ZGF EZ Clean Phoenix Product Data Sheet with Description and Operation

The Most Advanced, Automatic, Non-Disposable Liquid Filtration System

ZERO GRAVITY FILTERS

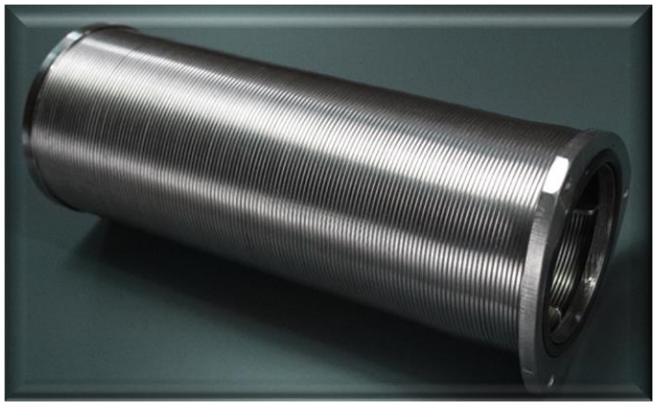
Phoenix is the Most Advanced, Automatic, Non-Disposable Liquid Filtration System
Performance, Simplicity, Consistency, Reliability and the Lowest Cost of Ownership

The Phoenix is the most advanced, automatic, non-disposable liquid filtration system. The patented design allows for 24/7 uninterrupted operation. The Phoenix is designed to handle flow rates from 40 gpm to 250 gpm with the lowest installed footprint. Duplex and triplex Phoenix arrangements allow for even higher flows.

There are three models, Electric, Electro-Pneumatic and Pneumatic. Your choice depends upon site and process conditions.

The Phoenix features three modes of backwash control - automatic based on differential pressure or time, and manual override.

The Phoenix filter includes (6) ZGF Spring Filter elements. The proprietary, non-disposable, absolute gap filter elements are available in micron ratings ranging from 20 – 400 micron and are guaranteed for 5-years!



The ZGF Spring Filter element to opens uniformly along its entire length during backwash. The benefits are as follows:

1. Particles wedged or lodged are quickly released and washed away as the gap is increased.
2. The Spring filter element “shimmers” which further enhances the cleaning process.
3. The moment the filter element begins to open during backwash, the fluid velocity is instantaneously increased and subsequently followed by a surge in flow that scours the coil effectively and efficiently removing the contaminants.

Phoenix	Precision Absolute Gap							
Design Flowrate	20 µ	35 µ	50 µ	75 µ	100 µ	150 µ	200 µ	400 µ
	60 gpm	110 gpm	150 gpm	180 gpm	250 gpm	250 gpm	250 gpm	250 gpm

NOTES:

1. ***The design flowrate is a GUIDELINE based upon a clean differential pressure of 2.5 psi or less**. The solids loading in the feed stream can also impact the design flowrate*. **MAXIMUM flowrates are documented in the Product Specification Sheets**.
2. *Backwash Volume*: < 5 gallons
3. *Based on “663” Spring Filter elements.*
4. *The solids loading, physical characteristics, material and density of the particles impact system sizing / design flowrate. 500 ppm is typical maximum loading for ZGF EZ Clean filtration systems utilizing the proprietary ZGF Spring Filter elements.*
5. *Designed for continuous service: Pneumatic up to 170°F, Electro-Pneumatic up to 160°F and pressures from 45 - 120 psi.*

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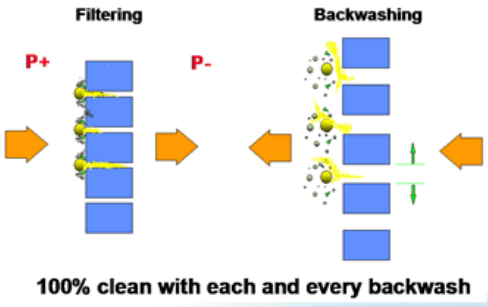
ZGF Phoenix filters provide value in several industries including Automotive, Steel, Power Generation, Food Processing, Pulp & Paper, HVAC and Oil & Gas. Phoenix technology is used to filter machining coolant, wash solutions, process / cooling water, wastewater, white water, surface water and many other aqueous fluids.

