



Allegro™ Connect Virus Filtration System

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Introduction

Executing any process without the right degree of monitoring, control or reporting runs the risk of process deviations. This could potentially lead to the adulteration of valuable drug substance and intermediates, whilst wasting valuable operator time. Allegro Connect Systems provide robust, accurate and automated platforms that integrate with your manufacturing processes on every level, keeping unit operations within critical parameters to ensure that you spend less time collating data and more time optimizing your process.

Our range of Allegro Connect Systems share a compact form factor, designed with operators in mind, that are configurable to meet your process requirements without the time-consuming pain of modification.

The Allegro Connect Virus Filtration System

The Allegro Connect Virus Filtration System is a single-use automated filtration system designed to deliver robust process control during this critical downstream step.

This next generation compact and elegant system is designed to minimize risk through a fully automated process with recipe-controlled steps, including pre-use manifold leak test, pre-use and post-use filter integrity tests (with the help of an integrated Palltronic® Flowstar IV Filter Integrity Test Instrument), system priming, product filtration and buffer chase, with all data stored in a batch reporting system, significantly reducing non-conformities and manual labor.

New innovative design features enable manifolds to be configured to meet a variety of process needs; supporting a wide range of liquid filter capsules (prefilters and virus filters) and also accommodating non-Pall filters.

The problem

Manual and semi-automated filtration often lacks robustness, increasing the risk of critical deviations, non-conformities and sometimes even batch loss. The process data that is generated by the current systems is often insufficient and hard to access, making it very difficult to accurately evaluate any deviations or conduct routine process analysis, causing a significant impact on both cost and labor.

Current trends show an increasing number of multi-product facilities being built and/or being retrofitted together with significant investments in automated bioprocessing equipment.

Most of the existing automated virus filtration systems are designed to fit a specified process scale and are therefore less flexible.

80%
of process deviations in
pharmaceutical manufacturing
environments can be attributed to
human error*



* Eliminating Human Error From Your List of Manufacturing Deviations, (podcast), Ginette Collazo, March 23, 2021

The solution

Minimize process risk

Fully automated process – fully integrated virus filter integrity test & pre-use manifold leak test with minimal operator intervention

Smooth phase transition with no pressure loss

All data in one place

Maximize configurability

Choice of manifolds

Choice of filters†

Good fit across 200 L pilot to 2000 L production scale

Maximize productivity

Single-use technology (SUT) for faster turnaround between batches

Reduced deviations

Reduced downtime

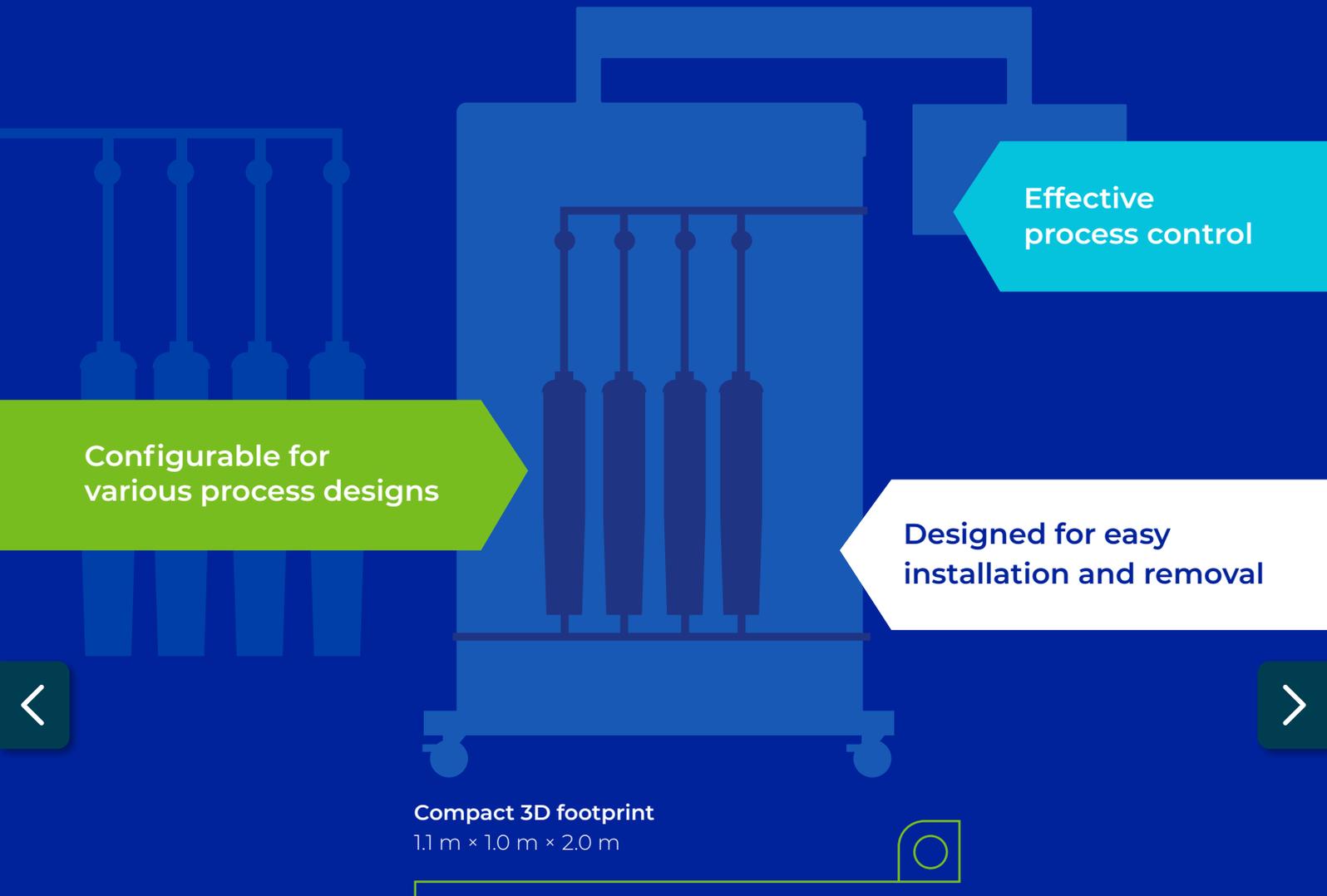
The solution is a fully automated configurable system

