thermo scientific

HyPerforma Single-Use Mixer (S.U.M.) User's Guide

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ThermoFisher SCIENTIFIC

Contents

Warnings, safety, and warranty information

Thank you for purchasing high-quality Thermo Scientific™ equipment. We have included safety information in this guide, based on our knowledge and experience. It is important, however, for you to work with your safety management personnel to ensure that this equipment is integrated into your safety practices. Please take some time to perform your own job safety analysis in order to identify and control each potential hazard.

WARNING: Read and understand this user's guide before operating the equipment.

The Thermo Scientific™ HyPerforma™ Single-Use Mixer (S.U.M.) is designed to be operated under traditional pharmaceutical conditions. A general understanding of mixing systems and their operation is important prior to using the system for the first time. Read and understand the user's guide before operating; failure to do so could result in injury.

WARNING: Hazardous voltage inside.

The mixer motor, motor controller, and control panel all have electrical components. There is a risk of electrical shock and injury. Disconnect power before opening electrical components. Service should be performed by certified personnel only. Thermo Fisher Scientific recommends using standard lockout procedures when working on electrical components. The main breaker on the electrical control may be locked out.

WARNING: Static electricity may build up in BPCs.

- BioProcess Containers (BPCs) may act as insulators for electrostatic charge. If electrostatic charge is transferred to a BPC, the charge may be stored in the BPC and/or the product inside. This phenomena varies by product and use; therefore, it is the sole responsibility of the end user to ensure a hazard assessment is conducted and the risk of electrostatic shock is eliminated.
- Where applicable, a product contact stainless steel coupler may be grounded to the frame to dissipate electrostatic build up from the material within a BPC. It is good practice to dissipate electrostatic buildup by grounding all BPCs prior to coming in contact with them. When working with BPCs, the use of nonconductive materials, such as nonconductive gloves, is recommended.

WARNING: Rotating parts—entanglement hazard.
Rotating and moving parts can cause injury. Keep hands away from moving parts during operation.

- Do not operate this equipment unless the supplied guarding is in place and properly functioning.
- It is the responsibility of the end user to assess this equipment and ensure that equipment and safeguards are in good working condition, and that all operators are trained and aware of entanglement hazards and associated protective devices, such as hazard signs and guarding.

WARNING: Use ladders and elevated platforms with caution.
A few operations, such as loading a BPC into a large S.U.M., may require the use of a ladder or platform. Before use, ensure the ladder has been inspected and weight-rated for its user. When using a ladder or platform, be sure that it is stable, maintain three points of contact, and make sure the steps are clean.

WARNING: Follow lockout/tagout procedures.
To prevent injury when servicing equipment, use your company's lockout/tagout procedures to isolate electrical, mechanical, pneumatic, hydraulic, chemical, thermal, gravitational, or any other potential energy, and protect workers from the release of hazardous energy.

WARNING: Use caution with hazardous chemicals or materials.
Personnel servicing equipment need to know the hazards of any chemicals or materials that may be present on or in the equipment. Use general hazard communication techniques such as Safety Data Sheets, labels, and pictograms to communicate any hazards.

WARNING: Potential confined space.
Operators may enter larger S.U.M. systems. Evaluate this equipment against your confined space standards and procedures.

WARNING: Burst hazard—air under pressure.
The S.U.M. BPC chamber is under slight pressure under normal operating conditions. Normal passive venting prevents any excess of pressure building up within the chamber. Chamber pressure and inlet line pressure should be monitored for proper settings.

- Contents under pressure
- Do not exceed 0.03 bar (0.5 psi) BPC pressure
- Do not exceed 0.34 bar (5 psi) inlet pressure
- Ensure vent filter is both positioned and working properly

WARNING: Hot surface—do not touch.
The heating jacket is designed to heat the inner vessel wall. Normal operating conditions generate heat and could create hot surfaces.

- Hot surface inside
- Contact with surfaces may cause burns
- Do not touch while in operation

WARNING: Pinch hazard.
The Powdertainer hanger on the S.U.M. can be manually raised and lowered. Caution should be used to avoid pinching an operator or causing damage to the equipment or the BPC.

WARNING: The Thermo Scientific HyPerforma Single-Use Mixer may not be installed in a potentially explosive atmosphere as set forth in the applicable EU ATEX Directive.

WARNING: Tipping hazard. The vessel should only be moved by pushing using the provided handles or at the mid-point of the vessel. If pulled or moved too quickly, the vessel can tip, potentially leading to damage to equipment or injury to personnel. To reduce the risk of tipping, the vessel should only be moved slowly over smooth, flat surfaces by at least two qualified personnel. During movement, any locking feet should be retracted, and casters should be in the unlocked position. The vessel should not be moved by pulling of any kind.

Protective earth grounding

Protective earth grounding must be verified prior to plugging the S.U.M. into any electrical outlet. Ensure the receptacle is properly earth grounded.

Environmental conditions

- Operating: 17 to 27°C; 20 to 80% relative humidity, non-condensing
- Storage: -25 to 65°C
- Installation category II (over voltage) in accordance with IEC 664
- Altitude limit: 2,000 meters

Electrical connections

Power should be supplied by a non-GFCI 15 amp circuit. Ground faults occur when current is leaking somewhere, in effect, electricity is escaping to the ground. **Electrocution can occur when the human body serves as the path for the leakage to the ground.** A Ground Fault Circuit Interrupter (GFCI) senses the current flowing to the ground and switches off the power (trips the GFCI) in a fraction of a second at currents well below those that are considered dangerous. Due to the

sensitivity of GFCIs to electrical leakage (a few mA), it is recommended that the Single-Use Mixer NOT be plugged into a GFCI outlet.

Water jacket vessel information

The S.U.M. hardware unit with water jacket has been designed to be operated with water as the heat transfer medium, with temperatures not exceeding 50°C (122°F) under less than 150 psig (1 MPa) operating pressure. For the utmost safety it is recommended that the S.U.M. be operated at 75 psig or less.

Note: The S.U.M. BPC operating limits for temperature are 5 to 40°C. The internal pressure should not exceed 0.5 psi. The water jacket is not required to be registered, inspected and stamped with the Code U symbol per section U-1(c)2(f) of the ASME Boiler and Pressure Vessel Code and/or European Pressure Equipment Directive (PED) 97/23/EC. Upon request, a Declaration of Conformity, PED Sound Engineering Practices can be made available.

Warranty information

Any warranties, if applicable, covering this equipment exclude: (a) normal wear and tear; (b) accident, disaster, or event of force majeure; (c) your misuse, fault, or negligence; (d) use of the equipment in a manner for which it was not designed; (e) causes external to the equipment such as, but not limited to, external puncturing, power failure, or electrical power surges; (f) improper storage and handling of the equipment; (g) use of the equipment in combination with equipment or software that we did not supply; (h) equipment sold to you as 'used' products; (i) contact with improperly used or unapproved chemicals or samples; (j) installation, removal, use, maintenance, storage, or handling in an improper, inadequate, or unapproved manner, such as, but not limited to, failure to follow the documentation or instructions in the deliverables or related to the equipment, operation outside of stated environmental or other operational specifications, or operation with unapproved software, materials or other products; (k) manufacture in accordance with requirements you gave us; (l) installation of software or interfacing or use of the equipment in combination with software or products we have not approved; (m) use of the deliverables or any documentation to support regulatory approvals; (n) the performance, efficacy or compatibility of specified components; and (o) the performance of custom equipment or products or specified components or achievement of any results from the equipment, specified components or services within ranges desired by you even if those ranges are communicated to us and are described in specifications, a quote, or a statement of work. **ADDITIONALLY, ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION, OR ALTERATION TO OR OF, OR OTHER**

TAMPERING WITH, THE EQUIPMENT PERFORMED BY ANY PERSON OR ENTITY OTHER THAN US WITHOUT OUR PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS WE HAVE NOT SUPPLIED, WILL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED EQUIPMENT. IF THE EQUIPMENT IS TO BE USED IN THE UNITED STATES, WE MAY VOID YOUR WARRANTY IF YOU SHIP THE EQUIPMENT OUTSIDE OF THE UNITED STATES.

Use restrictions

You must use this equipment in accordance with our documentation and if applicable, with our other associated instructions, including without limitation, a “research use only” product label or “limited use” label license. This equipment is intended for research use or further manufacturing in bioprocessing applications and not for diagnostic use or direct administration into humans or animals, we do not submit the equipment for regulatory review by any governmental body or other organization, and we do not validate the equipment for clinical or diagnostic use, for safety and effectiveness, or for any other specific use or application.

Seismic guidance

The buyer of the equipment is responsible for ensuring that country-specific codes and seismic values are assessed for suitability of equipment installation and safety at the designated site. In addition, it is the buyer’s responsibility to assess the building structure for the designated equipment to ensure correct seismic anchoring and tethering designs for both the equipment and facility. It is highly recommended that the buyer consult with a local, licensed third party architecture and engineering firm to provide the buyer with correct engineering analysis and stamped documentation prior to equipment installation at the facility. In addition, the buyer will be responsible for rigging and anchoring of the equipment to a specified, fixed location. Upon request, Thermo Fisher Scientific can assist with establishing compliant seismic anchoring and tethering designs for purchased equipment based on building and country codes, at an agreed upon fee.

It is also noted that movable equipment (i.e. non-fixed or caster mount) is exempt from seismic design requirements according to ASCE 7-16, Chapter 13, section 1.4. Although these units are exempt from the seismic design requirements of ASCE 7, it should be noted that such equipment is susceptible to overturning during a seismic event. Therefore, it is the responsibility of the buyer to address seismic safety for movable equipment at the designated facility.

How to use this guide

Scope of this publication

This user's guide contains information about the standard Thermo Scientific HyPerforma S.U.M. system, including hardware, components, product design verification methods, installation, operation, and specifications. It is intended for use by people who may or may not have experience with Thermo Scientific systems, but who have some knowledge of bioproduction processes and large-scale mixing systems.

Document change information

Revision	Date	Section	Change made	Author
A	07/2015	--	Initial release	S. Jelus
B	11/2015	Various	Removed references to "sterility" of BPCs, and provided more information about gamma irradiation	S. Jelus/ G. Brau
C	11/2017	--	Reformatted using new brand template	E. Hale
D	01/2018	Various	Updated warning symbols	E. Hale
D	11/2018	Warnings, safety, and warranty information	Included seismic guidance information and added emphasis to "Electrical connections" paragraph	E. Hale
D	11/2018	5.1.2	Added note about replacing the reusable bearing port annually	E. Hale
D	11/2018	2.3 and 4.1	Updated photos of E-Box	E. Hale
D	11/2018	Appendix A	Removed Appendix A concerning AC-Tech VFD recalibration	E. Hale
D	11/2018	How to use this guide	Changed "Input into Thermo Scientific publications" paragraph to "Questions about this publication"	E. Hale
E	09/2019	6.2	Updated cart length dimension on Figure 6.8	T. Golightly
E	12/2019	Various	Minor revisions	T. Golightly
F	06/2020	Warnings, safety, and warranty information; 2.2.1	Updated warning symbols and added "tipping hazard" warning	E. Hale
F	06/2020	--	Minor formatting changes	E. Hale

Questions about this publication

If you have any questions or concerns about the content of this publication, please contact **technicaldocumentation@thermofisher.com** and your Thermo Fisher Scientific sales team.

Related publications

Please contact your local sales representative for information about the related publications listed below.

Publication	Description
Thermo Scientific HyPerforma S.U.M. Validation Guide (DOC0003)	Information about validation procedures
Thermo Scientific HyPerforma S.U.M. Data Sheets (for various sizes)	Product descriptions and ordering information

Abbreviations/acronyms

See the list below for definitions of abbreviations used in this publication.

BPC	BioProcess Container
DO	Dissolved oxygen
E-Stop	Emergency stop button
ETP	Equipment Turnover Package
GFCI	Ground fault circuit interrupter
ID	Inner diameter
IEC	International Electrical Code
OD	Outer diameter
PBS	Phosphate-buffered solution
PED	Pressure Equipment Directive
P&ID	Process and Instrument Diagram
RTD	Resistance temperature detector
S.U.M.	Single-Use Mixer
TCU	Temperature control unit
VFD	Variable frequency drive

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S.U.M. overview

Chapter contents

1.1. Introduction

The Thermo Scientific HyPerforma Single-Use Mixer (S.U.M.) offers a single-use alternative to traditional stirred-tank mixing. It is based on the same mixing principle as the Thermo Scientific HyPerforma Single-Use Bioreactor (S.U.B.). Both systems use an impeller linked to an overhead mixing motor via a sealed bearing assembly, which allows the impeller to turn while maintaining the integrity of the system. The S.U.M. is designed for powder-to-liquid and liquid-to-liquid closed system mixing with single-use contact surfaces, as well as open-top mixing.

Each S.U.M. system consists of the following:

- Stainless steel hardware, including support, mobility, mixing motor, and electric control panel (E-Box). Available options include integrated hardware with tank and mixing motor on the same skid, and tanks with or without heating/cooling jackets.
- Optional load cells to facilitate weighing.
- BioProcess Container (BPC), which is supplied gamma irradiated.

Figure 1.1. 200 L S.U.M. system.

The outer support container is a stainless steel vessel that holds and supports the BPC. It is engineered and fabricated to fully support each BPC while allowing easy access for operation. The drive shaft is detachable and reusable, and is inserted into closed-top BPCs through the mixing assembly and into the bearing port. Load cells are available for all systems to facilitate weighing.

The BPC provides ready-to-use single-use contact surfaces, including an impeller, a sealed bearing assembly, and tubing for liquid transfer. Options include:

- Open-top liner for media/buffer preparation
- Closed BPCs with a powder port, designed to integrate with the Thermo Scientific Powdertainer, in order to provide ergonomic and contained media/buffer preparation
- Closed BPCs with monitoring probe capabilities
- Closed BPCs for liquid-to-liquid mixing of critical sterile solutions

This user's guide covers the setup, operation, maintenance, and troubleshooting of all S.U.M. systems in the following volumes: 50, 100, 200, 500, 1,000, and 2,000 liters.

1.2. Hardware characteristics

1.2.1. S.U.M. hardware components

Figures 1.2 and 1.3 below illustrate available components of S.U.M. systems in 500 L and 2,000 L sizes.

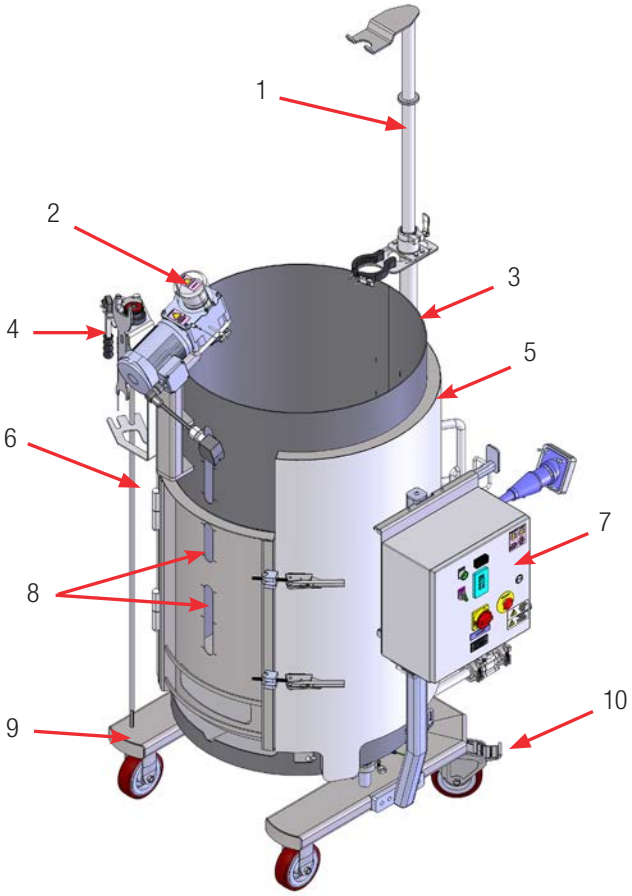

Figure 1.2. Front view of 500 L S.U.M.

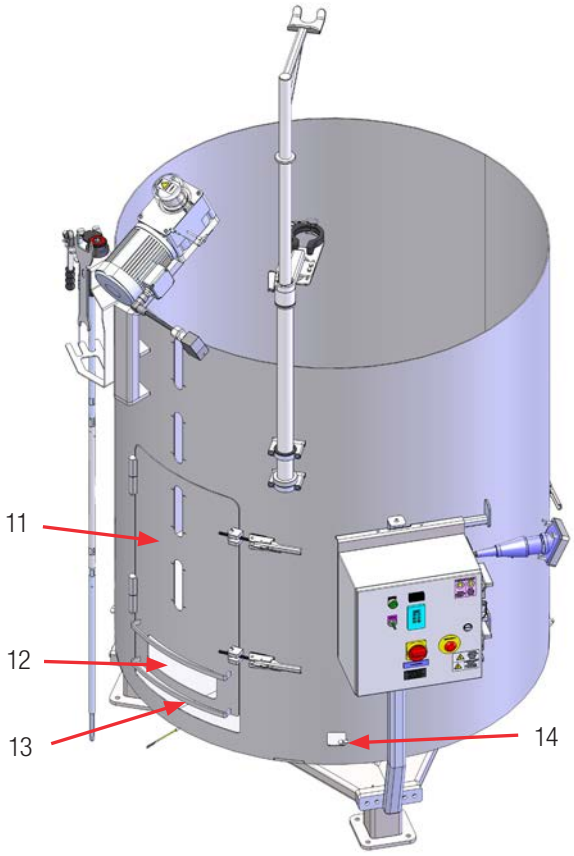

Figure 1.3. Front view of 2,000 L S.U.M.

1. Powdertainer arm (optional)
2. Mixer motor with safety cover
3. 0.95 cm (3/8 in.) dimpled jacket
4. Standard tool set: 10 mm (3/8 in.) x 16.9 Nm (150 in-lb.) square torque wrench, load cell and motor cap lockout wrench
5. Stainless steel outer support container
6. Drive shaft, stored
7. E-Box
8. Liquid sight windows
9. Cart assembly
10. Locking casters (50–1,000 L units only)
11. Door for BPC loading
12. Probe access window
13. Probe clip hanger
14. Bottom cutouts/pins for BPC attachment and alignment

1.2.2. S.U.M. system features

The S.U.M. is designed for mobility, operation simplicity, and easy disposable integration. **Note:** 2,000 L systems are not designed to be portable and do not have wheels. Hardware drawings and specification tables for all S.U.M. sizes can be found in Chapter 6—Specifications and parts information.

Agitation

The mixing speed of the S.U.M. is adjusted using the keypad interface on the E-Box. The agitation control interface includes a digital display to indicate stirring speed in units of revolution per minute (rpm). Power is supplied to the motor by a two-position power switch. The up and down arrows on the agitation keypad adjust the stirring speed.

Temperature control

The water-jacketed S.U.M. is designed to be operated with water as the heat transfer medium with a temperature range of 2°C to 50°C. Under certain conditions, higher temperatures may be possible. Consult your Thermo Scientific representative if higher temperatures are needed. The process temperature may be monitored with an optional RTD inserted into the thermowell of a S.U.M. BPC equipped with probe ports. Water-jacketed system temperature control is maintained through a separate temperature control unit (TCU) supplied by the end-user or as an option from Thermo Scientific (refer to the TCU data sheet, document number CO1197701214).

Load cells

Load cells are available on all stainless steel S.U.M. hardware. Load cells can be installed at the factory or added later by a certified service technician. The load cell kit comes with three load cells, summing block, wiring, and display with a choice of several data interfaces. Load cells arrive uncalibrated; the load cell manufacturer or a qualified technician should calibrate these systems on site.

1.3. End-user supplied components

1.3.1. pH probes

The following table shows the length and diameter requirements for sensor integration into the S.U.M. These requirements are based on the necessary insertion depth of the probe when used with the probe port.

Table 1.1. Recommended pH probes for use with the S.U.M.

Probe lengths (from O-ring to tip) must not exceed 235 mm (9.25 in.)				O-ring to probe tip	
				Print/lit.	Actual
Probe	Part number	Diameter	Thread type	Length	Length
AppliSens pH	Z001023551	12 mm (0.47 in.)	13.5 PG	235 mm (9.25 in.)	235 mm (9.25 in.)
Mettler Toledo pH	405-DPAS-SC-K8S/225, PN 104054481IG	12 mm (0.47 in.)	13.5 PG	195 mm (7.67 in.)	219 mm (8.62 in.)
Broadley-James pH	F-635-B225-DH	12 mm (0.47 in.)	13.5 PG	225 mm (8.85 in.)	219 mm (8.62 in.)
Finesse pH	PHS-EFP-K8-225	12 mm (0.47 in.)	13.5 PG	225 mm (8.85 in.)	220 mm (8.66 in.)

Note: Consult probe manufacturer's websites for the appropriate probe cable connection and part number.

1.3.2. Controllers

Many controllers can be adapted for use with the S.U.M., such as those manufactured by:

- ABEC
- Bellco
- Broadley-James
- Dasgip
- Emerson
- Honeywell
- New Brunswick Scientific
- Pendotech
- Sartorius Stedim Biotech

Some work well when controlling pH. Users seeking advanced control functionality and data logging capabilities for parameters of pH, temperature, and agitation can determine their own preferred approach in order to interface these parameters with a single controller.

Please refer to the Equipment Turnover Package (ETP), supplied with each hardware system, for electrical schematics. Discussions regarding the integration of specific control systems for advanced control functionality should be directed to technical support staff for Thermo Scientific HyPerforma products and the selected controller manufacturer.

1.4. BPC characteristics

1.4.1. S.U.M. BPC features

The S.U.M. BPC (either a closed BioProcess Container or an open-top liner) contains the mixing process. The BPC chamber is manufactured from either CX5-14 film or Aegis5-14 film. The open-top liner is manufactured from CX3-9 film. The BPC and liner are co-extruded structures specifically designed for use in biopharmaceutical processes. All materials are qualified for a range of physical, mechanical, biological, and chemical compatibility requirements. The mixer BPC is gamma irradiated at a minimum threshold of more than 25 kGy. This results in electron disruption, which destroys microorganisms, or makes them incapable of reproduction throughout a packaged BPC. However, it does not create residuals or radioactivity in the BPC. Two standard BPC configurations are available for powder-to-liquid applications and liquid-to-liquid applications, each available with or without probe ports. The open-top liner has a separate impeller and drive shaft sheath system for open-top mixing. For more information about BPCs, see section 6.3.

1.4.2. Operating pressure

WARNING: The S.U.M. BPC is not rated as a pressure vessel. Gas pressure should not exceed 0.03 bar (0.5 psi) within a static BPC, or 0.007 bar (0.1 psi) when the motor is rotating during operation. The BPC should not be allowed to become tight during inflation. Conditions of over pressure may result in BPC damage or personal injury. Custom BPCs can be ordered with an optional disposable pressure transducer for monitoring pressure (not supplied).

1.4.3. Working volume

Each S.U.M. is designed for a specific working volume range. The minimum working volume and the rated working volume are listed in the specification tables provided in Chapter 6—Specifications and parts information. Actual working volumes should not exceed the indicated rated working volumes. However, if necessary, the BPC can accommodate a slight volume overage (68 L for 50 L S.U.M., 110 L for the 100 L S.U.M., 220 L for 200 L S.U.M., 550 L for 500 L S.U.M., 1,100 L for 1,000 L S.U.M., 2,100 L for 2,000 L S.U.M.).
CAUTION: Working volumes less than the minimums listed can result in hardware malfunction and damage to the BPC.

1.4.4. Draining

The S.U.M. is equipped with a bottom drain line that allows for liquid harvest by means of a peristaltic pump. Connection of the bottom drain line can be accomplished using the provided 12.7 mm (1/2 in.) quick-connect fitting. Manipulation of the S.U.M. BPC as the last few liters of fluid are removed can minimize liquid hold-up.

1.4.5. Aseptic connections

Multiple aseptic connection options exist for S.U.M. users. The standard BPC includes tubing welder sections, quick-connects for use under a laminar flow hood, and steamable sanitary connections for liquid-to-liquid BPCs. The S.U.M. BPC is designed with various lengths and dimensions of thermoplastic tubing for the purpose of addition and dispensing from the S.U.M. BPC. Refer to custom BPC options in section 6.3.8 of this publication for custom end-treatment options.

1.4.6. Sampling

During operation of the S.U.M., samples may need to be taken for monitoring of various parameters established by the user, such as pH, spectrophotometric analysis, and osmolality. Samples can be taken from the S.U.M. in various ways depending on the BPC configuration. Samples are easily taken, utilizing the recirculation loop and the SmartSite port on all standard BPC configurations. In full volume applications where the recirculation loop is not being utilized, samples can be taken directly through the powder port, using one of the line sets on the top of the BPC, or through the drain line.

For BPC configurations that utilize probe ports, the S.U.M. can be equipped with a small volume sample port that is part of the BPC thermowell. This small diameter silicone dip tube of 15.24 cm (6 in.) length allows low void volume samples to be taken. The dip tube is supplied with an aseptic luer lock connector (SmartSite™) that allows for direct sampling or attachment of various sampling manifolds, using the standard luer lock connection. Alternatively, manifolds can be welded onto the C-Flex sample line using a tubing welder.

1.5. Additional/optional system components

1.5.1. Probe integration

The probe assembly is an innovative disposable design that packages user-supplied pH probes and connects them to the S.U.M. BPC. The probe assembly (Figure 1.4) includes the following components:

1. Molded bellows cover
2. Threaded probe adapter
3. Pall™ Kleenpak™ connector (KPCHT series, for high temperature)
4. Cable ties

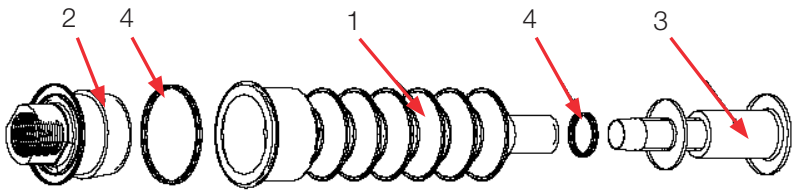

Figure 1.4. Probe assembly.

Note: Figure 1.4 (above) shows a probe assembly with a Kleenpak aseptic connector. Your S.U.M. BPC may use CPC™ AseptiQuik™ aseptic connectors or non-aseptic quick-connects, instead.

1.5.2. Required and optional accessories

To assist in the operation of the S.U.M., the following additional accessories are available. See Chapter 6 for more information about hardware accessories.

Thermo Scientific Powdertainer hanger and holding arm

The Powdertainer™ hanger and holding arm (Figure 1.5) is an optional accessory that is used to hang and position powdertainer bags. It is for S.U.M. systems using powder-to-liquid mixing.

Figure 1.5. 50 L S.U.M. Powdertainer hanger and holding arm.

Heavy-duty tubing clamps

Tubing clamps (Figure 1.6) are required for manually pinching off line sets that are not in use in order to prevent process fluids from moving into the line sets. **Note:** Prior to sterile probe insertion, tubing clamps must be in place to close off probe ports. Users should have one tubing clamp for each connection port used.

Figure 1.6. Heavy-duty tubing clamp.

Probe clips

Probe clips (Figure 1.7) are required to hold probes in place during operation of the S.U.M. Although plastic probe clips are provided with standard S.U.M. systems, your system may use metal probe clips instead.

Figure 1.7. Metal and plastic probe clips.

Autoclave tray for probe kits

The stainless steel autoclave tray (Figure 1.8) is designed for aseptic applications and required during the sterilization process. The support tray provides an inclined fixture for two probes during autoclaving to minimize stress on the probes, and to prevent collapse of the silicone bellows. **Note:** Figure 1.8 shows the autoclave tray used with Kleenpak aseptic connectors. Systems with AseptiQuik connectors require the use of a different autoclave tray. For more information, see section 6.4—Accessories and options specifications.

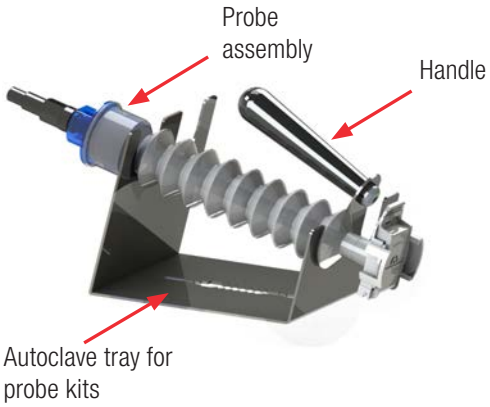

Figure 1.8. Autoclave tray.

Load cells

Load cells are used to determine the weight of the contents of a S.U.M. Load cells are optional for all systems, and consist of three load cells, summing block, wiring, and display with a choice of several data interfaces.

Cable management system

The cable management system is optional for all S.U.M. systems, and helps manage cables and line sets. Includes options for configuration on the right or left side of the tank.

Drive shafts

The drive shaft is inserted into closed-top BPCs through the mixing assembly and into the bearing port. Multiple-segment drive shafts are available as an option for 200–1,000 L units. A three-segment drive shaft is standard for 2,000 L units.

AC and DC motors

S.U.M. systems in 50–1,000 L sizes are only available with DC motors without E-Boxes. 2,000 L S.U.M.s are only available with AC motors.

Miscellaneous items

- **S.U.M. thermowell or sample port**—optional port for temperature sensor calibration and validation
- **Communications cable**—optional
- **Probes**—optional
- **Temperature sensor**—optional
- **P&ID tags**—optional
- **Water jacket pressure relief valve**—optional, for water-jacketed systems only

For more information about hardware accessories, see section 6.4—Accessories and options specifications.

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Hardware assembly and setup

Chapter contents

2.1. Site preparation

2.1.1. Electrical connections

The S.U.M. hardware cannot be used on circuits equipped with GFCI circuit protection because of the potential for nuisance tripping. The electrical plug on the S.U.M. offers a secure ground. These connectors meet the electrical safety codes for portable equipment and are International Electrical Code (IEC) rated (meet IEC standard 60309). This plug provides electrical ground prior to power connection. The supplied electrical receptacle should be hard wired into the facility by a qualified electrical technician. For U.S. installations, the receptacle requires the use of an adapter mounting plate (supplied), which fits into a two-gang box. For additional information on the adapter mounting plate, please see the Equipment Turnover Package (ETP). Alternatively, the system can be hard wired directly into the facility.

2.1.2. Hardware preparation

The hardware is shipped directly from the manufacturer and arrives with various safety mechanisms in place. Please follow the guidelines below to set up the S.U.M. upon arrival.

CAUTION: Any procedures that require the E-Box to be open must be performed with the main electrical disconnect in the locked out position, and all power sources removed from the E-Box. For operator safety, secure the location of the S.U.M. hardware by disabling the swivel casters (50–1,000 L units only) before servicing.

2.2. Hardware assembly

2.2.1. Hardware uncrating

The S.U.M. hardware is shipped directly from the manufacturer and will arrive crated. Be sure to follow the unpacking instructions provided and retain all packaging for possible future use. **If you discover that any damage has occurred in shipping after unpacking the hardware, contact your sales representative immediately.**

The S.U.M. hardware will arrive with the following items:

- Outer support container, including platform, tank, probe door plates (2), and E-Box
- Powdertainer arm assembly (optional)
- Drive shaft, mounted in the crate

- Torque and spanner wrenches
- Equipment Turnover Package (ETP), located on a USB drive (shipped separately)

For more information about unpacking the S.U.M., refer to the HyPerforma S.U.M. Packing and Unpacking Guide (DOC0001).

WARNING: Tipping hazard. The vessel should only be moved by pushing using the provided handles or at the mid-point of the vessel. If pulled or moved too quickly, the vessel can tip, potentially leading to damage to equipment or injury to personnel. To reduce the risk of tipping, the vessel should only be moved slowly over smooth, flat surfaces by at least two qualified personnel. During movement, any locking feet should be retracted, and casters should be in the unlocked position. The vessel should not be moved by pulling of any kind.

2.2.2. 2,000 L S.U.M. motor assembly

Due to the size of the 2,000 L S.U.M. unit, the mixing motor must be removed for shipping. For 2,000 L S.U.M. units only, follow the steps below to mount the mixing motor onto the outer support container.
Note: For safety, assembly of the motor onto the tank requires two people.