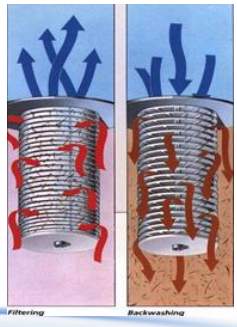
PHOENIX FEATURE	YOUR BENEFIT
Full 1-year warranty on Phoenix filter assembly & 5-year warranty on Spring Filter elements	Peace of mind, Reduced operating and maintenance costs
Fully automatic, self-cleaning operation	Reduced maintenance and operating costs, Labor is now available for other value-added plant services
ZGF Spring Filter - precision engineered "Absolute Gap" manufactured to Aerospace specifications	Consistent and efficient particle capture & removal, Improved quality and lower operating costs
ZGF Spring Filter element "Continuous Coil wound with a Variable Pitch"	All contaminants are cleaned off the filter element during the backwash cycle, Consistent & reliable performance
Uninterrupted flow, even during backwash	24-hour / 7-day operation, eliminates downtime, allows for optimized operational productivity
Consistent and reliable performance	Improved quality and lower operating costs
In-line design	Eliminates need for additional pumps, motors and controls reducing maintenance and operating costs
Compact design (18 in^3)	Saves valuable floor space
Low energy requirement	It uses less energy than a light bulb. Economically and environmentally responsible
Efficient and environmentally responsible design	Creates no additional waste (i.e. no disposable media, no packaging). It uses less energy than a light bulb.
Secondary batch processing system (Green Screen)	Allows for recovery of valuable process fluids and reduces waste. Reduced operating costs.
Permanent (i.e. non-disposable) media filter elements (316 Stainless Steel, Inconel/Super Duplex)	Replacement not required, No waste, No disposal, Improved Productivity
Minimal moving parts through simplicity of design	Increased reliability, Reduced maintenance and operating costs



100% clean with each and every backwash

ZGF Phoenix Backwash

- ✓ Quick: 3 to 4 seconds per filter element
- ✓ Efficient: <1 gallon per filter element
- ✓ Effective: 100% clean with each backwash



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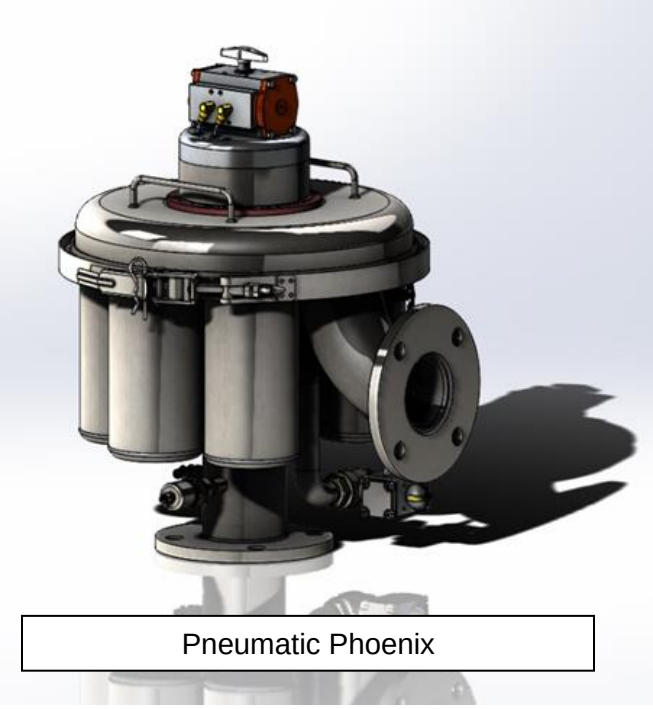
Phoenix – Basic Description & Operation

Electric / Electro-Pneumatic Phoenix



Pneumatic Phoenix

Filter Operation (basic description)

The Phoenix is automatic, self-cleaning filtration system.