The Allegro Connect Virus Filtration System is a fully automated and completely flexible platform that can accommodate a product stream from 200 L to 2000 L bioreactor scale.

- Integrated Palltronic Flowstar IV Filter Integrity Test Instrument for *in-situ* pre-use and post-use integrity testing of virus filters as well as pre-use manifold leak test.
- Configurable recipe-controlled phases to automatically perform pre-use system equilibration, product filtration and buffer chase, with maximum product recovery utilizing standard manifolds.
- Smooth transition between filtration and buffer chase phase while keeping the process parameter within the limit to eliminate impact on virus retention from back diffusion during process interruptions.
- Wide range of process options to control functions such as flow, differential pressure and inlet pressure, that covers the majority of virus filtration process strategies.
- Flexible configuration compatible with all commonly used virus filters.
- Easy to install single-use flow path with the shadow board concept and guided human machine interface (HMI) instructions for installation in less than 60 minutes and uninstallation in less than 15 minutes by a single operator.
- Batch reporting summary compiling data from the single-use sensors within the flow path, filter integrity testing results, and other critical process parameters.

† Capsule, hollow fiber & cassette type virus filters

High-performance virus filtration



Configurable for various process designs

Effective process control

Designed for easy installation and removal

Compact 3D footprint
1.1 m x 1.0 m x 2.0 m



Increased assurance



Robust control



Maximized productivity



Scale the equipment to meet your process needs

The following images show the scalability of the system to achieve various configuration options, tailored to meet your individual process needs. With a range of manifolds and hardware configurations available, end users are able to support all commonly used virus filters, up to 4 × 762 mm (30 in.) prefilters (PF) and up to 2 × 762 mm (30 in.) virus filters (VF) equating to throughputs typical of 200 L to 2000 L bioreactor scales.

254 mm (10 in.) configuration



4 × 254 mm (10 in.) PF and 2 × 254 mm (10 in.) VF

508 mm (20 in.) configuration



2 × 508 mm (20 in.) PF
and 1 × 508 mm (20 in.) VF



4 × 508 mm (20 in.) PF
and 2 × 508 mm (20 in.) VF

762 mm (30 in.) configuration



2 × 762 mm (30 in.) PF
and 1 × 762 mm (30 in.) VF



4 × 762 mm (30 in.) PF
and 2 × 762 mm (30 in.) VF

Increased assurance

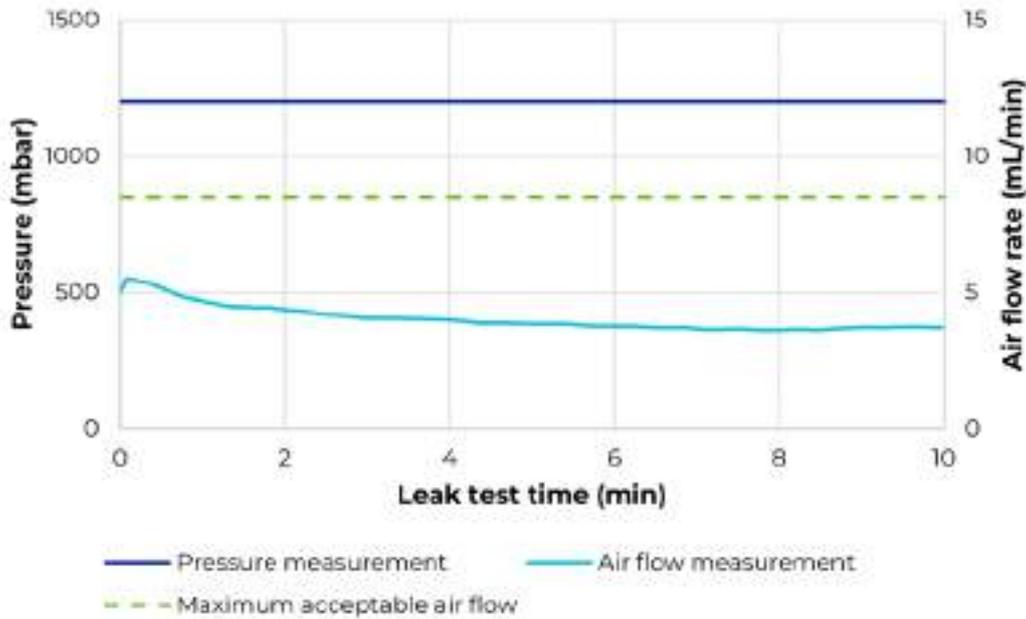
Manual pre-use and post-use filter integrity tests of virus filters increase the risk of operator error due to mishandling, which could potentially lead to filter damage and integrity breach, impacting the batch. The integrated Palltronic Flowstar IV Filter Integrity Test Instrument eliminates that risk by automatically performing pre-use and post-use integrity testing on virus filters. In addition, the pre-use manifold leak test provides leak-free assurance prior to starting product filtration.



