Diameter (in (cm))	Permeate ports (in (cm))	Feed/Retentate ports (in (cm))	Drain port (SIP)	Vent port (SIP)	Cartridge size (in (cm))	2 2"x1 1/2" reducers	Total length with reducers
45	19.8 (50.3)	4.24 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	19.8 (50.3)	-	19.8 (50.3)
35	14.0 (35.6)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	14.0 (35.6)	6	14.0 (35.6)
35 SMO-DP	14.7 (37.3)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	14.7 (37.3)	6	14.7 (37.3)
45 SMO-DP	20.8 (52.8)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	20.8 (52.8)	-	20.8 (52.8)
35 STM	17.1 (43.4)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	17.1 (43.4)	6	17.1 (43.4)
65	28.8 (73.2)	4.25 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	28.8 (73.2)	-	28.8 (73.2)
65 MSM-DP	29.8 (75.7)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	29.8 (75.7)	-	29.8 (75.7)
152 M	32.0 (81.3)	6.63 (16.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	32.0 (81.3)	-	32.0 (81.3)
55	26.5 (67.3)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	26.5 (67.3)	6	26.5 (67.3)
55 SMO-DP	27.3 (69.3)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	27.3 (69.3)	6	27.3 (69.3)
35 (2 in series)	28.0 (71.1)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	28.0 (71.1)	6	28.0 (71.1)
35 SMO-DP	29.4 (74.7)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	X-X-X	29.4 (74.7)	6	29.4 (74.7)
(2 in series)									
55 STM	29.6 (75.2)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	29.6 (75.2)	6	29.6 (75.2)
45 (2 in series)	39.6 (100.6)	4.24 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	39.6 (100.6)	-	39.6 (100.6)
35 STM	34.2 (86.9)	3.6 (9.1)	1.5 (3.8)	1.5 (3.8)	0.5	0.5	34.2 (86.9)	6	34.2 (86.9)
(2 in series)									
45 MSM-DP	41.6 (105.7)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	41.6 (105.7)	-	41.6 (105.7)
(2 in series)									
75	44.5 (113.0)	3.0 (7.6)	1.5 (3.8)	1.5 (3.8)	X-X-X	X-X-X	44.5 (113.0)	6	44.5 (113.0)
85	51.5 (130.8)	4.25 (10.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	51.5 (130.8)	-	51.5 (130.8)
85 MSM-DP	52.7 (133.9)	4.5 (11.4)	1.5 (3.8)	2.0 (5.1)	0.5	X-X-X	52.7 (133.9)	-	52.7 (133.9)
154 m	54.8 (139.2)	6.63 (16.8)	1.5 (3.8)	2.0 (5.1)	X-X-X	X-X-X	54.8 (139.2)	-	54.8 (139.2)

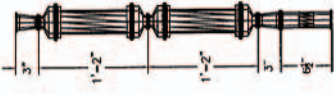
GrandStand 550 system housing and pipe spools dimensions continued

Dimensions housing	Not pipe spool required (in (cm))	Pipe spool 6.5" (in (cm))	Pipe spool 13.5" (in (cm))	Using both spools (in (cm))	Center to center swing elbows (in (cm))	Angle
45	-	-	-	39.8 (101.1)	15.0 (38.1)	20.36
35	-	-	-	40.0 (103.4)	14.8 (37.6)	22.33
35 SMO-DP	-	-	-	40.0 (103.4)	14.1 (35.8)	28.21
45 SMO-DP	-	-	-	40.8 (103.6)	14.0 (35.6)	28.96
35 STM	-	-	-	43.1 (109.5)	11.7 (29.7)	43.01
65	-	-	42.3 (107.4)	-	12.5 (31.8)	38.62
65 MSM-DP	-	-	43.3 (110.0)	-	11.5 (29.1)	44.05
152 M	-	-	45.5 (115.6)	-	9.3 (23.6)	54.46
55	-	-	46.0 (116.8)	-	8.8 (22.4)	56.63
55 SMO-DP	-	-	46.8 (118.9)	-	8.0 (20.3)	60.00
35 (2 in series)	-	40.5 (102.9)	-	-	14.3 (36.3)	28.65
35 SMO-DP	-	41.9 (106.4)	-	-	12.9 (32.8)	36.27
(2 in series)						
55 STM	-	42.1 (106.9)	-	-	12.7 (32.3)	37.46
45 (2 in series)	-	46.1 (117.1)	-	-	8.7 (22.1)	57.06
35 STM	-	46.7 (118.6)	-	-	8.1 (20.6)	59.59
(2 in series)						
45 MSM-DP	41.6 (105.7)	-	-	-	13.2 (33.5)	34.41
(2 in series)						
75	44.5 (128.3)	-	-	-	4.3 (10.9)	74.41
85	51.5 (130.8)	-	-	-	3.3 (8.4)	78.10
85 MSM-DP	52.7 (133.9)	-	-	-	2.1 (5.3)	Don't use swing elbows
154 m	54.8 (139.2)	-	-	-	0	Don't use swing elbows

**35 SMO-DP
(2 SERIAL)**



35 (2 SERIAL)



55 SMO-DP



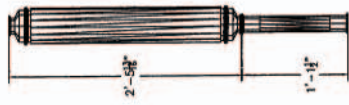
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152M



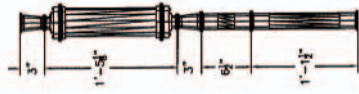
65 MSM-DP



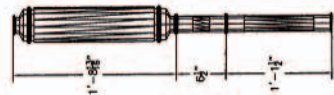
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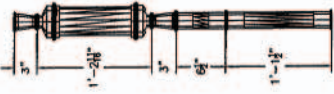
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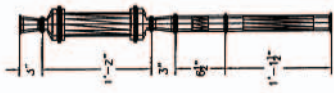
45 MSM-DP



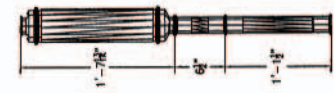
35 SMO-DP



35



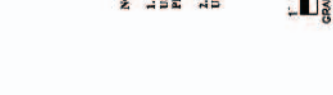
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**35 SMO-DP
(2 SERIAL)**



35 (2 SERIAL)



55 SMO-DP



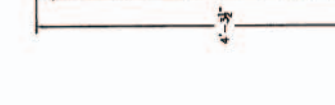
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152M



65 MSM-DP



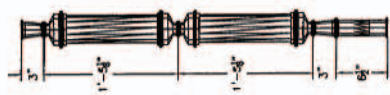
65



35 STM



**45 MSM-DP
(2 SERIAL)**



**35 SMO-DP
(2 SERIAL)**



35



45



NOTES:
1. DO NOT USE SWING ELBOWS.
USE REGULAR ELBOW AND 2 1/2\"