1. The backwash cycle can be initiated 3 ways:
   - ✓ differential pressure (user-defined set-point)
   - ✓ time interval (user-defined)
   - ✓ manual initiation
2. Once initiated, the filter will complete a self-cleaning operation called a backwash. This backwash operation is designed to clean all the pods in sequence while still maintaining flow of clean liquid to the downstream process

Even during the backwash cycle, there will not be an interruption of clean, filtered fluid to the process.

There are three Phoenix models available:

- Pneumatic
- electro-pneumatic
- electric.

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Below is a basic description of operation for the Phoenix. The "basic" operation for all three Phoenix models is similar. However, as stated above the drive mechanism for the indexing and the controls differ.

The filter contains six (6) pods in a radial design around an inlet chamber with a filter element in each pod. Liquid enters the Phoenix via a 3" inlet on the bottom of the filter and is then diverted to enter each of the six pods/filter elements. The entry to each pod is tangential which produces a centrifugal action within each pod allowing the heavier particles to remain in suspension while the filter elements remove the finer particles. This allows the filter to accommodate heavier particle loading than would otherwise be possible. In filter mode, the fluid flow is from outside the element to the inside. The filtered liquid from each pod / filter is then joined in a common doughnut shaped chamber situated on the top of the Phoenix filter and exits via the 3" flange on the side of the filter.

A pressure transducer is fitted on the inlet and on the outlet of the Phoenix. The inlet and outlet pressure are continuously monitored. The Phoenix will initiate an automatic backwash sequence once the differential pressure reaches the predetermined set point established by the user.

From initiation to completion, the Phoenix's internal diverting valve rotates through the 360°, 7-position backwash cycle. (The filter has 6 filter element positions and 1 home position). A small, internal proximity switch located in the top of the filter provides a signal to the control system once the backwash cycle has been completed and stops any further advancing of the indexer. Fitted on the backwash outlet is a pneumatically (or electrically) actuated ¾" backwash valve. This valve opens and closes six times throughout the backwash process, once for each element, thereby allowing uninterrupted flow during the backwash process.

Upon backwash initiation, the internal diverting valve advances 51º (360/7) so that the 'shoe' is positioned over the inlet to pod 1, thereby shutting off its inlet. After a pause of 0.5 seconds, the pneumatic backwash valve opens. By opening the backwash valve to atmosphere, a portion of clean filtered liquid flows in a reverse direction from the inside to the outside of the filter element. This reverse supply of clean liquid will cause the filter element to open along its entire length while 'shimmering' at the same time. The combination of the filter element opening, and 'shimmering' allows for a very quick and efficient backwash.

In this way, all debris is removed from the outside of the filter element, even debris that may be lodged on the surface of the filter element. The result is a very efficient backwash with very little fluid required. The backwash sequence to clean each pod is normally 3-4 seconds (adjustable depending on system pressure and contaminant). When one pod has been backwashed, the internal diverting valves advances another 51º (360/7) so that the 'shoe' is positioned over the inlet to pod 2, thereby shutting off its inlet. After a pause of 0.5 seconds, the pneumatic backwash valve opens. This cycle continues until all six pods have been backwashed. Once the backwash has been completed, the filter will return to its clean differential pressure every time.

The Phoenix uses < 5 gallons of fluid per backwash, and the backwash cycle is completed in less than 1 minute.

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Pneumatic Phoenix

The **Pneumatic Phoenix** is fitted with a pneumatically actuated backwash valves and uses a pneumatic actuator to index a pair of dog clutches for rotating the diverting valve during the backwash sequence. The Pneumatic Phoenix's backwash sequence in initiated and controlled by a logic module control system with a proprietary control sequence / program. The controls are contained in a wall mounted NEMA 4 enclosure for hazardous, wet, and hot applications

Pneumatic Phoenix – Logic Module Control System

The pneumatic Phoenix is monitored and controlled by means of a logic module with a user / operator interface.

