

Powerfuge® for liquid/solid separations

CARR® Powerfuge® Pilot

Bridging the gap between
bottles and continuous flow.



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Powerfuge Pilot
(9000 PLT)

BRIDGING THE GAP BETWEEN BOTTLES AND CONTINUOUS FLOW

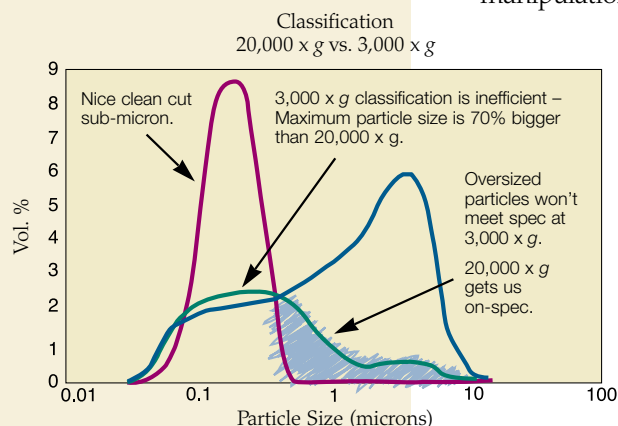
There's a point in discovery when you need efficient, high-volume product throughput. And, at this point, dealing with bottles would impede productivity. So you look at continuous flow. But what if your application doesn't call for that kind of yield or expense? This is precisely when you need the CARR® Powerfuge® Pilot, the high-productivity, batch liquid/solid separation system for yeast, proteins and sub-micron particles.

Simple, easy-to-use design

The Powerfuge Pilot allows fast assembly and disassembly for quick and simple cleaning. The design also helps reduce the time required for maintenance, particularly since there are few parts to replace. And when you're at the end of a run, compressed solids are easily removed with minimal time and effort using a hand scraper contoured to fit the 1 L-capacity bowl.

Time-saving operation

Fast processing at a rate of up to 1 L per minute means you can accomplish more runs in a single day, which is especially useful for larger batch sizes. And because the Powerfuge Pilot eliminates the need for bottles, you can set up runs in less time – with fewer manipulations.



Complete liquid/solid separations

A maximum RCF of 20,000 x g offers sufficient force to separate solids from liquids completely, resulting in drier solids and clearer centrates than those of common centrifuges and filtration systems. Full-separation performance makes the Powerfuge Pilot ideal for sub-micron applications, including classification of solids.

Fast, efficient and easy to use.

Helping you comply with cGMP

Because cGMP is critical to so many applications, the Powerfuge Pilot has been designed to support compliance. Virtually all process-wetted and fabricated components, fittings and valves are sanitary in design and are constructed of 316L stainless steel, with a surface finish of RA-32 or better.

In addition, a complete cGMP documentation package is available.

- Documentation for Traceability
- Documentation of System Configuration

Customer training – Operator training is offered at our facility or in the field. Training includes basic continuous-flow centrifugation theory, protocol optimization, operation and preventive maintenance of the Pilot system. Full documentation is provided along with a certificate.

Installation Qualification/Operation Qualification (IQ/OQ) –Verification that the system is operating correctly after installation at the customer's site is offered with our IQ/OQ package. This includes testing of system functions (speed, time and temperature) and verifying fault systems. An IQ Checklist and OQ Certificate are left at the customer site for validation files.

Easy solids removal and cleaning



Loosen large Tri-clamps to remove bowl case cap...



remove the centrate case.

Lock the bowl in place with the handles on each side.



Place the pegs of the bowl wrench into the notches on the bowl. Carefully unscrew...



and lift out bowl.



Place the bowl on its side on a soft surface and use the contoured hand scraper to remove collected solids.

Flexible design options.



Powerfuge Pilot
hazardous-duty
model

Hazardous-duty Powerfuge Pilot

Wherever there's a risk of hazards due to mixtures of vapor and air, equipment must be designed to minimize risk. For such an environment, Powerfuge offers a hazardous-duty centrifuge with an inert gas purge system, a NEMA 7 enclosure for motor and system controls, and intrinsically safe wiring.

