Donaldson
FILTRATION SOLUTIONS

Hydraulic Filtration Product Guide

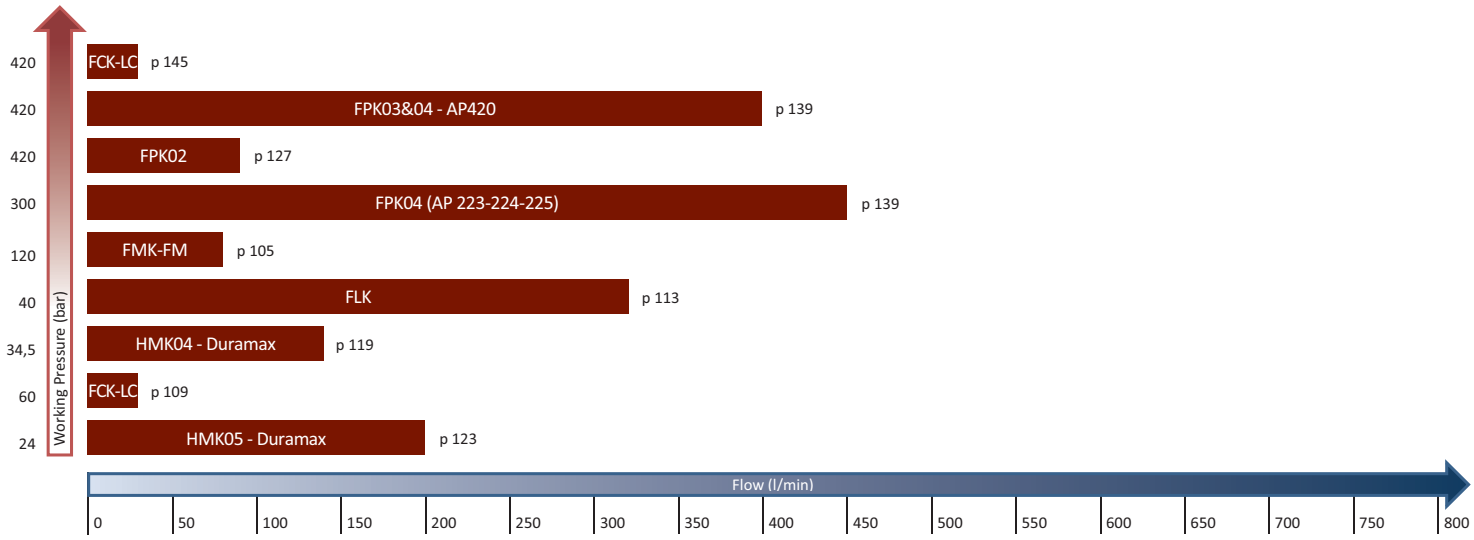
Return Line Filters • Suction Line Filters • In-Line Filters • Service Instructions • Accessories

Donaldson Delivers Performance Under Any Pressure!