1. Remove the motor from its box.

2. Remove the attached safety cap mounting plate from the top of the motor.

3. Place the motor on the motor block portion of the support arm (Figure 2.1).

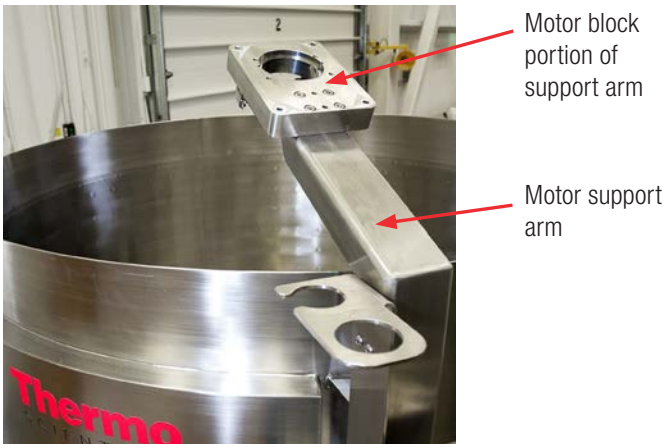


Figure 2.1. 2,000 L S.U.M. motor support arm assembly.

4. While one operator holds the motor in place, have the second operator place the safety cap mounting plate on top of the motor (Figure 2.2).

Figure 2.2. Safety cap mounting plate with bolts.

5. Close the motor safety cap and use the pin (attached to a cable) to secure it.

6. Insert the four 0.95 x 15.8 cm (3/8 x 6.25 in.) bolts through the plate, motor, and into the motor block portion of the support arm.

7. Tighten all four bolts (Figure 2.3).

Figure 2.3. Tightening bolts.

2.2.3. Cable management system assembly for 2,000 L systems

If your 2,000 L system was ordered with the optional cable management system, it will need to be assembled onto the unit. All other sizes arrive with the cable management system attached to the unit. Follow the steps below to assemble the cable management system onto 2,000 L systems. **Note:** Assembly requires two people.

1. Remove the bolts located on the bottom edge of the tank cart.

2. While one person holds the cable management beam upright, have a second person tighten the bolts (Figure 2.4).

Figure 2.4. Attaching the cable management beam to the cart.

3. The short horizontal adjustable arm, often used to house wiring, may also need to be assembled onto the cable management system. Figure 2.5 illustrates how to attach the arm to the cable management system beam.

Figure 2.5. Attaching the cable management arm onto the beam.

4. The length of the horizonal arm may be adjusted by loosening the nut and sliding the outer portion of the arm (Figure 2.6). The beam of the cable management system is hinged and may be adjusted by pushing it closer to or pulling it away from the tank.

Figure 2.6. Adjusting the horizontal arm.

2.2.4. Load cell preparation

When S.U.M. units are purchased with factory-installed load cells, the load cells are shipped in the locked position (threaded up) for equipment protection (Figure 2.7).

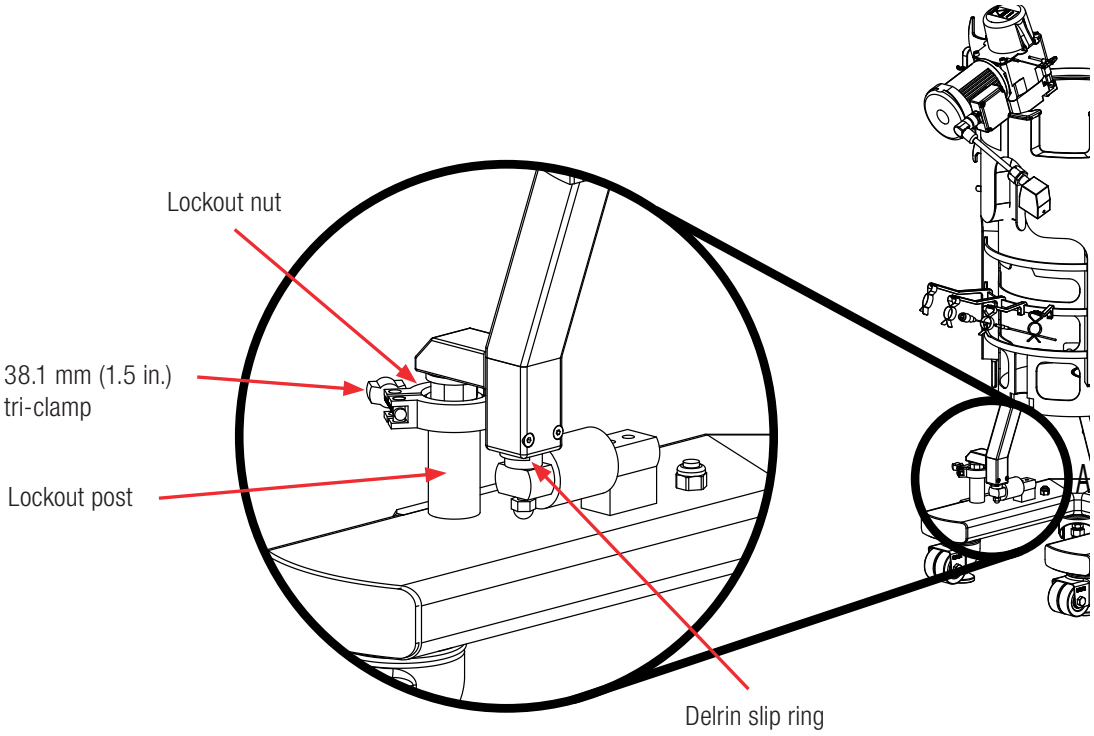


Figure 2.7. Load cell detail.

After the equipment is in place, use the instructions below to unlock the load cells.

1. Remove and discard the Delrin slip ring, if present.

2. Remove the tri-clamp.

3. Loosen the lockout nut, using the small end of the supplied tool, until the nut is tight against the base or leg of the tank.

4. Repeat this process for each load cell until all lockout nuts are disengaged from the lockout posts.

5. Do not reinstall the tri-clamp.

6. Once unlocked, the load cells need to be calibrated in accordance with your company's policy. If your system has a load cell display, contact Mettler Toledo and refer to the IND331 manual provided with your Equipment Turnover Package (ETP). If you are using a third-party controller with your system, load cell calibration is performed using the controller. **CAUTION:** Do not move the unit, especially while filled, when load cells are unlocked. This can damage the load cells.

To lock load cells that have been unlocked:

1. Hand-tighten the lockout nut onto the post.

2. Use the supplied tool to turn the nut an extra 1/4 turn.

   CAUTION: To avoid damaging the load cells, do not over-tighten the nut.

3. Assemble a standard stainless 38.1 mm (1.5 in.) tri-clamp around the flanges.

4. Complete this process for all load cells.

2.2.5. Additional items for assembly

1. If you will be using probes, and have ordered optional probe clips (Figure 2.8), attach the probe clips to the probe access cutout by snapping them onto the brace. **Note:** Figure 2.5 shows a plastic probe clip. Your system may use metal probe clips, instead.

Figure 2.8. Plastic probe clip.

2. Insert the drive shaft, tools, and bearing hub into the brackets provided on the S.U.M. hardware unit (Figures 2.9–2.11).

Figure 2.9. Stored tools and multiple-section drive shaft.

Figure 2.10. Bearing hub and storage bracket.

Figure 2.11. Storage of single-section drive shaft.

3. If your system is equipped with a water jacket, use the tri-clamp fitting to attach the water jacket inlet and outlet ports to the bottom of the outer support container (Figures 2.12 and 2.13).

Figure 2.12. Removing tri-clamp on water jacket outlet.

Figure 2.13. Attaching fitting to water jacket port.

4. If your unit is equipped with the optional Powdertainer arm, install it onto the outer support container as shown below (Figure 2.14).

Figure 2.14. Installing Powdertainer arm.

2.3. Hardware setup

All movement of the S.U.M. hardware should be moved over smooth surfaces with the S.U.M. empty and disconnected from all power and feed sources. Before moving the S.U.M. unit, if the system is equipped with load cells, they must be locked. Follow the steps below to set up the S.U.M. hardware for operation.

1. Move the S.U.M. into the desired location and lock the casters to immobilize the unit. **Note:** The 2,000 L S.U.M. does not have casters.

2. Verify that the electrical supplies in the facility are sufficient to support the power requirements of the S.U.M. and ancillary components, such as controllers or pumps.

3. The S.U.M. is shipped with a special electrical receptacle (Figure 2.15), which must be installed by a qualified electrician. See Appendix B for more information.

WARNING: Potential for electrical shock while installing the electrical receptacle.

Figure 2.15. Electrical receptacle (blue) and adapter (white).

4. Verify the location of the pH controllers (if used), and ensure the cable/tubing lengths are satisfactory.

5. Refer to Figure 2.16 for steps 6–8.

6. Verify that the main power switch is in the “off” position. The selection switch should be pointing to the small circle. **Note:** Figure 2.16 shows the switch in the “on” position.

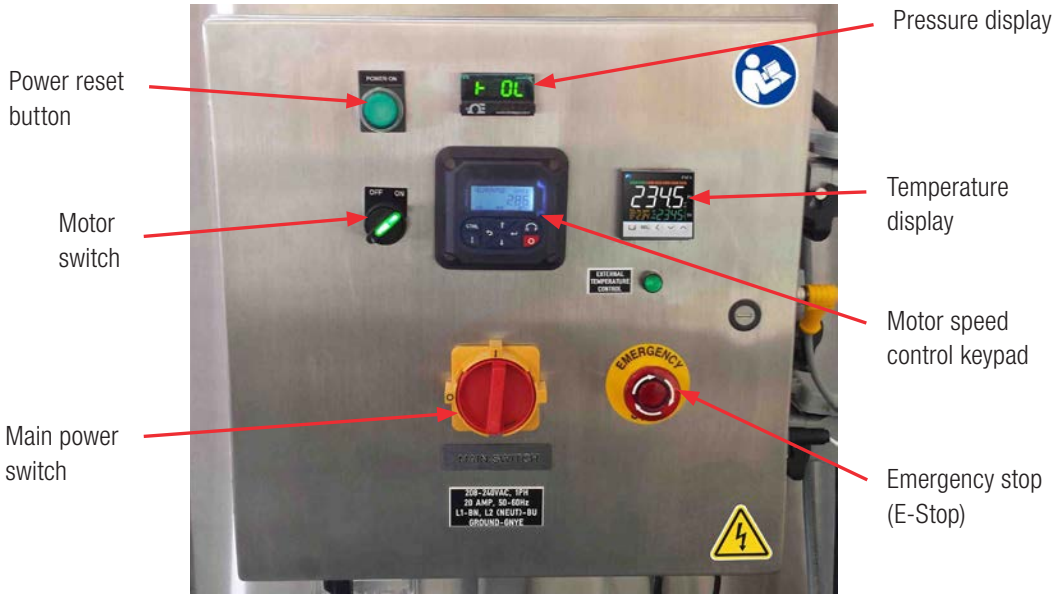


Figure 2.16. Main motor power switch in “On” position.

7. Verify that the emergency stop (E-Stop) is disengaged (pulled out). **Note:** The E-Stop disconnects all power to the system, and an alarm buzzer will sound when it is activated.

8. Verify that the motor switch is turned off.

9. Connect all electrical plugs to facility power (Figure 2.17). Refer to hardware/electrical labels and schematics to ensure proper electrical voltage is connected to the S.U.M.

Figure 2.17. Electrical plug.

10. Connect the motor power cable to the motor (Figure 2.18) and to the motor control connection outlet on E-Box (Figure 2.19).

Figure 2.18. Connecting the motor.

Figure 2.19. Connecting the E-Box.

11. If used, connect the RTD device cable to the input port on the E-Box (Figure 2.20). You may also want to connect monitoring devices to the pressure input and output ports (Figure 2.21).

Figure 2.20. RTD input port.

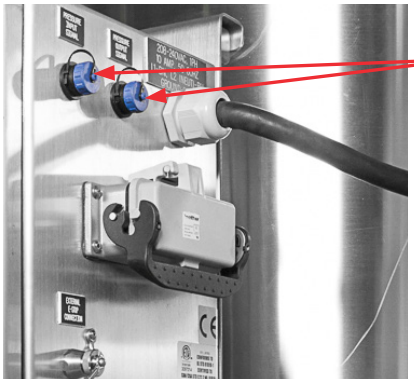


Figure 2.21. Pressure ports.

12. Use the additional electrical outlets on the bottom of the electrical control panel, as needed. The red receptacle is designed for devices, such as pumps, that should be connected to the emergency stop feature. The green receptacle is for devices, such as data loggers, that should not be connected to the E-Stop (Figure 2.22).

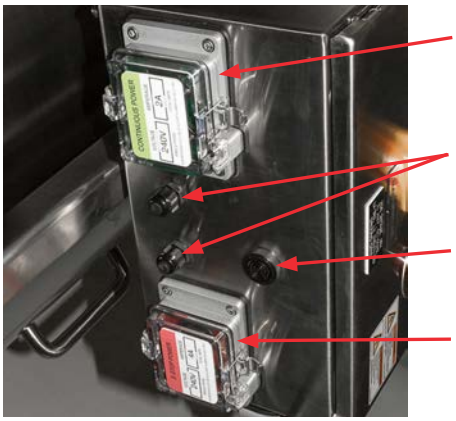


Figure 2.22. Bottom view of E-Box.

13. If you want to mount an emergency stop button remotely in order to provide easy access (such as when using large scale systems), plug it into the external E-Stop port on the E-Box (Figure 2.23).

Figure 2.23. External E-Stop port on the E-Box.

14. When you are ready to operate the system, turn on the main power switch and press the green “Power On Reset” button (Figure 2.24). **Note:** Do not turn on the motor switch as pictured until the BPC has been loaded and you are ready to start agitation.

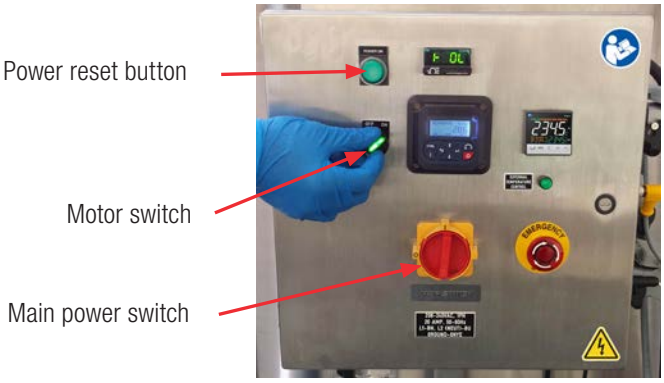


Figure 2.24. Front view of the E-Box.

15. If your unit has a water jacket, connect the inlet and outlet lines from the temperature control unit (TCU) to the S.U.M. water jacket ports (Figures 2.25 and 2.26). The inlet is typically on the left side when you are facing the connectors. **Note:** Refer to the TCU manufacturer's guidelines for detailed TCU setup and operating instructions.

Figure 2.25. Connecting the TCU to the water jacket.

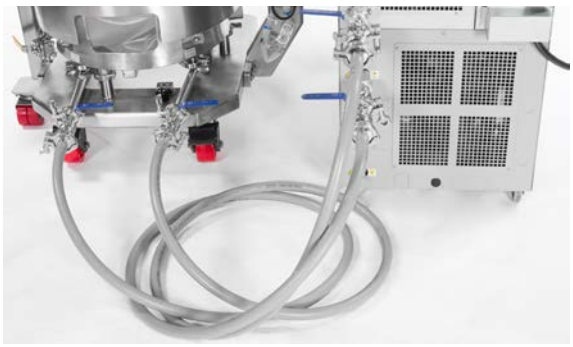


Figure 2.26. Connections between S.U.M. and TCU.

16. If you are using a separate controller, plug the 16-pin communications cable into the E-Box (Figure 2.27) and attach the ground cable from the bottom of the S.U.M. outer support container to the controller (Figure 2.28). **Note:** See section 3.8 for information about the setup required for open top mixing applications.

Figure 2.27. Plugging the communication cable into the E-Box.

Figure 2.28. The connection of the ground wire from the controller to the bottom of the S.U.M.

3

BPC loading and probe insertion

Chapter contents

3.1. General handling guidelines

3.1.1. BPC preparation and setup

Please familiarize yourself with the S.U.M. BPC and hardware before loading the BPC. For reference, the front of the BPC is designated as the panel containing the bearing port. The bearing port should face the bearing port receiver located under the motor mount as the BPC is loaded. In addition, confirm that the volume of the BPC being loaded corresponds to the volume of the S.U.M.

3.1.2. BPC handling instructions

Do not use scissors or any other sharp objects when opening the outer polybags on BPCs. When placing a BPC in the outer support container, do not drag the BPC over corners or sharp objects. Do not lift the BPC by the corners or top seams. For storage, carefully coil the tubing on top of the BPC to prevent the tubing being punctured with cable ties or clamps. Use cushioning between the tubing and the BPC for storage and transport.

3.1.3. Working volume

Each S.U.M. is designed for a specific working volume range. The minimum working volume and rated working volume are listed in Chapter 6—Specifications and parts information. For normal operation, the actual working volumes should not exceed the indicated rated working volumes.

3.1.4. Liquid transfer

The S.U.M. BPC is designed with thermoplastic tubing, quick-connects, and tri-clamps for adding to and dispensing from the BPC. For liquid-to-liquid applications, a sterile environment can be maintained as long as all connections are made in an aseptic manner. To maintain sterility of the mixing system, connection of additional lines (quick-connects and tri-clamp fittings) should be made under a laminar flow hood, or with a sterile tubing welder.

3.1.5. Dispensing

The agitator should not be operated when volumes are less than the stated minimum volume. The S.U.M. is equipped with a drain line that allows for liquid removal by means of peristaltic pump. The drain is located at the bottom of the S.U.M. BPC, allowing for minimal hold up volumes. Connection of the bottom drain line can be accomplished using the provided 12.7 mm (0.5 in.) quick-connect fitting. Turn off agitation during draining when approaching the minimum working volume.

3.2. Loading the BPC

Follow the steps below to load a BPC into the outer support container.
Note: Adherence to these procedures is critical to the successful operation of the S.U.M. For larger systems (500–2,000 L), we recommend using two operators to load the BPC into the outer support container. Larger systems also require access to a ladder or other elevated platform.

1. If you are using a 500–2,000 L S.U.M., first open the door of the outer support container (Figure 3.1).

Figure 3.1. Opening the door on a 500 L S.U.M.

2. Remove the BPC from the protective double polybags (Figure 3.2). Be careful not to cut the BPC when opening the polybag.

Figure 3.2. Opening the polybag.

3. After removing the BPC from the double polybag, visually inspect the BPC for any damage. **If the BPC is damaged, contact your sales representative immediately.**

4. Close all BPC line clamps (Figure 3.3). Make sure the drain line clamp is located as close as possible to the BPC port and is completely closed.

Figure 3.3. Closing line set clamp.

5. Orient the BPC with the bearing port facing up, toward the motor drive, and with the probe ports (if present) facing the bottom access cutout. For 500–2,000 L S.U.M.s, load the BPC through the open door of the outer support container. For 50–200 L S.U.M.s, load the BPC through the top of the outer support container.

6. Route the drain line through the bottom plate (Figure 3.4). The bottom plate may be removed to facilitate loading this lower line set. Then position the BPC inside the tank. For larger units, close the door on the outer support container.

Figure 3.4. Routing the drain line through the tank.

7. If you are using a BPC with probe ports, verify that all port clamps are closed on port connector lines, and are located as close as possible to the body of the BPC (Figure 3.5).

Figure 3.5. Verifying the location of port clamps.

8. Open the bearing port latch at the front of the motor block. Verify that the black bumpers are present at the back of the motor mount block and in the inside of the latch (Figure 3.6). Then, insert the bearing port into the receiver and close and clamp the latch (Figure 3.7).

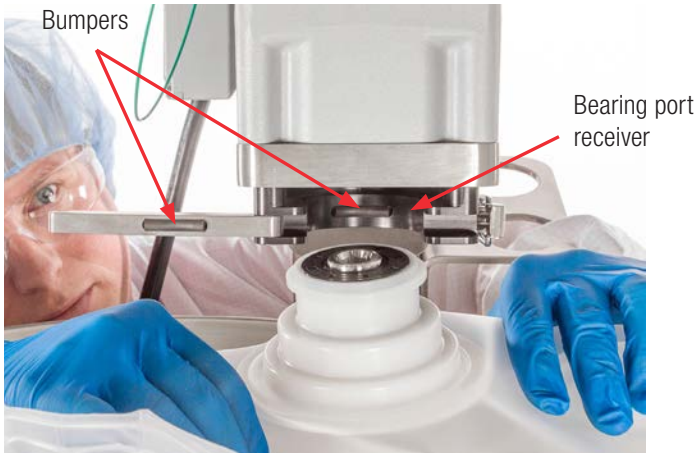


Figure 3.6. Inserting the bearing port into the receiver.

Figure 3.7. Closing and latching the bearing hub receiver.

9. Use the four bottom cutouts in the base of the outer support container to align the positioning tabs on the BPC with the pins on the hardware (Figure 3.8).

Figure 3.8. Aligning BPC positioning tabs with pins.

10. Attach the tabs on the BPC to each of the four bottom corner pins on the outer support container. Cutout windows in the back of the tank facilitate tab attachment. For 500 L and 1,000 L sizes, you can facilitate attachment of the tabs by lifting up on the brace across the cutout in the back of the tank and removing it. For 2,000 L units, a door is provided in the back of the tank to facilitate attachment of the positioning tabs to the pins.

11. Once the BPC is fully seated, make sure the drain line is fully extended through the bottom port, and that the bearing port on the BPC is in the proper position (facing the receiver port).

12. Once the bearing port is engaged, ensure that the film is not being pulled too tightly around the bearing port. The area affected is on the front BPC panel, below the bearing port (Figures 3.9 and 3.10). To ensure proper insertion of the drive shaft, and to reduce tension on the bearing port, pull up slightly on the front panel of the BPC to provide excess film in the affected area.

Figure 3.9. Properly loaded BPC.

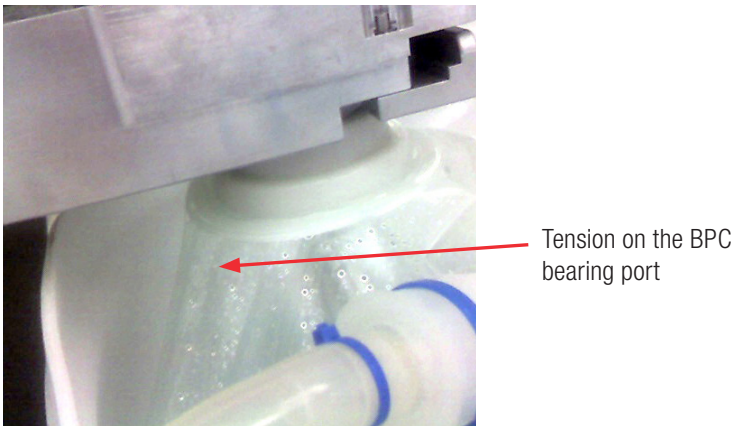


Figure 3.10. Improperly loaded BPC.

13. If the BPC you are using has probe ports, align the row of probe ports through the access window.

3.3. Setting up the recirculation line

An optional recirculation or sampling loop may be set up, if needed. Follow the steps below to connect the recirculation line.

1. Run the drain line through a peristaltic pump (Figure 3.11).

Figure 3.11. Drain line in peristaltic pump.

2. For non-sterile applications, join the quick-connects of the recirculation or sampling line and the drain line to form the recirculation loop. To make this connection, first open the tamper-proof polybag covering the quick-connects on the recirculation/ sampling line and drain lines (Figure 3.12).

Figure 3.12. Removing polybag.

3. Remove the caps from the quick-connects. Line up the recirculation and drain quick-connects and make the connection (Figure 3.13). **Note:** For sterile applications, this connection must be made under a laminar flow hood or by utilizing a sterile tubing welder.

Figure 3.13. Line connection.

4. Be sure the clamps on the recirculation line are closed before filling the BPC.

5. When you are ready to use the recirculation loop, open all clamps on both of the line sets. Figure 3.14 shows a completed recirculation loop.

Figure 3.14. Complete recirculation loop.

3.4. Filling the BPC with air

During the manufacturing process, a slight vacuum forms inside the BPC, causing the panel surfaces to cling to each other and the impeller assembly. Before the drive shaft can be inserted, this vacuum must be released either by opening the tri-clamp on the powder port (for non-sterile applications) or by air inflation through the sterile filter (for sterile liquid applications).

To ensure that the BPC is correctly positioned in the outer support container, connect the air source to a sterile vent filter and begin filling the BPC with air. As the BPC is inflating, ensure the BPC maintains the proper orientation in the support container. **Note:** You can begin filling with liquid through one of the addition ports while the BPC is inflating. Proceed to the next step once the BPC panels no longer cling to the impeller tubing in the center of the BPC (filled to half volume with air). Do not allow the BPC to become tight as it inflates.

WARNING: The S.U.M. BPC is not rated as a pressure vessel.
The BPC should not be allowed to become tight during inflation. Static pressure in the BPC should not exceed 0.03 bar (0.5 psi) at any time. During operation, pressure should not exceed 0.006 bar (0.1 psi). Conditions of over pressure may result in BPC damage or personal injury.

Turn off the supply of air to the S.U.M. BPC, and disconnect the air line from the filter, if applicable.

3.5. Probe insertion

3.5.1. Inserting the temperature sensor

Use the following steps to insert the RTD or another selected temperature sensor into the thermowell.

1. Place a small amount (0.5 mL) of glycerol (Sigma™ part number G6279) in the thermowell to aid in heat transfer. The glycerol also serves as a lubricant and aids in insertion. Twist the RTD slightly as you insert it (Figure 3.15).

Figure 3.15. Inserting the RTD.

2. Insert the sensor until the base of the probe meets the mouth of the thermowell.

3. Secure by twisting the luer lock collar (Figure 3.16). The thermowell will stretch slightly when the RTD is seated.

Figure 3.16. Twisting the RTD to secure.

3.5.2. Inserting pH/conductivity sensors

Preparation and sterilization

Use the following steps to insert a pH or conductivity sensor.
Note: Before beginning probe insertion, please become familiar with the Kleenpak connector procedure described in section 3.9 of this publication.

1. Select the appropriate probe. Make sure a Teflon™ support ring and O-ring are on the probe and visually inspect them for damage.

2. Perform any required probe maintenance and calibrate the pH/conductivity probe (see the Probe Calibration topic at the end of this section).

3. Place a small amount (0.5–1 mL) of Thermo Scientific phosphate-buffered solution (PBS) buffer or saline solution onto the threaded end of the probe adapter.

4. Insert the probe into the probe assembly through the threaded adapter.

5. Verify that the probe tip is not touching (greater than 6.35 mm [1/4 in.] gap) the membrane of the Kleenpak connector before threading it into the probe adapter.

6. Hand-tighten the adapter and verify the probe tip is not touching the membrane.

7. Place the probe assembly with probe into the autoclave tray for probe kits (Figure 3.17).

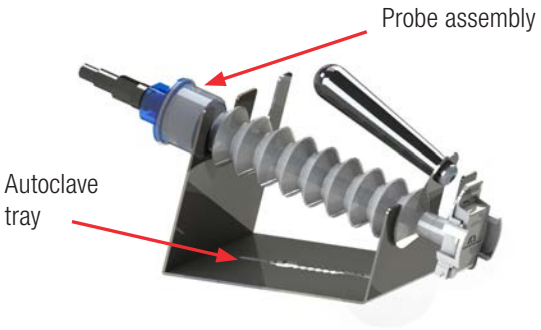


Figure 3.17. Probe assembly in the tray.

8. Autoclave the probe assembly using a validated sterilization cycle (approximately 30 minutes at 122°C). Sterilization cycles of 30 minutes are generally sufficient. Wet or dry cycle parameters can be used. Slow exhaust cycles are preferred, as this minimizes stress on the probes during the temperature and pressure changes of autoclaving.

9. When stored properly, the autoclaved probe assemblies can be stored dry for short periods of time (less than 24 hours) without loss of sensor longevity, performance, or sterility.

Inserting the pH/conductivity probe

Use the following steps to insert probes into the BPC using the probe assembly (autoclaved, if required).

1. Place tubing clamps on all probe ports prior to attempting to connect probe assemblies (Figure 3.18). This will prevent sterility loss in the event that errors are made during the connection of Kleenpak connectors.

Figure 3.18. Placing a tubing clamp on a probe port.

2. Ensure that the RTD or other temperature sensor (if used) has been inserted and secured.

3. Attach the ground clip on the bottom of the outer support container to the insert on the sample line (Figures 3.19 and 3.20).

Figure 3.19. Ground clip on the outer support container.

Figure 3.20. Attaching the ground clip to the metal insert on the sample line.

4. Connect the Kleenpak connector to the pH/DO probe port using the protocol outlined in section 3.9.

5. Ensure that all four snaps click on each connector, and that the base and barrel are fully seated.

6. Remove the tubing clamp on the individual probe port.

7. Insert the pH/conductivity sensor probe by collapsing the bellows toward the S.U.M. The probe is seated when the bellows are fully collapsed. **Note:** A small amount of liquid may enter the bellows if the probe is loaded after liquid fill.

8. Hang a probe clip from the horizontal band on the outer support container (Figure 3.21). Place the entire collapsed probe assembly into the probe holder (Figure 3.22). If necessary, compress the probe bellows further to allow the probe assembly to be positioned and locked into the other end of the probe holder.

9. Allow the probe bellows to relax.

Figure 3.21. Attaching a probe clip.

Figure 3.22. Placing collapsed probe assembly into the clip.

Note: Probe ports that are not used prior to liquid fill must remain clamped. Unused probe ports can be accessed later for probe replacement or redundancy purposes, if required.

Calibrating the probe

Probe calibration is controller-specific. However, for sterile applications, pH probes must be calibrated prior to steam sterilization. The calibration of the probe can be standardized by comparison of an offline sample once the pH probe is connected to the S.U.M.

3.6. Inserting the drive shaft

Before inserting the drive shaft, familiarize yourself with the mixing assembly illustration below (Figure 3.23). **Note:** When inserting or removing the drive shaft, take care to keep the shaft from impacting the ceiling or ceiling fixtures. Refer to Chapter 6 for ceiling height requirements for drive shaft insertion.

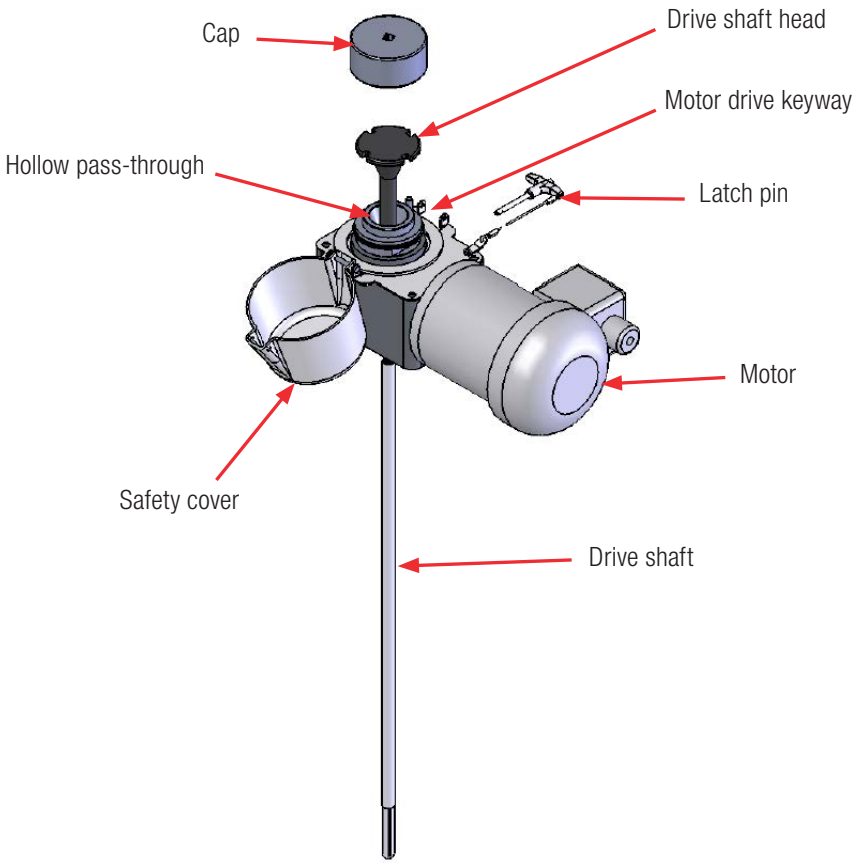


Figure 3.23. Mixing assembly.

1. Before loading the drive shaft, ensure that the BPC has been filled with air (section 3.4).

2. Remove the latch pin from the safety cover of the motor (Figure 3.24). Use the two supplied wrenches to loosen the threaded cap covering the hollow pass-through of the motor (Figure 3.25). Then unscrew and remove the cap.

Figure 3.24. Removing safety cover.

Figure 3.25. Removing cap.