In order to provide a safe environment for the separation of Class I, Division I, Group D volatile materials, the inside of the Powerfuge is purged using a standard purging cycle with inert gas (nitrogen). This nitrogen sweep circulates enough gas to fill the centrifuge four times over, and takes from 2-5 minutes depending upon the model and ancillary equipment supplied with the system. The initial purge produces an internal atmosphere that will reduce the proportion of oxygen in the three-component system – namely inert gas, oxygen and combustible material – to a level outside of the ignition range. The effect of the purge cycle has been tested and validated with an oxygen analyzer.

The Hazardous-duty Powerfuge Pilot also uses NEMA 7 enclosures to house all electrical components, which will contain and withstand an internal explosion without causing an external hazard. In addition, all the electrical control wiring is rated as “intrinsically safe,” meaning electrical power used and/or stored is below the level of energy required to set off an explosion in a hazardous area.

Vacuum-Equipped Powerfuge Pilot

The Powerfuge Pilot is also offered with a vacuum option, which aids in temperature control and temperature reduction by limiting frictional heat generation, the reduction of foaming, as well as vapor and aerosol containment, and in some applications, an increase in flow rate. The vacuum configuration creates and maintains a vacuum environment of up to 27" (750 mm) Hg.

Any Powerfuge Pilot model can be easily ordered with a vacuum option. This option comes with all the equipment necessary to convert to vacuum operation on the Pilot machine, including a 1-liter stainless steel, dished-bottom, vacuum-rated centrate receiver vessel and a centrate pump.

Flexible operation.

Variable speed – for your choice of separating power

Maximum speed and g-force aren't always what you want. Which is why the Powerfuge Pilot has been equipped with a variable-speed drive. Users can select their desired flow rates of up to 60 L/hr and RCF to 20,000 \times g, providing the operational control necessary to optimize your process.

Fully transportable

The Powerfuge Pilot may be easily moved from one site to another, since there are no special or lengthy installation requirements like bolt-down. In addition, the system is compact when compared to other products of similar capacities, which helps conserve valuable bench space while giving you more freedom to position the unit in the best possible location.

A wide choice of temperatures

An integral cooling jacket helps maintain product temperatures anywhere from 2°C-40°C. The jacket itself can withstand flow rates as high as 2 L/minute and internal cooling temperatures as low as -10°C in order to provide the desired net process temperature.

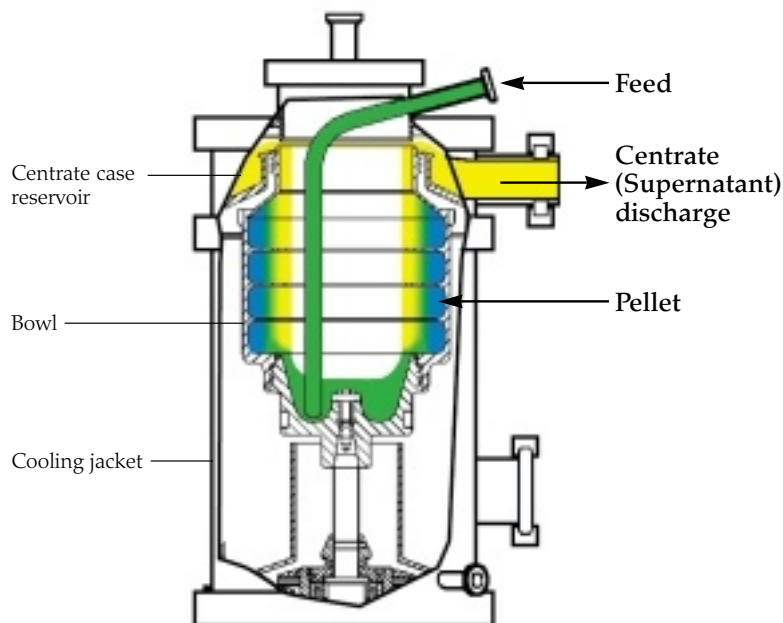
CARR CE Powerfuge Pilot

With all of the operating capabilities of the Powerfuge Pilot, the CE Powerfuge Pilot has the added benefit of full compliance with the CE European Safety Conformity requirements. The CE Powerfuge Pilot meets the EMC (Electro-magnetic Compatibility) directive, CE low-voltage directive, and CE safety measures directive. As part of the CE safety measures directives, an integrity test is required to confirm that there are no leaks and that the system has been properly assembled. The CE Powerfuge Pilot is controlled by an Allen-Bradley Programmable Logic Controller (PLC) interfaced with a PanelView 300 Micro Operator Interface Terminal (OIT). The OIT is used to monitor and control the operation of the Pilot, indicating the current state of the system, presenting informative messages related to the selected operation, and allows for run programmability.