Control system features include the following.

- NEMA 4 steel control enclosure painted ZGF Blue
- A logic module.
- A user / operator interface. The user / operator has the following features and capabilities.
  - ✓ Displays system conditions and faults
  - ✓ Allows for adjustment of designated program variables (i.e. backwash differential pressure set-point, backwash duration, etc.)
  - ✓ Allows for manual initiation of the backwash cycle
- A 3-color stack light that displays system condition (power on, alarm condition, backwash)
  - ✓ GREEN lamp - indicates that the 120 VAC electrical supply is connected
  - ✓ WHITE lamp - indicates that a backwash cycle is in progress
  - ✓ YELLOW lamp - indicates a fault condition.

The standard control package includes the following:

a) Manual backwash button - used to manually initiate a backwash.

b) Backwash duration timer - length of time in seconds for backwashing each pod.

c) Backwash interval timer - maximum length of time before the filter will initiate a backwash.

d) Backwash set point adjustment - the differential pressure at which the filter will backwash.

e) High set point adjustment – the differential pressure at which the filter will provide alarm indication that there is an excessive differential pressure across the filter.

f) Backwash counter - non-reset counter that is incremented at completion of each backwash.

g) The controls are installed in a NEMA 4, steel enclosure.

h) Air solenoid valves are installed in the control panel for operation of the pneumatically actuated butterfly valves.

i) Two stainless steel wetted pressure transducers. Two settings will be calculated by the logic module. The backwash set-point will be the differential at which the filter will initiate a backwash. The high set point will signal an alarm condition.

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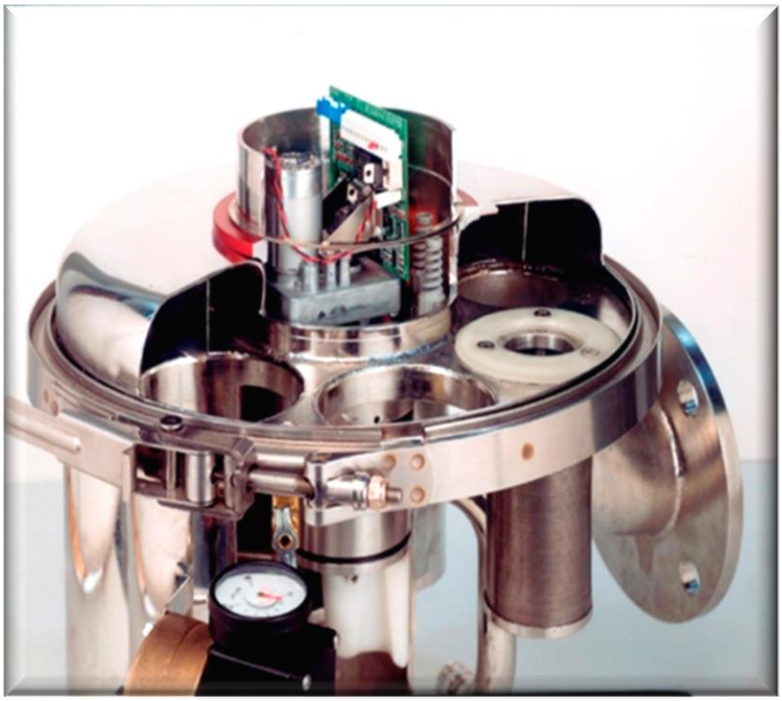
Electro-Pneumatic and Electric Phoenix

The Electro-Pneumatic (EP) Phoenix and Electric (E) Phoenix models use a proprietary Printed Circuit Board (PCB) control system to initiate and control the backwash sequence, and 24 VDC motor/gearbox assembly for rotating the diverting valve during backwash cycle. EP and E Phoenix filter controls are contained inside the Phoenix filter for compactness.