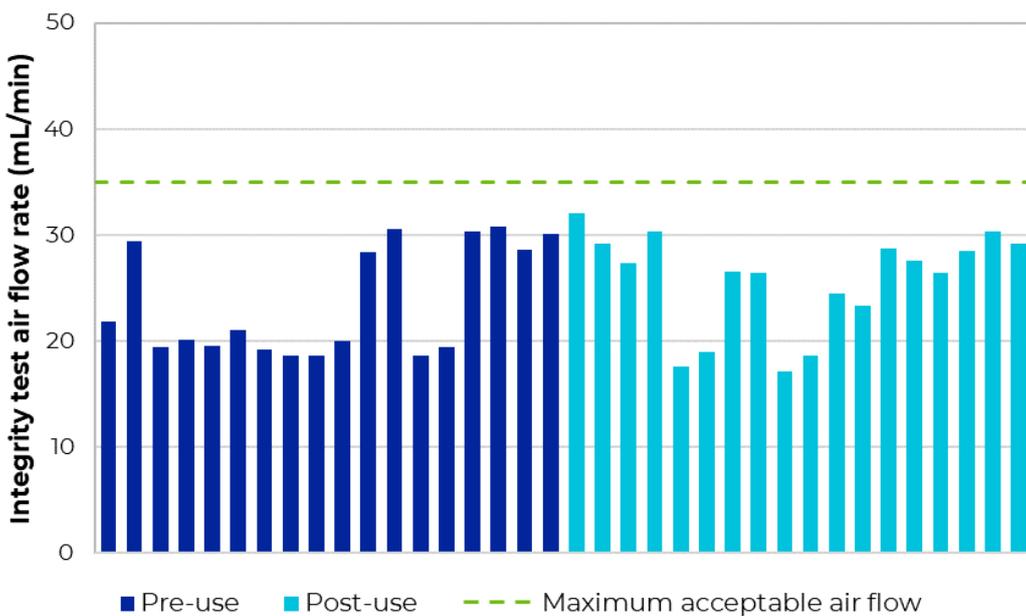
Integrated Palltronic Flowstar IV Filter Integrity Test Instrument installed inside the system.

Automated pre-use manifold leak test and filter integrity test

Automated pre-use manifold leak test



Automated filter integrity testing showing results of Pegasus™ Prime membrane in Kleenpak™ Nova 254 mm (10 in.) filter capsule format

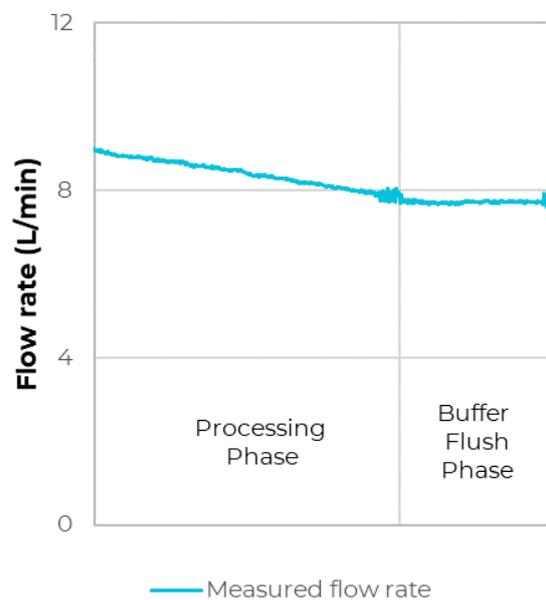
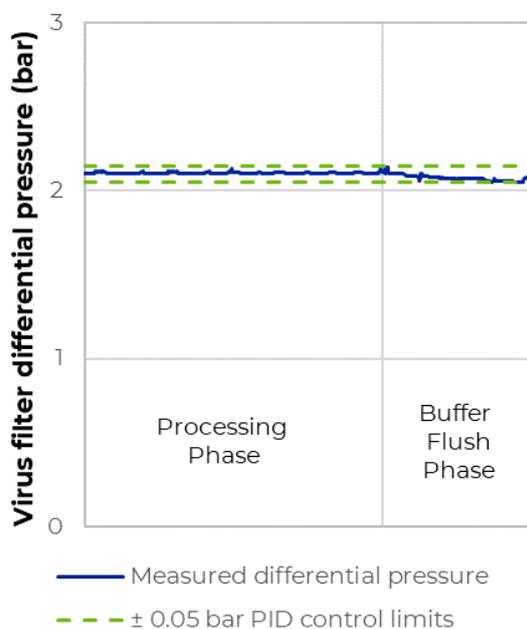