154M



NOTE 1

85 MSM-DP



NOTE 1

85



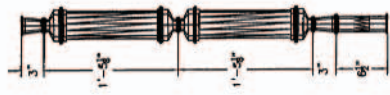
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**45 MSM-DP
(2 SERIAL)**



**35 STM
(2 SERIAL)**



**45
(2 SERIAL)**



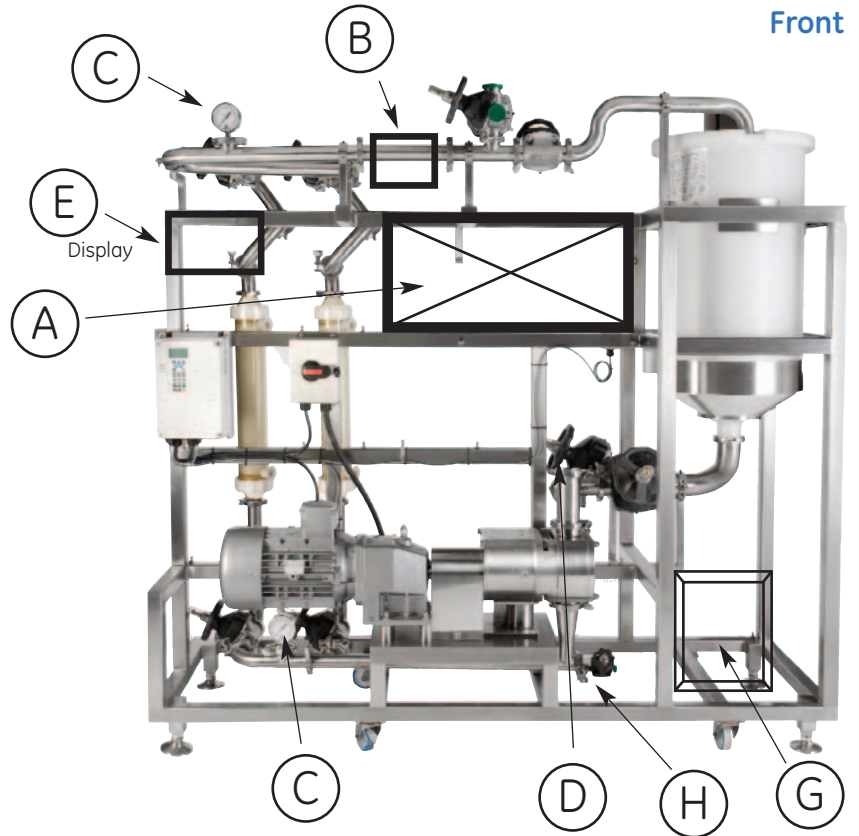
55 STM



Photographic System Tour

GrandStand™ system modular accessories

- A. Data Acquisition Enclosure
- B. Flow Meter (requires A)
- C. Pressure Sensor (requires A)
- D. Temperature Sensor (requires A)
- E. Conductivity Sensor (requires A)
- F. UV Sensor (requires A)
- G. Permeate Pump
- H. SIP Kit
- I. 4 Position HF Kit
- J. Kwick Flow Cassette Kit (replaces HF filters)



Back

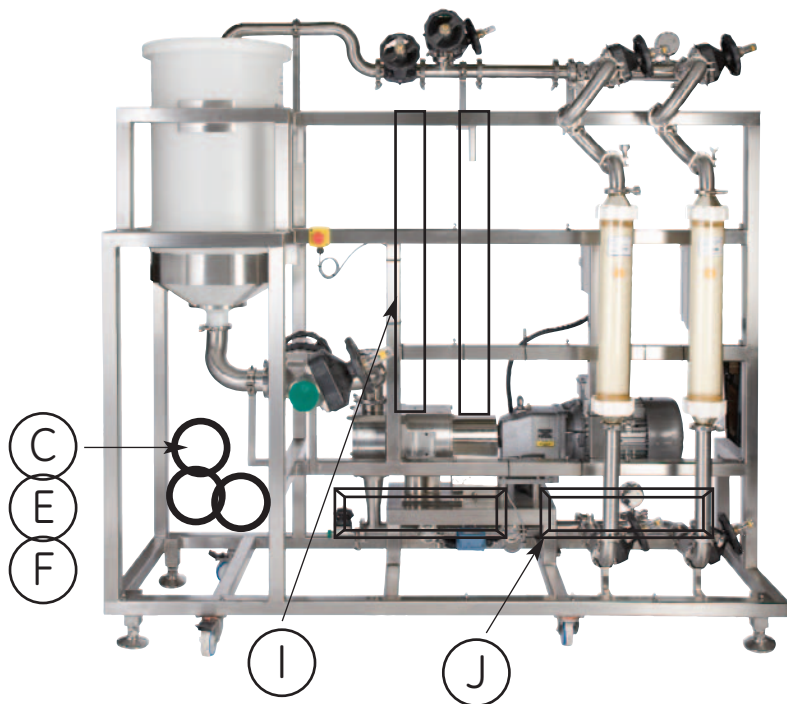
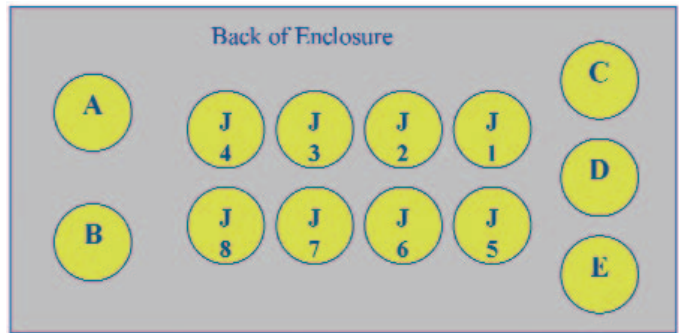
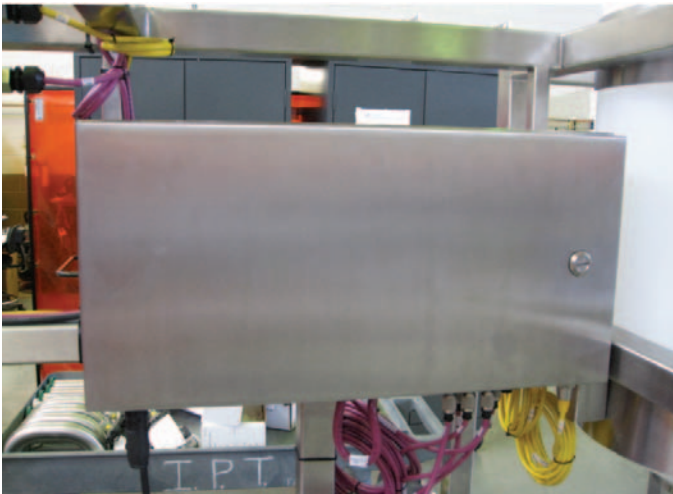


Fig 4. General arrangement of accessory options. The GS550 is shown. GS450 is similar (except for 4 position option). Permeate side tubing removed for simplicity.