3. Insert the drive shaft through the hollow pass-through of the motor assembly, as described below. **Note:** Lubricate the threaded ends of multi-segment drive shafts with a light coat of food-grade anti-seize with each use. When installing a multi-segment drive shaft, reverse-thread the segments together and use the cap latch pin to hold the segment in place while threading (Figures 3.28 and 3.29).
   - Use two hands to load the drive shaft through the top of the mixing assembly (Figure 3.26); a slight back and forth twisting motion will aid in insertion.
   - When approximately 5.08 cm (2 in.) of the shaft remains, twist slightly to engage impeller.
   - When approximately 2.54 cm (1 in.) of the shaft remains, twist slightly to engage bearing assembly.
   - When approximately 0.64 cm (0.25 in.) of the shaft remains, twist to align the motor drive keyway with one of the four outer slots on the drive shaft head (Figure 3.27).

Figure 3.26. Inserting drive shaft.

Figure 3.27. Aligning with the keyway.

Figure 3.28. Multi-segment drive shaft held in place with the safety cap latch pin.

Figure 3.29. Reverse-threading of second segment of multi-segment drive shaft.

4. Directly couple the drive shaft to the motor drive.
   - Place the threaded cap on the hollow pass-through and hand-tighten clockwise (Figure 3.30).
   - Place the spanner wrench on the hollow pass-through and tighten the cap using the supplied torque wrench (Figure 3.31). **Note:** The torque wrench is a standard 10 mm (3/8 in.) square drive, and it is calibrated at the factory at 16.9 Nm (150 in-lb.).
   - Verify that the wrenches have been removed from the system and placed in storage holders.
   - Close the safety access cover and insert the latch pin.

Figure 3.30. Replacing the cap.

Figure 3.31. Tightening the cap.

3.7. Taring the system

To ensure accurate weight measurements, use the following steps to tare (weigh) your system before beginning liquid fill.

1. Verify that all parts of the mixer (drive shaft, BPC, probe door plates, probe clips, and tools) are located on the outer support container. The BPC should also be installed in the unit. The Powdertainer may also need to be installed, depending on your weighing process.

2. Tare the skid on the scale with the BPC installed, or use another weighing method, such as load cells, if available.

3. Refer to your internal formulation procedures before proceeding.

3.8. Loading BPCs for open-top mixing

For open-top mixing applications, the S.U.M. includes a reusable bearing port (Figure 3.32), a single-use impeller and sleeve (Figure 3.33), and a single-use tank liner with a drain line.

Figure 3.32. Bearing hubs for 2,000 L tri-clamp connections (left) and quick-connections (right).

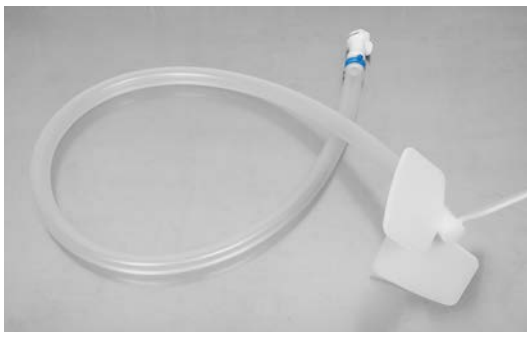


Figure 3.33. Impeller and sleeve.

To accomplish open-top mixing in all S.U.M. tanks, insert the reusable bearing port (for either tri-clamp or quick-connections) into the bearing port receiver of the motor. The 2,000 L S.U.M. uses the tri-clamp version of the reusable bearing port, while all other sizes use the quick-connect version (Figure 3.32). Similarly, there are two matching impeller and sleeve combinations: one with the tri-clamp fitting, and one with the quick-connect fitting.

Follow the steps below to set up your system for open-top mixing.

1. Load the BPC liner into the S.U.M. outer support container. Follow the loading instructions included in section 3.2—Loading the BPC, to secure the liner to the hardware unit.

2. Expand the top opening of the liner to stretch over the outer rim of the hardware and drape it over the sides (Figure 3.34).

Figure 3.34. Installing the liner.

3. Open the retention clamp for the bearing and insert the reusable bearing hub into the receiver (Figure 3.35). Then close and latch the clamp.

Figure 3.35. Inserting the reusable bearing hub.

4. Attach the impeller sleeve directly to the reusable bearing port using the quick-connect attachment on the plastic sheath. An audible click will confirm that the attachment has been successfully made (Figure 3.36). **Note:** The 2,000 L unit does not have a quick-connect fitting. For 2,000 L units, make the connection using a tri-clamp.

Figure 3.36. Attaching the impeller sleeve.

5. Insert the drive shaft into the motor as described in section 3.6. Then, use the instructions in section 3.7 to tare (weigh) your system before liquid fill.

3.9. Making probe connections

The probe connection instructions provided in this section apply to Pall™ Kleenpak™ aseptic connectors. **Note:** Your S.U.M. system may use CPC™ AseptiQuik™ aseptic connectors, or non-aseptic quick-connects, instead of Kleenpak. Contact your sales representative for information on making these alternative probe connections.

3.9.1. Kleenpak specifications

The Kleenpak connector has a maximum working pressure of 3 bar (43.5 psi) at 40°C in compatible fluids.

WARNING: Operation outside the above specifications and/or with fluids incompatible with construction materials may cause personal injury and result in damage to the device.

3.9.2. Receipt of equipment

The male and female Kleenpak connectors are supplied in separate packages. There are several types of end fittings in order to match different tubing size requirements, and to allow for different attachment possibilities to flexible tubing.

Please note the following recommendations:

- Store the male and female Kleenpak connectors in clean, dry conditions, and wherever practical, in the external packaging as delivered.
- DO NOT remove Kleenpak connectors from the inner device bag packaging as delivered.
- Male and female Kleenpak connectors are supplied protected by an inner and outer bag. Ensure that the packaging is undamaged.
- The assembly aid is provided non-sterile, and can be reused multiple times. It needs to be stored in clean, dry conditions between each use. The assembly aid is supplied separately, and is available for purchase from your local Pall representative.

3.9.3. Installation

Before installation, it is essential to verify that the Kleenpak connector is suitable for the liquid that it will be in contact with for the application. Follow the appropriate instructions listed below.

- Install the male and female Kleenpak connectors using compatible connections. Ensure that the tubing is attached firmly to the hose barb to prevent leakage during operation by using cable ties or other methods. During tubing assembly, premature actuation of the male plunger is prevented by the anti-actuation ring. The anti-actuation ring needs to remain in place until the actual connection takes place. The presence of valves before the connector on the tubing is recommended to prevent liquid contact with the Kleenpak connectors prior to use.
- If the connectors are to be autoclaved, position them with the peel strips facing upward to prevent peel strip blockage by condensate.

WARNING:

- The device must remain dry prior to connection of the male and female Kleenpak connectors. If there is fluid present in the line or around the devices, do not use.
- These disposable Kleenpak connectors must not be in-line steam sterilized. Material design limitations will be exceeded when these devices are exposed to pressurized steam, and they will rupture.

3.9.4. Gamma irradiation

1. Connect the male or female Kleenpak connector to the single-use system. A valve or clamp must be installed close to the connector to prevent accidental wetting after the system is filled with liquid.

2. Ensure that the protective cap is firmly in place. Autoclave paper or another radiation-resistant material can be used to ensure that the cap does not become dislodged during handling.

3. It is recommended that the entire assembly be placed in an inner and outer bag for protection prior to gamma irradiation.

4. Treat with gamma radiation. The maximum allowable radiation dose is 50 kGy (5 mrad).

Important note: Pall recommends that the efficiency of the gamma irradiation cycle is validated using an appropriate method. These connectors have not been validated for repeated gamma irradiation exposure.

3.9.5. Autoclave instructions

1. Install the male or female Kleenpak connector to the equipment to be autoclaved. If the Kleenpak connector is attached to a tank, the tank should be vented appropriately with a vent filter.

2. Ensure that the protective cap of the Kleenpak connector is firmly in place. Autoclave paper or another autoclavable and air/steam permeable material can be used to cover the cap loosely to ensure that the cap does not become dislodged during handling.

3. The Kleenpak connectors should be allowed to vent during autoclaving. The venting strip should be facing upward to prevent blockage by condensates.

WARNING: To avoid collection of condensate within the connectors, do not place the venting strip downwards during autoclaving. The connector should not be covered with heavy objects during the autoclave cycle. Pall recommends that the efficiency of the autoclave cycle is validated using an appropriate method.

Note: The maximum temperature is 121°C for ACD part numbers, and 130°C for KPCHT part numbers. The maximum exposure time is 75 minutes. Do not autoclave at a higher temperature or for a longer period of time. A slow exhaust cycle is recommended.

3.9.6. Making the connection

Figure 3.37 illustrates the male and female Kleenpak connector parts, as well as the complete actuated connector.

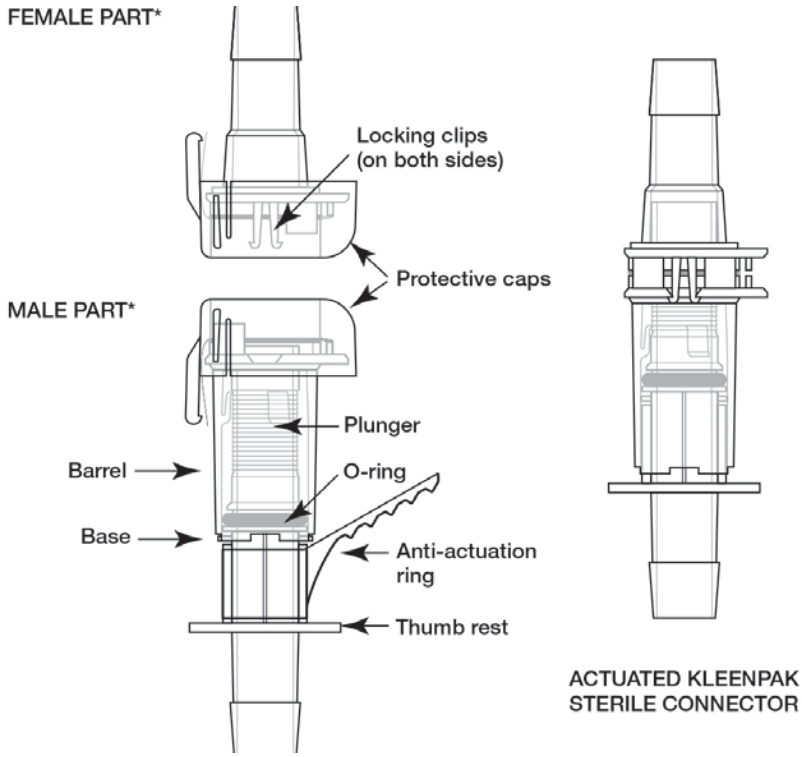


Figure 3.37. Kleenpak connector schematic.

WARNING: Do not use if fluid is in contact with the connector. Do not use if the protective caps are loose or displaced.

Making the connection using the connector assembly aid

Follow the steps below to make the Kleenpak connection using the assembly aid.

1. Lift and pull the tab off of the protective caps to remove the caps from the Kleenpak connectors (Figure 3.38).

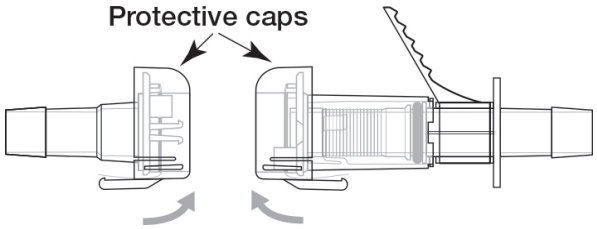


Figure 3.38. Protective caps on connectors.

2. Hold the barrel of the larger (male) Kleenpak connector above the base. Align the smaller (female) Kleenpak connector with the male connector. The flat sides should be aligned, and both peel-away strips should remain folded (Figure 3.39). **Note:** If the Kleenpak connectors are not aligned properly, the connection cannot be made.

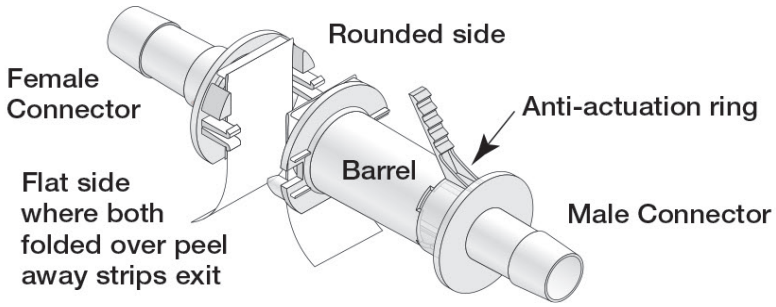


Figure 3.39. Flat sides of connectors aligned.

3. After they have been aligned correctly, firmly press the two connectors together until both locking clips snap together tightly (Figure 3.40).

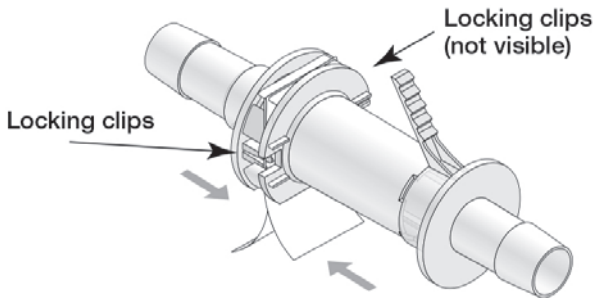


Figure 3.40. Pressing connectors together.

4. Support both the male and female Kleenpak connectors, and remove the anti-actuation ring from the male connector by pulling the tab toward the barbed end of the male Kleenpak connector (Figure 3.41).

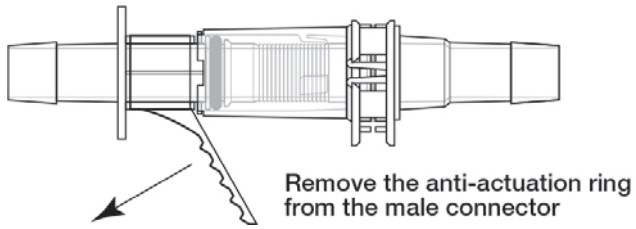


Figure 3.41. Removing the anti-actuation ring.

5. If you are using the Kleenpak connector assembly aid, place the connector inside the aid so that the peel-away strips protrude through the opening (Figure 3.42). If not, hold the connector firmly on each side, with the peel-away strips pointing away from your hand. The Kleenpak connector should stay securely in the assembly aid when properly installed.

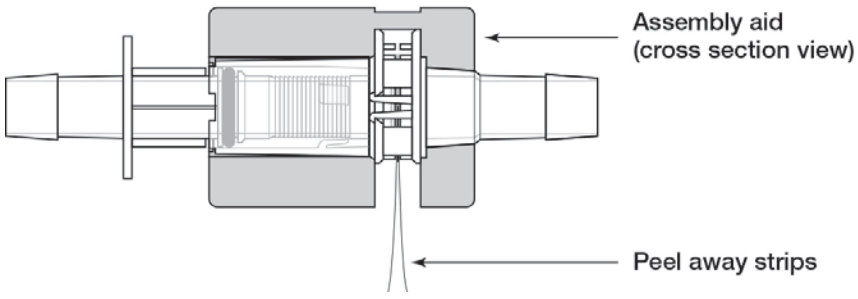


Figure 3.42. Peel-away strips protruding from assembly aid.

6. Hold the assembly aid in the palm of your hand with the Kleenpak connector facing outward, and your thumb supporting the Kleenpak connector in the assembly aid. Using your other hand, firmly grasp both peel-away strips as close as possible to the body of the assembly aid to ensure a secure grip, and pull both strips together in one continuous motion. Ensure that the Kleenpak connector is perpendicular to the peel-away strips (Figure 3.43).

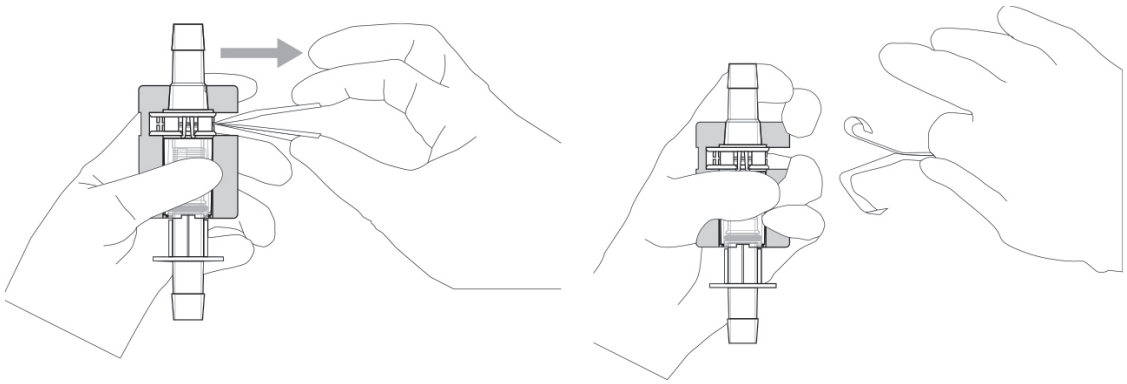


Figure 3.43. Removing the peel-away strips from the connector.

WARNING: Do not use the connector if only one peel-away strip is removed instead of both.

7. With the Kleenpak connector still secured in the assembly aid, push the thumb rest of the male Kleenpak connector toward the base of the barrel (Figure 3.44).

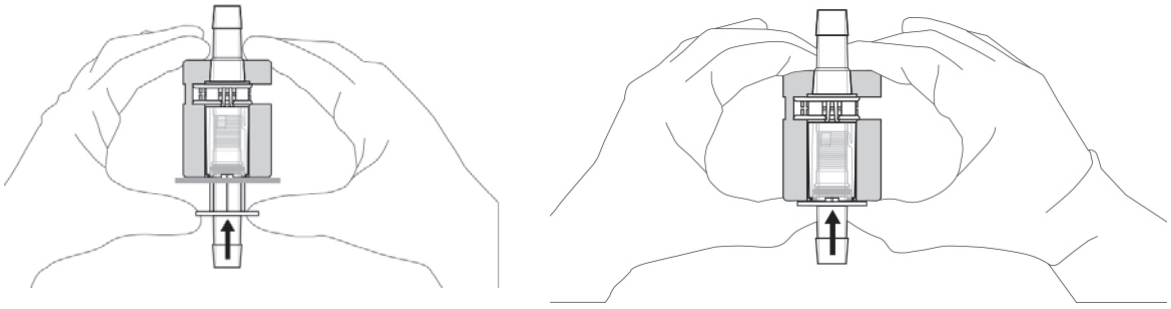


Figure 3.44. Pushing the thumb rest of the connector toward the base of the barrel.

Note that in order to establish a proper connection, the plunger inside the male Kleenpak connector must be fully inserted into the female Kleenpak connector. As a verification, repeat actuation until a hard stop is reached.

If necessary, the Kleenpak connector may be removed from the assembly aid to complete the plunger movement.

8. After the Kleenpak connector assembly is complete, the assembly aid may be removed. When the assembly aid is removed, verify actuation until a hard stop is reached. Then start the fluid transfer (Figure 3.45).

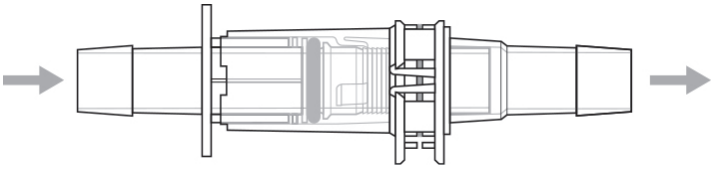


Figure 3.45. Beginning fluid transfer.

Making the connection without using the connector assembly aid

Follow the steps below to make the Kleenpak connection without using the assembly aid.

1. Lift and pull off the protective caps to remove the caps from the Kleenpak connectors (Figure 3.46).

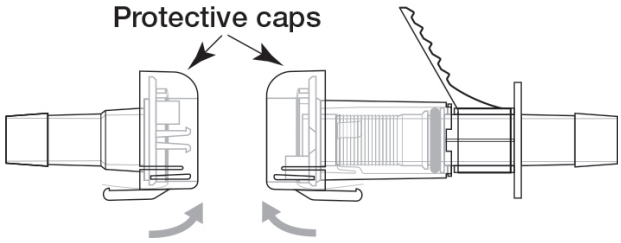


Figure 3.46. Removing protective caps.

2. Hold the barrel of the larger (male) connector above the base. Align the smaller (female) connector with the male connector. The flat sides should be aligned, and both peel-away strips must remain folded (Figure 3.47). **Note:** If the Kleenpak connectors are not aligned properly, the connection cannot be made.

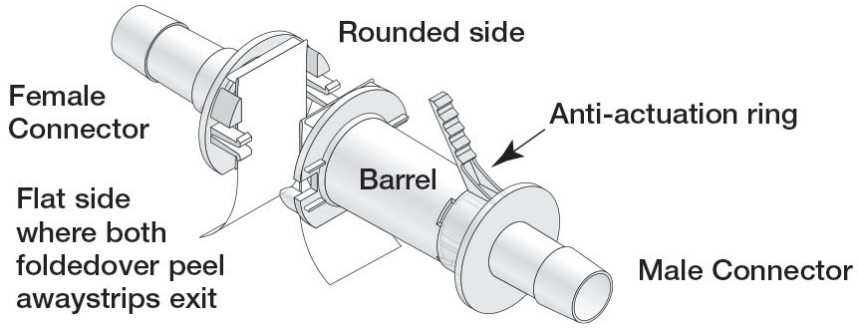


Figure 3.47. Aligning male and female connectors.

3. After the connectors have been aligned correctly, firmly press the two connectors together until both locking clips snap together tightly (Figure 3.48).

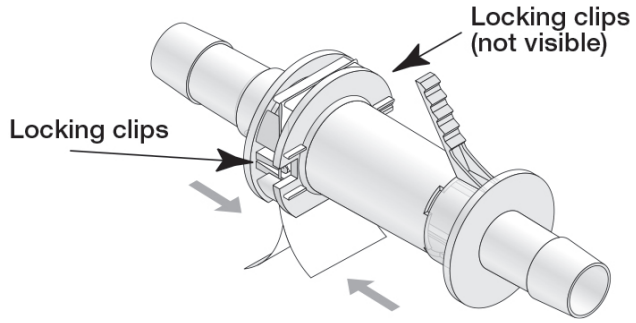


Figure 3.48. Pressing the connectors together.

4. Support both the male and female Kleenpak connectors. Remove the anti-actuation ring from the male connector by pulling the tab toward the barbed end of the male Kleenpak connector (Figure 3.49).

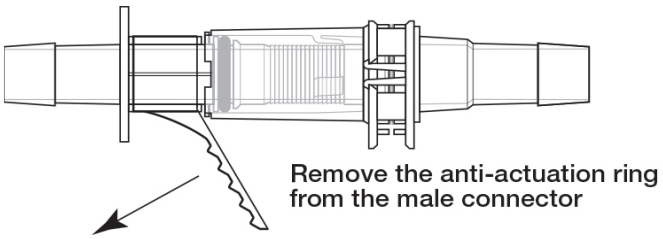


Figure 3.49. Removing the anti-actuation ring.

5. With one hand, support the male and female sides of the Kleenpak connector by wrapping your fingers around both sides of the connector, next to the flange. Using your other hand, grasp both of the peel-away strips as close as possible to the flat side of the connector to ensure a good grip, and pull them out together in one continuous motion. Ensure that the connector is perpendicular to the peel-away strips shown in Figure 3.50. The perpendicular orientation must be maintained while the two strips are pulled simultaneously. Do not use if only one of the peel-away strips is removed instead of both.

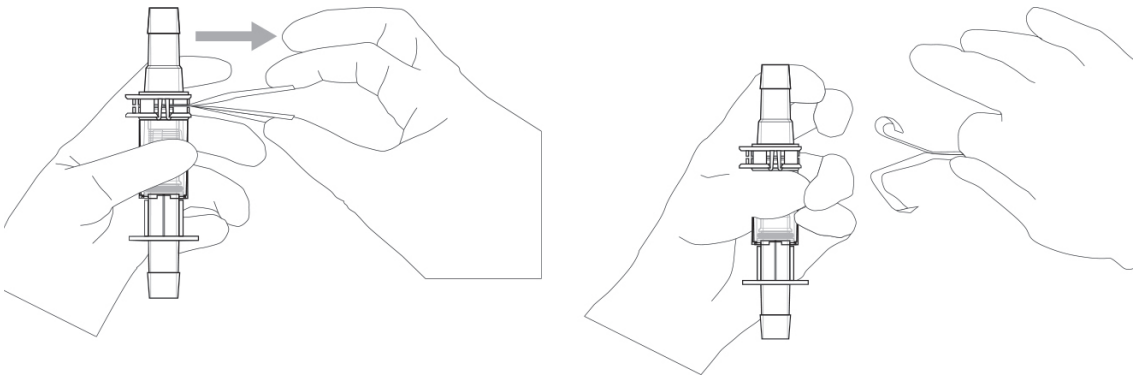


Figure 3.50. Removing the peel-away strips from the connector.

Note: Do not impart perpendicular forces on the connector, as it can cause the connector to break. If a perpendicular force is present due to items attached to the Kleenpak connector, then the connector must be properly supported.

6. Push the thumb rest of the male Kleenpak connector toward the base of the barrel until they meet (Figure 3.51).

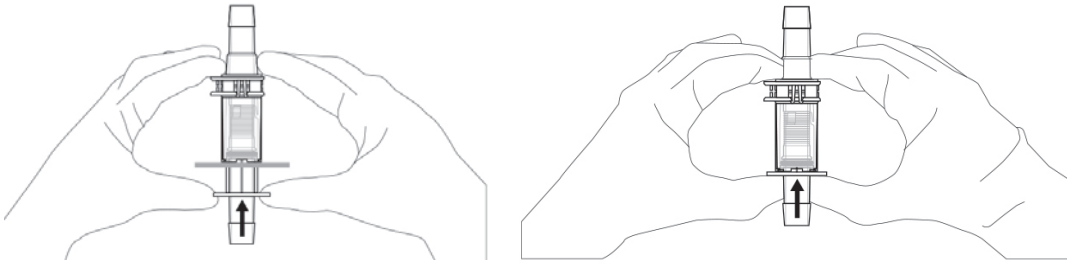


Figure 3.51. Pushing the thumb rest toward the barrel.

Note that in order to establish a proper connection, the plunger inside the male connector must be fully inserted into the female connector. As a verification, repeat actuation until a hard stop is reached. Then start the fluid transfer (Figure 3.52).

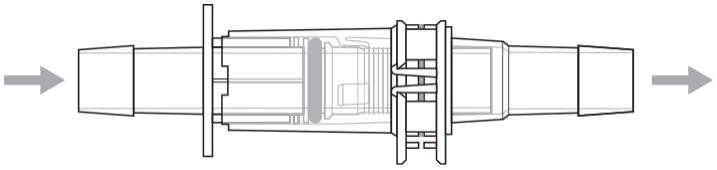


Figure 3.52. Beginning fluid transfer.

4

Operating information

Chapter contents

The instructions provided in this chapter represent a general outline of operating procedures. Because procedures can vary greatly from application to application, it is important to consult your internal formulation protocols for proper procedures.

Please note that the information provided below includes information for both sterile and non-sterile mixing applications. For sterile applications, all connections must be made aseptically.

4.1. Setting agitation

Use the following steps to start agitation in your S.U.M. system.

1. After the volume has reached the minimum operating volume of the S.U.M., the mixer control can be turned on using the motor controller power switch (Figure 4.1).

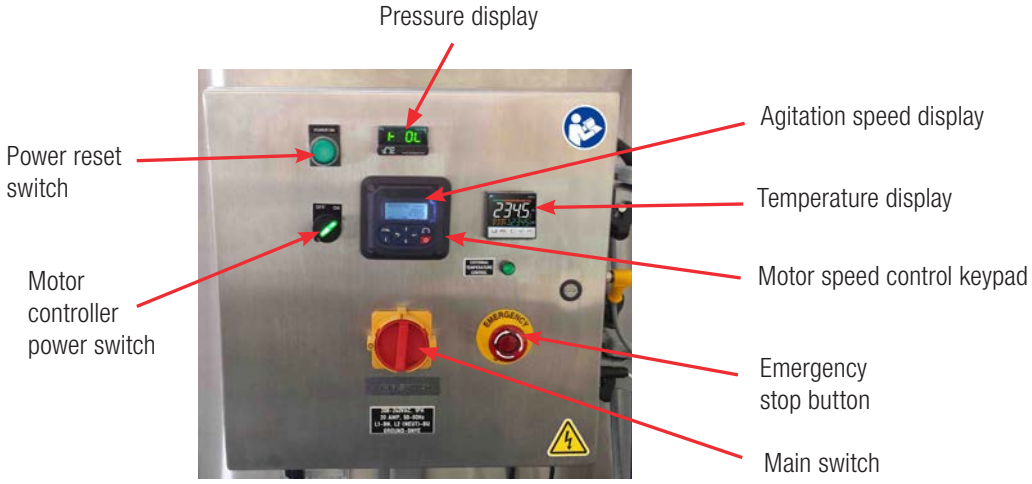


Figure 4.1. Front view of E-Box.

2. Use the arrow keys on the motor speed control keypad (Figure 4.1) to adjust the setpoint speed to the desired level. The red LED display indicates the speed in rpm. Adjust the mixing rate based on application and liquid volume.

3. Allow the speed to stabilize. Then make fine adjustments, if necessary.

4. Verify that the drive shaft is rotating in a counter-clockwise direction.

4.2. Adding powder with the Powdertainer

The S.U.M. can be equipped with a Powdertainer support arm for the addition of solids, such as powder. See section 6.4.2 of this publication for Powdertainer specification information.

The following instructions describe the use of the Powdertainer BPC in conjunction with the S.U.M. when it is equipped with the Powdertainer arm. While other methods for solids addition can also use the BPC powder port, complete protocols are not included here, as individual protocols vary.

1. Ensure that the clamp on the Powdertainer bag is completely closed.

2. Suspend the Powdertainer from the support arm hanger by its handle (Figure 4.2).

Figure 4.2. Hanging the Powdertainer on the support arm.

3. If necessary, adjust the Powdertainer arm height by flipping the latch down, sliding the upper pole up or down, re-engaging the latch, and then turning the lever clockwise to tighten it.

4. Remove the tape and cap from the Powdertainer BPC opening (Figure 4.3).

Figure 4.3. Removing the cap from the Powdertainer.

5. Snap the powder port on the BPC into the bracket on the Powdertainer support arm. If necessary, adjust the bracket in or out to accommodate the position of the powder port on the BPC.

6. Remove the clamp and protective cap from the powder port on the BPC.

7. Align the Powdertainer opening and the powder port on the BPC (Figure 4.4).

Figure 4.4. BPC powder port in the clamp.

8. Use the tri-clamp provided on the Powdertainer arm to connect to two ports (Figure 4.5).

Figure 4.5. Connecting the Powdertainer to the BPC powder port.

9. To initiate the addition of solids, release the clamp on the bottom of the feed bag (Figure 4.6). Ensure the entire contents of the feed bag are added before detaching the Powdertainer from the BPC. The powder port cover, gasket, and clamp can be replaced if no other dry ingredients are to be added, or it may be left open for pipette sampling.

Figure 4.6. Releasing the Powdertainer feed clamp.

4.3. Adding more powder or liquid during mixing

Depending on your operation procedures, it may be necessary to add more powder or liquid to the solution during the mixing process. Follow the steps below to add components to the S.U.M. during operation.

4.3.1. Adding powder to liquid

1. Suspend the Powdertainer BPC from the hanger on the S.U.M.
2. Remove the clamp, cover, and gasket from the powder port on the BPC.
3. Use the holding arm to hold the powder port of the BPC in place as the Powdertainer is positioned.
4. Remove the protective tape and cap from the port on the Powdertainer.
5. Attach the Powdertainer to the powder port on the BPC using the tri-clamp.
6. Verify that the mixer motor is operating at the desired speed.
7. Open the bag clip to release the contents of the Powdertainer into the S.U.M. BPC.
8. Continue mixing until all powder is solubilized before proceeding to the next ingredient.

4.3.2. Adding liquid to liquid

1. Verify that the mixer motor is operating at the desired speed.
2. Connect the liquid source line to an addition line set on the top of the BPC via the quick-connect or tri-clamp fittings.
3. To introduce the liquid, open the flow path by releasing any clamps on the line set. Continue mixing until all liquid has been introduced before proceeding to the next ingredient.

4.4. Fluid transfer

4.4.1. Transferring fluid using quick connects or tri-clamps

Fluid transfer may be made with quick connects or tri-clamp connectors, as described in the following steps.

1. First, close the clamp on the BPC line set. Then expose the tubing quick-connect or tri-clamp by tearing the perforated seal on the tubing line sets' protective packaging, and removing the connector caps (Figure 4.7).