Robust filtration

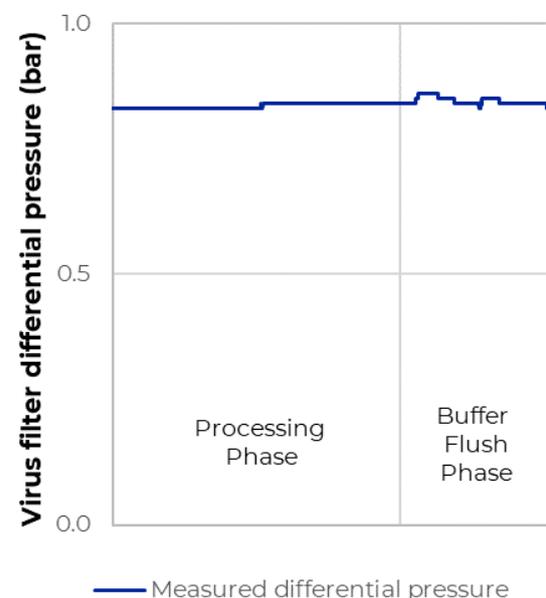
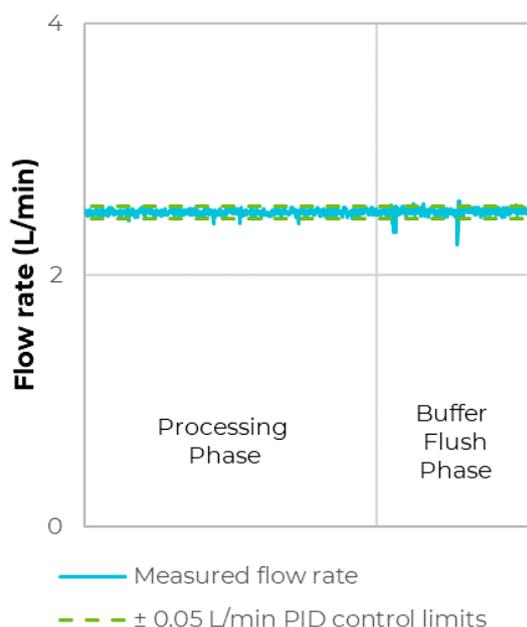
Seamless phase transition from product filtration to buffer chase provides better process control by maintaining the critical process parameters within limits.

Product filtration to buffer chase phase transition

Differential pressure control showing flow rate in response to fouling



Fixed flow control with virus filter differential pressure shown for information



Maximizing productivity

The Allegro Connect Virus Filtration System utilizes single-use technology (SUT) to ensure faster turnaround between product batches, eliminating the need for clean-in-place (CIP) and sterilization-in-place (SIP) operations and associated cleaning validation, reducing maintenance costs and system downtime, thereby ensuring increased plant productivity.

The entire flow path has been designed for easy installation and removal, with clearly marked connections and a shadow board to visibly guide the user, reducing the risk of human error.

Designed for ease of use

The Allegro Connect Virus Filtration System has undergone extensive usability trials to ensure the system is simple and intuitive to use. Visual instructions for installation (IFI) have been created and are accessible via the HMI screen providing operators with a step-by-step guide to installing the single-use flow paths and making the relevant fluid connections. Sample IFI screens can be seen below:



Operator using the intuitive HMI screen for process monitoring.



Guided instruction for installation (IFI), where the operator is instructed by the recipe to install prefilter inlet manifold.



Guided instruction for installation (IFI), where the operator is instructed by the recipe to install virus filters.

A total virus filtration solution

The Allegro Connect Virus Filtration System can also be connected with some of our other single-use systems to provide a total virus filtration solution for your process, such as LevMixer® systems for product and Allegro High-density Polyethylene (HDPE) Totes for buffer and water for injection (WFI).



System options

The Allegro Connect Virus Filtration System is available with three automation options:

- Programmable logic controller (PLC), Rockwell• or Siemens•, and human machine interface (HMI) for local stand-alone control
- Remote input/output (I/O) (no PLC) for integration into a DCS or supervisory control and data acquisition (SCADA) system
- Remote I/O (no PLC) controlled by centralized PLC system

The automation architecture is based on either Siemens S7 PLC or Rockwell CompactLogix• PLC, an industrial PC, and a 22 in. thin client which is applied across our range of Allegro Connect Bioprocessing Systems enabling a truly modular 'plug-and-play' concept, with the ability to control single or multiple unit operations from one centralized cabinet.



Quality standards

Detailed validation turnover package for each system according to ASTM 2500 Standards (A Standard Guide for Specification, Design, and Verification of Pharmaceutical and Biopharmaceutical Manufacturing Systems and Equipment).