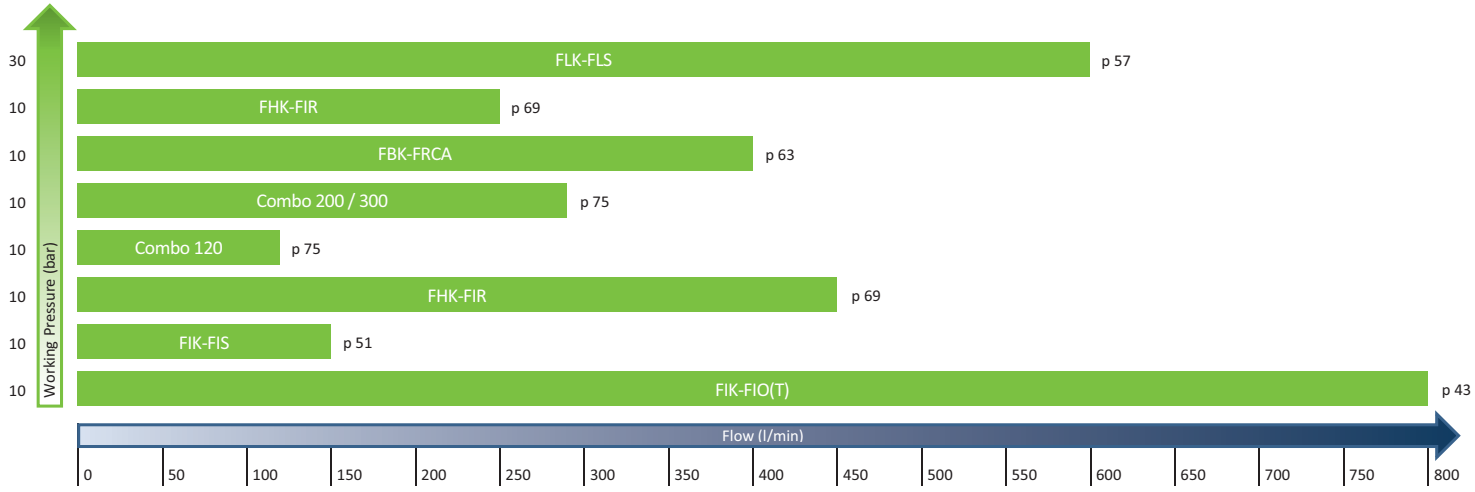
Clean, dry oil is essential for your equipment.
Donaldson Company, a leader in filtration solutions for 100 years, has proven performance in thousands of applications – offering the industry's largest selection of replacement hydraulic, lube and gear oil filtration products for contamination control.

Distributed by:

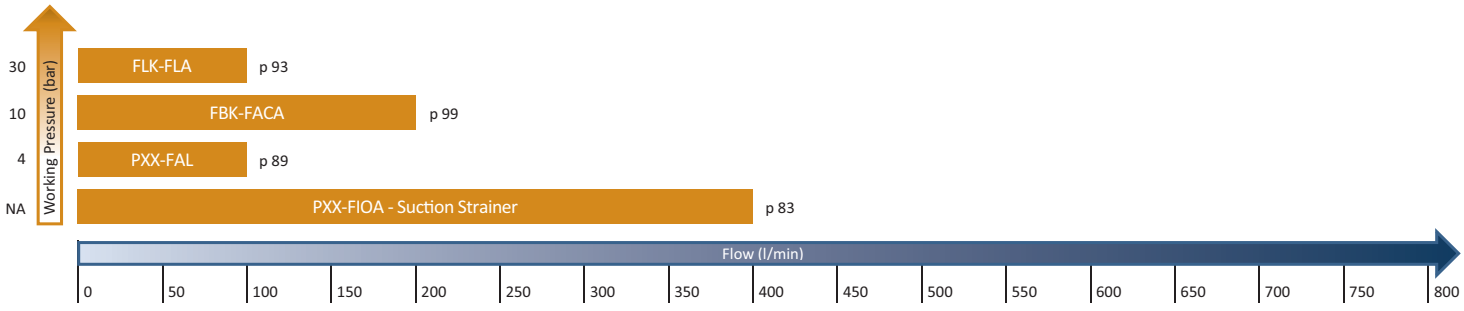
Medium and high pressure filters

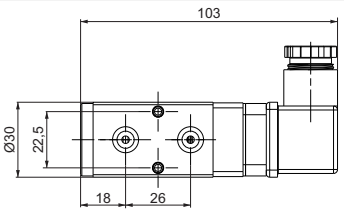
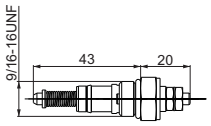
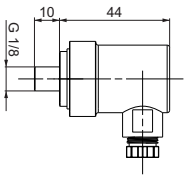
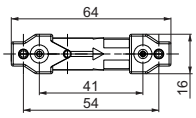
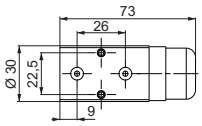
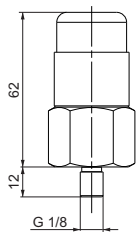
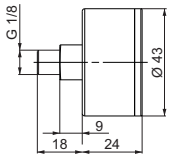