Data acquisition enclosure

Facing the front of the GrandStand system (side where motor and VFD are located), mount the data acquisition enclosure to the horizontal frame using the threaded studs and nuts provided on the system. Ref item A location in the system schematic. The enclosure is plugged directly into a wall outlet. The enclosure provides 24VDC power to the data acquisition modules. See data acquisition connectivity diagram for power and data collection positions for each of the modules.



Cable connection key

Yellow cables are power cables

A is for enclosure power cord

B is for permeate pump power cord

C is for conductivity meter power

D is for UV sensor power

E is for retentate flow meter power

Purple cables are data transmission cables

J1 is for feed temperature sensor

J2 is a spare

J3 is for feed pressure indicator

J4 is for retentate flow meter readout

J5 is for retentate pressure indicator

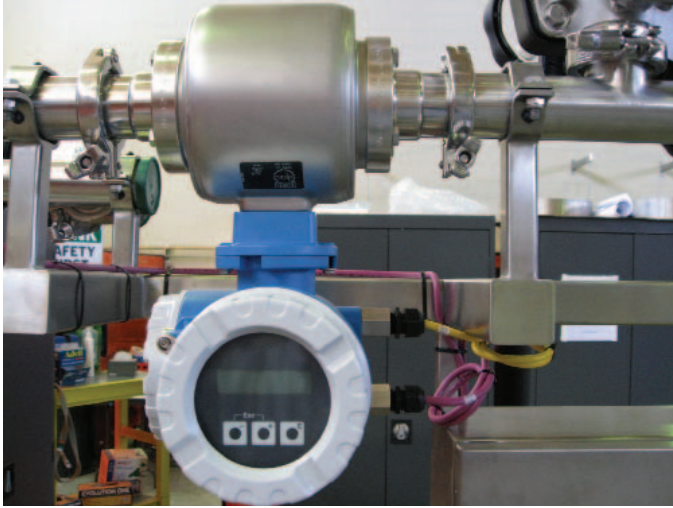
J6 is for permeate pressure indicator

J7 is for UV sensor

J8 is for conductivity sensor

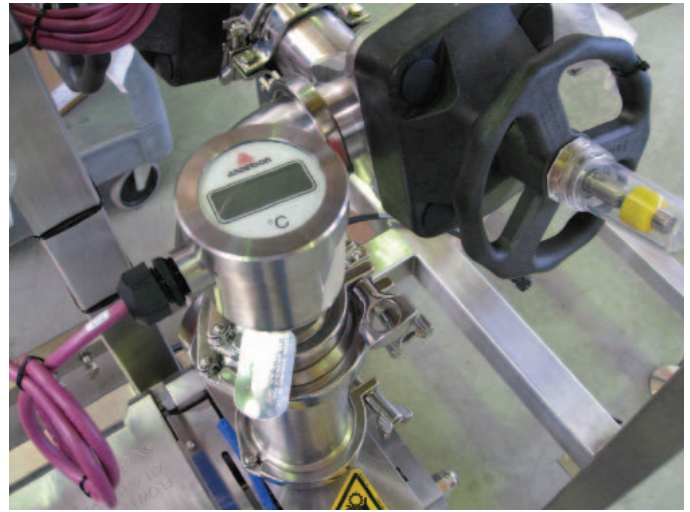
Flow meter

The retentate flow meter is mounted on the retentate line where indicated on the installation guide. Locate the piping spool piece, remove the tri-clover clamps and gaskets and spool piece. Replace the spool piece with the flow meter positioning the flow meter readout below the retentate line and facing the back of the system. Reassemble the tri-clover clamps and gaskets and tighten sufficiently to seal the process piping. Connect power and data transmission cables. Position the cables along the system frame from the flow meter to the data acquisition enclosure and secure with cable ties.



Temperature sensor

The temperature sensor is mounted vertically on the feed line where indicated on the installation guide. Locate the piping end cap, remove the tri-clover clamps and gasket. Replace the end cap with the temperature sensor. Reassemble the tri-clover clamps and gaskets and tighten sufficiently to seal the process piping. Connect data transmission cable. Position the cable along the system frame from the sensor to the data acquisition enclosure and secure with cable ties.



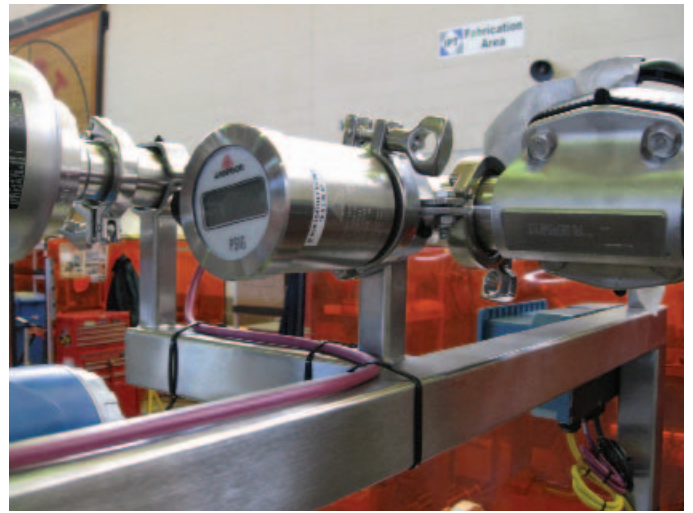
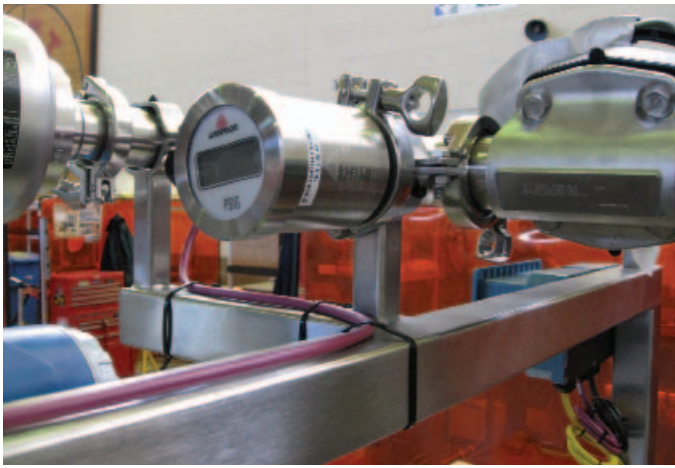
Pressure indicators

The pressure indicators are mounted on the feed, retentate and permeate lines (as purchased) where indicated on the installation guide. For the feed line, the pressure indicator replaces the pressure gauge. Remove the tri-clover clamp, gasket and pressure gauge. Replace the pressure gauge with the pressure indicator and reassemble with the clamp and gasket.