2. Make the tubing connection to another line set equipped with compatible quick-connects or a tri-clamp fitting (Figure 4.8).

Figure 4.7. Tearing open the protective packaging.

Figure 4.8. Making a line set connection with a quick-connect.

3. Release the tubing clamp on the BPC line set to permit fluid flow.

4.4.2. Transferring fluid using a sterile tubing welder

1. Close all clamps on line sets that will be connected. Then, use a sterile tubing welder to connect an addition/drain line to the appropriate BPC line set (Figure 4.9).

Figure 4.9. Sterile tubing welder.

2. Inspect welds and open the flow path by pinching the weld locations. Then open the clamps on the line sets to permit fluid flow.

4.5. Sampling

4.5.1. Sampling using a recirculation loop

Samples can be taken from the SmartSite™ port on the recirculation loop by attaching a luer lock syringe and drawing a sample while the recirculation loop is operating. Samples can also be taken on BPCs equipped with a thermowell/sampling port located in one of the probe ports. The following instructions are for aseptic sampling via the SmartSite port. For these instructions, use the standard luer lock on a 60 mL syringe, or sterile manifold.

1. Remove the dust cover from the SmartSite (Figure 4.10).

2. Clean the SmartSite with a sanitary wipe. Then, connect the sanitary luer lock type syringe (Figure 4.11).

Figure 4.10. Removing cap.

Figure 4.11. Inserting syringe.

3. Apply a small amount of vacuum pressure by pulling out the syringe plunger slightly and pull a sample (approx. 30–60 mL).

4. Close the pinch clamp and remove the syringe (this will be considered a purge sample).

5. Clean the SmartSite with a sanitary wipe and connect the sanitary luer lock type syringe.

6. Apply a small amount of vacuum pressure using the syringe, and pull the desired sample volume (approx. 10–20 mL).

7. Remove the syringe (this will be considered a representative sample).

8. Clean the SmartSite with a sanitary wipe and replace the dust cap.

4.5.2. Sampling without a recirculation loop

When the recirculation loop is not being used, a line set can be used for sampling instead. To use a line set for sampling, push the line set down to the liquid level. Use a pump to draw off liquid into a secondary container. A sample may also be pulled via the drain line in the same manner.

4.6. Draining

4.6.1. Draining using a recirculation loop

If you are using a recirculation loop, the drain line is located on the addition line “Y.” Open the clamp on the 30.5 cm (12 in.) section of tubing on the recirculation loop “Y” and connect to the intended transfer line. Use the peristaltic pump already installed on the recirculation line to transfer the contents of the S.U.M. Be sure to stop the mixing motor before you reach the minimum working volume.

4.6.2. Draining without a recirculation loop

Use the following steps to drain the BPC if you are not utilizing a recirculation loop.

1. Connect the bottom drain tubing set to the intended transfer line.
   Note: For sterile applications, this must be done aseptically.

2. Open the clamp positioned at the bottom drain port.

3. Use a peristaltic pump to begin draining the BPC. Be sure to stop the mixing motor before the liquid in the BPC reaches the minimum working volume.

4. When approximately 3–5 liters remain in the BPC, lift the BPC from the top.

5. Hold the bottom drain line near the floor while lifting the top of BPC to facilitate draining the final liter of liquid.

4.7. Shutdown and disposal

1. After draining the S.U.M., turn off the power to the outer support container by switching off the main power disconnect.

2. Remove the drive shaft and store it by reversing the steps used during assembly. See section 3.6—Inserting the drive shaft. **Note:** Exercise caution when removing the drive shaft from the S.U.M. under low-clearance ceilings to avoid impacting the ceiling or ceiling fixtures (see the ceiling height requirements in Chapter 6).

3. If the S.U.M. hardware has been in contact with caustic materials, lightly rinse the affected areas with water, followed by a routine cleaning. See Chapter 5—Maintenance for more information.

4. Return any loose items, such as the drive shaft and tools, to their storage locations to prevent accidental damage.

5. Remove the BPC from the outer support container and dispose of the BPC according to your facility regulations. All product contact materials may be disposed of in a waste container or incinerator. If the reusable bearing port has been used for open-top mixing, store it for future use.

Note: Maintain a Safety Data Sheet (SDS) on the equipment as directed by local, state, and federal requirements.

5

Maintenance and troubleshooting

Chapter contents

5.1. Maintenance guidelines

5.1.1. Routine maintenance guidelines

Environmental conditions, operating parameters, and the ability of the user to adhere to standard operating procedures, as outlined in this user's guide, can have a significant impact on the useful life of the S.U.M. hardware. High-wear items that are common to conventional systems, such as bearings, seals, O-rings, and sterilization valves have been considered in the design of the disposable construction of the S.U.M. This creates a mixing system that is inherently robust, and requires low levels of routine maintenance. The following routine maintenance guidelines are based on standard operating conditions, as defined in this user's guide.

Take time between mixing batches to clean the exterior of the S.U.M. This will improve the appearance and overall longevity of the hardware system. Between runs, the outer support container, drive shaft, mixer drive, and E-Box can be wiped down with sanitary wipes. Steel surfaces on the outer support container can also be cleaned with a stainless steel cleaner.

The S.U.M. hardware is constructed in accordance with IP-54 ingress protection ratings, and can be cleaned to the extent of standard laboratory cleaning procedures. Ensure that all electrical connections have been disconnected and electrical enclosures are closed tightly. The unit must be allowed to fully dry prior to being brought back into operation.

5.1.2. Preventive maintenance guidelines

Follow the preventive maintenance guidelines below to ensure dependable system use. Wear components should be visually inspected before and after use. Refer to the drawings on the ETP for information on replacement parts. **Note:** The reusable S.U.M. bearing port should be replaced annually.

Drive motor

The drive motor is an industrial-grade induction motor with a permanently sealed and lubricated gear box. The drive motor will operate a minimum of 10,000 hours at a continuous load before it will need to be replaced.

Drive shaft assembly

The drive shaft will wear slightly with use, and should be visually inspected after each run. Lightly coat multi-segment drive shaft threads with food-grade anti-seize to aid in making drive shaft connections. Generally, the drive shaft assembly should be replaced after one year of use. For special conditions, refer to the drive shaft head wear specifications provided in Table 5.1.

Table 5.1 shows minimum drive shaft hex diameters. Diameters are measured at the widest location across the points. Replace a worn drive shaft head assembly when the drive shaft hex diameter at the widest location measures equal to or less than the measurement across the points. See Figure 5.1 for measurement location.

Table 5.1. Drive shaft head hex diameter measurements.

S.U.M. size	Minimum drive shaft hex diameter
50, 100, 200, 500, and 1,000 L	14.4 mm (0.566 in.)
2,000 L	20.8 mm (0.820 in.)

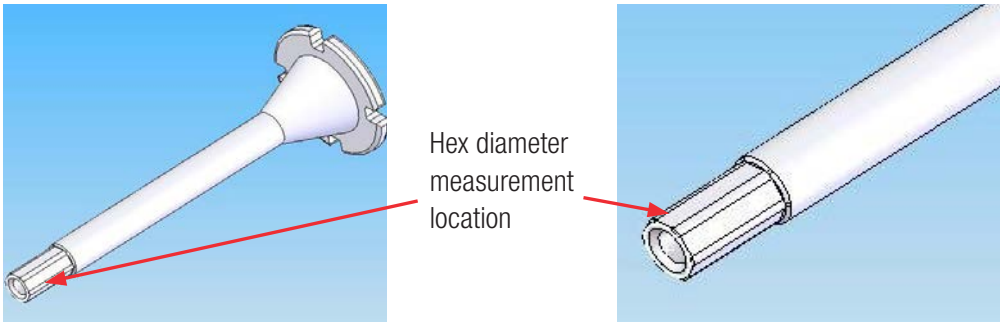


Figure 5.1. Drive shaft head assembly.

5.2. Troubleshooting and frequently asked questions

Issue: **The S.U.M. will not operate.**

Solution: **Check the power supply.**

- Verify the main electrical plug connection at the wall outlet, the position of the main power disconnect, and the position of the E-Stop switch.
- Verify the condition of the main electrical circuit breaker of your facility. If the protection breaker has been tripped, determine the fault condition. The condition may exist where other electrical systems are requiring current loads beyond those allowed by the breaker. The S.U.M. system should be placed on its own electrical circuit.

Issue: **There is too much tension in the film near the bearing port of the loaded BPC.**

Solution: **Reload the BPC, if possible, by carefully following the BPC loading instructions in this publication.**

- Provide excess film to that region of the BPC nearest to the bearing port when aligning the BPC in the tank.
- Do not begin liquid fill until the BPC is properly seated in the tank.
- Verify that the black bumper located in the motor mount block is present.

Issue: **I am not familiar with the use of Pall Kleenpak connectors, and am concerned about making aseptic connections.**

Solution: **Familiarize yourself with the Pall Kleenpak Connector instructions found in section 3.9 of this guide before beginning to make aseptic connections.**

- When a connection is being made, visually evaluate the status of the four locking external clips and verify that they are tightly secured. The snap should be audible for all four clips when pressing the connectors together. Always make sure the four locking clips are fully engaged for the male/female connection before removing the paper strips.

- A common cause for a leaking Kleenpak connector is an error in the final step of seating the tapered barrels of the male/female connector. There is a series of concentric rings inside the male connector (0.3 in. in front of the black O-ring). Visually verify that the four internal clips are on the last set of rings. Using both hands, place the connector flanges between your index fingers and thumbs, and squeeze until properly seated.

Issue: **I did not introduce the pH probe prior to liquid fill. Can a sterile connection still be made under these conditions?**

Solution: **You can still make a sterile connection after filling the BPC, as long as the clamps were closed on the Kleenpak connector probe ports before liquid fill.**
The Kleenpak connectors must be dry to make the connection of the probe assemblies. When media is already present in the S.U.M., follow the probe insertion procedures as outlined in section 3.5 of this guide. Some fluid may enter the bellows when the probe is inserted into a BPC already filled with fluid.

6

Specifications and parts information

Chapter contents

6.1. Hardware features

6.1.1. Design features of 50, 100, and 200 L S.U.M.s

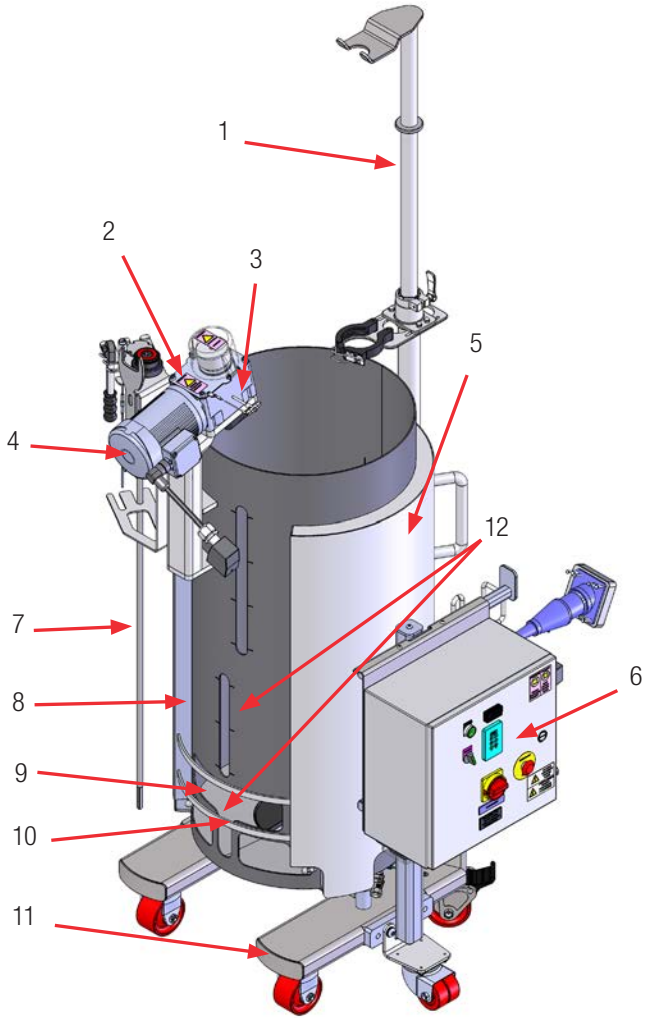


Figure 6.1. 200 L jacketed S.U.M. (front view).

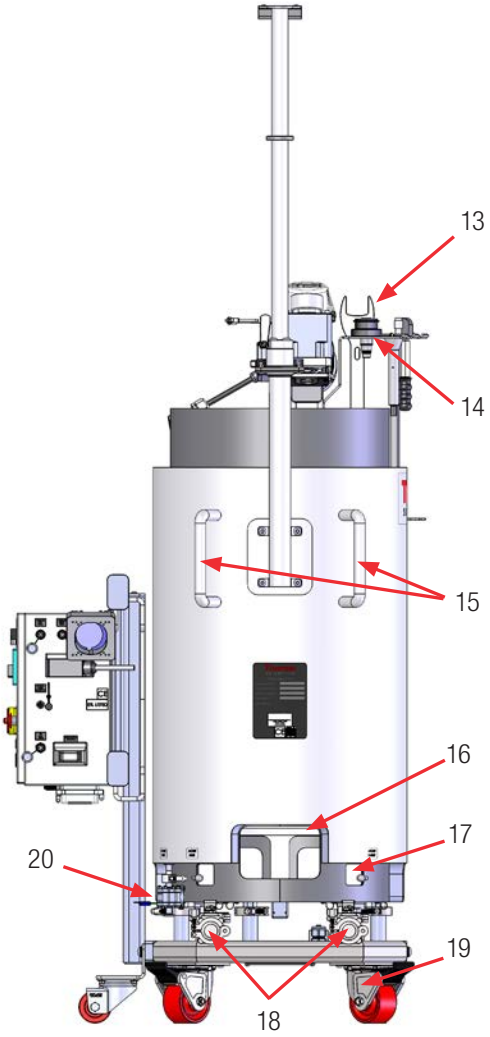


Figure 6.2. 200 L jacketed S.U.M. (back view).

1. Powdertainer arm (optional)
2. Mixing assembly with shield
3. Bearing port receiver with clamp
4. Mixer motor
5. Stainless steel outer support container
6. Electrical control panel (E-Box)
7. Drive shaft (stored)
8. 0.95 cm (3/8 in.) dimpled jacket
9. Probe access window
10. Probe hanger bracket
11. Cart assembly
12. Liquid sight windows
13. Standard tool set: 10 mm (3/8 in.) x 16.9 Nm (150 in-lb.) square torque wrench, load cell and motor cap lockout wrench
14. Bearing hub (for open-top mixing only)
15. Handles
16. Cutout for BPC loading
17. Bottom cutouts/pins for BPC attachment and alignment
18. 3.81 cm (1.5 in.) tri-clamp connection ports for water inlet/outlet (jacketed models only)
19. Casters (3 swiveling, 2 fixed)
20. Bleed valve (jacketed models only)

6.1.2. Design features of 500 and 1,000 L S.U.M.s

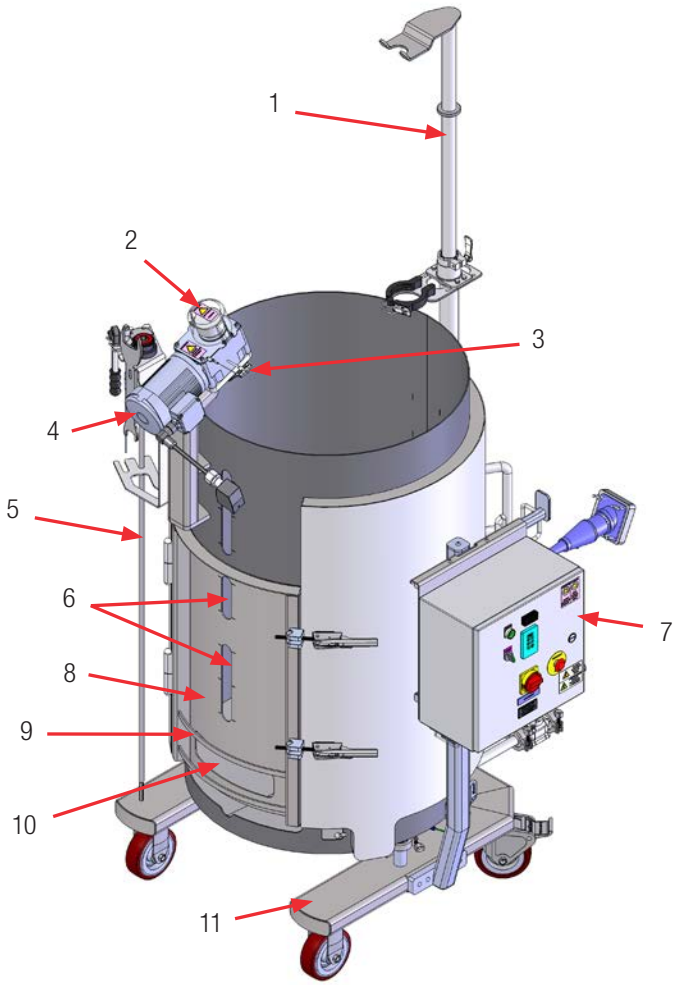


Figure 6.3. 500 L jacketed S.U.M. (front view).

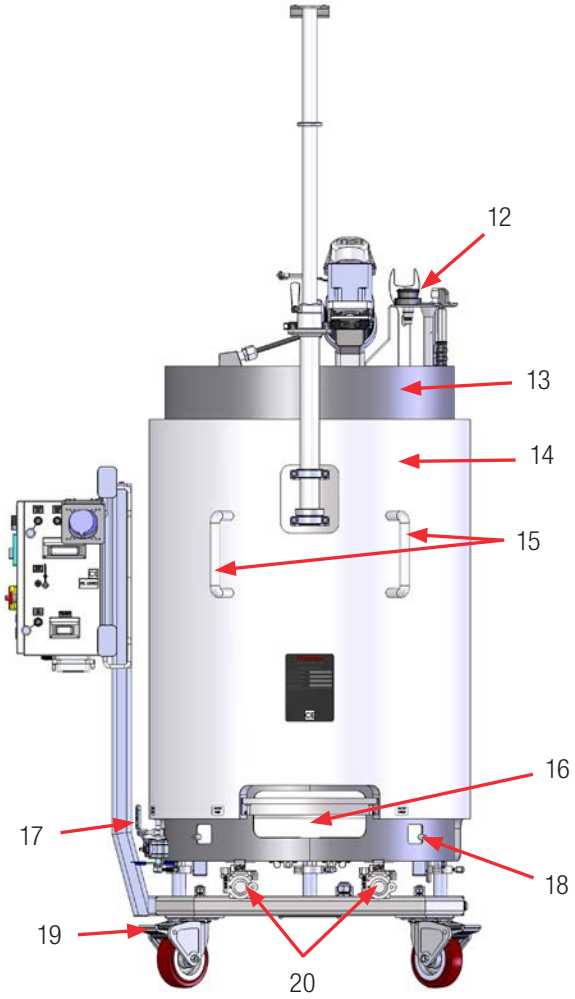


Figure 6.4. 500 L jacketed S.U.M. (back view).

1. Powdertainer arm (optional)
2. Mixing assembly with safety cap
3. Bearing port receiver with clamp
4. Mixer motor
5. Drive shaft, stored
6. Liquid sight windows
7. Electrical control panel (E-Box)
8. Door for BPC loading
9. Probe clip hanger
10. Probe access window
11. Cart assembly
12. Standard tool set: 10 mm (3/8 in.) x 16.9 Nm (150 in-lb.) square torque wrench, load cell and motor cap lockout wrench
13. 0.95 cm (3/8 in.) dimpled jacket
14. Stainless steel outer support container
15. Handles
16. Cutout with removable brace for BPC loading
17. Bleed valve (jacketed models only)
18. Bottom cutouts/pins for BPC attachment and alignment
19. Casters (2 swiveling, 2 fixed)
20. 3.81 cm (1.5 in.) tri-clamp connection ports for water inlet/outlet (jacketed models only)

6.1.3. Design features of 2,000 L S.U.M.s

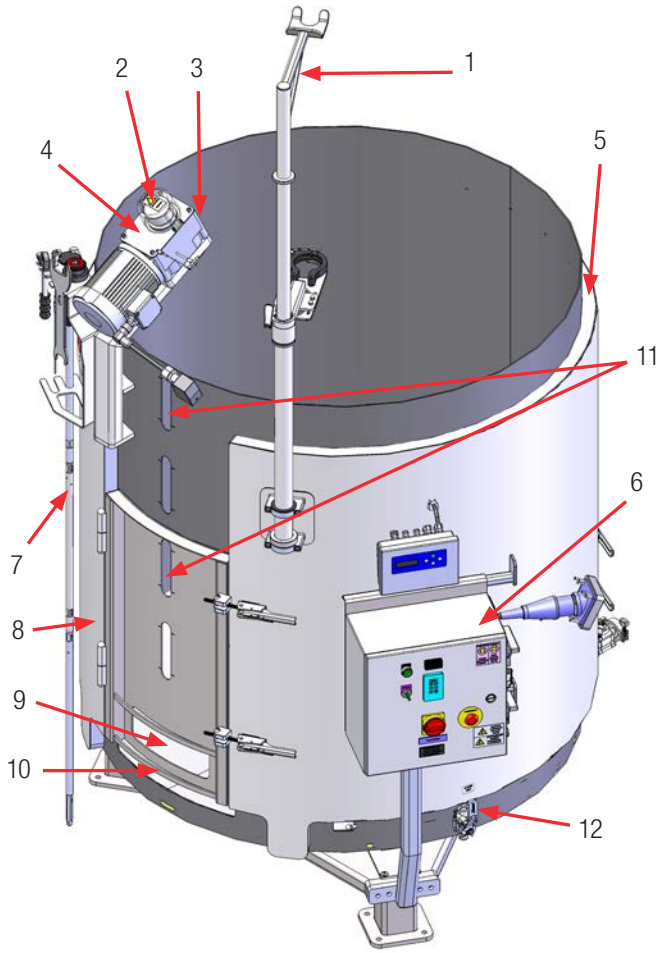


Figure 6.5. 2,000 L jacketed S.U.M. (front view).

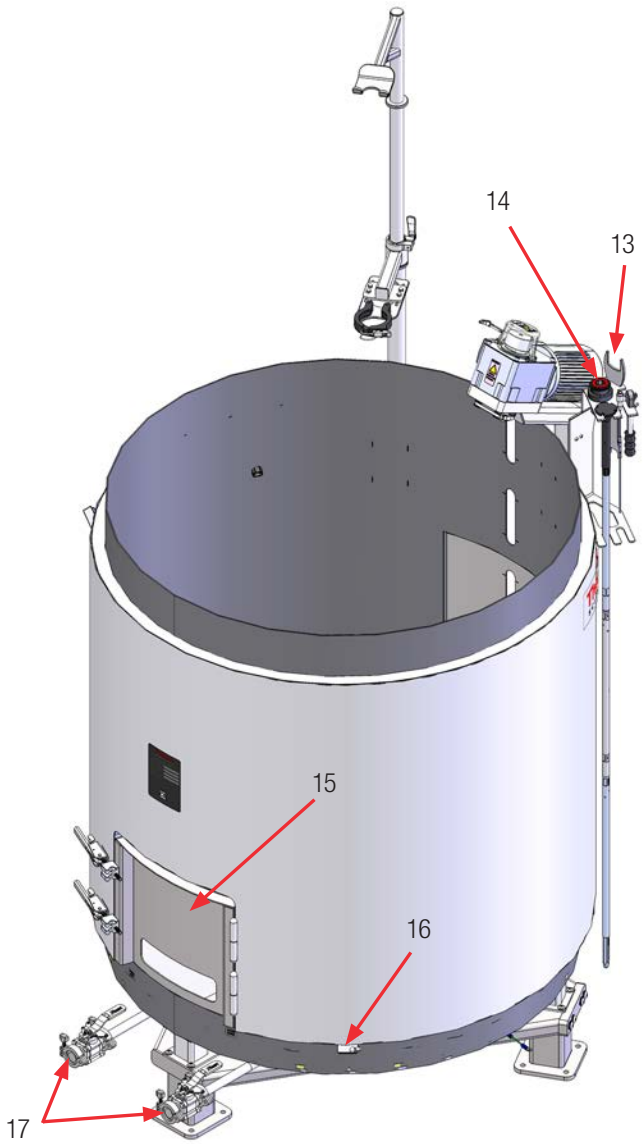


Figure 6.6. 2,000 L jacketed S.U.M. (back view).

1. Powdertainer arm (optional)
2. Mixing assembly with shield
3. Bearing port receiver with clamp
4. Mixer motor
5. Stainless steel outer support container
6. Electrical control panel (E-Box); optional
7. Drive shaft (stored)
8. 0.95 cm (3/8 in.) dimpled jacket
9. Probe access window
10. Probe hanger bracket
11. Liquid sight windows
12. Bleed valve (jacketed models only)
13. Standard tool set: 10 mm (3/8 in.) x 16.9 Nm (150 in-lb.) square torque wrench, load cell and motor cap lockout wrench
14. Bearing hub (for open-top mixing only)
15. Rear door (for BPC loading), with sight window
16. Bottom cutouts/pins for BPC attachment and alignment
17. 3.81 cm (1.5 in.) tri-clamp connection ports for water inlet/outlets (jacketed models only)

6.2. Hardware specifications

The following tables and figures provide specification information for 50–2,000 L S.U.M. systems.

Table 6.1. 50 L S.U.M. specifications.

		DC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	50 L	
	Minimum liquid working volume	10 L	
	Total chamber volume (liquid & gas)	80 L	
	BPC chamber diameter	34.9 cm (13.75 in.)	
	BPC chamber shoulder height	84.8 cm (33.4 in.)	
	Liquid height at rated working volume	52.1 cm (20.5 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1.5:1	
	Hold-up volume	< 50 mL	
	Overall mixer geometry (height/diameter ratio)	1.9:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	2/5	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	14.6 cm (5.75 in.)	
Agitation	Mixing rate range	30–350 rpm	
	Tip speed	22.9 cm/s (45.2 ft/min)–267.7 cm/s (526.9 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	12.5°	
	Agitation shaft centerline offset	1.9 cm (0.75 in.)	
	Overall drive shaft length	91.7 cm (36.1 in.)	
	Drive shaft diameter	1.27 cm (0.5 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	11.75 cm (4.63 in.)	

Table 6.2. 50 L S.U.M. specifications (continued).

		DC motors only	
		Jacketed	Non-jacketed
Motor	Agitation motor drive (type, voltage, phase)	Brushless, 48 VDC	
	Motor power rating	400 W (0.536 hp)	
	Motor torque rating	8.6 Nm (76 in-lb.)	
	Gear reduction	7.5:1	
	Programmable VFD, remote panel interface, power fault auto restart	-	
	Motor communication methods (for external controller)	-	
Fluid jacket	Jacket area: full/half volume	0.38 m^2 (4.1 ft^2) / 0.32 m^2 (3.4 ft^2)	-
	Jacket volume	2 L (0.53 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	99 L/min (26.4 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF2500: 2800/2500 W	-
	Approximate liquid heat-up time (5–37°C)	1.2 hr	-
	Approximate liquid cool-down time (37–5°C)	2.7 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	56.5 cm (22.25 in.) without E-Box	
	Overall length	77 cm (30.3 in.) without E-Box	
	Overall height	198 cm (78.2 in.)	
	Dry skid weight (mass)	171 kg (376 lb.)	152 kg (335 lb.)
	Wet skid weight—rated working volume (mass)	221 kg (486 lb.)	202 kg (445 lb.)
General	Ceiling height required for drive shaft loading	228.6 cm (90 in.)	
	Electrical power supply requirement (voltage, phase, amp)	Dependent on controller	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	10–50 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.7 and 6.8, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

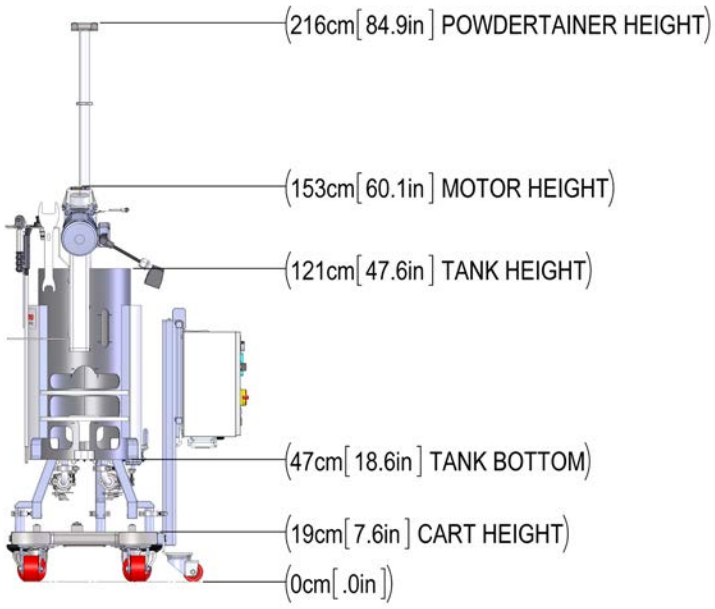


Figure 6.7. 50 L S.U.M. dimensions (front view).

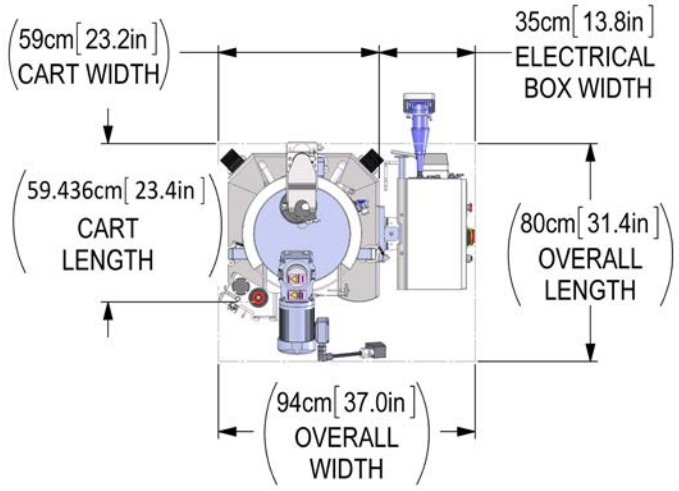


Figure 6.8. 50 L S.U.M. dimensions (top view).

Table 6.3. 100 L S.U.M. specifications.

		DC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	100 L	
	Minimum liquid working volume	20 L	
	Total chamber volume (liquid & gas)	150 L	
	BPC chamber diameter	43.8 cm (17.25 in.)	
	BPC chamber shoulder height	100.8 cm (39.7 in.)	
	Liquid height at rated working volume	66 cm (26 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1.5:1	
	Hold-up volume	< 50 mL	
	Overall mixer geometry (height/diameter ratio)	1.9:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	1/3	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	14.6 cm (5.75 in.)	
Agitation	Mixing rate range	30–350 rpm	
	Tip speed	22.9 cm/s (45.2 ft/min)–267.7 cm/s (526.9 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	15°	
	Agitation shaft centerline offset	5.08 cm (2 in.)	
	Overall drive shaft length	104.4 cm (41.1 in.)	
	Drive shaft diameter	1.27 cm (0.5 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	4.9 cm (1.93 in.)	
Motor	Agitation motor drive (type, voltage, phase)	Brushless, 48 VDC	
	Motor power rating	400 W (0.536 hp)	
	Motor torque rating	8.6 Nm (76 in-lb.)	
	Gear reduction	7.5:1	
	Programmable VFD, remote panel interface, power fault auto restart	-	
	Motor communication methods (for external controller)	-	

Table 6.4. 100 L S.U.M. specifications (continued).