These controls are not suitable if the equipment is subject to washdown / direct spraying of water.

The **Electro-Pneumatic Phoenix** backwash valve is a pneumatically actuated, ball valve. Whereas the **Electric Phoenix** utilizes an electrically actuated COAX valve.



Electro-Pneumatic and Electric Phoenix Printed Circuit Board Controls

The membrane keypad and LCD provide the user an interface for displaying operational status and configuring user timing parameters.

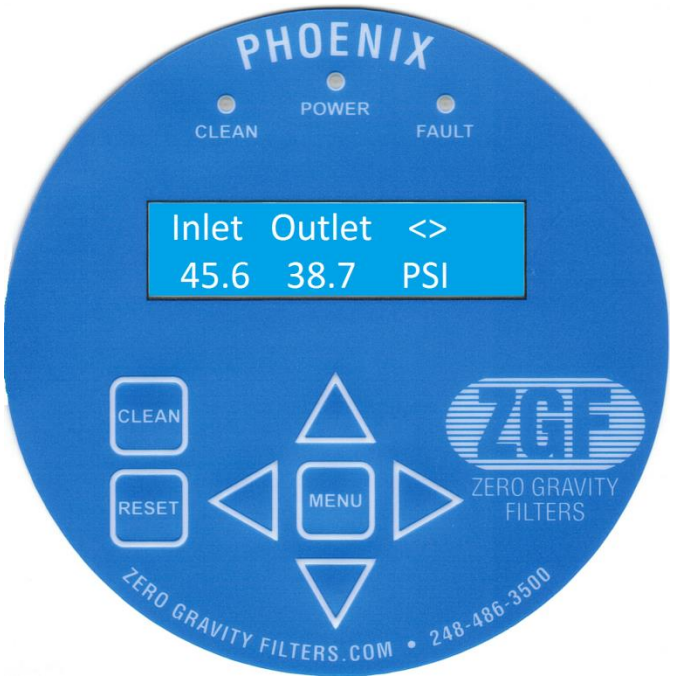


Figure 1. Membrane Keypad & LEDs

- **CLEAN LED (Blue) – on during the backwash sequence.**
- **POWER LED (Green) – on to indicate 24V power applied.**
- **FAULT LED (Red) – flashes to indicate a fault condition.**
- **RESET Button – resets the fault condition.**
- **CLEAN Button – manually initiates a backwash sequence.**
- **MENU and Arrow Keys – see User Interface section.**

Backwash Sequence

A backwash sequence can be initiated in three ways:

1. Manually by pressing the CLEAN button on the membrane keypad.
2. External condition depending on the input type:
   - ✓ Pressure Sensors: Differential pressure threshold reached (i.e. inlet pressure – outlet pressure >= configured threshold).
   - ✓ Discrete Inputs: Backwash trigger from a PLC: >12VDC for 100ms on Analog In
3. User configurable timer interval.

User Interface

The operator can select the display of status items and configure operational parameters through the MENU and Arrow keys on the membrane keypad. The controller has two modes of operation: Normal Mode and Configuration Mode. See Table 1 for a list of the operational parameters that can be configured.

Normal Mode

When in Normal Mode, the controller is either performing a backwash sequence or waiting to start one. During this mode, the LCD displays inlet and outlet pressures for pressure sensor inputs, or the states of the discrete inputs when they are used. The microcontroller also performs continuous monitoring for fault conditions. The MENU and Arrow keys have the following functions.

- MENU – exit Normal Mode and enter Configuration Mode.
- Right Arrow – displays the next status item. Status items include:
  - ✓ Inlet and Outlet Pressures or Discrete Inputs States
  - ✓ Power Supply Voltage
  - ✓ Total Backwash Sequence Count
  - ✓ Software Version Number
  - ✓ Input Type
  - ✓ ZGF Company Information
- Left Arrow – displays the previous status item.
- **Up Arrow – not used**.
- **Down Arrow – not used**.