Regulatory dossier, compiled of:

- Regulatory compliance ROHS I to ROHS III directives
- Raw material compliance data (USP Standards)
- Packaging and packaging waste directive 94/62/EV
- System designed in accordance with the American Society of Civil Engineers (ASCE), ASCE 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

Technical specifications

Process specifications

Equipment	Specification
Functionality	Filtration
Filtration configuration	Virus filters in series with prefilters
Minimum prefilter and virus filter capsule size	127 mm (5 in.)
Maximum prefilter and virus filter capsule size	762 mm (30 in.)
Feed pump	1
Pump flow rate range	20 – 1200 L/h
Number of inlets	3 (2 × water for injection [WFI]/buffer and 1 × product)
Number of outlets	3 (1 × product, 1 × drain and 1 × process waste outlet)
Tube dimension	½ in. (internal diameter [ID])
Flow path operating pressure	Non-virus filter manifolds: 0 – 4 bar (0 – 58 psi) Virus filter manifold: 0 – 3.5 bar (0 – 51 psi)
Integrity test pressure ¹	Up to 5.7 bar (83 psi) with a maximum exposure of ≤ 10 hours
Flow path operating temperature range	4 – 40 °C
Pressure sensor	Up to 3 (1 after feed pump with integrated, hard-wired pressure switch; 1 before virus filter and 1 after virus filter)
External connections	6 (2 × ethernet for mixer, 2 × HC-DD24 for mixers, 2 × HAN16E for scales)

¹Acceptable pressure rating of the air filters

System specifications

System	Specification
System dimensions (W × D × H)	112 × 102 × 197 cm (44 × 40 × 78 in.)
System mass (empty)	500 kg (1102 lbs)
System floor clearance	115 mm (4.5 in.)
Environmental conditions	5 – 30 °C, relative humidity 10 – 70 % (non-condensing)
Materials of construction	Stainless steel 304
Surface finish	Cold rolled steel (typically Ra < 1 µm)
Ingress protection rating	IP54 (main, outer panel or chassis)

Utility specifications

Utilities	Specification
Electrical supply	230 VAC – 50 Hz (European), 208 VAC – 60 Hz (North American)
Operating voltage control	24 VDC – 20 A
Ingress protection for internal electrical cabinets	IP 56 (European), NEMA 4X (North American)
Recommended FI switch	RCD 30 mA, Type B
Power consumption	≤ 2.4 kVA
Amperage	10 A
Motor power	0.75_kW (pump)
Process air	6 bar (87 psi) minimum 10 bar (145 psi) maximum 40 m³/h minimum flow rate Pressure reducer. ON/OFF valve. Pressure safety valve
Instrument air	10 bar (145 psi) maximum. Instrument air, clean, dry and oil free. Manual pressure regulator and integrated Palltronic Flowstar IV Filter Integrity Test Instrument

Component specifications

Component specifications, sensor range and accuracies are as per OEM datasheets and correct at the time of compiling this proposal. Pall Corporation does not accept any responsibility in the case of deviation to the specifications outlined below.

Process equipment	Type	Specification
Primary pump	QF1200 single-use diaphragm pump	Flow: 20 – 1200 L/h
Process valves	Gemü• Q30	Pneumatically operated pinch valve
Pressure	PendoTECH• – single-use sensor with pressure sensitivity chip	Range: -0.48 to 5.20 bar Accuracy: ± 2% from 0 to 0.41 bar, ± 3% from 0.41 to 2.07 bar, ± 5% from 2.07 to 4.10 bar
Level detector	Rechner• – capacitive sensor	Operating distance: 0.5 mm (min.) – 15 mm (max.)
Conductivity sensor	Optek• ACF60 single-use sensor	Range: 0 to 10 µS/cm to 850 mS/cm Accuracy: ± 1% of MV ± 0.25 µS/cm, from 0 to 250 mS/cm, ± 2% of MV ± 0.25 µS/cm, from 250 to 500 mS/cm, ± 5% of MV ± 0.25 µS/cm, from 500 to 850 mS/cm
Integrity test instrument	Palltronic Flowstar IV Integrity Test Instrument	Forward flow test: 0.1 – 1000 mL/ min., ± 3% of value or ± 0.05 mL/min, whichever is the greater

Recommended process equipment and fittings

Process equipment	Recommendation
Product input and output mixer	LevMixer stainless steel cubical tank (ASME available upon request)
Product input and output mixer drive	LevMixer drive unit LMG403
Buffer tote	Allegro 200 L HDPE tote

The Allegro Connect Virus Filtration System is compatible with all Pall Corporation single-use mixing technology and can also be integrated with most mixing equipment from other suppliers.

Cleaning

The system can be cleaned with the following typical cleaning solutions:

- 70% ethanol
- 70% IPA
- 0.5% sodium hypochlorite
- 0.02% w/w benzalkonium chloride
- 2% sodium hydroxide
- Spor-Klenz• Ready-to-Use (RTU)

Automation specification

The system is equipped with Wonderware• Batch Management and Wonderware System Platform, which enables end users to create recipes based on their process needs. Recipes are created using operations that are comprised of predefined phases. Each phase is parameterized to allow the end user to tailor the recipes as per their requirements.

The system also provides flexible phases, that allow for a fully manual creation of recipes.

Automation architecture is based on either Siemens S7 PLC or Rockwell CompactLogix• PLC, an industrial PC, and a 22 in. touch screen HMI.

The automation platform allows the end user to create an unlimited number of recipes.

An OPC UA client is installed if a communication link is desired with the unit operation. The Pall Corporation automation platform enables compliance with 21 CFR Part 11 and follows the GAMP• V life cycle for software development.