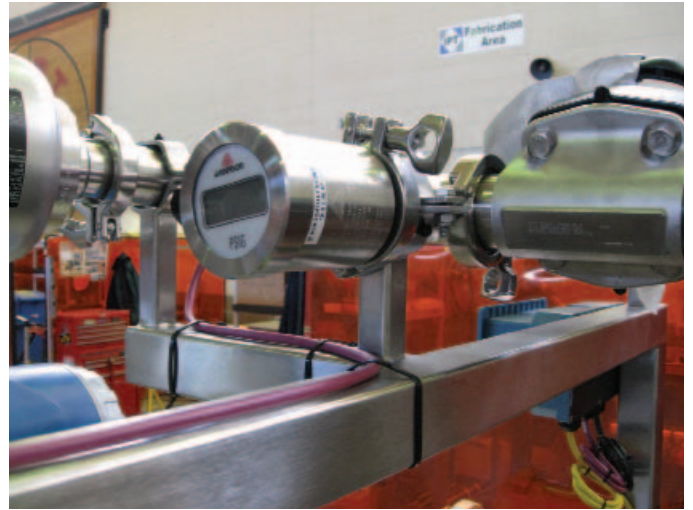
Feed line pressure indicator

For the retentate line, the pressure indicator is placed at the end of the retentate piping to facilitate local readout viewing. Remove the tri-clover clamp, end cap and gasket. Replace the end cap with the pressure indicator and reassemble with the clamp and gasket. The end cap may be used to replace the pressure gauge on the retentate line above the filter positions. The permeate pressure indicator is assembled within the permeate line when the system includes a permeate pump kit or may be assembled in a customer supplied permeate line if properly supported. When reassembling tri-clover clamps and gaskets, tighten sufficiently to seal the process piping. Connect data transmission cables as indicated in the connection key above. Position the cable along the system frame from the sensor to the data acquisition enclosure and secure with cable ties.



Conductivity sensor

The conductivity sensor is mounted on the permeate line supplied as part of the kit where indicated on the installation guide. The readout is mounted on the frame in position E adjacent to the data acquisition enclosure using frame mounted studs and nuts. Connect the power and data transmission cables as indicated in the cable connection diagram above. Position the cables along the system frame from the sensor to the data acquisition enclosure and secure with cable ties.



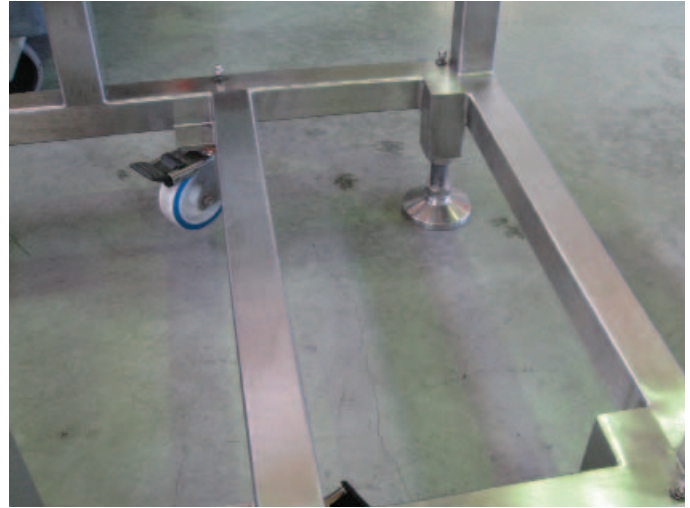
UV sensor

The UV sensor is mounted on the permeate line supplied as part of the kit where indicated on the installation guide. Connect the data transmission cables as indicated in the cable connection diagram above. Position the cables along the system frame from the sensor to the data acquisition enclosure and secure with cable ties.



Permeate pump

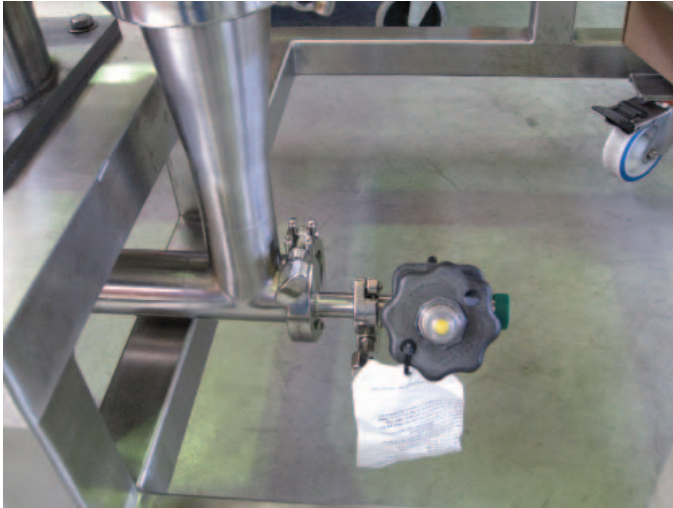
The permeate pump is mounted on the frame where indicated on the installation guide position G, below the CIP tank. Secure the kit plate with the studs and nuts found on the frame. The pump selected rests on the plate and connects to the data acquisition enclosure as indicated in the connection diagram. Position the cable along the system frame from the pump to the data acquisition enclosure and secure with cable ties.



The permeate pump is typically used to restrain the flow from microfiltration cartridges to a preset level. When cartridges are arranged in parallel, the top permeate lines can be manifolded to a single tube passing through the pumphead. When cartridges are arranged in series, the flows must be segregated using multiple heads on the permeate pump. Consult GE Healthcare Technical Support for specific recommendations.

SIP kit

The SIP kit is installed in position H of the installation guide diagram. Loosen and remove the tri-clover clamp, gasket and drain valve from the end of the feed line. Position the steam trap between the drain valve and the feed line low point. Install the steam trap and drain valve using the tri-clover clamps and gaskets. When reassembling tri-clover clamps and gaskets, tighten sufficiently to seal the process piping.



Note: Second set of valves and steam traps are required for the permeate side of the stainless steel housing(s) and SIP cartridge intended for your process. Stainless steel housing and permeate side connections must be purchased separately. Refer to the Steam Sterilization Handbook (18-1174-71 AA) for more details on proper installation and operation of SIP hollow fiber cartridges.