CE Powerfuge Pilot

Components and specifications.



Data	Standard	Hazardous Duty	CE
Force (variable)	Up to 20,000 x g ¹	Up to 20,000 x g ¹	Up to 20,000 x g (SG<1.5) ¹
Power	(1 HP) 120VAC, 15 Amp, 60 Hz, 1 Phase (Cat. # 9000 PLT) (1.5HP) 230VAC, 15 Amp, 50/60 Hz, 1 Phase (Cat. # 9002 PLT)	(1.5 HP), 230VAC, 14.4 Amp, 50/60 Hz, 1 Phase (Cat. # 9001 PLT)	1.1 kW, (1.5 HP) 230VAC, 15 Amp, 50 Hz (Cat. # 9010 PLT)
Construction			
- Process Contact Parts	316L SS/Ti-6AL-4V	316L SS/Ti-6AL-4V	316L SS/Ti-6AL-4V
- Non-wetted Parts	316 and 304 SS Electroless nickel-coated aluminum	316 and 304 SS Electroless nickel-coated aluminum	316 and 304 SS Electroless nickel-coated aluminum
Dimensions (WxLxH)			
- Centrifuge	305 x 584 x 584 mm (12"x 23"x 23")	305 x 737 x 635 mm (12"x 29"x 25")	330 x 610 x 709 mm (13"x 24"x 28")
- Control	229 x 254 x 406 mm (9"x 10"x 16") NEMA 4	381 x 432 x 406 mm (15"x 17"x 16") NEMA 4X/7	203 x 495 x 469 mm (8"x 19.5"x 18.5") IP 54
Weight (pilot & drive)	150 lbs. (68.2 kilograms)	190 lbs. (86.4 kilograms)	304 lbs. (137.8 kilograms)
Capacity			
Flow Rate (nominal) ²	60 Liters/hour	60 Liters/hour	60 Liters/hour
Bowl Volume	1.1 Liters	1.1 Liters	1.1 Liters
Solids Space	1 Liter (nominal)	1 Liter (nominal)	1 Liter (nominal)
Discharge (typical)	5 to 10 minutes	5 to 10 minutes	5 to 10 minutes

¹High specific gravity may require derating.

²Actual capacity (throughput) is dependent on the characteristics of the fluids, amount and type of solids and required degree of clarification. Practical capacities may be substantially larger or smaller for your application.

Applications.

APPLICATION OVERVIEW

Biological

Virus recovery	E.coli cell separation
Vaccine recovery	Yeast cell separation
Plasma fractionation	Inclusion body recovery
Protein recovery	Serum
Crystal drug production	Fermentation broth

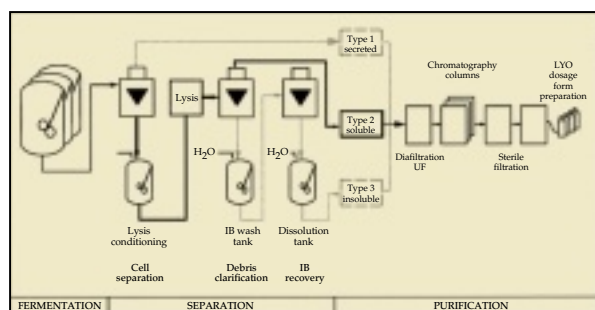
Chemical

Ink classifications	Epoxy clarification
Sucrose recovery	Fiber optic-Silica separation
Optical brightener dewatering	Latex polymer clarification

CASE STUDIES

SEPARATION

E.coli protein recovery – A therapeutic protein manufacturer using traditional E.coli fermentation employed dead-end cartridge filtration to remove cell debris from cell lysate containing the soluble protein – a process that recovered only 15-20% of the active protein produced in the fermenter. Further, the poor quality filtrate stream clogged and fouled the downstream affinity chromatography resin. In a side-by-side evaluation with the existing system, Powerfuge achieved a 147% increase in overall protein recovery while dramatically reducing affinity column fouling.