Automation hardware specification²

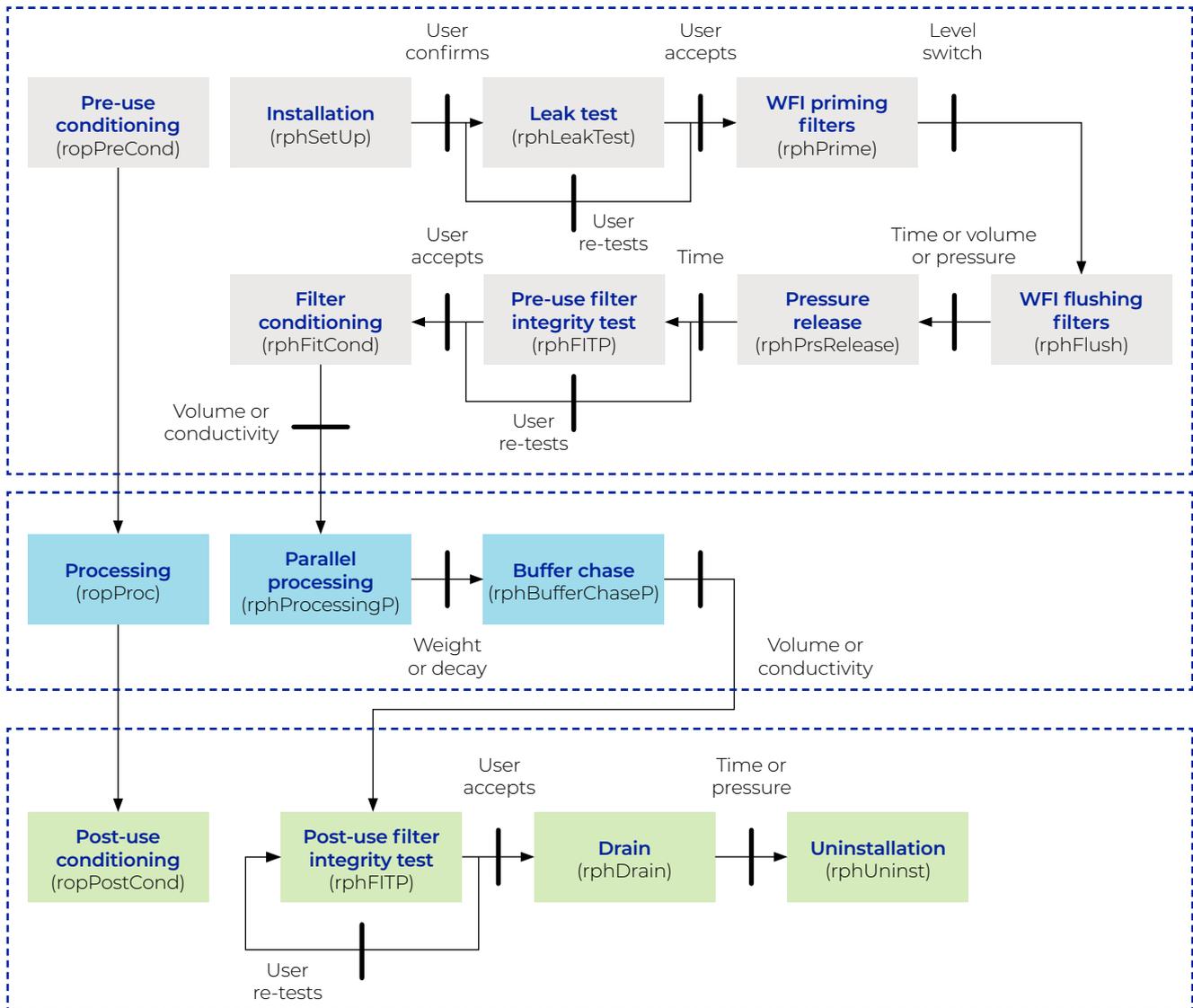
Utilities	Specification
PLC vendor (option 1)	Siemens
PLC model (option 1)	SIMATIC• S7-1500, CPU 1516-3 PN/DP
PLC software (option 1)	Siemens TIA V16
PLC vendor (option 2)	Rockwell
PLC model (option 2)	5069-L380ERM
PLC software (option 2)	Rockwell Studio 5000 V32
Database	SQL
Operating system	Windows• Server 2016
Batch engine	Wonderware Batch Management
Historian	Wonderware Historian
Reporting	AVEVA• Reports for Operations / Wonderware System Platform
HMI	SIMATIC ITC2200 V3 PRO, Industrial Thin Client, 22
Panel PC	INDUSTRY PC Stratus ztC Edge 110i
UPS	QUINT-UPS•/ 24DC
Remote I/O	Turck BL20• series
Ethernet switches	Phoenix Contact• 8 port (managed switch)
OPC server	Archestra• Client

² Technical equivalent replacements are possible depending on market availability, refer to Pall's Turnover Package (TOP) documentation.

Process sequence

The generalized configurable virus filtration phases are shown in the following figure:

Example virus filtration process model for buffer-wetted, parallel filters



Additional phases which may be used to build custom recipes:



Key:



Process screens

Process screens have been created to summarize and expand on critical process information throughout the operation. The integrated Palltronic Flowstar IV Filter Integrity Test Instrument will also be controlled via the system HMI when performing filter integrity testing and/or leak testing – sample screens are also shown below.