Four position HF expansion kit

The four position HF expansion kit is mounted to the feed and retentate lines to the left of the 2 filter positions already installed as indicated in the installation guide diagram. Each filter position includes inlet and outlet valves and piping spool pieces. Assemble each position to the feed and retentate lines using tri-clover clamps and gaskets, using this photo as a guide. Each position has at the retentate side a set of two 180° elbows and one 90° elbow. The elbow assemblies are configured as indicated in the housing and pipe spool matrix on page 19 of this manual. When assembling tri-clover clamps and gaskets, tighten sufficiently to seal the process piping.



Kvick flow cassette kits

The Kvick Flow cassette kits are installed in position K as indicated on the installation guide diagram. In order to install the Kvick Flow kits, the hollow fiber cartridge position spool pieces are removed. The frame structural components of the kit are installed using the studs and nuts provided on the frame. GrandStand 450 is limited to one set of 2 Kvick Flow holders and therefore can accommodate one (1) kit. Grandstand 550 allows for 2, 4 or 6 holders therefore accommodate one (1), two (2) or three (3) kits. Be sure to secure the kits to the base and to the horizontal frame component at the appropriate heights for the number of kits installed.

The Kvick flow manual holder is mounted to the horizontal plate for each kit.

Kvick Flow holder ports are connected to the system feed and retentate lines using the manifold provided as part of the kit. These are connected to the system such that the manifold is positioned between the Kvick Flow holders, which face each other. (see graphics below).

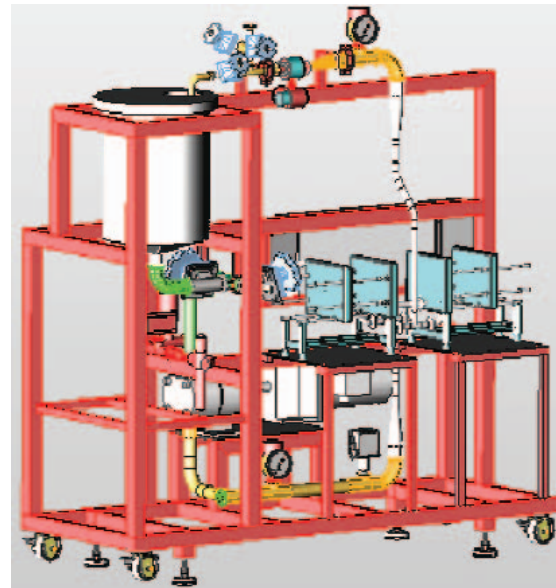
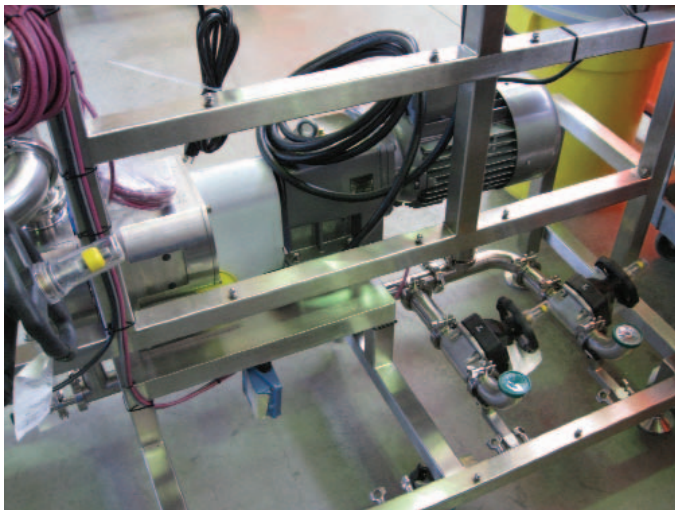


Fig 5. 450 Installation Diagram.

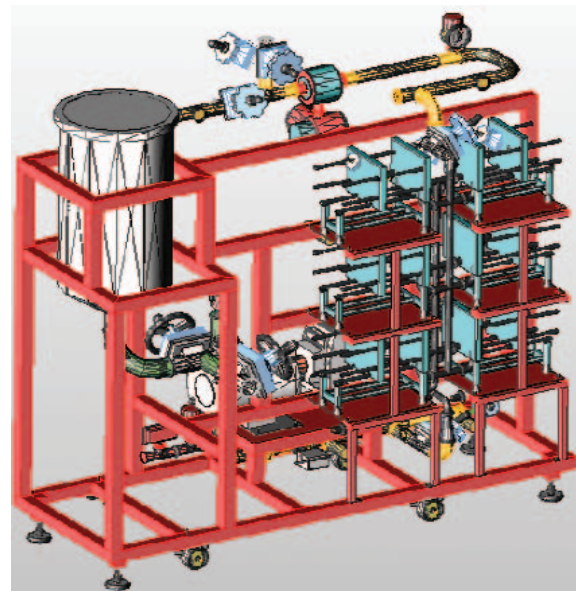


Fig 6. 550 Installation Diagram.

Using the Membrane System

Introduction

Systems with data acquisition accessories installed use software installed on a nonintegrated computer: the software only provides data collection and data display functions.

Data acquisition operating environment

Enclosure transfers data to computers under Microsoft Windows NT 4.00, Windows 2000 or Windows XP, using the English keyboard settings. Connect cable to RS232 port according to instructions in documentation package.

Work flow

For data logging systems, you control the run manually. After completing the run, you can transfer the data to a Microsoft Excel spreadsheet.

System Preparation

General

This chapter describes the initial start-up and testing procedures for membrane systems. The procedures below assume you have installed the system in accordance with the installation instructions in this guide and that the personnel performing these tasks have the appropriate knowledge of the system and the application.

GE Healthcare engineers test all membrane systems before shipping. The system documentation contains the results of the system tests.

Checking pump oil

Read the pump user guide to ensure you understand its operation and maintenance before using the system. Ensure that the pump transmission is filled with lubricant.

System installation

The GrandStand™ System as shipped requires minor on-site assembly and minimal effort to initiate operation. It is the customer's responsibility to follow all National and Local codes pertaining to both plumbing and electrical connections.

1. Unpackage the system carefully. Some components, such as the pressure gauges, are easily damaged if handled roughly.
2. Install the pressure gauges with a gasket and tri-clamp to the inlet and outlet manifolds.
3. Install any modular accessory kits that were purchased.
4. Install the customer-supplied retentate and permeate piping.
5. Connect the AC inverter into local electrical power main supply following all electrical codes and referring to AC inverter manual. Failure to properly connect the inverter can severely damage the inverter and/or motor. A qualified electrician should perform this work and make sure the pump is rotating properly.