		DC motors only	
		Jacketed	Non-jacketed
Fluid jacket	Jacket area: full/half volume	0.69 m^2 (7.4 ft^2) / 0.41 m^2 (4.4 ft^2)	-
	Jacket volume	4 L (1.1 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	100 L/min (26.4 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF2500: 2800/2500 W	-
	Approximate liquid heat-up time (5–37°C)	2 hr	-
	Approximate liquid cool-down time (37–5°C)	5.1 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	56.5 cm (22.25 in.) without E-Box	
	Overall length	74 cm (29.1 in.) without E-Box	
	Overall height	153.3 cm (60.35 in.) without Powdertainer arm	
	Dry skid weight (mass)	179 kg (395 lb.)	201 kg (442 lb.)
	Wet skid weight—rated working volume (mass)	279 kg (616 lb.)	301 kg (663 lb.)
General	Ceiling height required for drive shaft loading	236.2 cm (93 in.)	
	Electrical power supply requirement (voltage, phase, amp)	Dependent on controller	
	Validated system reliability (minimum)	0.9 at 90%	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	20–100 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.9 and 6.10, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

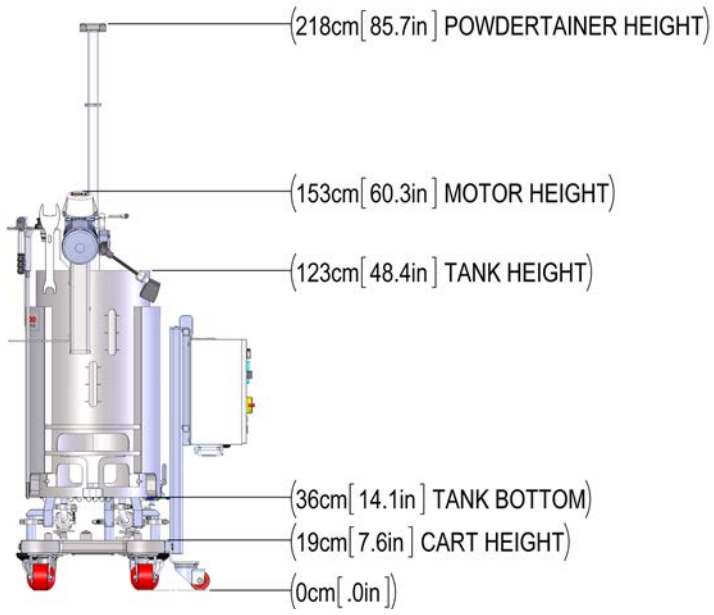


Figure 6.9. 100 L S.U.M. dimensions (front view).

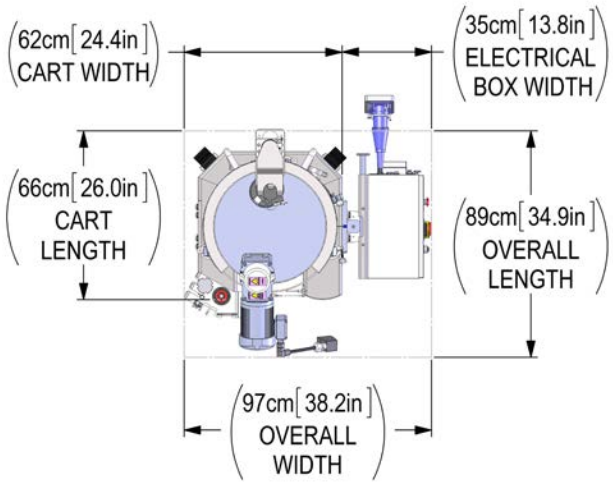


Figure 6.10. 100 L S.U.M. dimensions (top view).

Table 6.5. 200 L S.U.M. specifications.

		DC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	200 L	
	Minimum liquid working volume	40 L	
	Total chamber volume (liquid & gas)	250 L	
	BPC chamber diameter	59.7 cm (20 in.)	
	BPC chamber shoulder height	123.4 cm (48.6 in.)	
	Liquid height at rated working volume	99 cm (39 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1.5:1	
	Hold-up volume	< 50 mL	
	Overall mixer geometry (height/diameter ratio)	1.95:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	2/5	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	20 cm (7.87 in.)	
Agitation	Mixing rate range	30–350 rpm	
	Tip speed	31.4–366.6 cm/s (61.9–721.6 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	12.5°	
	Agitation shaft centerline offset	6.4 cm (2.5 in.)	
	Overall drive shaft length	129.5 cm (51 in.)	
	Drive shaft diameter	1.27 cm (0.5 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	7.9 cm (3.1 in.)	
Motor	Agitation motor drive (type, voltage, phase)	Brushless, 48 VDC	
	Motor power rating	400 W (0.536 hp)	
	Motor torque rating	8.6 Nm (76 in-lb.)	
	Gear reduction	7.5:1	
	Programmable VFD, remote panel interface, power fault auto restart	-	
	Motor communication methods (for external controller)	-	

Table 6.6. 200 L S.U.M. specifications (continued).

		DC motors only	
		Jacketed	Non-jacketed
Fluid jacket	Jacket area: full/half volume	1.2 m^2 (13 ft^2) / 0.69 m^2 (7.4 ft^2)	-
	Jacket volume	6.5 L (1.7 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	99.4 L/min (26.3 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF2500: 2800/2500 W	-
	Approximate liquid heat-up time (5–37°C)	3.4 hr	-
	Approximate liquid cool-down time (37–5°C)	6.8 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	59.7 cm (23.5 in.) without E-Box	
	Overall length	96.9 cm (31.8 in.) without E-Box	
	Overall height	175.3 cm (69 in.) without Powdertainer arm	
	Dry skid weight (mass)	266 kg (586 lb.)	237 kg (523 lb.)
	Wet skid weight—rated working volume (mass)	466 kg (1027 lb.)	437 kg (964 lb.)
General	Ceiling height required for standard drive shaft loading	281.9 cm (111 in.)	
	Ceiling height required for optional 2-piece drive shaft loading	242.3 cm (95.4 in.)	
	Electrical power supply requirement (voltage, phase, amp)	Dependent on controller	
	Validated system reliability (minimum)	0.9 at 90%	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	40–200 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.11 and 6.12, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

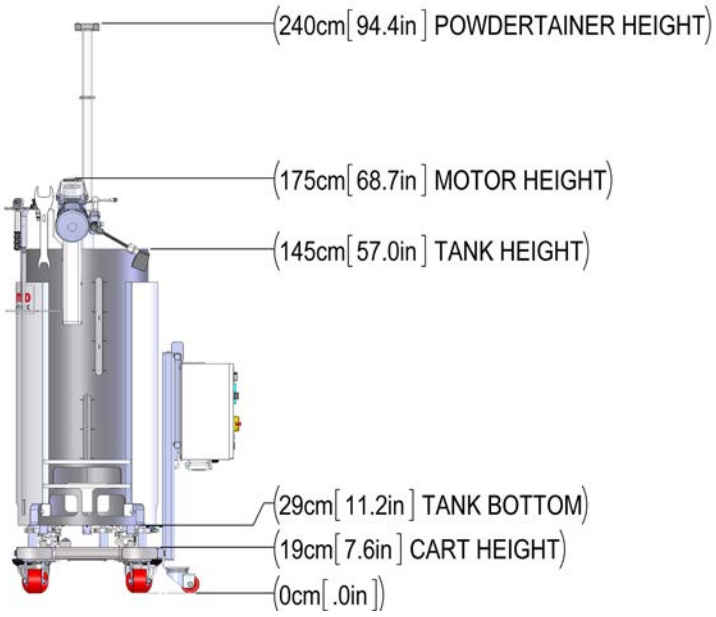


Figure 6.11. 200 L S.U.M. dimensions (front view).

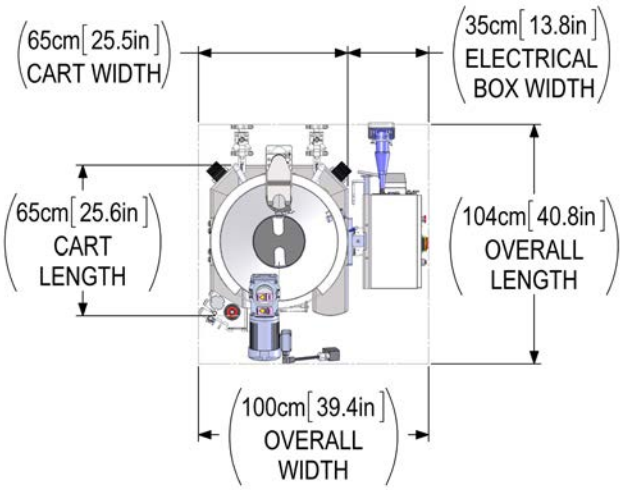


Figure 6.12. 200 L S.U.M. dimensions (top view).

Table 6.7. 500 L S.U.M. specifications.

		DC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	500 L	
	Minimum liquid working volume	100 L	
	Total chamber volume (liquid & gas)	660 L	
	BPC chamber diameter	75.56 cm (29.75 in.)	
	BPC chamber shoulder height	146 cm (57.5 in.)	
	Liquid height at rated working volume	111.8 cm (44 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1.5:1	
	Hold-up volume	< 100 mL	
	Overall mixer geometry (height/diameter ratio)	1.7:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	9/34	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	20 cm (7.87 in.)	
Agitation	Mixing rate range	30–350 rpm	
	Tip speed	31.4–366.6 cm/s (61.9–721.6 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	20°	
	Agitation shaft centerline offset	10.56 cm (4.16 in.)	
	Overall drive shaft length	152.4 cm (60 in.)	
	Drive shaft diameter	1.27 cm (0.5 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	7.52 cm (2.96 in.)	
Motor	Agitation motor drive (type, voltage, phase)	Brushless, 48 VDC	
	Motor power rating	400 W (0.536 hp)	
	Motor torque rating	-	
	Gear reduction	7.5:1	
	Programmable VFD, remote panel interface, power fault auto restart	-	
	Motor communication methods (for external controller)	-	

Table 6.8. 500 L S.U.M. specifications (continued).

		DC motors only	
		Jacketed	Non-jacketed
Fluid jacket	Jacket area: full/half volume	2.2 m^2 (23.9 ft^2) / 1.4 m^2 (14.8 ft^2)	-
	Jacket volume	11 L (2.9 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	96.8 L/min (25.5 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF10000: 6100/10000 W	-
	Approximate liquid heat-up time (5–37°C)	2.6 hr	-
	Approximate liquid cool-down time (37–5°C)	3.7 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	86.4 cm (34 in.) without E-Box	
	Overall length	130.2 cm (51.25 in.) without E-Box	
	Overall height	251.1 cm (98.9 in.) without Powdertainer arm	
	Dry skid weight (mass)	431 kg (951 lb.)	333 kg (734 lb.)
	Wet skid weight—rated working volume (mass)	931 kg (2053 lb.)	833 kg (1836 lb.)
General	Ceiling height required for standard drive shaft loading	320 cm (126 in.)	
	Ceiling height required for optional 2-piece drive shaft loading	275.6 cm (108.5 in.)	
	Electrical power supply requirement (voltage, phase, amp)	Dependent on controller	
	Validated system reliability (minimum)	0.9 at 90%	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	100–500 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.13 and 6.14, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

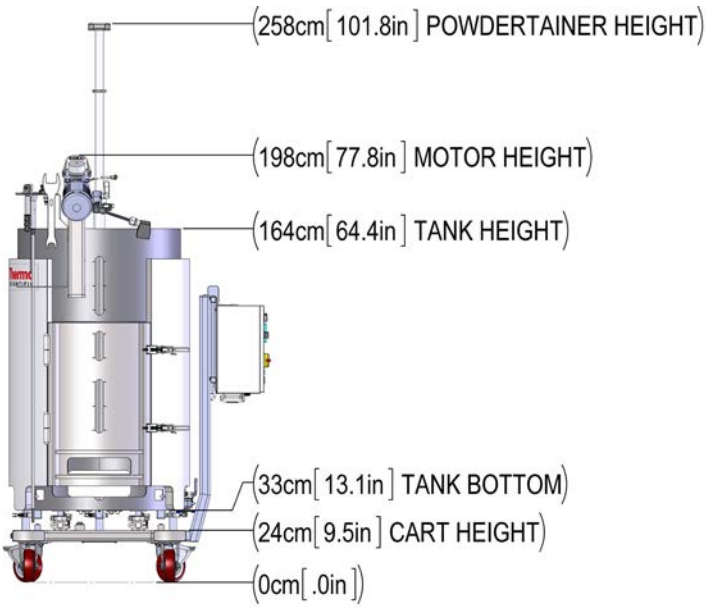


Figure 6.13. 500 L S.U.M. dimensions (front view).

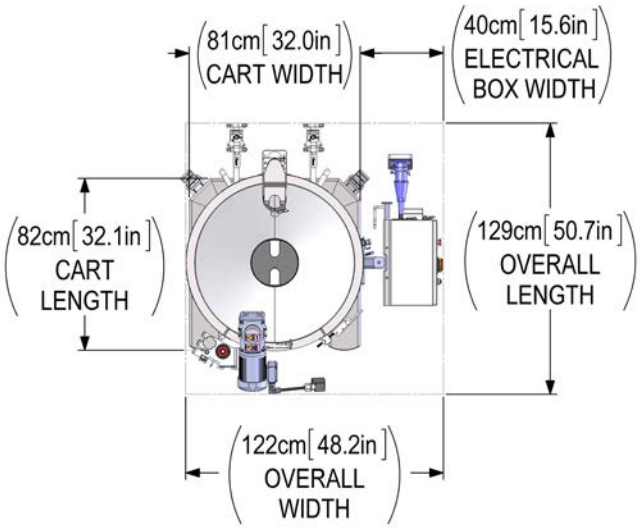


Figure 6.14. 500 L S.U.M. dimensions (top view).

Table 6.9. 1,000 L S.U.M. specifications.

		DC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	1,000 L	
	Minimum liquid working volume	200 L	
	Total chamber volume (liquid & gas)	1,380 L	
	BPC chamber diameter	105.4 cm (41.52 in.)	
	BPC chamber shoulder height	157.2 cm (61.9 in.)	
	Liquid height at rated working volume	115.6 cm (45.5 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1.1:1	
	Hold-up volume	< 300 mL	
	Overall mixer geometry (height/diameter ratio)	1.2:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	8/25	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	20 cm (7.87 in.)	
Agitation	Mixing rate range	30–350 rpm	
	Tip speed	31.4–366.6 cm/s (61.9–721.6 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	22°	
	Agitation shaft centerline offset	12.7 cm (5 in.)	
	Overall drive shaft length	152.4 cm (60 in.)	
	Drive shaft diameter	1.27 cm (0.5 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	11.81 cm (4.65 in.)	
Motor	Agitation motor drive (type, voltage, phase)	Brushless, 48 VDC	
	Motor power rating	400 W (0.536 hp)	
	Motor torque rating	8.6 Nm (76 in-lb.)	
	Gear reduction	7.5:1	
	Programmable VFD, remote panel interface, power fault auto restart	-	
	Motor communication methods (for external controller)	-	

Table 6.10. 1,000 L S.U.M. specifications (continued).

		DC motors only	
		Jacketed	Non-jacketed
Fluid jacket	Jacket area: full/half volume	3.5 m^2 (37.6 ft^2) / 2.1 m^2 (22.7 ft^2)	-
	Jacket volume	17.5 L (4.6 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	102 L/min (27 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF24000: 22500/24000 W	-
	Approximate liquid heat-up time (5–37°C)	1.6 hr	-
	Approximate liquid cool-down time (37–5°C)	2.3 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	113.2 cm (44.57 in.) without E-Box	
	Overall length	155.8 cm (61.33 in.) without E-Box	
	Overall height	201 cm (79.1 in.) without Powdertainer arm	
	Dry skid weight (mass)	566 kg (1248 lb.)	446 kg (983 lb.)
	Wet skid weight—rated working volume (mass)	1566 kg (3453 lb.)	1446 kg (3188 lb.)
General	Ceiling height required for standard drive shaft loading	320 cm (126 in.)	
	Ceiling height required for optional 2-piece drive shaft loading	277.6 cm (109.3 in.)	
	Electrical power supply requirement (voltage, phase, amp)	Dependent on controller	
	Validated system reliability (minimum)	0.9 at 90%	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	200–1,000 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.15 and 6.16, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

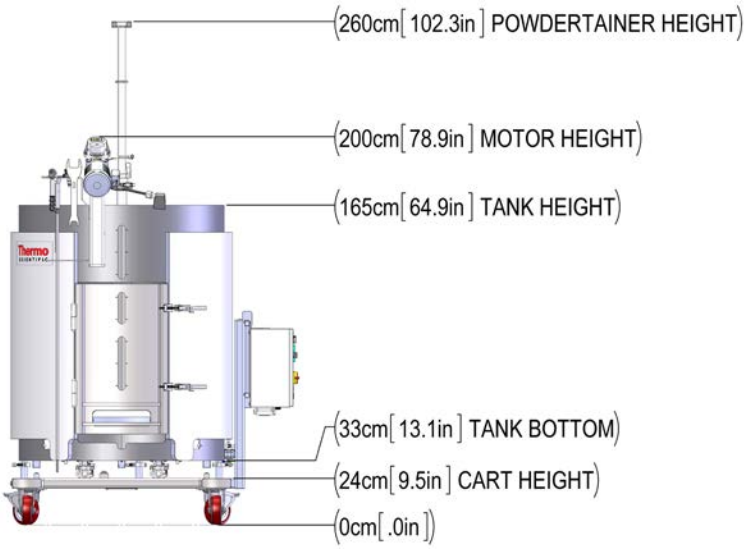


Figure 6.15. 1,000 L S.U.M. dimensions (front view).

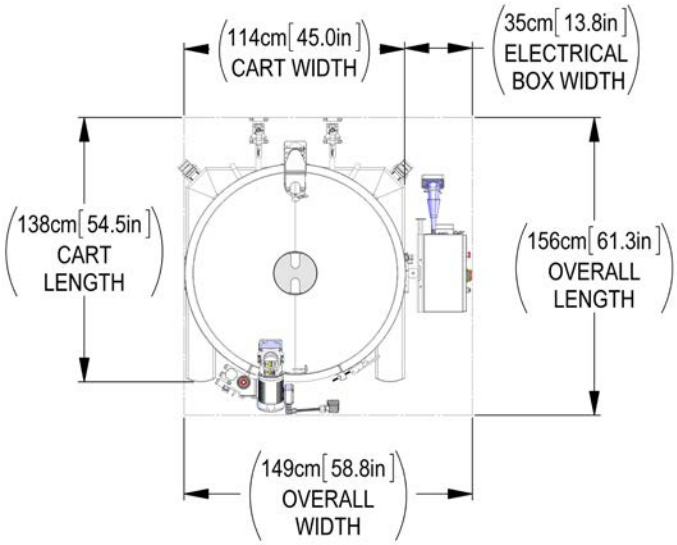


Figure 6.16. 1,000 L S.U.M. dimensions (top view).

Table 6.11. 2,000 L S.U.M. specifications.

		AC motors only	
		Jacketed	Non-jacketed
Mixer geometry	Rated liquid working volume	2,000 L	
	Minimum liquid working volume	400 L	
	Total chamber volume (liquid & gas)	2,700 L	
	BPC chamber diameter	135 cm (53 in.)	
	BPC chamber shoulder height	185 cm (73 in.)	
	Liquid height at rated working volume	140 cm (55 in.)	
	Fluid geometry at working volume (height/diameter) ratio	1:1	
	Hold-up volume	< 1 L	
	Overall mixer geometry (height/diameter ratio)	1.2:1	
	Tank baffles	None	
Impeller	Impeller (quantity x blade count)	1 x 3	
	Impeller scaling (impeller diameter/tank diameter)	1/5	
	Impeller blade pitch (angle)	45°	
	Impeller diameter	9.85 in.	
Agitation	Mixing rate range	30-350 rpm	
	Tip speed	39.4–459.7 cm/s (77.6–904.8 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	27°	
	Agitation shaft centerline offset	17.8 cm (7 in.)	
	Overall drive shaft length	192.5 cm (75.78 in.)	
	Drive shaft diameter	1.9 cm (0.75 in.)	
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)	
	Impeller clearance from tank bottom	5.08 cm (2 in.)	
Motor	Agitation motor drive (type, voltage, phase)	Induction, 208 VAC, 3 phase	
	Motor power rating	745.7 W (1 hp)	
	Motor torque rating	18 Nm (159 in-lb.)	
	Gear reduction	5:1	
	Programmable VFD, remote panel interface, power fault auto restart	Standard	
	Motor communication methods (for external controller)	0–10 V; 4–20 mA	

Table 6.12. 2,000 L S.U.M. specifications (continued).

		AC motors only	
		Jacketed	Non-jacketed
Fluid jacket	Jacket area: full/half volume	5.3 m^2 (57.3 ft^2) / 3.3 m^2 (35.5 ft^2)	-
	Jacket volume	26 L (6.9 gal.)	-
	Jacket flow rate at 3.4 bar (50 psi)	93 L/min (24.5 gal/min)	-
	Process connection	1 in. Sanitary tri-clamp	-
Temperature control	TCU model: maximum heating/cooling	TF24000: 22,500/24,000 W	-
	Approximate liquid heat-up time (5–37°C)	2.7 hr	-
	Approximate liquid cool-down time (37–5°C)	3.9 hr	-
	RTD or thermocouple, 3.18 mm (1/8 in.) OD	Pt-100 (standard)	
Support container	Overall width	139.1 cm (54.77 in.) without E-Box	172.2 cm (67.8 in.) without E-Box
	Overall length	159.6 cm (62.83 in.) without E-Box	
	Overall height	224.8 cm (88.52 in.) without Powdertainer arm	
	Dry skid weight (mass)	762 kg (1,680 lb.)	558 kg (1,230 lb.)
	Wet skid weight—rated working volume (mass)	2762 kg (6,089 lb.)	2558 kg (5,639 lb.)
General	Ceiling height required for standard drive shaft loading	292.1 cm (115 in.)	
	Electrical power supply requirement (voltage, phase, amp)	120/240 VAC, single, 20/10 A	
	Validated system reliability (minimum)	0.9 at 90%	
	pH & DO probe—autoclavable type (Applisens, Broadley-James, Mettler Toledo)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
	Noise level	< 70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	2–40 +/- 0.1°C (36–104 +/- 0.2°F)	
	Motor speed	30–350 rpm	
	Volume range	500–2,000 L	
	Maximum static BPC pressure	0.03 bar (0.5 psi)	
	Maximum BPC pressure during operation	0.007 bar (0.1 psi)	
	Continuous operating time	21 days mixing at nominal volume only	

Note: Figures 6.17 and 6.18, below, show mixers with water jackets. Models without water jackets may have slightly different dimensions. See the drawings provided with your unit for exact measurements.

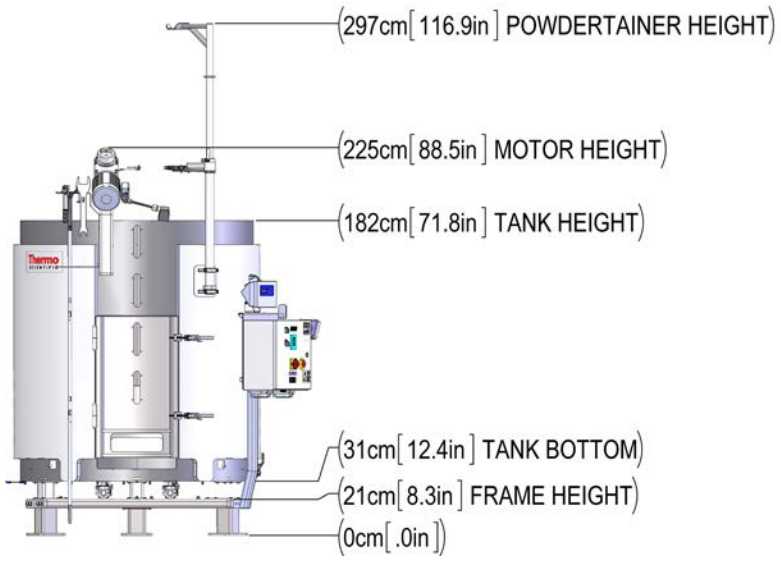


Figure 6.17. 2,000 L S.U.M. dimensions (front view).

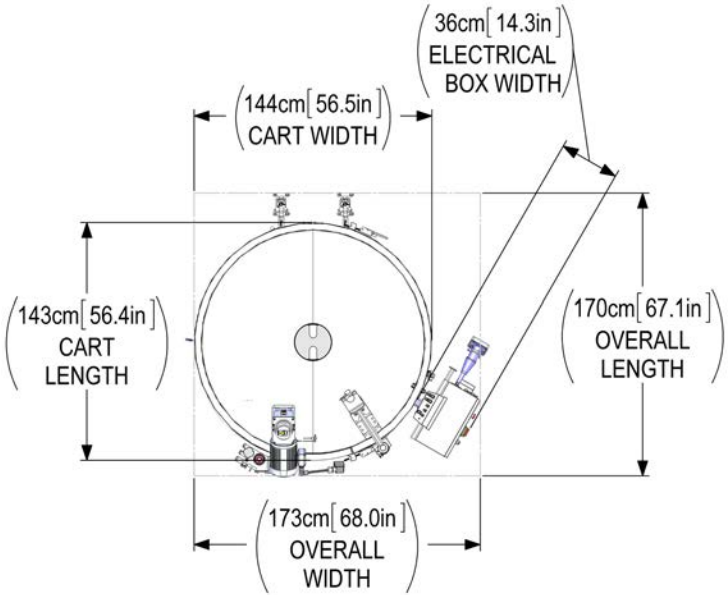


Figure 6.18. 2,000 L S.U.M. dimensions (top view).

6.3. BPC specifications

6.3.1. Standard 50 L BPCs

See the following sections for various standard 50 L S.U.M. BPC drawings and specifications.

Standard 50 L powder-to-liquid BPC (without probe ports)

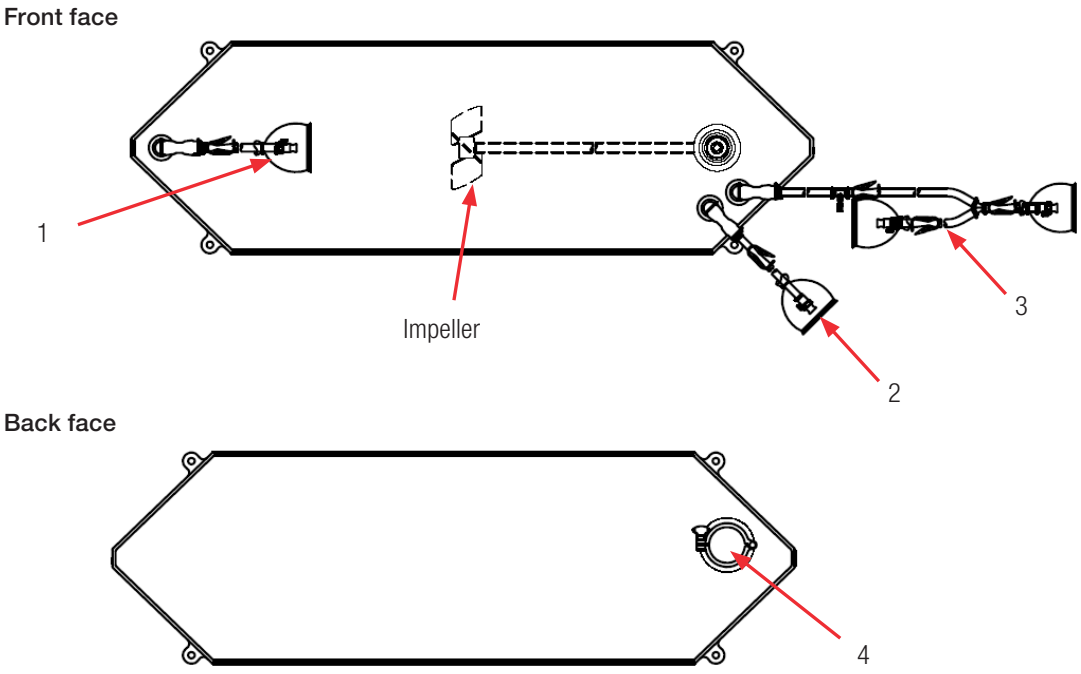


Table 6.13. 50 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX insert
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	76 mm (3 in.) sanitary fitting, tri-clamp	Cap with gasket

Standard 50 L liquid-to-liquid BPC (without probe ports)

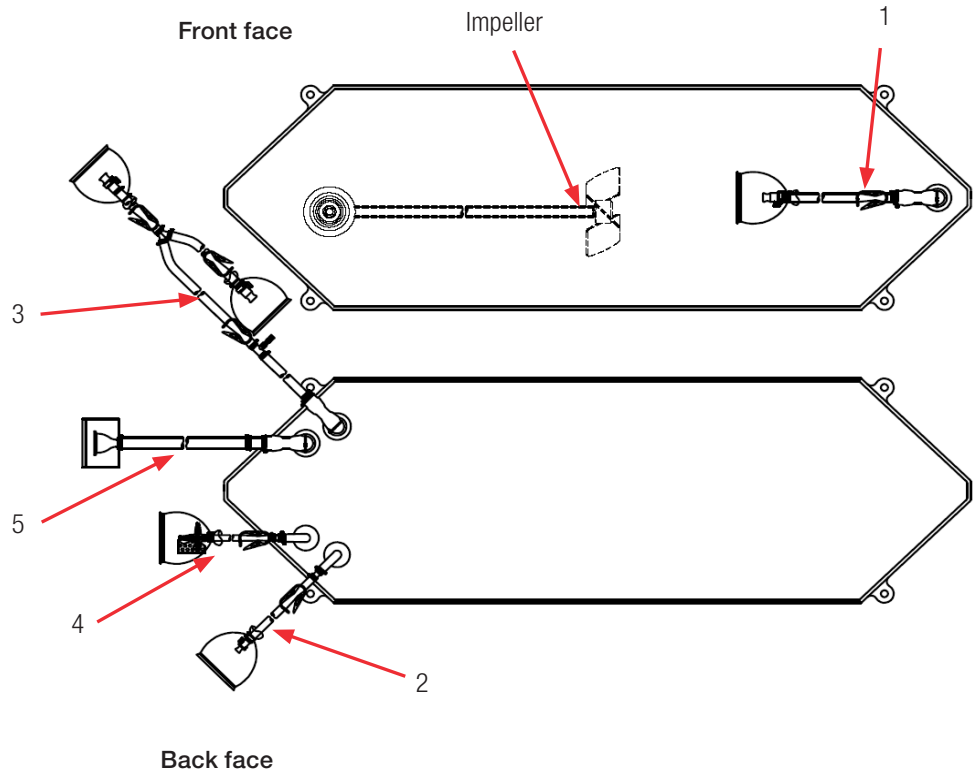


Table 6.14. 50 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX insert
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 61 cm (24 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz

Standard 50 L powder-to-liquid BPC (with probe ports)

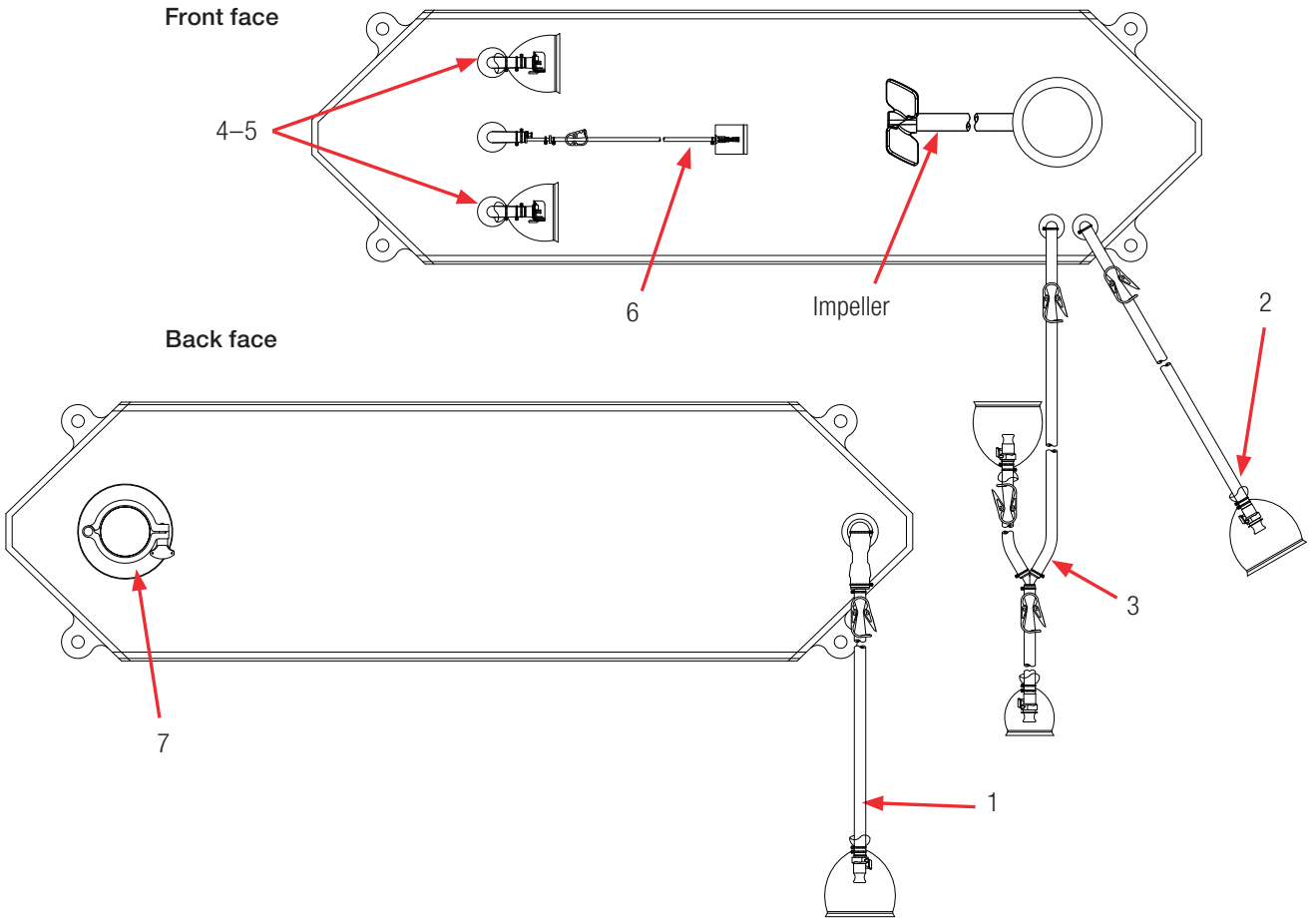


Table 6.15. 50 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX insert
3	Recirculation line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4–5	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
6	Thermowell/ small volume sample line	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port
7	Powder addition port	76 mm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 50 L liquid-to-liquid BPC (with probe ports)