Batch report

Upon operator selection, batch reports will be generated automatically at the end of a batch for each single step. Both a summary and detailed batch report is generated, and the content of these batch reports is predefined. Batch reports can be configured to specific needs by the end user via AVEVA Reports (Dream Reports). Sample batch reports can be provided upon request.

Predefined batch records contain the following major information:

- General batch information, phase information and transition conditions
- Global and recipe parameters
- Audit trails excerpt
- Alarms summary
- Trends for differential pressure across filters
- Trends for input product weight
- Trends for filtered product weight

Ordering information

System hardware and accessories

Part number	Part number description
Main system	
ACVFSEUPLC	Allegro Connect Virus Filtration System: PLC 230 VAC, software automation
ACVFSWHPLC	Allegro Connect Virus Filtration System: PLC 208 VAC, software automation
ACVFSEUIO	Allegro Connect Virus Filtration System: I/O 230 VAC, DCS ready no automation
ACVFSWHIO	Allegro Connect Virus Filtration System: I/O 208 VAC, DCS ready no automation
FAT	
ACVFSFAT	Allegro Connect Virus Filtration System: FAT 2.5 days with flow kit
Seismic feet	
ACSEISMIC	Allegro Connect System seismic leveling feet
Other accessories	
ACGEN3COMSCBL	Allegro Connect System GEN3 mixer communication cable
ACGEN4COMSCBL	Allegro Connect System GEN4 mixer communication cable
ACLGRCOMSCBL	Allegro Connect System LGR mixer communication cable

Contact our sales representative for UL61010 certification requirement.

Single-use assemblies



The flow path selection table on the next page lists the standard part numbers of the Pall products designed and approved to support the Allegro Connect Virus Filtration System. Due to the configurability of the system enabling multiple different combinations of filter capsules (membrane and size), we are only able to list a limited number of the possible filtration assemblies in the table below. Filtration combination sets which do not appear in this table but are within the scope of the system are available from Pall Corporation, on request. The figure above shows images of the single-use flow paths sections with ½ in. internal diameter (ID).

Single-use assemblies for virus filtration (for capsule type filters)

Flow path selection	Part number	Description
Step 1: Pick inlet manifold		
Inlet and pump	7465-1485T	System inlet manifold with MPX connector
Step 2: Choose prefilter inlet manifold depending on the number of prefilters required		
Prefilter inlet	7465-1841C	1 × prefilter inlet manifold with MPX connector
	7465-1485S	2 × prefilter inlet manifold with MPX connector
	7465-1488D	4 × prefilter inlet manifold with MPX connector
Step 3: Choose your prefilters³ (Skip Step 3 and proceed to Step 8 if off-the-shelf filters with 1½ in. tri clamp at the downstream connection is used)		
Prefilter	7465-1557U	Pegasus Protect 254 mm (10 in.) filter module with MPX connector
	7465-1526N	Pegasus Protect 508 mm (20 in.) filter module with MPX connector
Step 4: Choose prefilter outlet manifold depending on the number of prefilters required		
Prefilter outlet	7465-1778Y	1 × prefilter outlet manifold with MPX connector
	7465-1485R	2 × prefilter outlet manifold with MPX connector
	7465-1487Y	4 × prefilter outlet manifold with MPX connector
	7465-1778Z ⁴	1 × prefilter outlet manifold with 1½ in. tri clamp connector
	7465-1779A ⁴	2 × prefilter outlet manifold with 1½ in. tri clamp connector
	7465-1526T ⁴	4 × prefilter outlet manifold with 1½ in. tri clamp connector
Step 5: Choose virus filter inlet manifold depending on the number of virus filters required		
Virus filter inlet	7465-1485U	1 × virus filter inlet manifold with MPX connector
	7465-1488K	2 × virus filter inlet manifold with MPX connector
Step 6: Choose your virus filters³ (Skip Step 6 and proceed to Step 8 if off the shelf filters with 1½ in. tri clamp at the downstream connection is used)		
Virus filter outlet	7465-1488X	Pegasus Prime 127 mm (5 in.) filter module with MPX connector
	7465-1488C	Pegasus Prime 254 mm (10 in.) filter module with MPX connector
	7465-1863U	Pegasus Prime 508 mm (20 in.) filter module with MPX connector
Step 7: Choose virus filter outlet manifold depending on the number of virus filters required and if a conductivity sensor is required for the process		
Virus filter outlet	7465-1484Q	1 × virus filter system outlet manifold with MPX connector
	7465-1527H	2 × virus filter outlet manifold with MPX connector
	7465-1535J	1 × virus filter system outlet manifold with MPX connector and conductivity sensor
	7465-1488W	2 × virus filter system outlet manifold with MPX connector and conductivity sensor
	7465-1607N ⁴	1 × virus filter system outlet manifold with 1½ in. tri clamp connector
	7465-1607M ⁴	2 × virus filter system outlet manifold with 1½ in. tri clamp connector
	7465-1841K ⁴	1 × virus filter system outlet manifold with 1½ in. tri clamp connector and conductivity sensor
	7465-1841L ⁴	2 × virus filter system outlet manifold with 1½ in. tri clamp connector and conductivity sensor
Step 8 (optional): Choose adaptor kit to connect to the downstream side of the prefilters and virus filters if off the shelf filters with 1½ in. tri clamp at the downstream connection is used		
Filter adaptor kit	7465-1727K	NP5 filter module adaptor kit with MPX outlet connector
	7465-1527J	NP6 filter module adaptor kit with MPX outlet connector
	7465-1484P	NP7 filter module adaptor kit with MPX outlet connector

³ Contact our sales team if a different filter configuration is required.