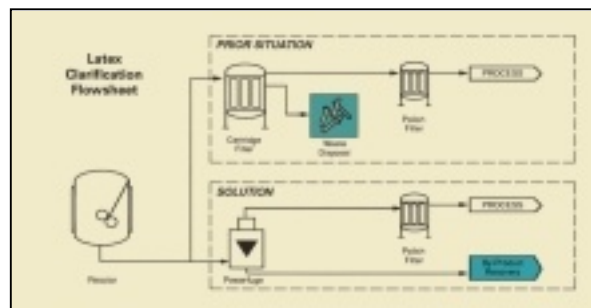
E. Coli process flow sheet

Plasma fractionation – Valuable products such as human serum albumin (HSA), gamma globulins and antihemophilic factor (AHA) are derived by plasma fractionation, where full separation and recovery of the centrate and compacted solids is essential. Powerfuge enables a completely contained plasma fractionation process with temperature control that helps avoid yield loss

from product denaturation and precipitate dissolution. Although performance varies according to the steps and methods specific to each process, testing of numerous Powerfuge-based fractionators has revealed an average 2% higher yield for each protein being produced.

CLARIFICATION

Separation of viscous latex polymers – A film manufacturer had been using filtration techniques to clarify one of the polymers used in producing photographic film. The semi-congealed solids would collect and blind the filters, resulting in frequent filter changes and product loss due to disposal. Powerfuge subsequently reduced product loss, downtime and associated labor costs by producing a dry cake, and the customer achieved a 3% increase in product yield.



Latex classification flow sheet

CLASSIFICATION

Separation of fine solids from coarse solids – In ink manufacturing, colored solids are added to a liquid base, and the size of these solids must be controlled to prevent clogging the ink cartridge. The acceptable particle size distribution is from 50 nm (0.05 μm) in diameter to 220 nm (0.22 μm), with a mean size of 128 nm (0.13 μm). Testing confirmed that the Powerfuge Pilot successfully classified solids within the acceptable range, and recovered 90% of the desired ink solids in the supernatant – results that were previously impossible with a competitive system.

Integrated scalability.

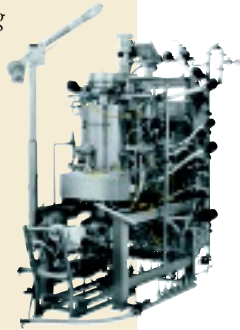
Powerfuge P-6

Flow rates up to 60 L/hr*
RCF up to 20,000 x g
Compressed solids
capacity 1 L



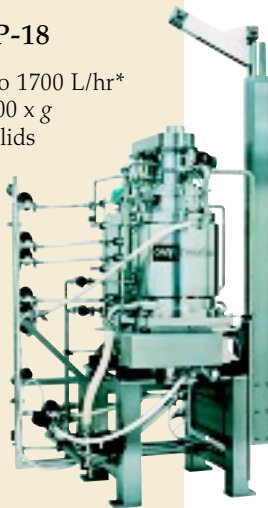
Powerfuge P-12

Flow rates up to 500 L/hr*
RCF up to 20,000 x g
Compressed solids
capacity 8.5 L



Powerfuge P-18

Flow rates up to 1700 L/hr*
RCF up to 20,000 x g
Compressed solids
capacity 32 L



Scale up easily with commercial Powerfuge Systems

The Powerfuge Pilot provides simple, direct scalability to flow rates of up to 1700 L/hour with our larger, fully automated, Powerfuge Systems.

This family includes the P-6 (60 L/hr, 1 L solids capacity), P-12 (500 L/hr, 8.5 L solids capacity) and P-18 (1700 L/hr, 32 L solids capacity).

All share the same separation technology as the Powerfuge Pilot. As a result, you can achieve equivalent, production-scale separations without the time and extensive validation re-work that would be required to move between different technologies.

In addition, commercial Powerfuge systems incorporate True Clean™ – a sanitary design with flexible CIP/SIP software/hardware that enables cleaning validation. These systems also offer automated solids removal.

* Actual capacity (throughput) is dependent on the characteristics of the fluids, amount and type of solids and required degree of clarification. Practical capacities may be substantially larger or smaller for your application.

For more information, contact your CARR Centritech representative at the facilities listed below.

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