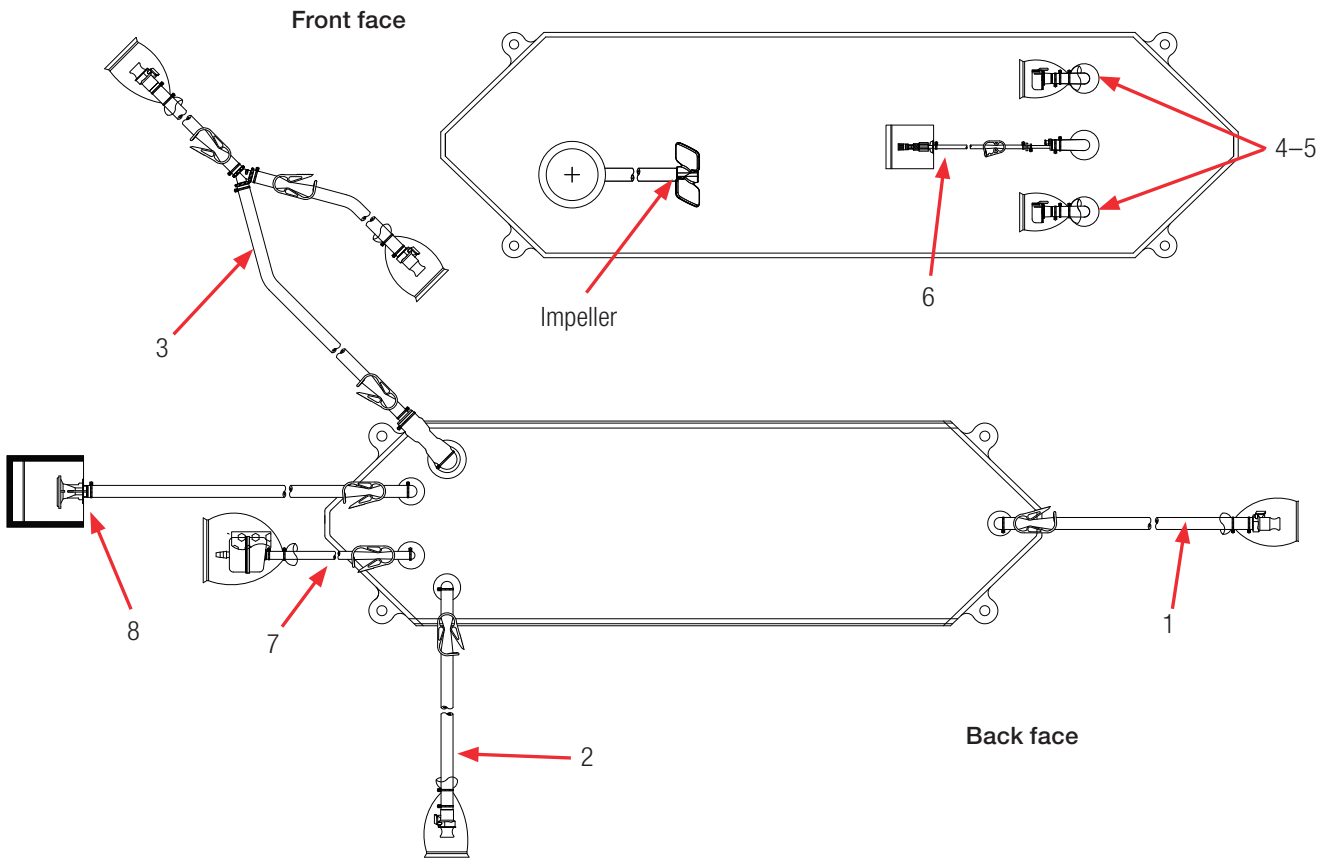


Table 6.16. 50 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX insert
3	Recirculation line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4–5	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
6	Thermowell/ small volume sample line	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port
7	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Cap with gasket
8	Fill line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	1.5 in. Tri-clamp SterilEnz

6.3.2. Standard 100 L BPCs

See the following sections for various standard 100 L S.U.M. BPC drawings and specifications.

Standard 100 L powder-to-liquid BPC (without probe ports)

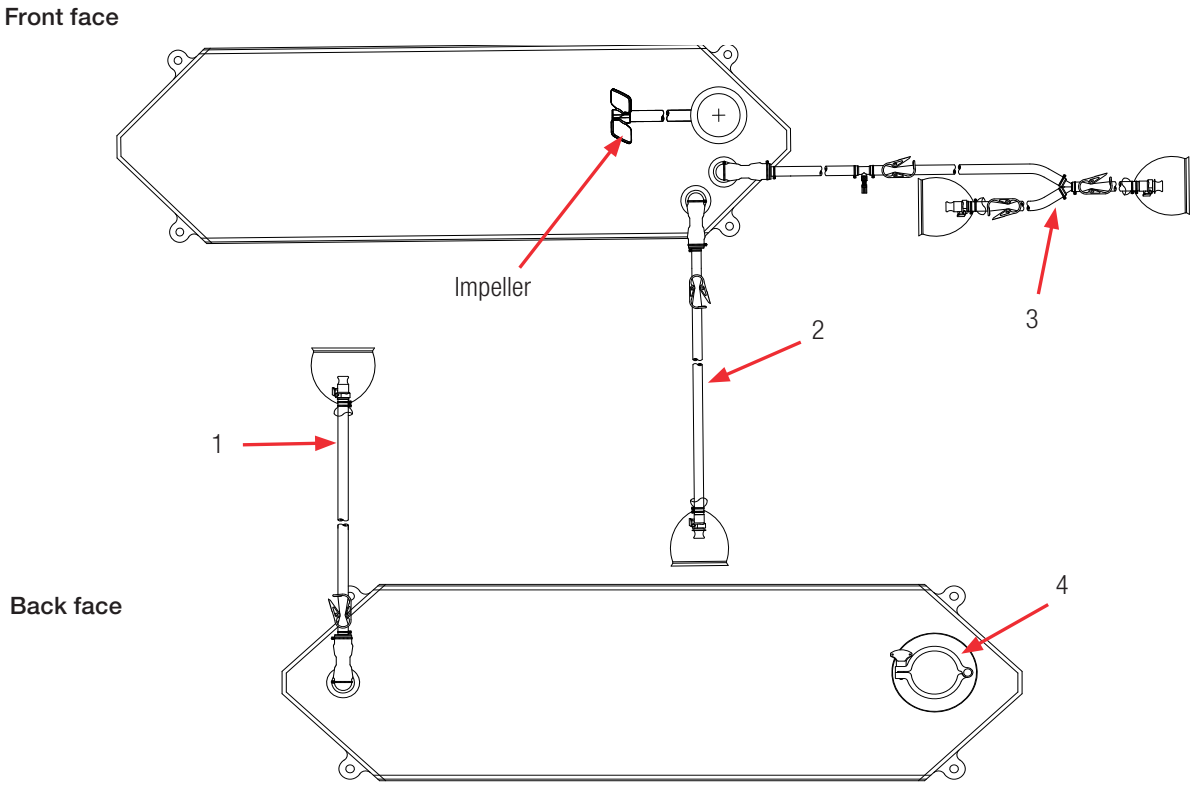


Table 6.17. 100 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX insert
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	76 mm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 100 L liquid-to-liquid BPC (without probe ports)

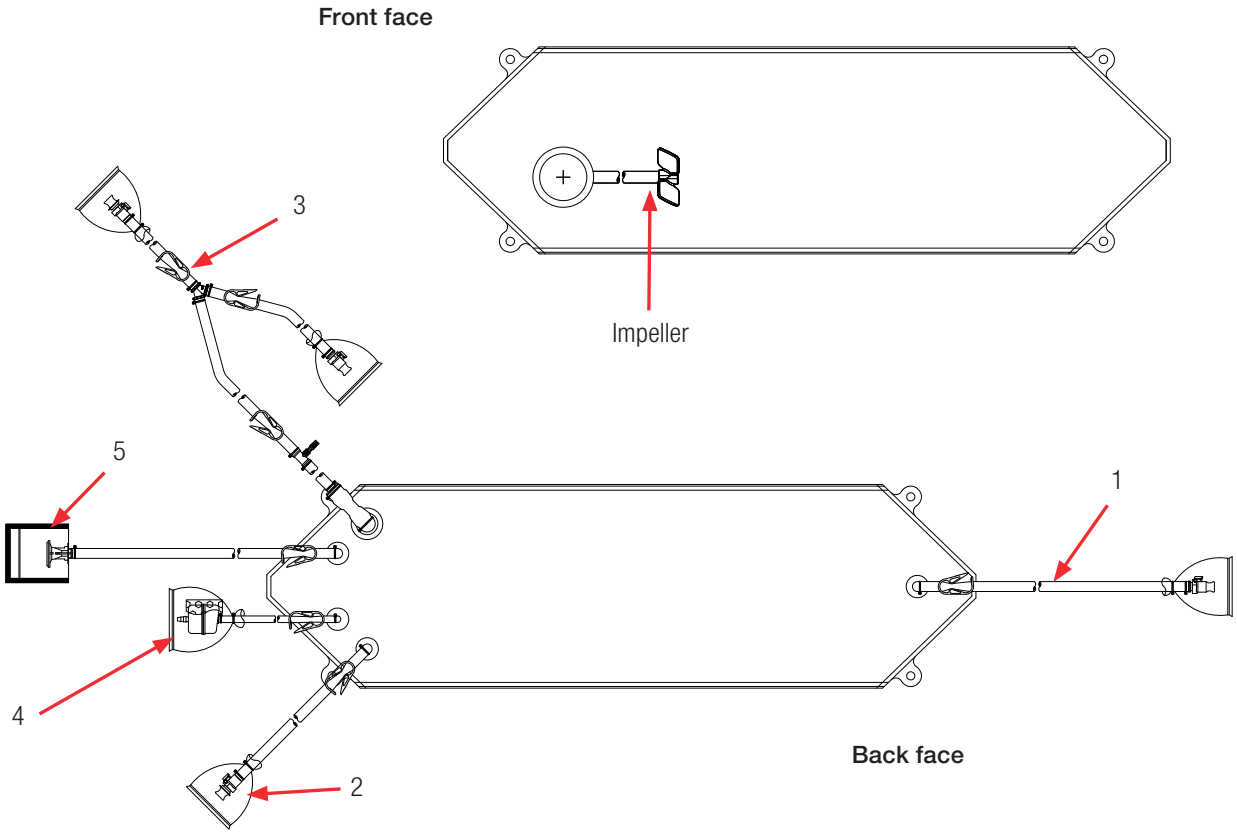


Table 6.18. 100 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX insert
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz

Standard 100 L powder-to-liquid BPC (with probe ports)

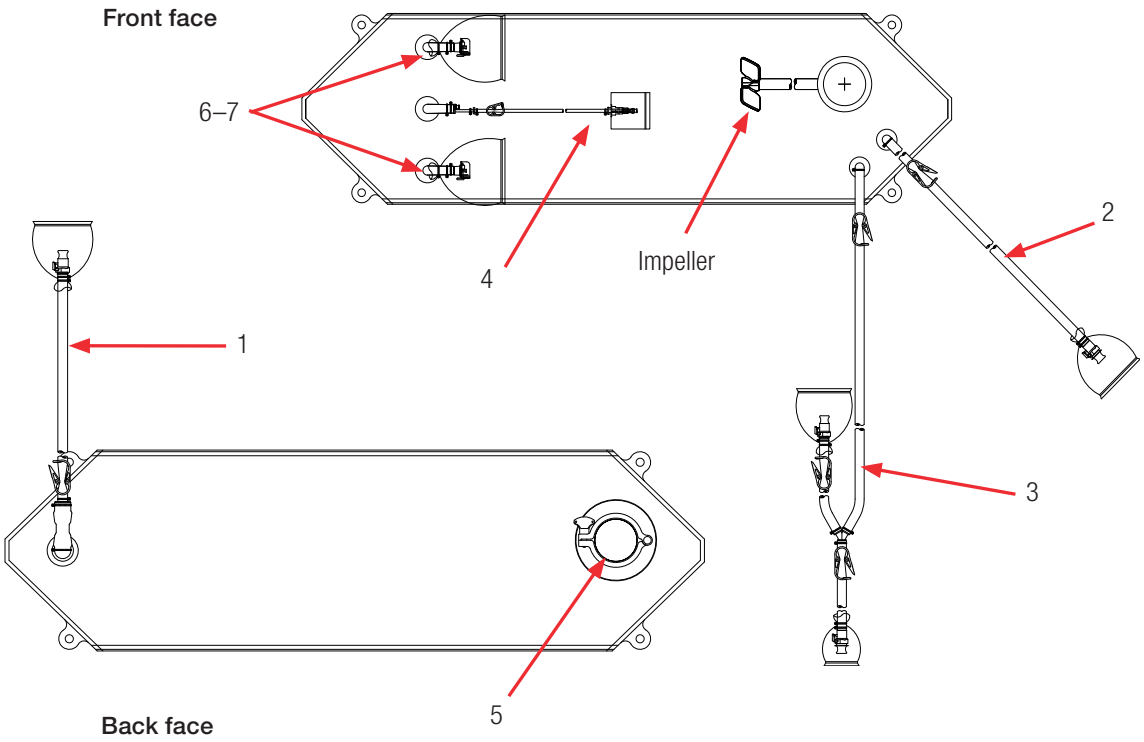


Table 6.19. 100 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 9.5 mm (3/8 in.) MPX insert
3	Recirculation line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, plugged 12.7 mm (1/2 in.) MPX body
4	Thermowell/ small volume sample line	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port
5	Powder addition port	76 mm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket
6–7	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)

Standard 100 L liquid-to-liquid BPC (with probe ports)

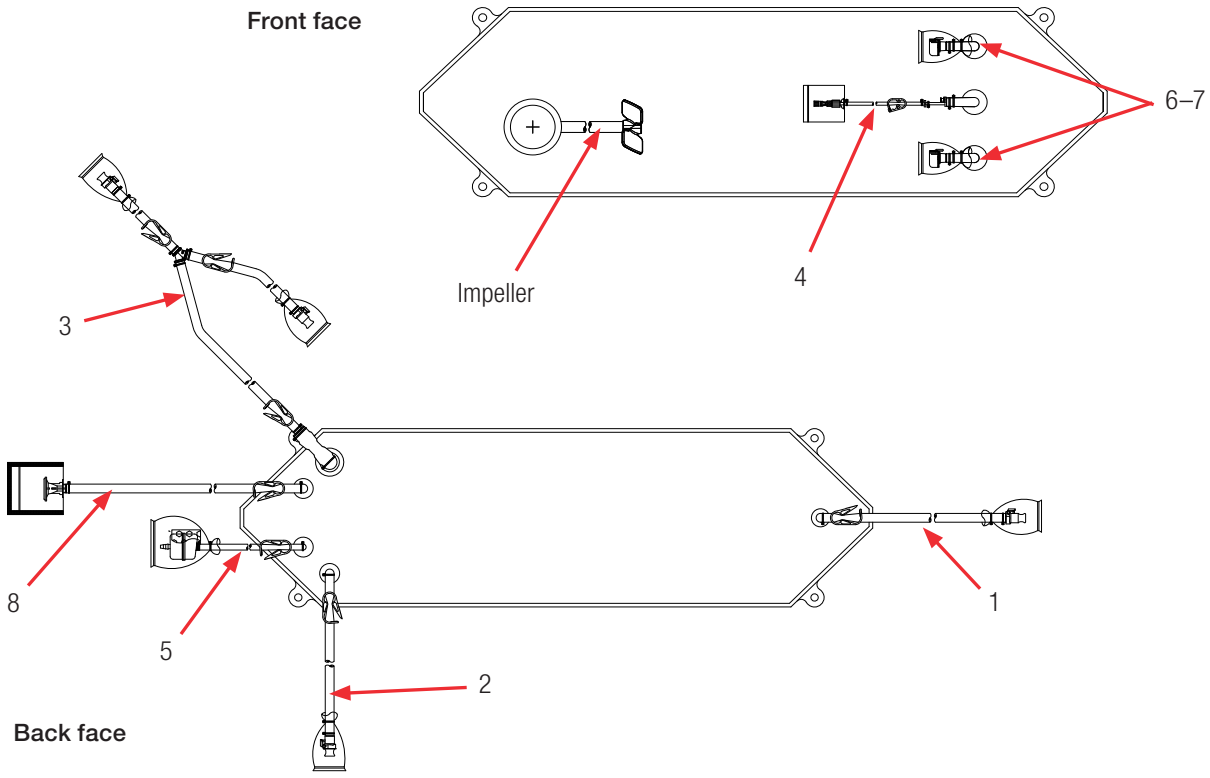


Table 6.20. 100 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 9.5 mm (3/8 in.) MPX insert
3	Recirculation line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Thermowell/ small volume sample line	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port
5	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
6–7	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
8	Fill line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	38.1 mm (1/5 in.) Tri-clamp SterilEnz

6.3.3. Standard 200 L BPCs

See the following sections for various standard 200 L S.U.M. BPC drawings and specifications.

Standard 200 L powder-to-liquid BPC (without probe ports)

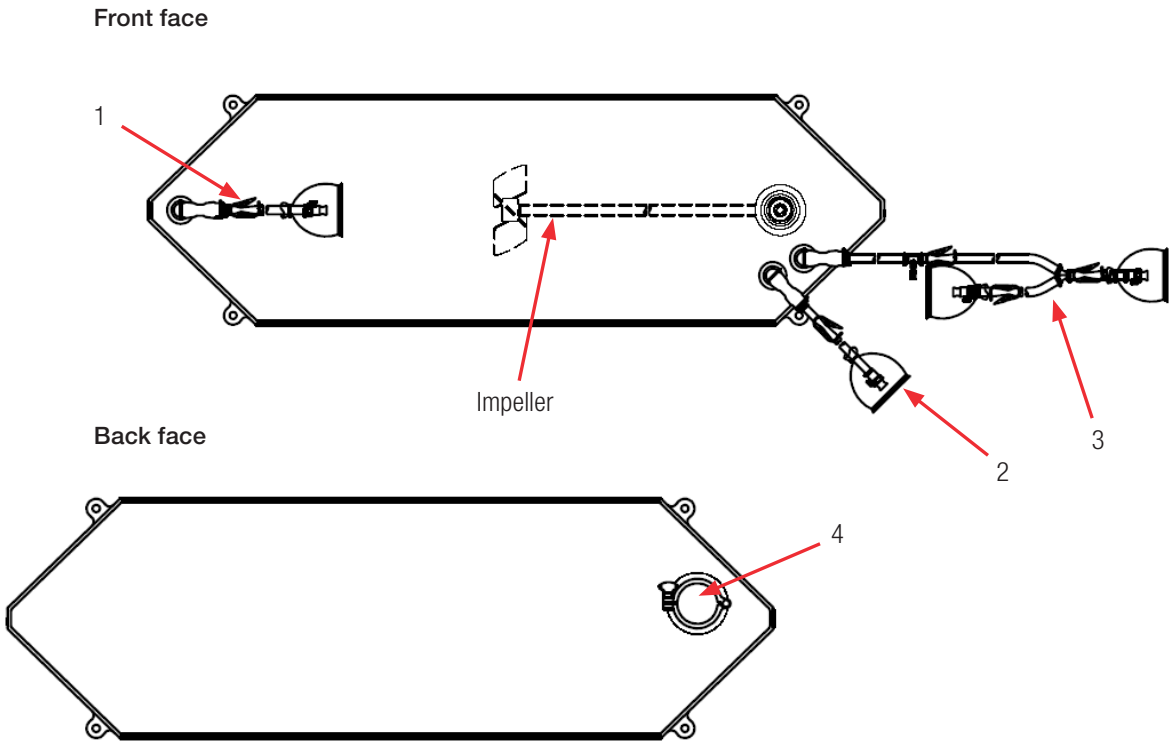


Table 6.21. 200 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 200 L liquid-to-liquid BPC (without probe ports)

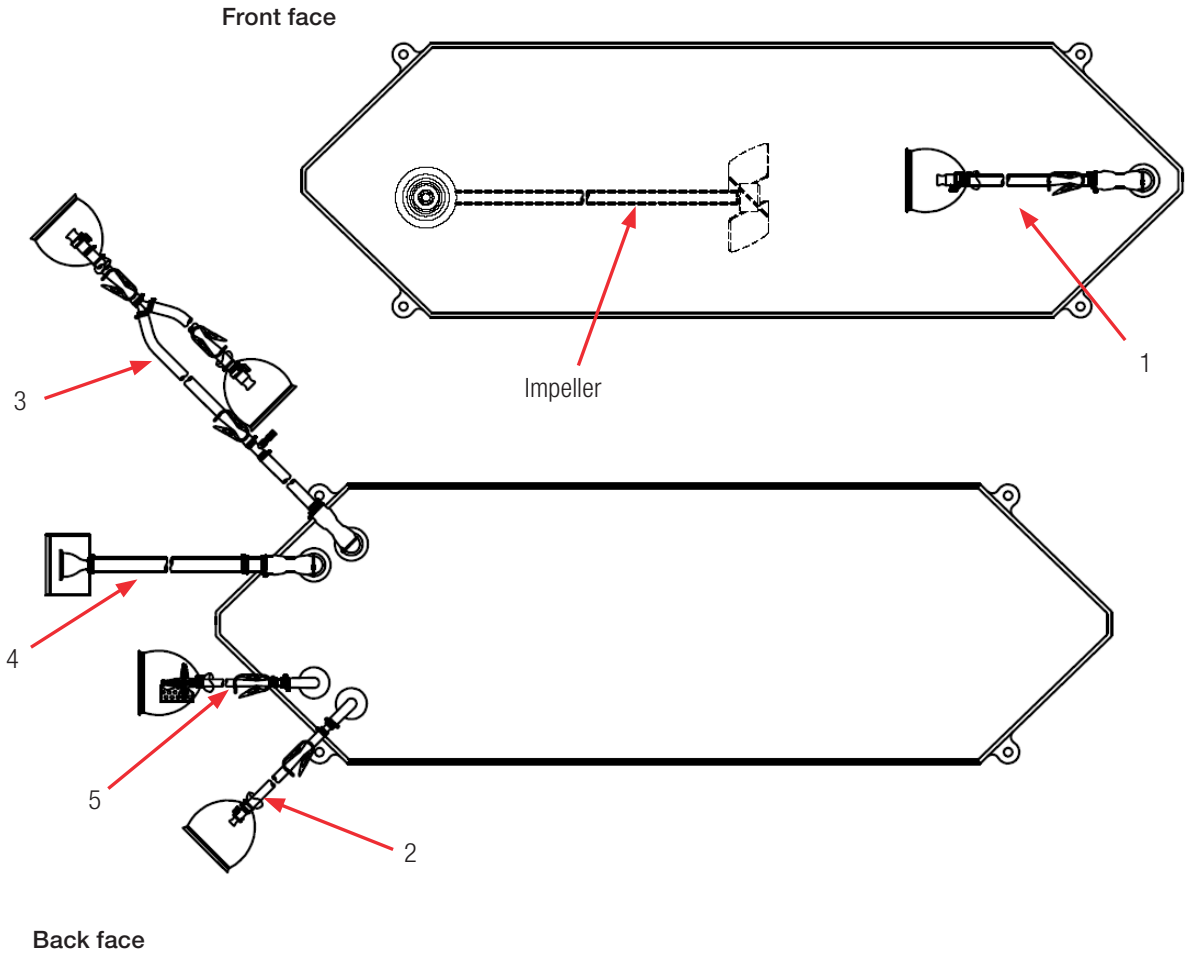


Table 6.22. 200 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 122 cm (48 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz
5	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)

Standard 200 L powder-to-liquid BPC (with probe ports)

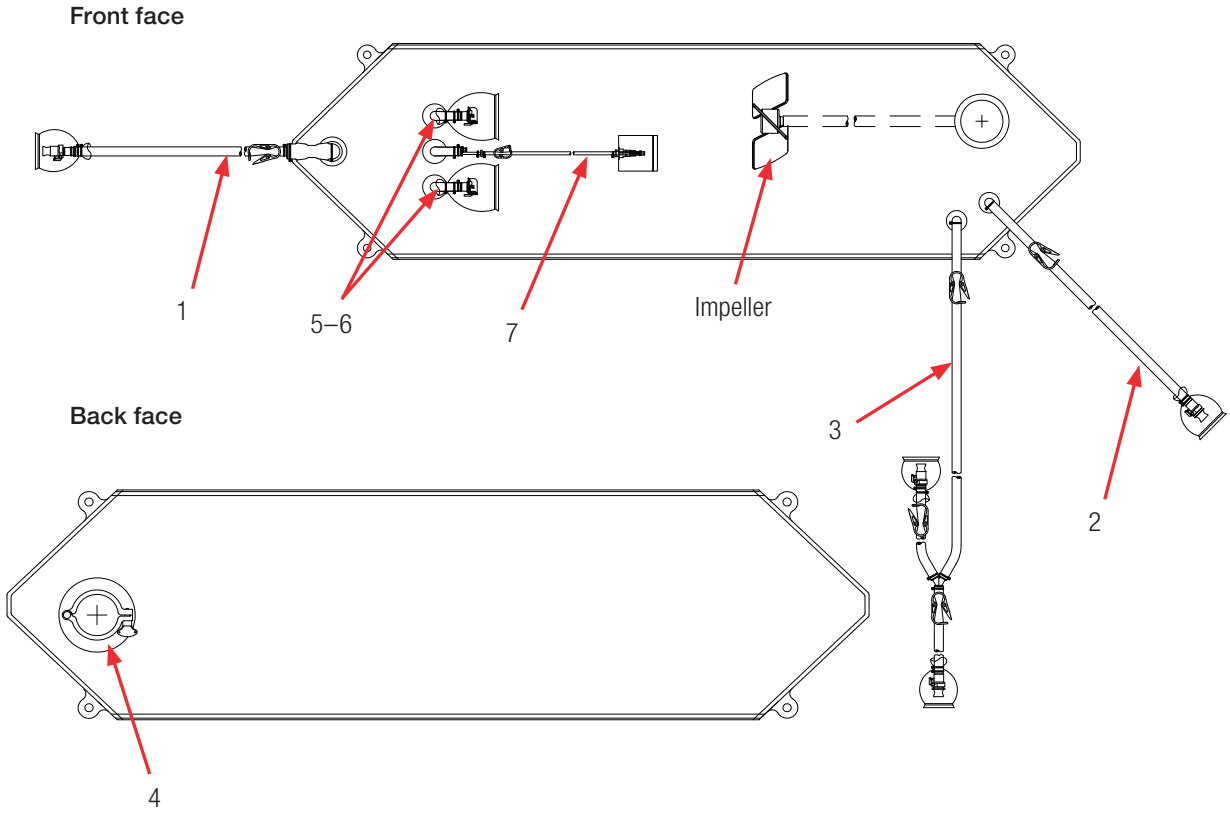


Table 6.23. 200 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket
5–6	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
7	Thermowell/ small volume sample port	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

Standard 200 L liquid-to-liquid BPC (with probe ports)

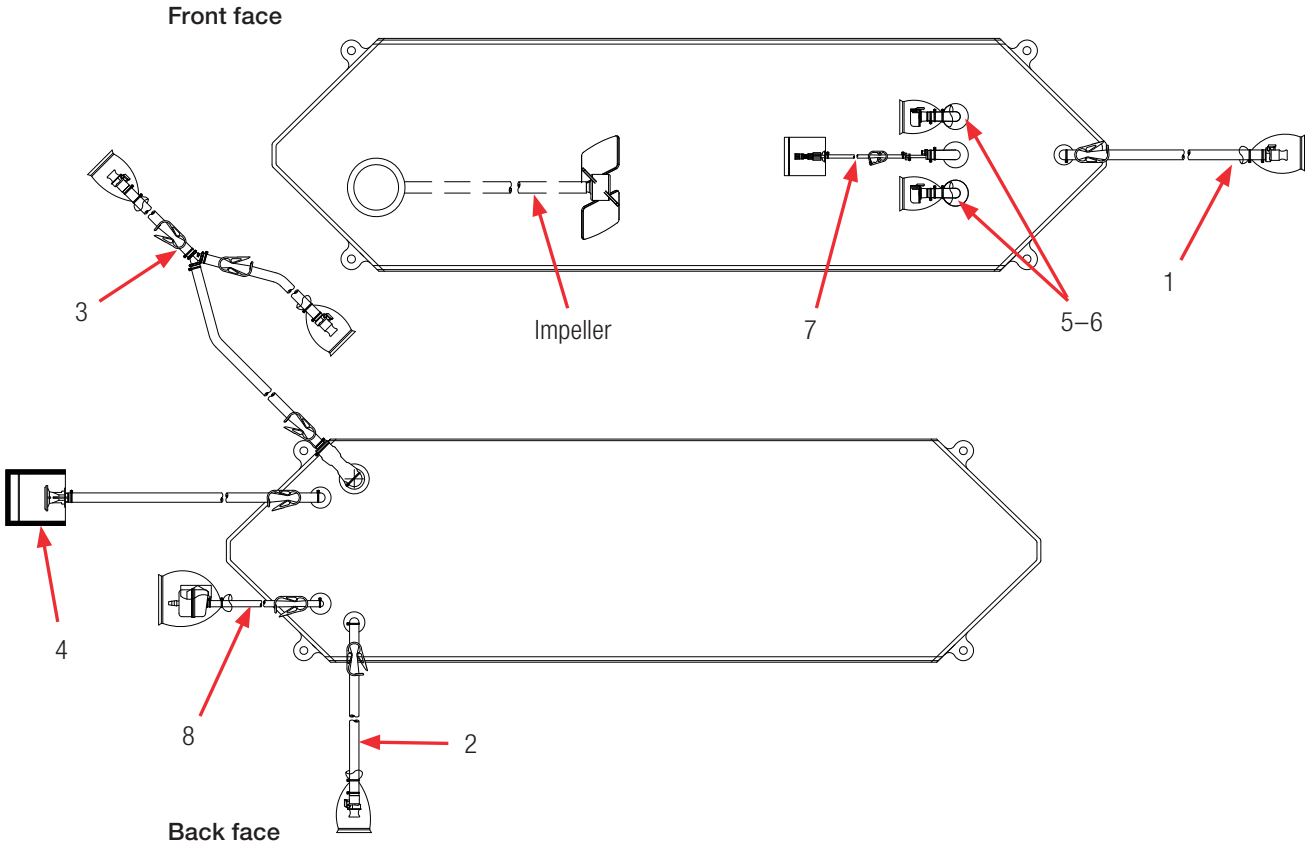


Table 6.24. 200 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 6 cm (24 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 122 cm (48 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz
5–6	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
7	Thermowell/ small volume sample port	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port
8	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)

6.3.4. Standard 500 L BPCs

See the following sections for various standard 500 L S.U.M. BPC drawings and specifications.