Starting the system

Ensure these items are complete before starting the system:

1. Connect main pump power supply according to section "Electrical System Main Power Supply" on page 8.
2. Install any modular accessories according to the instructions supplied with each kit.
3. Install your membrane cassette or hollow fiber cartridge according to the instructions supplied with the cassette or cartridge holder.
4. Turn the main switch to the ON position (refer to P&ID and electrical drawings).
5. Power up computer if connected to data acquisition enclosure after membrane system is on.

Cartridge installation

1. Place the cartridge on the outlet piping of the bottom manifold, making sure that a tri-clamp gasket is seated properly.
2. Place a tri-clamp gasket on the top (retentate) port of the cartridge.
3. Maintaining a firm grip on the cartridge, lower the top manifold until the tri-clamp gasket is seated properly.
4. Still keeping a firm grip on the cartridge, clamp the inlet and outlet of the cartridge with the supplied tri-clamps.
5. Install the permeate hoses, keeping in mind that the permeate ports are not intended to support heavy valves, flowmeters, or piping, as the resulting stress could damage the cartridge housing. (Gaskets, tri-clamps, and adapters to flexible tubing are supplied with the system; permeate hoses are customer supplied).

WARNING

Before connecting power compare this system's specs with your power supply main voltage, power phase and cycles per second.

New cartridge rinsing procedures

The following Quick Flush is more than adequate for glycerin removal under most situations. Refer to page 5 of the GE Healthcare Bio-Sciences Operating Guide for general information about flushing glycerin from cartridges.

1. Close all valves.
 2. Fill the clean-in-place (CIP) tank with 10,000 NMWC ultrafiltered water or better. (GrandStand 550=30 gallon (113 liters), GrandStand 450=15 gallons (56 liters)).
 3. Open CIP feed valve 100% to flood the pump suction side.
 4. Be sure that the permeate and retentate lines are directed back to the CIP tank and secured. Permeate side valves should be set in "open" position.
 5. Open the retentate valve (s) 100% until all the air has escaped from the system, then adjust to 20% open (approximately 1 turn).
 6. Push the FWD key on the AC Inverter.
 7. Push the up arrow on the AC Inverter until the inlet pressure reaches approximately 8 psig (0.55 barg).
 8. Adjust the pump speed and retentate valve together until inlet pressure (P_{in}) is 10 psig (0.69 barg) and outlet pressure (P_{out}) is 6 psig (0.41 barg) for microfiltration cartridges. For ultrafiltration cartridges use P_{in} of 15 psig (1.03 barg) and P_{out} of 11 psig (0.76 barg). After 5 minutes reduce pressure on microfiltration cartridge to P_{in} of 3 (0.21 barg), P_{out} of 2 (0.14 barg). Flow rates will depend on installed cartridges. For example, two size 45 cartridges with 1.0 mm ID fibers at 500 lpm flow will be approximately P_{in} of 10 psig (0.69 barg) and P_{out} of 6 psig (0.41 barg).
- NOTE:** The amount the retentate valve needs to be opened or how high the RPM needs to be set will depend on cartridge and fiber configuration, larger diameter fiber will require the valves to be more and a higher RPM.
9. Continue rinsing for at least 10 minutes.
 10. Push the STOP key on the AC Inverter.
 11. Close all the valves and allow the cartridge to soak for at least 30 minutes.
 12. Drain the system using the drain valve.
 13. Repeat steps 2-11.
 14. Drain the system using drain valve, keeping retentate valve (s) open to allow air into the system.

Clean water flux determination

In order to evaluate cleaning processes, a baseline clean water flux measurement should be established. Once established, comparing water flux before and after process runs will provide an idea of the effectiveness of the cleaning procedure. Refer to Page 6 of the GE Healthcare Operating Guide for sample water flux calculations.

Microfiltration membranes are so highly permeable that water flux testing requires low pressure operation and very sensitive pressure monitoring. Consult GE Healthcare Technical Support for recommendations.

1. Close all valves.
 2. Fill the clean-in-place (CIP) tank with 10,000 NMWC ultrafiltered water or better.
 3. Open CIP feed valve 100% to flood the pump suction side.
 4. Be sure that the permeate and retentate lines are directed back to the CIP tank and secured.
 5. Open the retentate valve (s) 100% until all the air has escaped from the system, then adjust to 20% open (approximately 1 turn).
 6. Push the FWD key on the AC Inverter.
 7. Push the up arrow on the AC Inverter until the inlet pressure reaches approximately 8 psig (0.55 barg).
 8. Adjust the pump speed and retentate valve until $P_{in} \sim 10$ psig (0.67 barg) and $P_{out} \sim 6$ psig (0.41 barg) for microfiltration cartridges (15 psig (1.03 barg) in and 11 psig (0.76 barg) out for ultrafiltration cartridges).
- NOTE:** The amount the retentate valve needs to be opened or how high the RPM needs to be set will depend on cartridge and fiber configuration, larger diameter fiber will require the valves to be more and a higher RPM.
9. Record P_{in} , P_{out} , temperature, and the permeate flow rate. (Permeate flow can be measured with a stopwatch and graduate cylinder).
 10. Push the STOP key on the AC Inverter.
 11. Drain the system using drain valve.

Pressure hold and integrity tests

Before using the system, check the filters (cassette and holder or hollow fiber cartridges) for proper installation. Finally, check the tightness of all sanitary clamps.

Users normally check their cross flow systems for leaks by pressurizing the system with water and observing any leakage from process connections.

Users also check the integrity of membrane filters before using them by pressurizing the system and measuring the diffusion of air through the filters. If the diffusion rate meets acceptance criteria, then the user is assured that the membrane filters do not contain pinholes and are securely mounted in the system.

GE Healthcare recommends that you complete air integrity tests on the system filters before use.

Note: All GE Healthcare filter devices are tested for integrity before shipment. It is prudent to test integrity before and after each process cycle.

Processing

Since all feed streams behave differently, it is difficult to specify exactly how to run the system. This section will provide a starting point from which the path to successful processing can be developed. Refer to page 7 of the GE Healthcare Operating Guide for operating considerations. It is a good idea to test the system using water (10,000 NMWC ultrafiltered or better) before processing valuable feed solution.