After a period of 30 seconds of no key press activity, the LCD returns to displaying the inlet and outlet pressures.

Configuration Mode

When in Configuration Mode, the user can change the values of the operational parameters. Purging and fault monitoring are disabled. The MENU and Arrow keys have the following functions.

- MENU – saves any changes made to the operational parameters into the microcontroller's non-volatile EPROM and returns to Normal Mode.
- Right Arrow – selects the next operational parameter.
- Left Arrow – selects the previous operational parameter.
- Up Arrow – increases the selected operational parameter by the adjustment increment in Table 1.
- Down Arrow – decreases the selected operational parameter by the adjustment increment in Table 1.

After a period of 30 seconds of no key press activity, the mode changes back to Normal Mode without saving any changes that were made here.

Table 1. Operational Parameters that can be configured

Parameter	Range	Adjustment Increment	Default
Backwash Duration	2 - 7 sec	1 sec	4 secs
Backwash Interval	1 min, 15 min, 30 min, 1 hour, 8-hour, 24 hour	Limited to values in the Range column.	30 min
Backwash Setpoint[1]	1 - 60 PSI (0.069-4.13 bar) (6.9-413.6 kPa)	1 PSI (0.069 bar) (6.9 kPa)	10 PSI (0.689 bar) (68.9 kPa)
Differential Pressure Fault Setpoint[1]	1-60 PSI (0.069-4.13 bar) (6.9-413.6 kPa)	1 PSI (0.069 bar) (6.9 kPa)	30 PSI (2.07 bar) (206.8 kPa)
Pressure Units[1]	PSI, bar or kPa (kilo Pascal)	Limited to values in the Range column.	PSI
Pressure Sensors Operation[1]	Enabled or Disabled	Limited to values in the Range column.	Enabled
Display Backlighting	1 - 8 (brightest)	1	7
Display Contrast	1 - 50 (highest contrast)	1	40

1. Only applicable for pressure sensor inputs. Ignored for discrete inputs.

Fault Detection

During Normal Mode operation, the microcontroller continuously monitors for the fault conditions listed in Table 2. When a fault is detected, the red FAULT LED on the membrane flashes, the LCD displays the fault condition and the Fault Mode relay (Digital Output 4) closes to signal a fault to an external indicator. If a backwash sequence is underway when a fault is detected, the backwash valve is de-energized, and the indexing valve stops in its current position.

The fault is cleared by pressing the RESET button. This also will return the indexing valve to its home position. If the fault condition is not removed, another fault will immediately occur after pressing the RESET button.

Table 2. Fault Conditions

Fault Condition	Description
Motor Obstructed	High motor torque measured during backwashing.
Pressure Transducer Signal Loss[1]	0 mA signal measured.
High Differential Pressure	Pressure Sensors Greater than 30 PSI (207 bar, 206.8 kPa) differential pressure measured for more than 60 seconds. Note: this set point is configurable. Discrete Inputs PLC produced a high level (12VDC-24VDC) present on the High DP Fault input to signal a High Differential Pressure Fault.
Valve Not Home	The indexing valve did not return to the home position within 2 minutes after initiating a backwash.
Valve Left Home	The indexing valve unexpectedly left the home position.
Valve Misstart	The indexing valve was not in the home position at the start of the backwash sequence.
Valve Still Home	The indexing valve did not leave the home position within 6 seconds of initiating a backwash.

Phoenix – Standard Materials of Construction

Component	Materials of Construction
Spring Filter Element	316 Stainless Steel
Spring Filter Pod / Cage	304 Stainless Steel
Housing	304 Stainless Steel
Valves (wetted – disc & stem)	Stainless Steel
O-Rings	Buna or Viton
Pneumatic Phoenix Control Enclosure	NEMA 4 (painted steel, ZGF Blue)
Valve Seats	PFTE