Standard 500 L powder-to-liquid BPC (without probe ports)

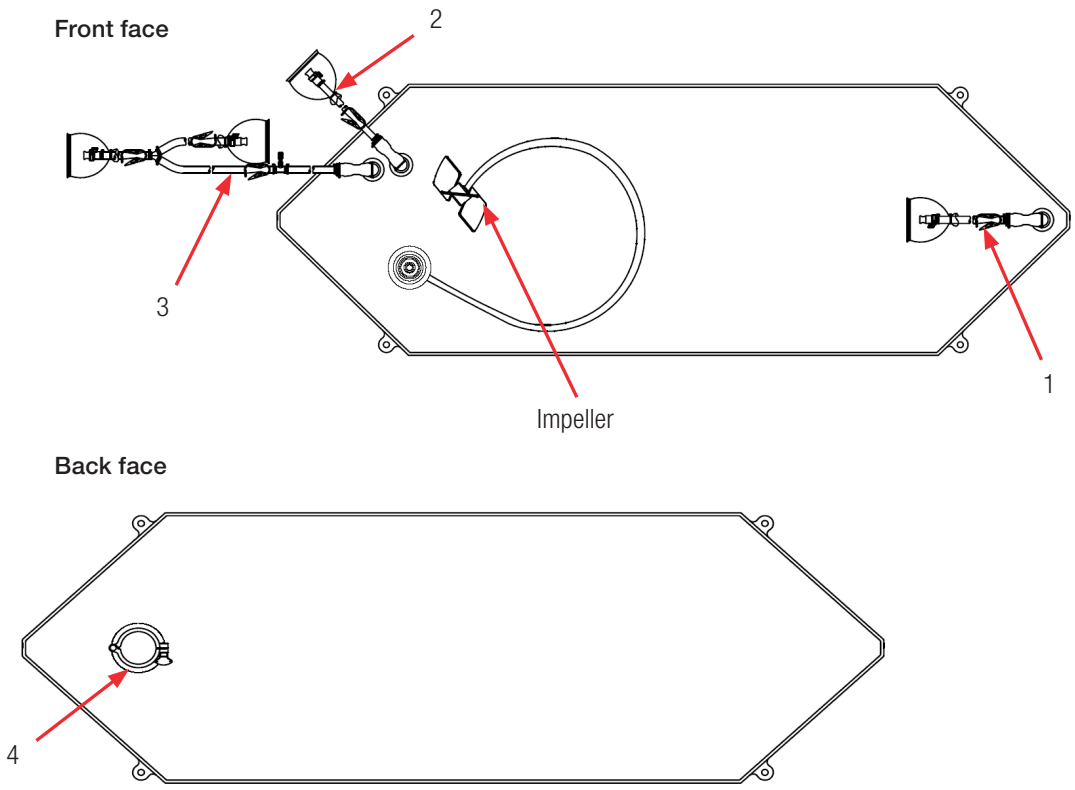


Table 6.25. 500 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 152 cm (60 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 137 cm (54 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 500 L liquid-to-liquid BPC (without probe ports)

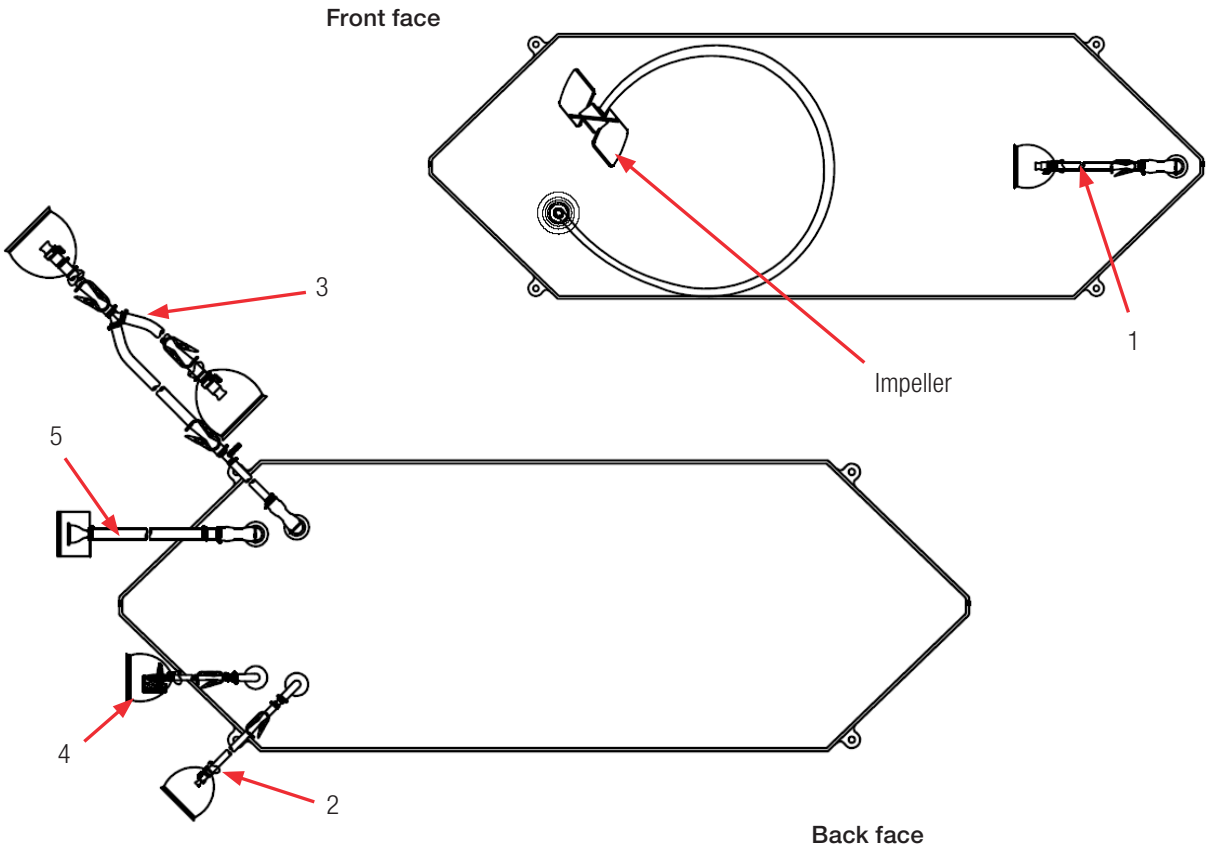


Table 6.26. 500 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 168 cm (66 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 152 cm (60 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz

Standard 500 L powder-to-liquid BPC (with probe ports)

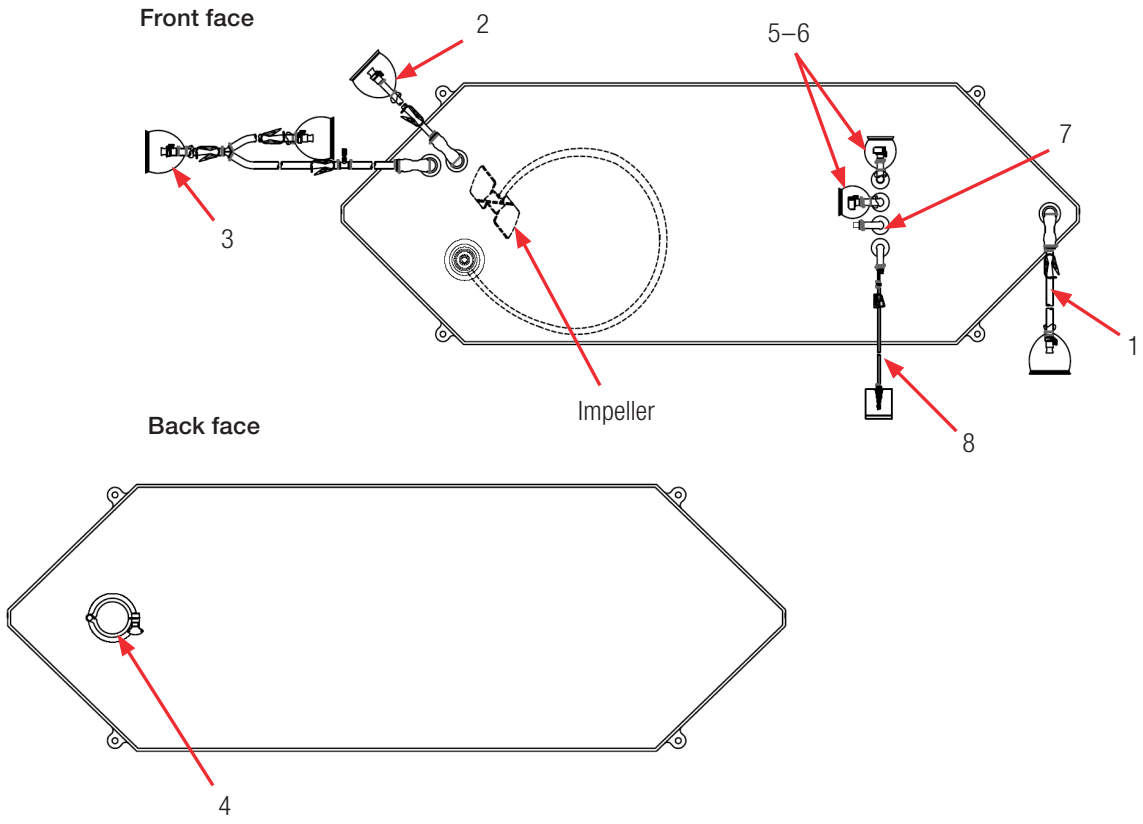


Table 6.27. 500 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 152 cm (60 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 168 cm (66 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket
5–6	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
7	Unused	None	Plug
8	Thermowell/ small volume sample port	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

Standard 500 L liquid-to-liquid BPC (with probe ports)

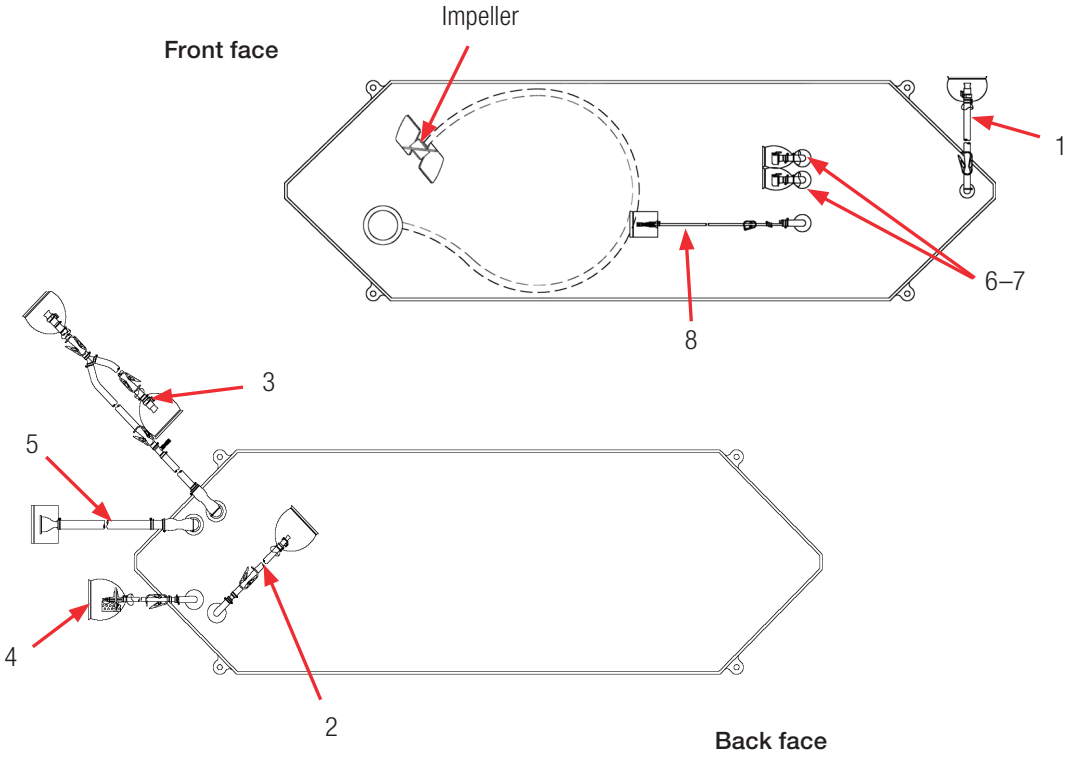


Table 6.28. 500 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 168 cm (66 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 152 cm (60 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz
6–7	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
8	Thermowell/ small volume sample	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

6.3.5. Standard 1,000 L BPCs

See the following sections for various standard 1,000 L S.U.M. BPC drawings and specifications.

Standard 1,000 L powder-to-liquid BPC (without probe ports)

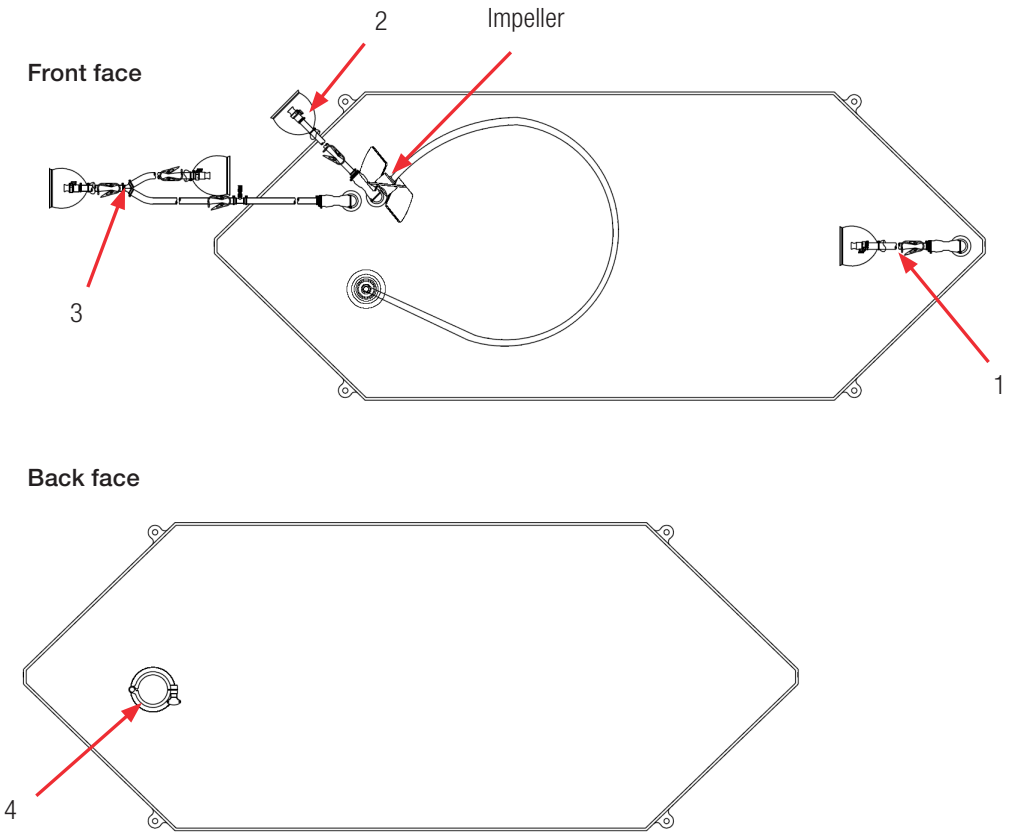


Table 6.29. 1,000 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 183 cm (72 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30.5 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 1,000 L liquid-to-liquid BPC (without probe ports)

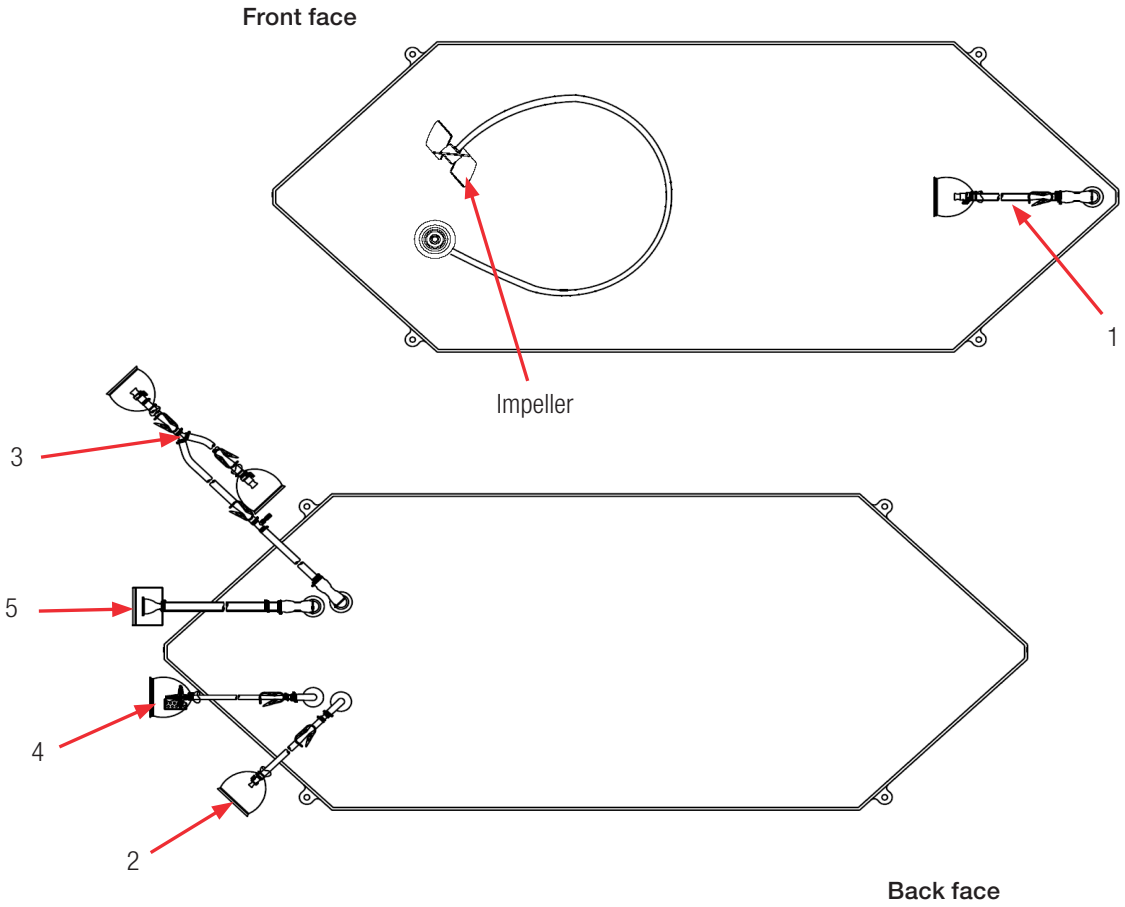


Table 6.30. 1,000 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 183 cm (72 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz

Standard 1,000 L powder-to-liquid BPC (with probe ports)

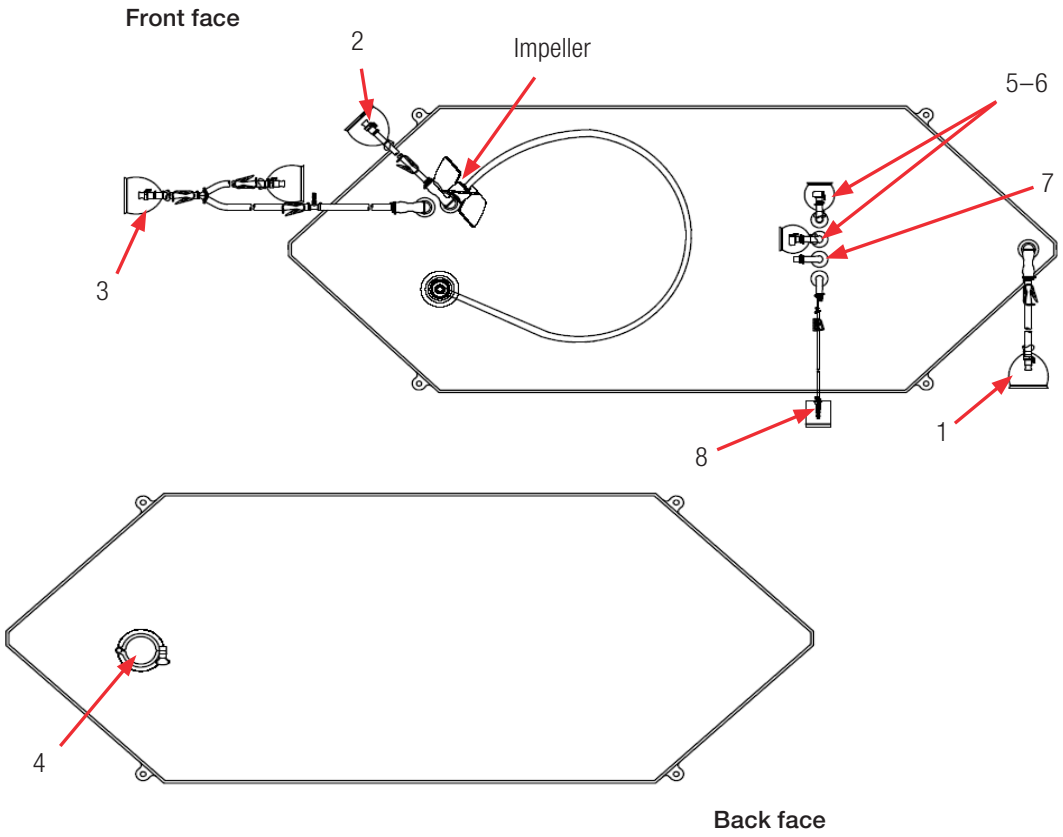


Table 6.31. 1,000 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket
5–6	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
7	Unused	None	Plug
8	Thermowell/ small volume sample port	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

Standard 1,000 L liquid-to-liquid BPC (with probe ports)

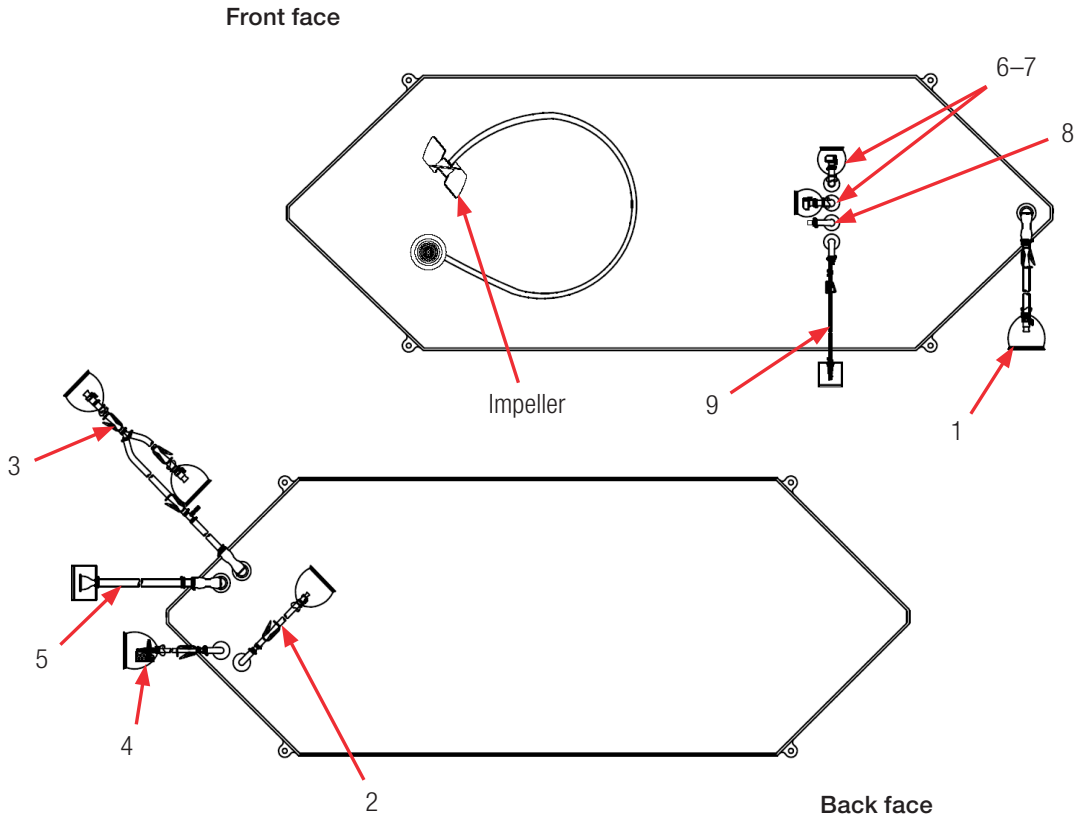


Table 6.32. 1,000 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 183 cm (72 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz
6–7	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
8	Unused	None	Plug
9	Thermowell/ small volume sample	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex x 30 cm (12 in.)	Luer and SmartSite Valve port

6.3.6. Standard 2,000 L BPCs

See the following sections for various standard 2,000 L S.U.M. BPC drawings and specifications.

2,000 L powder-to-liquid BPC (without probe ports)

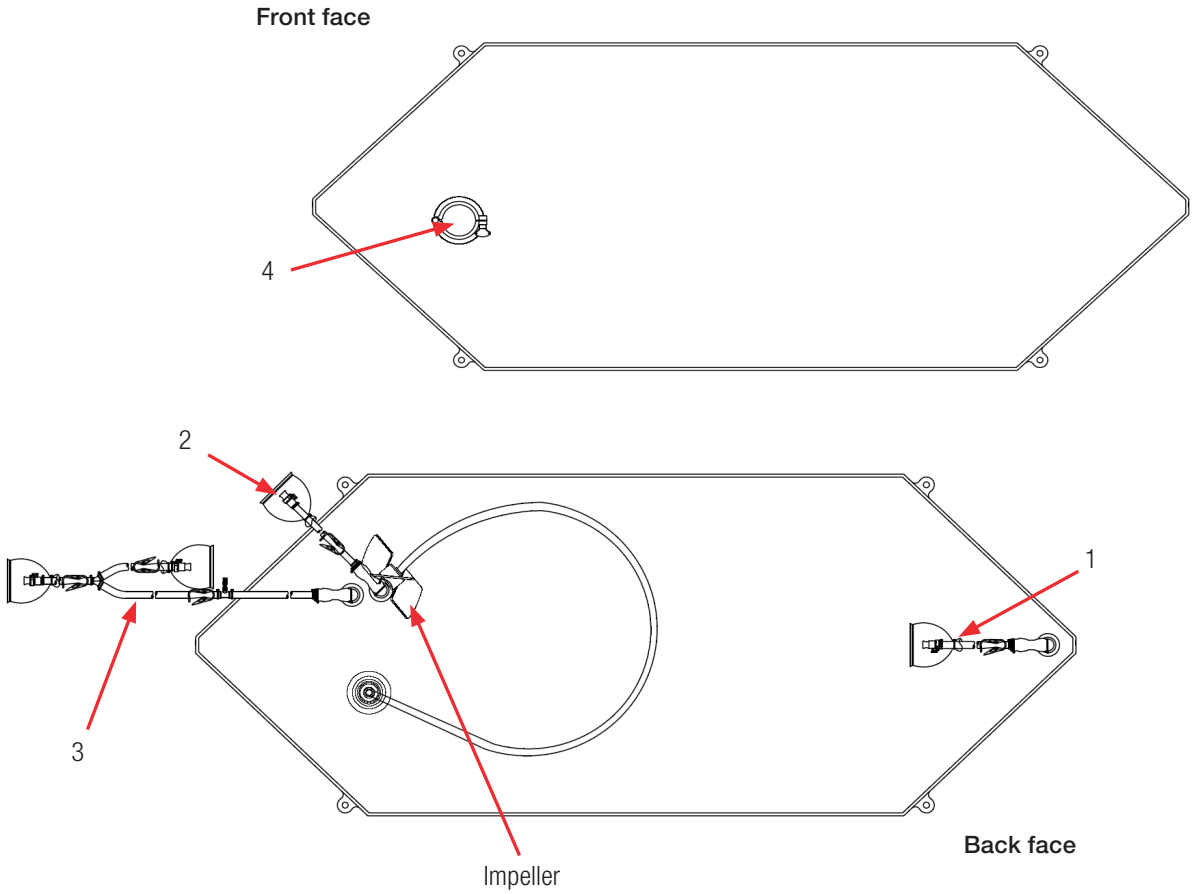


Table 6.33. 2,000 L BPC without probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 183 cm (72 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30.5 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket

Standard 2,000 L liquid-to-liquid BPC (without probe ports)

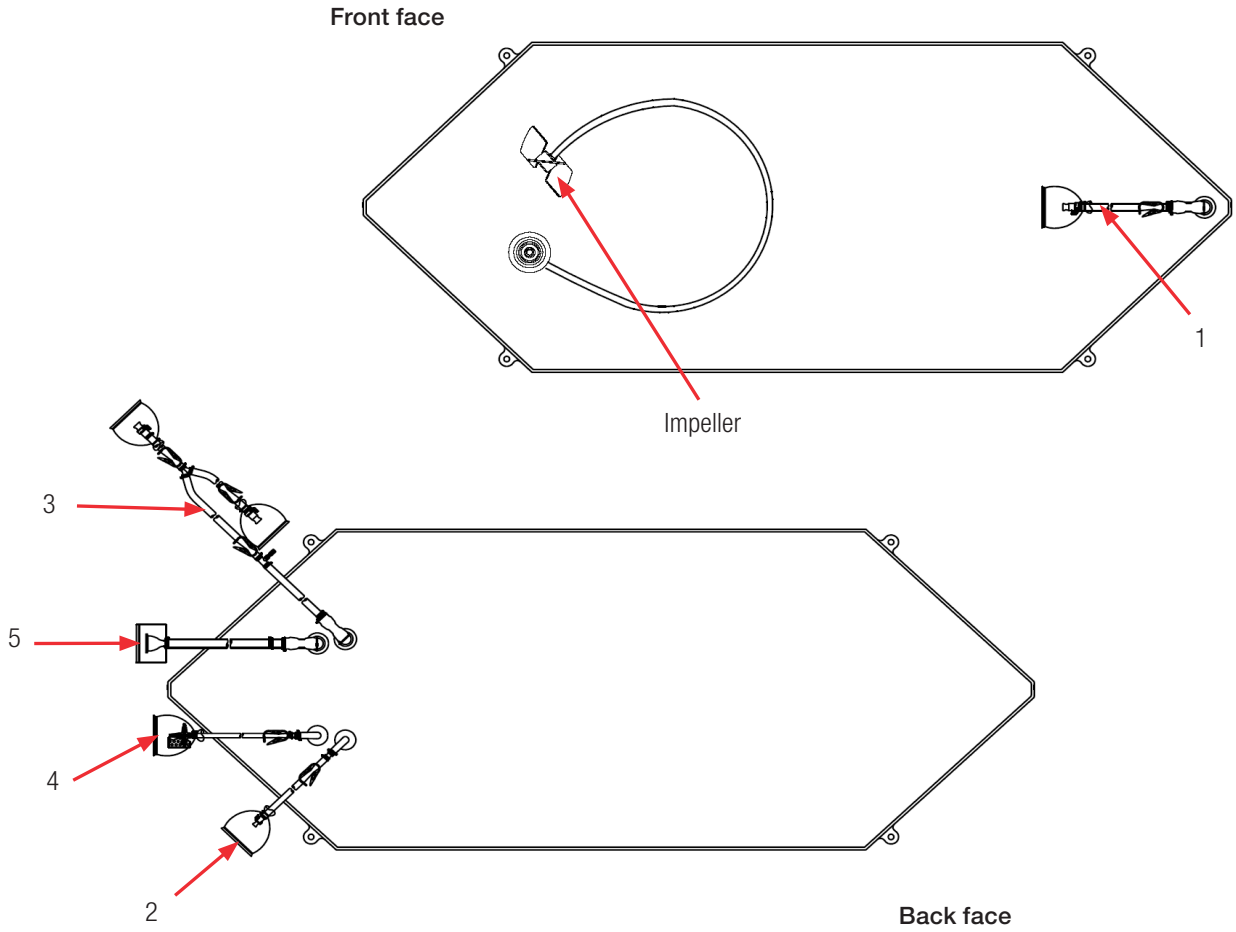


Table 6.34. 2,000 L BPC without probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 183 cm (72 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz

Standard 2,000 L powder-to-liquid BPC (with probe ports)