1. Close all valves.
 2. Be sure that there is ample feed solution to process in the feed tank (customer supplied).
 3. Open feed valve 100% to flood the pump suction side.
 4. Be sure that the permeate and retentate lines are directed to the appropriate destinations.
 5. Open the retentate valve (s) 100% until all the air has escaped from the system, then adjust 20% open (approximately 1 turn).
 6. Push the FWD key on the AC Inverter.
 7. Push the up arrow on the AC Inverter until the inlet pressure reaches approximately 8 psig (0.55 barg).
 8. Adjust feed flow and transmembrane pressure to suit your process requirements. If performing a microfiltration process, TMP will be governed by permeate flow control options.
- NOTE:** The amount the retentate valve needs to be opened or how high the RPM needs to be set will depend on cartridge and fiber configuration, larger diameter fiber will require the valves to be more and a higher RPM.
9. Record P_{in} , P_{out} , temperature, and the permeate flow rate as a function of time. (Permeate flow can be measured with a stopwatch and graduate cylinder).
 10. Push the STOP key on the AC Inverter.
 11. Drain the system using drain valve.
 12. With microfiltration cartridges it is common to restrict the permeate flow to a pre-set level. Permeate flow control can be regulated by a valve or peristaltic pump. This practice promotes increased throughputs and improved processing.

System Cleaning and Storing

Cleaning

To ensure that the membrane filtration system performs properly—and to extend its service life—clean and store the system as described below:

Cleaning the membrane filters—Membrane filters require cleaning using specific cleaning solutions and procedures. The membrane cassettes and hollow fiber cartridges are normally cleaned while installed on the system. Recirculate cleaning solutions through the membrane filters and either leave them in the system for short-term storage or removed them for long-term storage. To learn how to clean membrane filters consult either the *Hollow Fiber Operating Handbook* (18-1165-30 AB) or the *Kvick Lab and Kvick Flow Cassettes User Manual* (18-1171-69 AG). These documents can be requested from GE Technical Services.

Cleaning the exterior of the membrane system—After each run, clean the exterior of the system to remove contaminants. Wipe the exterior of the system down with clean water to remove any buildup of process and cleaning solutions. Dry the exterior components with a lint-free cloth.

Cleaning individual components—Some of the components such as conductivity probes have special cleaning requirements. Refer to the original manufacturer's user guides located in the system documentation to learn about cleaning these components.

Short-term storage

For short-term storage (less than ten days), perform the cleaning procedures summarized above (Cleaning section on page 34); then follow these steps:

1. Fill the system with 0.1M NaOH and circulate for 10 to 15 minutes. The NaOH will prevent any bacterial growth inside the system.
2. End the cycle and shut down the computer system.
3. Switch the system's main power switch to OFF.
4. Release back pressure valves.

WARNING

Do not drain system. Do not allow membranes to become dried out during storage.

Long-term storage

To store the system more than 10 days, perform the cleaning procedures summarized in the Cleaning section on page 34; then follow these steps:

1. Fill the system with 0.5M NaOH and circulate for 10 to 15 minutes.
2. End the cycle and completely drain the system.
3. Disconnect all process lines from the system and blank-off the connection points using sanitary end caps, gasket and clamp. Remove flex tubing on permeate side.
4. Remove the membrane cassettes or hollow fiber cartridges and store them according to their instructions.
5. Shut down the computer system.
6. Switch the system's main power switch to the OFF position.
7. Disconnect all utility lines from the system.
8. System is now ready for storage.
9. After long-term storage, system may require several cleaning cycles before use. Perform a calibration of all monitors and perform a leakage test before putting the system into production.

Storage conditions

Storage requirements include these:

Temperature: -10 to 50°C

Relative humidity: 0 to 100%, non-condensing

Troubleshooting

Troubleshooting guide

If the membrane system does not work properly, consult the troubleshooting guide (Table 1).

Table 1. Membrane system troubleshooting guide.

Symptom	Possible Cause	Solution
Process solution leaks from sanitary connections	Sanitary connection gasket missing, worn, damaged, improperly mounted, or wrong size	Replace worn, damaged, or improperly sized gaskets
	Sanitary clamp loose	Tighten sanitary clamp
Feed pressure is too high	Membrane filter is fouled	Clean the membrane filter
	Obstruction in feed line or retentate line	Inspect lines for obstruction
	Feed inlet in the membrane filter plugged	Switch feed and retentate lines to reverse flow, and rinse with deionized water or WFI
	Pump speed setting too high	Either open retentate valve to allow more flow or reduce pump speed
System leaks during integrity testing	Improperly seated or damaged gasket at sanitary fitting	Locate leaking area by feeling air leak with hand, or by applying soapy water and looking for bubbles. Remove, inspect, and reinstall sanitary fitting gaskets.
	Faulty valve	Check integrity of valves and replace as needed.

Maintenance

► Safety

WARNING: Inspecting and maintaining the membrane system without shutting it down, depressurizing it, and disconnecting all utilities can result in bodily injury from the accidental start-up of the pump or unexpected release of pressure. To prevent bodily injury, shut down the system, depressurize it, and disconnect the utilities before inspecting and maintaining the system.

Parts

The system documentation lists replacement parts and spare parts.

Inspection

Periodically, based on use and applications, perform the following inspections and maintenance:

- Inspect process piping and connections for damage or leaks.
- Inspect electrical connections for proper fit.
- Inspect the sanitary connection gaskets for damage or wear and replace the gaskets as needed.
- Inspect system components following the recommendations in the original manufacturers' user guides.

Maintenance

Lubricate and calibrate system components in accordance with the recommendations in the original manufacturers' user guides located in the system documentation.

GE Healthcare recommends that you purchase preventative maintenance services from GE Healthcare. Proper maintenance ensures that the system performs in accordance with GE Healthcare specifications.

General

For maintenance on specific instruments, read and follow the instructions in the OEM manuals in the system documentation.

Membrane systems are designed to require a minimum of service and maintenance. This chapter describes procedures for sanitizing and cleaning-in-place for routine component maintenance.

► Safety

WARNING: Only trained personnel, or personnel with equivalent knowledge of similar equipment, should complete system maintenance or service.

Cleaning before maintenance/service

Clean the system of infectious or aggressive fluids before service or maintenance. Document the cleanliness by completing a decontamination report. (You must supply a decontamination report before a GE Healthcare service technician can work on the system. The appendix includes an example of a typical decontamination report entitled, Health and Safety Declaration/Liability Form.)

Make sure that the cleaning procedure flushes all possible flow paths in the system. After cleaning, flush the entire system with water or suitable liquid to remove the CIP solution. (In some instances, you can use the system instrumentation to monitor the removal of cleaning solution.)

Component maintenance

The OEM guides in the system documentation provide preventative maintenance recommendations for each major system component.

Use only spare parts recommended or supplied by GE Healthcare to maintain the proper performance of the membrane system.

Replacement of fuses

► Safety

WARNING: If you attempt to replace a system fuse without switching off the main power switch and disconnecting the system from all electrical power supplies, bodily injury can result. To prevent bodily injury, switching off the main power switch and disconnecting the system from all electrical power supplies before replacing system fuses.

► Safety

WARNING: If you replace system fuses with fuses of a different rating or style, equipment damage or fire hazards can result. To prevent equipment damage or potential fire hazards, replace system fuses with the same type and rating of fuse.