⁴ Only applicable for 762 mm [30 in.] filter capsules.

Single-use assemblies for in-process/intermediate filtration

Flow path selection	Part number	Description
Step 1: Pick inlet manifold		
Inlet and pump	9465-1763D	System inlet manifold with Kleenpak® Presto sterile connector
Step 2: Choose prefilter inlet manifold depending on the number of prefilters required		
Prefilter inlet	9465-1763E	2 × prefilter outlet and 2 × prefilter inlet manifold with Kleenpak Presto sterile connector
	9465-1841D	2 × prefilter outlet and 4 × prefilter inlet manifold with Kleenpak Presto sterile connector
Step 3: Choose your prefilters (Skip Step 3 and proceed to Step 8 if off the shelf filters with 1½ in. tri clamp at the downstream connection is used)		
Prefilter		Refer to the Pall website for a range of pre-filters to suit your process needs
Step 4: Choose final filter inlet manifold depending on the number of filters required		
Final filter inlet	9465-1774Q	2 × prefilter outlet and 1 × final filter inlet manifold with Kleenpak Presto sterile connector
	9465-1526R	2 × prefilter outlet and 2 × final filter inlet manifold with Kleenpak Presto sterile connector
Step 5: Choose final filter (bioburden/sterilizing grade filter) depending on the number of filters required		
Final filter		Refer to the Pall website for a range of sterilizing grade and/or bioburden reducing filters to suit your process needs
Step 6: Choose final filter outlet manifold depending on the number of filters required		
Final filter outlet	9465-1526S	2 × final filter outlet manifold with Kleenpak Presto sterile connector
Step 7 (optional): Choose adaptor kit to connect to the upstream and downstream side of the prefilters and final filters if off the shelf filters with 1½ in. tri clamp at the downstream connection is used		
Inlet filter and outlet adaptor kit	9465-1840M	NP5 filter inlet or outlet adaptor kit with Kleenpak Presto sterile connector
	9465-1840L	NP6 filter inlet or outlet adaptor kit with Kleenpak Presto sterile connector
	9465-1840K	NP7 filter inlet or outlet adaptor kit with Kleenpak Presto sterile connector

In order to reduce our carbon footprint, we strive to provide single-use systems manufactured regionally. However, to ensure security of supply you may receive products from multiple global sites.

Scientific and laboratory services

The scientific and regulatory knowledge that supports the selection, adoption, and ongoing use of critical process technology – coupled with analytical, imaging and measurement capabilities – creates a versatile and practical resource ready to respond to an ever-changing industry. Pall duplicates these laboratories across the globe and leverages their cumulative knowledge to deliver practical scientific and regulatory support to all process technologies, to keep you moving forward.

Technical services

The accessibility of local technical support networks minimizes delays in your journey at all points. From the early stage of process development to on-site support for mature processes, Pall's technical support groups are there to help remove barriers to progress and make your journey as rapid and stress-free as possible. Our knowledge of the technology and the process can be applied to everything from training to troubleshooting and consultancy. Our global team of technology experts is on hand to respond to your changing needs.

Advanced separation systems

Operating within the defined design space demands the monitoring and control of critical process parameters to assure product quality. Systems that control critical unit operations and communicate with your existing process components can control process risks and maximize productivity by reducing operator involvement for many processes. Pall applies strong engineering and regulatory understanding to deliver compliant and qualified systems that safeguard and simplify your journey.

Process development services

Prior knowledge is a rare and valuable commodity, especially when preparing to take a new direction or when under pressure to deliver to a tight deadline. Take advantage of Pall's experience, process knowledge and technical know-how to help you achieve your goals. From the optimization of an end-to-end continuous process to establishing the right parameters for a single unit operation, our teams of scientists are ready to work with you and to generate the data you need to make the critical decisions necessary for success.

Validation services

Arriving at your destination counts for nothing without the necessary paperwork to proceed to the next stage. Pall's Validation Services are committed to delivering the supporting data packages and analysis required to quantify process risk and support regulatory submission. Our strengths include critical filtration technologies, such as the performance validation of sterilizing grade filtration, and we are at the forefront of the evolving needs in the area of extractables and leachables for all product contact components. We combine the generation of data with interpretation and consultancy to deliver data packages that are ready for regulatory scrutiny, and to ensure there are no barriers to progress.

Servicing and maintenance

Our range of service packages keeps your equipment protected and well maintained, and includes itemized, pay-as-you-go services, start-up care and training packages, and a variety of post-warranty service plans that include priority response times, discounts for emergency repairs, and flexible payment options. Pall service plans provide total peace of mind and worry-free support throughout the coverage period.



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