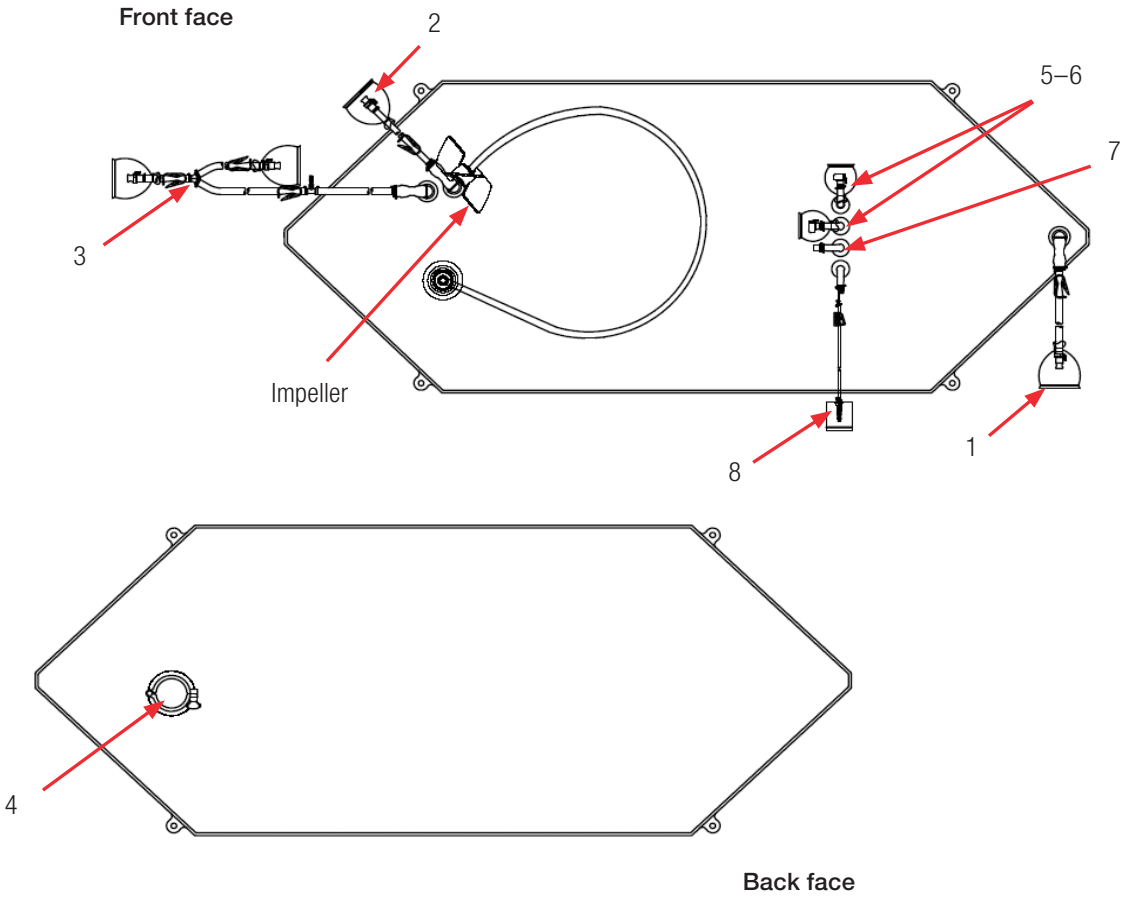


Table 6.35. 2,000 L BPC with probe ports for powder-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
2	Addition line	12.7 mm (1/2 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 122 cm (48 in.)	Plugged 12.7 mm (1/2 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Powder addition port	7.6 cm (3 in.) Sanitary fitting, tri-clamp	Cap with gasket
5–6	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
7	Unused	None	Plug
8	Thermowell/ small volume sample port	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

Standard 2,000 L liquid-to-liquid BPC (with probe ports)

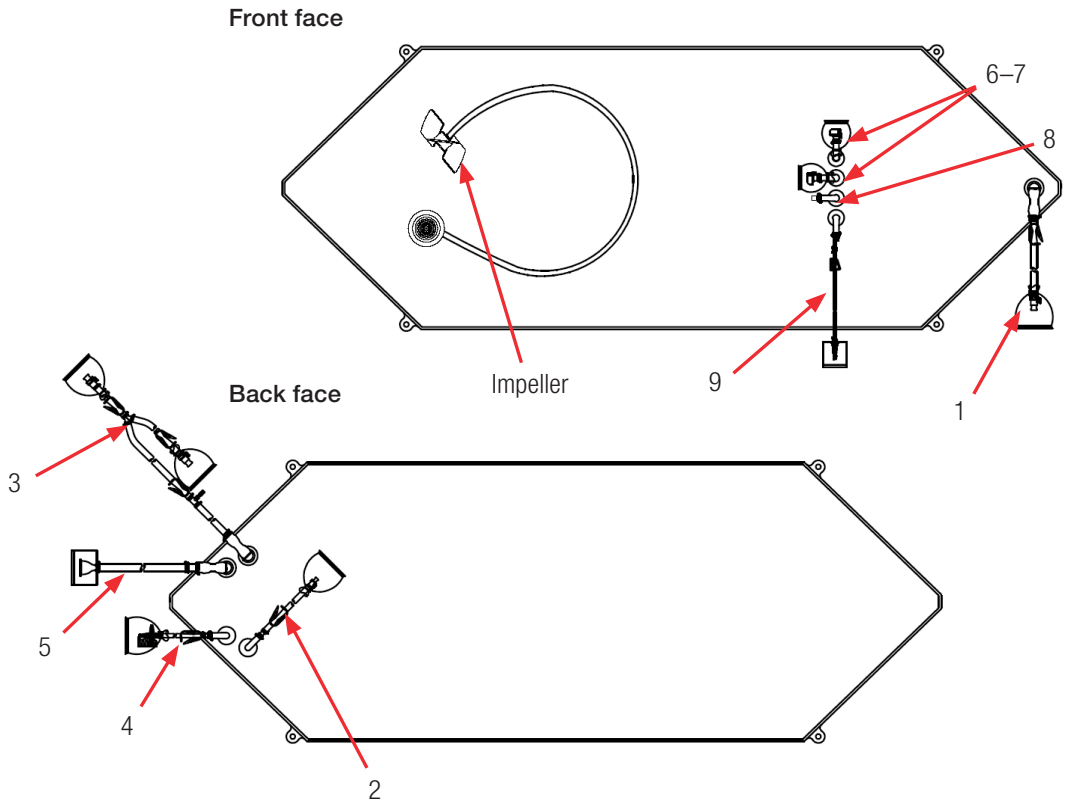


Table 6.36. 2,000 L BPC with probe ports for liquid-to-liquid applications.

Item	Description	Tubing set (ID x OD x length)	End treatment
1	Bottom drain	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 122 cm (48 in.)	Capped 12.7 mm (1/2 in.) MPX insert
2	Addition line	9.5 mm (3/8 in.) x 15.9 mm (5/8 in.) C-Flex tubing x 61 cm (24 in.)	Plugged 9.5 mm (3/8 in.) MPX body
3	Recirculation/ sample line	12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 198 cm (78 in.) splits to 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 61 cm (24 in.) and 12.7 mm (1/2 in.) x 19.1 mm (3/4 in.) C-Flex tubing x 30 cm (12 in.)	Capped 12.7 mm (1/2 in.) MPX insert, Plugged 12.7 mm (1/2 in.) MPX body
4	Vent filter	6.4 mm (1/4 in.) x 12.7 mm (1/2 in.) C-Flex tubing x 10.2 cm (4 in.)	Sterile hydrophobic vent filter (0.2 micron PVDF—Pall Acro 50)
5	Fill line	19.1 mm (3/4 in.) x 25.4 mm (1 in.) C-Flex tubing x 183 cm (72 in.)	38.1 mm (1.5 in.) Tri-clamp SterilEnz
6–7	Probe ports (2)	None	Pall Kleenpak aseptic connector KPCHT series (female)
8	Unused	None	Plug
9	Thermowell/ small volume sample	Thermowell adapter for 3.2 mm (1/8 in.) diameter 3.2 mm (1/8 in.) x 6.4 mm (1/4 in.) C-Flex tubing x 30 cm (12 in.)	Luer and SmartSite Valve port

6.3.7. Standard open-top liners and impeller sleeves

See the drawings and Table 6.37 below for specification and ordering information for open-top liners and impeller sleeves.

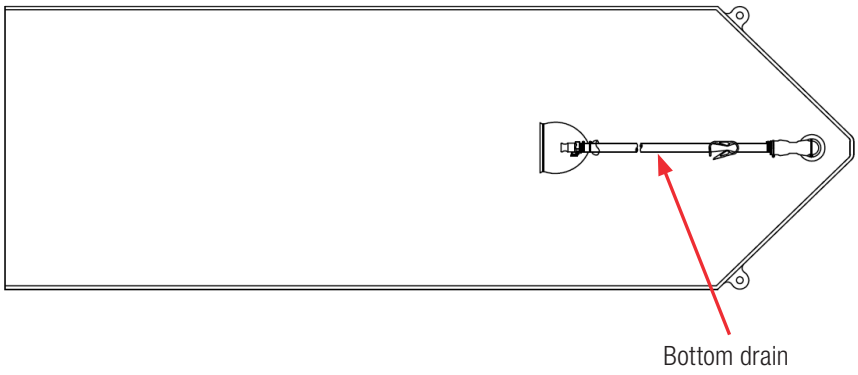
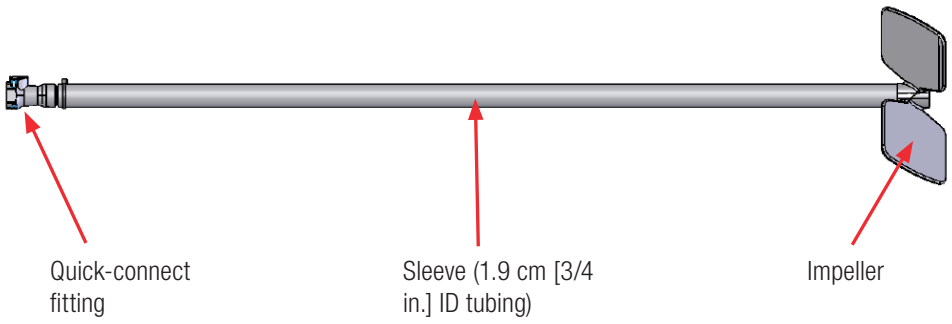


Table 6.37. Standard open-top liner.

Description	Tubing set (ID x OD x length)	End treatment
Bottom drain	182.9 mm (72 in.) of 12.7 mm (1/2 in.) C-Flex tubing	MPX insert connector



Please note: The bearing hub needed for open-top mixing is supplied standard with the tank hardware. The end treatment for the 2,000 L impeller has a tri-clamp fitting, rather than a quick-connect fitting.

6.3.8. Custom BPC products

See Table 6.38 below for descriptions of various custom BPC products. See your sales representative for more information.

Table 6.38. Specification information about custom BPC products.

Category	Options/capability	Notes
Tubing type	C-Flex, platinum cured silicone, PVC, PharMed, PharmaPure	More information is available in the Tubing Selection Guide
Tubing size	Ranges from 3.18–25.4 mm (1/8–1 in.) ID in various lengths	More information is available in the Tubing Selection Guide
Connectors	Luers, CPC quick-connects, SIP connectors, tri-clamp, Kleenpak, Lynx, SmartSite, Clave, Lynx steam thru, CPC steam thru, Gore steam valve, Gore Mini TC, BioQuate, SterilEnz, end plug, etc.	More information is available in the Connection System Selection Guide
Probe ports/line addition ports	Ports may be added if they are compatible with the hardware	The reusable probe connector can use Kleenpak or AseptiQuik connectors
Disposable sensors	Pressure sensor: PendoTECH and Finesse solutions (PendoTECH comes standard on 500 and 1,000 L) DO and pH: Finesse and PreSens pH: Mettler Toledo	Choice of qualified vendors available
Port sizes	Limited engineer-to-order customization only	Dependent on location in BPC and fit with hardware (e.g. 1 in. ID port on harvest line)
Rearrangement of lines on existing ports	Limited customization possible, such as moving sample/thermowell port of a probe tube port, or swapping exhaust outlet line with liquid lines	Dependent on location in BPC and fit with hardware
Dip tube lines	Limited customization possible	Length cannot interfere with impeller and shaft
Filters on media and supplement inlets	Limited engineer-to-order customization only—choice of filters used to sterilize incoming media or supplements are available	N/A

Please note: Not all options are available for all ports. It is not possible to customize port type, port location, chamber dimensions, or mixing assembly. For additional information, please see the Selection Guides in the BPC Catalog.

Table 6.39. BPC packaging information.

Outer packaging	Supplied “flat-packed,” two polyethylene outer layers
Label	Description, product code, lot number, expiry date on outer packaging, and shipping container
Gamma irradiation	Irradiation (25 to 38 kGy) inside outer packaging
Shipping container	Durable cardboard carton
Documentation	Certificate of Analysis provided with each lot for each delivery

6.4. Accessories and options specifications

The following section provides information about S.U.M. accessories and options.

6.4.1. Load cells

Load cells operate as a mechanical suspension and weighing system on the S.U.M. Load cells may be purchased either at the time of equipment sale or as retro-fit kits for existing S.U.M. units. Load cell systems include three load cells, a summing block, a display, and wiring.

Mettler Toledo 0745A Series load cells are used to enable weight measurements for 2,000 L S.U.M. units (Figure 6.21). Mettler Toledo MTB load cells (Figures 6.19 and 6.20) are used to enable weight measurements for all other S.U.M. sizes.

Figure 6.19. Mettler Toledo MTB load cell for 50–1,000 L S.U.M. units.

Figure 6.20. Close-up view of Mettler Toledo MTB load cell.

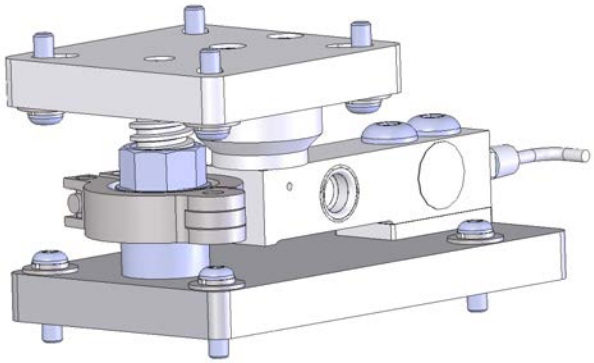


Figure 6.21. Mettler Toledo 0745A load cell for 2,000 L.

Load cells are typically radial mounted in sets of three. The mounting location varies slightly for each size in order to allow easy access to the bottom drain or sparging mechanisms and tubing. See Table 6.40 for load cell specifications, and Table 6.41 for ordering information.

Table 6.40. Specification information for S.U.M. load cells.

Weigh module parameter	50-100 L S.U.M.	200 L S.U.M.	500 L S.U.M.	1,000 L S.U.M.	2,000 L S.U.M.
Model number	MTB-100	MTB-200	MTB-300	MTB-500	0745A
Rated capacity per load cell	100 kg (220 lb)	200 kg (441 lb)	300 kg (661 lb)	500 kg (1102 lb)	1100 kg (2500 lb)
Safe load limit	150% of rated capacity				
Safe side load limit	100% of rated capacity				
Safe dynamic load	70% of rated capacity				
Weight (including load cell), nominal	0.6 kg (1.3 lb)				Entire assembly: 7.2 kg (16 lb) Load cell only: 0.9 kg (1.98 lb)
Material	304 stainless steel				

Table 6.41. Ordering information for Mettler Toledo load cell kits.

Size	Description	Cat. no.
50, 100 L	(3) Load cell with summing box, no display	SV50988.01
200 L	(3) Load cell with summing box, no display	SV50988.02
500 L	(3) Load cell with summing box, no display	SV50988.03
1,000 L	(3) Load cell with summing box, no display	SV50988.05
2,000 L	(3) Load cell with summing box, no display	SV51105.05

6.4.2. Powdertainer arm

The Powdertainer arm is available as an option for powder-to-liquid applications. Powdertainer arms are available in two sizes: one for 50 to 1,000 L units, and one for 2,000 L units (Figure 6.22). The arm holds the container of powder above the mixer and attaches it to the BPC with a clamp. The arm adjusts vertically and swivels to enable convenient lifting of a powder container onto the hanger. See Table 6.42 for Powdertainer arm ordering information.

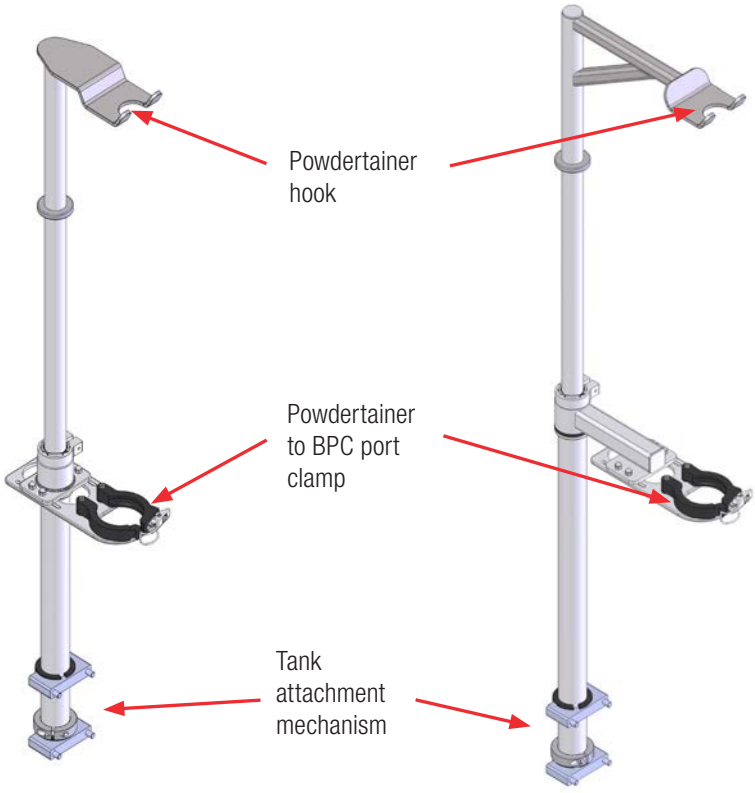


Figure 6.22. Powdertainer arms for 50–1,000 L units (left) and 2,000 L units (right).

Table 6.42. Ordering information for Powdertainer arms.

Size	Description	Cat. no.
50–1,000 L	Powdertainer arm for 50–1,000 L mixers	SV51002.01
2,000 L	Powdertainer arm for 2,000 L mixers	SV51002.02

6.4.3. Cable management system

The cable management system (Figure 6.23) includes the following:

- External channels for feed and base addition lines
- Drain line hook
- Adjustable arm for external control power cable management

See Table 6.43 for cable management system ordering information.

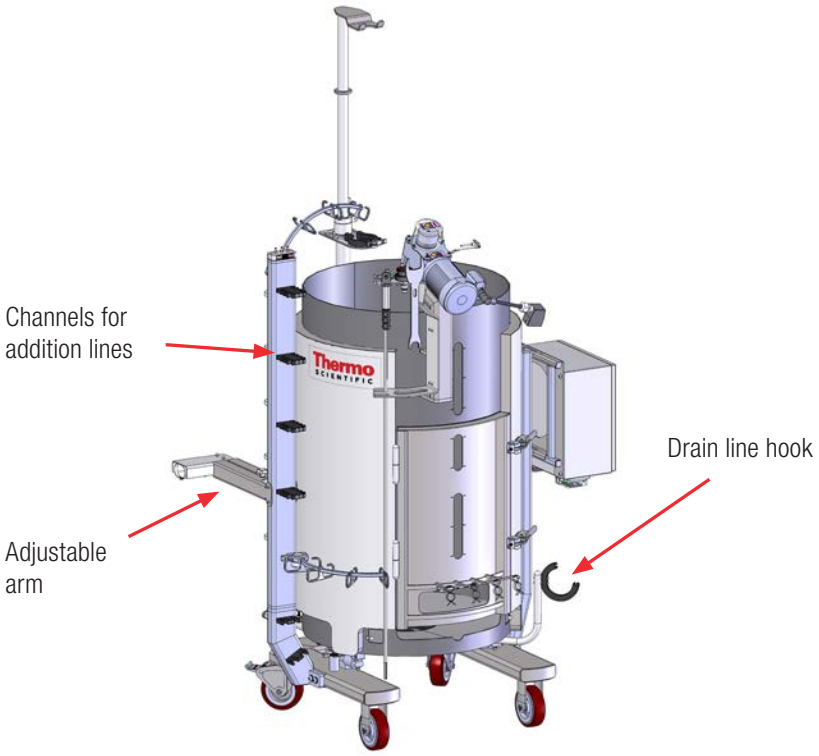


Figure 6.23. Cable management system on a 200 L mixer.

Table 6.43. Ordering information for cable management system.

Size	Description	Cat. no.
50–100 L	Cable management system	SV50992.01
200 L	Cable management system	SV50992.02
500–2,000 L	Cable management system	SV50992.03

6.4.4. AC and DC motors

AC and DC motor options are available to help tailor the system to specific needs. The DC motor (Figure 6.24) operates at lower voltage and, when integrated with a controller system that receives sensor feedback, provides more accurate speed control through a digital program transmitter. The DC motor comes with an encoder, but does not come with a motor control/E-Box option from Thermo Scientific.

The AC motor (Figure 6.25) may be used with the Thermo Scientific E-Box, includes the variable frequency drive and is controlled using either the provided keypad or a controller specified by the end-user.

Figure 6.24. DC motor (50–1,000 L only).

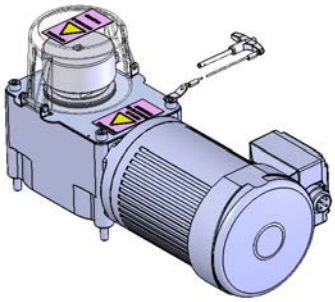


Figure 6.25. AC motor (2,000 L only).

6.4.5. Miscellaneous items

The following ancillary components support the operation of the HyPerforma S.U.M., and enhance the performance of the complete system. Ordering information for all miscellaneous items can be found in Table 6.44.

Autoclave tray for probes

The autoclave tray (Figure 6.26) holds the electrochemical probes and bellows in place during the autoclave sterilization process. The tray can accommodate two probes. Design elements include:

- Stainless steel fabrication
- A plastic handle, providing easy transport right out of the autoclave
- Ability to position probes on a 15% incline for greater probe/membrane longevity
- Ability to restrain probe bellows from collapsing during sterilization

Figure 6.26. Autoclave tray for Kleenpak aseptic connectors.

Heavy-duty tubing clamps

Heavy-duty tubing clamps (Figure 6.27) are used for pinching off line sets that are not in use in order to prevent process fluids from escaping. Tubing clamps must be in place prior to sterile probe insertion to close off probe ports.

Figure 6.27. Tubing clamp.

Probe clips

Both stainless steel probe clips (Figure 6.28) and plastic probe clips (Figure 6.29) are used to hold probes in place on the S.U.M. tank. The probe clips can be moved independently, and are positioned on a thin brace above the probe port tank cutout. Plastic probe clips are attached by sliding onto the brace with firm pressure. Metal probe clips are held in place by an adjustable spring plunger.

Figure 6.28. Metal probe clip.

Figure 6.29. Plastic probe clip.

Ordering information

See Table 6.44 below for miscellaneous item ordering information.

Table 6.44. Ordering information for miscellaneous items.

Description	Cat. no.
Autoclave tray for Pall Kleenpak connectors	SV50177.01
Probe assembly (non-sterile, for use in autoclave)	SH30720.01
Probe clips (4)	SV50177.23
Heavy-duty tubing clamps (single)	SV20664.01
Heavy-duty tubing clamps (10)	SV20664.03
Mettler Toledo pH monitoring device, single channel	SV51004.01
Mettler Toledo pH monitoring device, dual channel	SV51004.02
Mettler Toledo pH and conductivity monitoring device, dual channel	SV51004.07

Spare parts

For information about recommended spare parts, refer to the drawings supplied with the ETP.

6.5. Configurable options

See below for S.U.M. made-to-order configurable options.

S.U.M. MTO Configuration Table

This table describes the part number and configurable (make to order MTO) options for the SUM product line.

Example: SUMXXXX.AAAA00000000	SUM	0	A	A	A	A	0	0	0	0	0	0	0	0
Single Use Mixer														
Vessel Size (XXXX = XXXXL)														
1. Vessel Type/Material														
A= Non-Jacketed (304 SST) (Standard) Tank and Cart are 304 SST														
B= Jacketed (304 SST) (Standard) Tank and cart are 304 SST														
C= Non-Jacketed (316 SST) Tank and cart are 316 SST														
D= Jacketed (316 SST) Tank and cart are 316 SST														
2. Motor/Electrical Enclosure/Mount														
A= DC motor/No Electrical Enclosure														
B= AC motor/No Electrical Enclosure														
C= AC motor/120VAC Electrical Enclosure-R/H configuration (Standard)														
D= AC motor/240VAC Electrical Enclosure-R/H configuration (Standard)														
E= AC motor/120VAC Electrical Enclosure- L/H configuration														
F= AC motor/240VAC Electrical Enclosure- L/H configuration														
3. Drive Shaft														
A= 1 Piece Drive Shaft (SST)														
B= 2 Piece Drive Shaft (SST)														
C= 3 Piece Drive Shaft (SST)														
4. RTD														
0= No RTD														
A= Single RTD, PT100, 60" Bulgin Connector (Standard)														
B= Dual RTD, PT100, 120" DB9 Connector X 120" open lead wires														
C= Dual RTD, PT 100, 120" Bulgin X 120" Bulgin Connectors														
D= Dual RTD, PT 100, 120" DB9 X 60" Bulgin Connectors														
E= Dual RTD, PT 100, 120" Bulgin X 120" LEMO Connectors														
F= Single RTD, PT100, 120" Bulgin Connector														
G= Dual RTD, PT100, 120" DB9 X 120" Bulgin Connectors														
H= Single RTD, PT100, 60" LEMO Connector														
5. Load Cells and Display														
0= No load cells														
A= Loads cells, No display														
B= Loads cells, Wall mount display-Analog Output Communication														
C= Loads cells, Wall mount display -Allen-Bradley Communication														
D=Load cells, Wall mount display, Device net Communication														
E= Loads cells, Wall mount display-Modbus Communication														
F= Loads cells, Wall mount display-Profibus Communication														
6. Powder Arm Assembly														
0= No powder arm assembly														
A= Powder arm assembly														
7. Cable Management Tree														
0= No Cable management tree														
A= Cable management tree- L/H configuration														
B= Cable management tree= R/H configuration														
8. Communication Cable														
0= No Communicaiton Cable														
A= Communication Cable														
9. Monitoring Device														
0= No Monitoring Device														
A= pH Monitoring Device Single Channel with Display														
B= pH Monitoring Device Dual Channel with Display														
C= pH / Conductivity Monitoring Device with Display														
10. Probe Clip														
0= No Probe Clip														
A= Probe Clip (Qty 4)														
11. P&ID Tags (Pre-Defined Tags and Locations, Not Custom)														
0= No P&ID Tags														
A= Standard P&ID Tag Option (Pre-defined, Not Custom)														
12. Pressure Relief Valve														
0= No Pressure Relief Valve														
A= Pressure Relief Valve (Max Pressure set at 75 psi)														
B= Pressure Relief Valve with Pressure Indicator (Max Pressure set at 75 psi)														

Figure 6.30. S.U.M. MTO configuration table.

7

General ordering information

Chapter contents

7.1. Ordering instructions

BPCs and hardware components for the HyPerforma S.U.M. can be ordered directly from Thermo Fisher Scientific. These items include all components that have part numbers beginning with the following digits:

- SH
- SV
- SUM

7.2. Ordering and support contact information

In the Americas and Asia
1726 Hyclone Drive
Logan, Utah 84321
United States
Tel: +1 435 792 8500
Email: customerservice.bioprocessing@thermofisher.com

In Europe
Unit 9 Atley Way
Cramlington, NE 23 1WA
Great Britain
Tel: +44 (0) 670 734 093
Fax: +44 (0) 670 732 537
Email: customerservice.bioprocessing@thermofisher.com

7.3. Technical support

Technical support for the HyPerforma S.U.M. is available in a variety of formats. Some or all of the following may be appropriate, depending on individual experience and circumstances.

Technical service hotline and email

Contact your Thermo Fisher Scientific sales representative for general product pricing, availability, delivery, order information, and product complaints.

Call +1 435 792 8500 (United States) or +44 (0) 670 734 093 (Europe, U.K.) for direct and immediate response to overall product questions, and product technical information (Technical Support). You can also contact Tech Support by emailing:
techsupport.bioprocessing@thermofisher.com

Initial setup and operation

Appropriate technical support is available to assist in the initial setup and operation of each S.U.M. system. If you require assistance in setting up and operating your S.U.M. system, please inquire at the time of purchase.

Training

Training can be provided for start-up and operation of the S.U.M. Contact your Thermo Fisher Scientific sales representative for more information.

Appendix A—Installation of female electrical receptacle for units with AC motors and E-Boxes

1. In order to complete the installation for units with AC motors, the facility must be equipped with an electrical housing of sufficient size.
   - Typically, in the U.S., the plug will require a two-gang box when using the adapter plate (supplied).
   - For installations outside of the U.S. (where an adapter plate is not supplied), we recommend that an electrical panel be modified to accommodate the cutout dimensions as shown in Figure A.1 below.

2. Verify that the electrical power has been disconnected and locked out for safety.

3. Verify that the holes for mounting the receptacle housing are positioned properly. Center-to-center measurement of respective mounting holes is 85 mm (3.35 in) tall, and 77 mm (3 in.) wide.

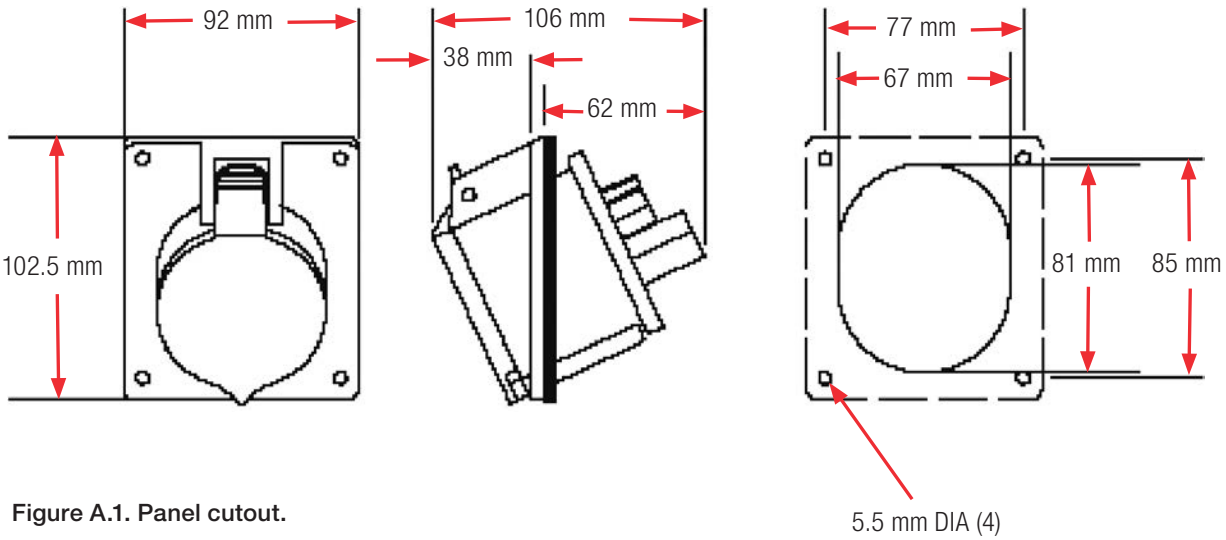


Figure A.1. Panel cutout.

4. Verify the condition of the three exposed wire leads and strip back to expose new wire, if needed.

5. Connect the wire leads on the receptacle (shown in Figure A.2 below) using the screw terminals, paying strict attention to obtain the correct wiring position as it is labeled on the receptacle.
   - Green (ground)
   - White (common)
   - Black in the U.S./Blue in the E.U. (hot)

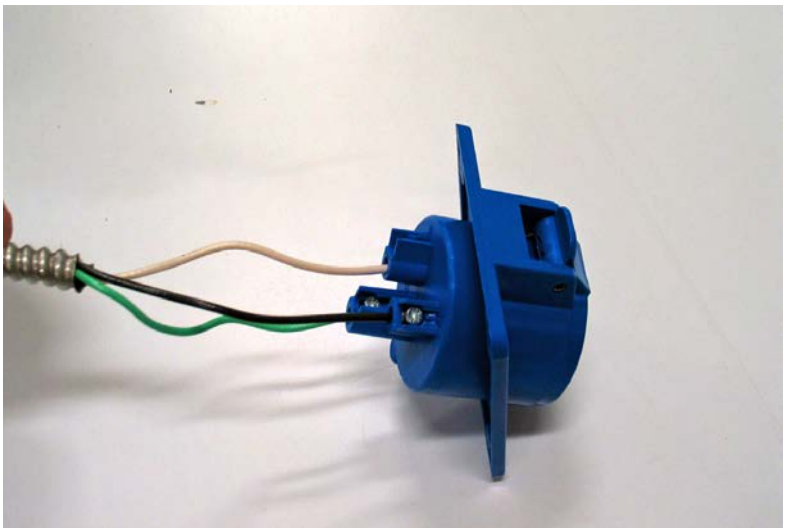


Figure A.2. Female receptacle (blue for 240 VAC, yellow for 110 VAC).

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Find out more at **thermofisher.com/sut**

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