If a fuse repeatedly blows, shutdown the membrane system main switch and contact your local GE Healthcare representative.

Instrumentation calibration

For reliable performance, calibrate the system instrumentation according to manufacturer's recommendation and the recommendations in Table 2.

Calibration compares the instrument to a known reference. If instrument adjustments are necessary, GE Healthcare recommends that you contact the instrument manufacturer or GE Healthcare for help.

Voiding of warranty

Any warranty provided with the membrane system become void if instruments are adjusted by anyone other than GE Healthcare service personnel, the instrument manufacturer's service personnel, or personnel authorized by GE Healthcare.

Disassembly and assembly

The operator must read and understand the instructions for system components before removing and installing them. Contact your local GE Healthcare representative for additional information or help if needed.

► Safety

WARNING: Disassembling the membrane system without shutting it down, depressurizing it, and disconnecting all utilities can result in bodily injury from the accidental start-up of the pump or unexpected release of pressure. To prevent bodily injury, shut down the system, depressurize it, and disconnect the utilities before disassembling the system.

After assembly, you must test the piping system for leaks at the maximum system pressure for continued protection against injury risks due to water jets or burst pipes (refer to leakage test in the system documentation).

Periodic maintenance

The maintenance recommendations differ depending on frequency of use. Hence, use the recommendation as a guideline and develop your own maintenance schedule based on use and experience (Table 2).

Table 2. Membrane system maintenance recommendations

Period	Component	Maintenance
Before each run	In-Line filters	Clean or replace filter cartridge
	UV monitor	Set auto-zero
	Test alarm buzzer	Use instruction in control system
Weekly	Tubing and connectors	Inspect the system for leaks
Monthly	Tubing, connectors, and sensors	Leakage test of the piping system, and inspection of tubing and sensors for internal coating, rust, etc.
	Pumps	Check oil level. Inspect for coating, rust, etc. Refer to the pump instruction manual in the system documentation for specific maintenance requirements
Annually or as necessary	UV monitor	Replace the lamp when low intensity or lamp failure is indicated. Refer to the UV monitor instruction manual in the system documentation
	Pumps	Replace wear components. Refer to the pump instructions manual in the system documentation
	All components	Replace gaskets, O-rings, and diaphragms

Service and Training

Service

Your local GE Healthcare representative can provide you with information about system servicing.

Training

GE Healthcare recommends that new operators attend membrane system training at GE Healthcare. This training provides the information necessary for inexperienced operators to safely operate the membrane system.

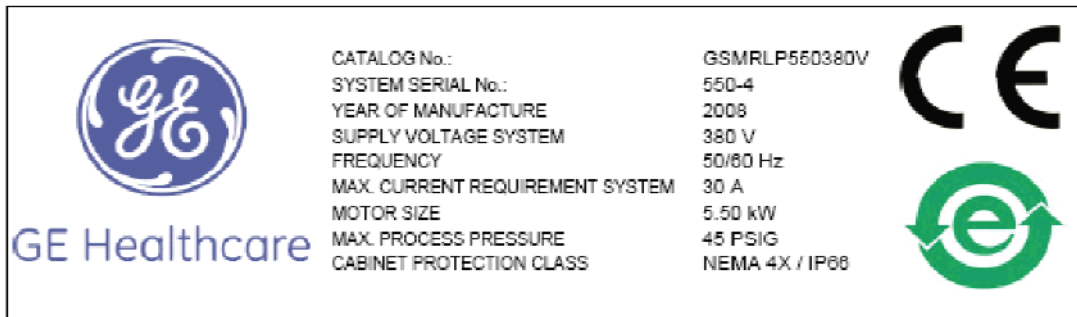
To arrange training, contact your local GE Healthcare representative.

Appendix

The appendix includes the membrane system label, system warning labels, and an example of a decontamination report.

Membrane system label

This is a typical system label that provides users with electrical supply requirements and operating parameters. This label indicates the maximum operating pressure of the system's process lines and process equipment. Exceeding this pressure can cause bodily harm and equipment failure.



Membrane system warning labels

This label indicates the emergency stop switch.



This label indicates hazardous moving parts (Keep hands away during operation).



WARNING

Keep hands away from moving machine parts.

This label indicates hazardous surface temperature during operation



WARNING

Hot surface.

Health and Safety Declaration/Liability Form

This document indicates the decontamination procedure you should follow before servicing the system.

GE Healthcare Life Sciences

Health & Safety Declaration Form

To ensure the mutual protection and safety of GE Healthcare's service personnel and our customers, all equipment and work areas must be clean and free of any contaminants before a Service Engineer starts a repair. To avoid delays in the servicing of your equipment, please complete this Declaration Form and present it to the Service Engineer upon arrival.

RA# _____
and/or
Service Ticket/Request # _____

1. Please note that equipment will NOT be accepted for servicing or return until this form is properly completed
2. Failure to complete the form completely accurately and truthfully can endanger GE Healthcare personnel
3. Equipment and/or work areas not sufficiently cleaned and safe for engineer arrival, or prior to return of equipment to GE Healthcare may lead to delays in servicing the equipment and could be subject to additional charges.

Equipment type / Product No. _____

Serial No _____

I hereby confirm that the equipment specified above has been cleaned to remove any hazardous substances or sanitation solution with exception of the named liquids (see lower right on this form). I also agree to give GE Healthcare sole control of the system / equipment (specified above).

Signed _____

Name in
Capital letters _____

Position in
institution or company _____

Date
(Year/month/date) 20____/____/____

Please specify if the equipment has been in contact with any of the following:

Yes No
 Radioactivity (please specify) _____

Yes No
 Infectious or hazardous biological substances (please specify) _____

Yes No
 Other Hazardous Chemicals (please specify) _____

Equipment must be decontaminated prior to service / return. Please provide a phone number where GE Healthcare can contact you for additional information concerning the system / equipment

Phone No. _____

Liquid and/or gas in equipment is:

Water Ethanol None, empty Argon, Helium, Nitrogen

Liquid Nitrogen Other, please specify: _____

Liability Form (Servicing Only)

I hereby confirm that I have taken full responsibility and control over the system / equipment:

Engineer
Signed _____

Name in
capital letters _____

Date
(Year/month/date) 20____/____/____

Changes / Improvements on system or equipment

See PM document

See Service report

None

The owner of the system / equipment confirms by signing in the service report that he has accepted to take the full responsibility and control

TO RECEIVE A RETURN AUTHORIZATION NUMBER OR SERVICE NUMBER,
CALL LOCAL TECHNICAL SUPPORT or CUSTOMER SERVICE NUMBER

70-5009-65/AH
Valid from: 2007-12-04



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