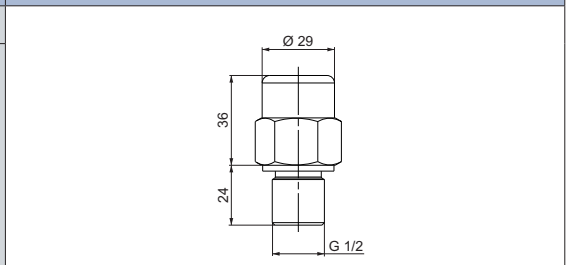
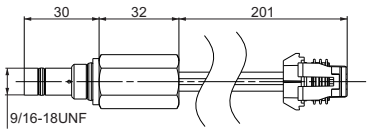
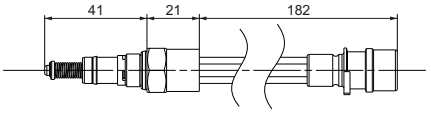
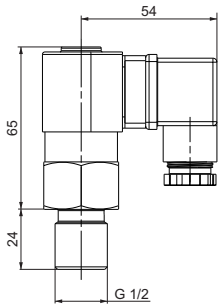
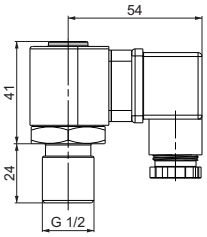
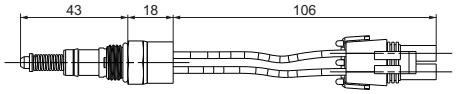
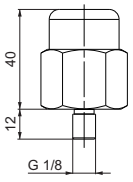
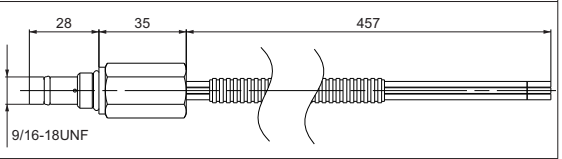
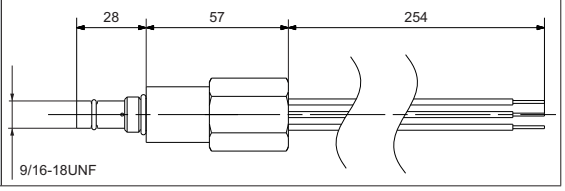
Return line filters



Suction line filters



Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values	Remark	
P171963	Electrical	Differential	A	1,4	Normally Open (3) / Closed (2)	IP65	PG11 - DIN 43650	30 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.	with thermostat at min. temperature at 30°C	
P171961	Electrical	Differential	A	1,4	Normally Open (3) / Closed (2)	IP65	PG11 - DIN 43650	30 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P163839	Electrical	Differential	B	1,25	Normally Closed			6-30 V DC; 0,2 A		
P162400	Electrical	Differential	B	1,25	Normally Open			6-30 V DC; 0,2 A		
P763976	Electrical	Differential	B	2,75	Normally Closed			6-30 V DC; 0,2 A		
P763975	Electrical	Differential	B	2,75	Normally Open			6-30 V DC; 0,2 A		
P167455	Electrical	Differential	B	2,75	Normally Closed			6-30 V DC; 0,2 A		
P165194	Electrical	Differential	B	2,75	Normally Open			6-30 V DC; 0,2 A		
P164745	Electrical	Differential	B	1,7	Normally Open			6-30 V DC; 0,2 A		
P171967	Electrical	Vacuum	C	-0,3	Normally Open	IP65	PG7 - DIN 46248	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P173105	Electrical	Vacuum	C	-0,3	Normally Closed	IP65	PG7 - DIN 46248	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P173104	Electrical	Pressure	C	1,2	Normally Closed	IP65	PG7 - DIN 46248	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P171966	Electrical	Pressure	C	1,2	Normally Open	IP65	PG7 - DIN 46248	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P764431	Electrical	Pressure	C	2,5	Normally Open	IP65	PG7 - DIN 46248	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P162696	Visual	Differential	D	1,7						
P167580	Visual	Differential	D	3,4						
P171950	Visual	Differential	E	1,4						
P171958	Visual	Pressure	F	1,2						
P764612	Visual	Pressure	F	2,5						
P171954	Visual	Vacuum	G	-1 till 3					3 color scale; connection central at back	
P171953	Visual	Vacuum	G	-1 till 5					3 color scale; connection at the side	

Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values	Remark	
P761058	Visual	Differential	H	3						
P171945	Visual	Differential	H	5						
P170926	Electrical	Differential	I	2,75	Normally Closed		Packard Connector	6-30 V DC; 0,1 A		
P171143	Electrical	Differential	J	1,25	Normally Open		Cannon Connector	6-30 V DC; 0,2 A		
P171944	Electrical	Differential	K	5	Normally Open (3) / Closed (2)	IP65	PG11	250 VAC - 30 VDC; 5 A res. and ind.	with thermostat at min. temperature at 30°C	
P171947	Electrical	Differential	K	5	Normally Open (3) / Closed (2)	IP65	PG11	250 VAC - 30 VDC; 5 A res. and ind.		
P761057	Electrical	Differential	L	3	Normally Open (3) / Closed (2)	IP65	PG11	30 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P761056	Electrical	Differential	L	5	Normally Open (3) / Closed (2)	IP65	PG11	30 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.		
P171087	Electrical	Differential	M	2,75	Normally Open		Packard Connector	6-30 V DC; 0.2 A		
P171959	Visual	Vacuum	N	-0,3						
P173893	Electrical	Differential	P	2,75	Normally Open (white) or Closed (red)	IP65	3 Wires	6-30 V DC; 0,1 A		
P173944	Electrical	Differential	Q	1,4	Normally Open (white) or Closed (red)	IP65	3 Wires	110V AC - 24V DC; 2 A		

Introduction

Return Line Filters

Low Pressure Filters in-Tank

Low Pressure Filters in-Line

Return &/or Suction Line Filters

Low Pressure Filters in-Tank

Suction Line Filters

Low Pressure Filters in-Tank

Low Pressure Filters in-Line

Medium Pressure Filters In-Line

High Pressure Filters In-Line

Hydraulic Accessories

Donaldson introduces new product line

FLK Medium Pressure Hydraulic Filtration

Engineered Filtration Power

Donaldson FLK filtration technology delivers all the latest hydraulic filtration advancements for Original Equipment Manufacturers in a single package. The FLK system, a reusable housing with disposable filter cartridge, can be configured with Donaldson's advanced Synteq XP™ media technology – or with other Donaldson media offerings – to satisfy a wide range of performance requirements.

Optimum Housing Design

FLK assemblies provide high pressure fatigue ratings. This robust, reusable housing and disposable cartridge design creates less waste than standard metal spin-on designs. The versatile FLK filter head also accommodates multiple filter lengths – reducing part numbers stocked while offering greater application coverage.

Cleaner, Easier Servicing

Industrial, raised hand grips make it easy to remove the housing from the head without the need for special servicing tools. The oil drain port on the bottom of the housing and the locking grab handles on the filter cartridge allow for cleaner servicing. The filter handles lock into place – simplifying positioning during reassembly. Short removal clearance is needed for filter replacement so the assembly can easily fit into tight spaces.

Our FLK hydraulic filtration systems are packed with innovative features that deliver cleaner, error proof filter servicing.

Integrated By-pass Valve
Robust, proven design

Unique Head to Cartridge Interface Connection

RadialSeal™ Sealing Technology
- *No metal-to-metal contact – downstream flow*
- *Robust, reliable seal on clean side of filter – prevents cross contamination of oil*

Filter Cartridge
- *Media beading on outside of cartridge supports optimum filtration under high pressure differential*
- *Locking grab handles makes for cleaner servicing and simplifies filter position during servicing*

Industrial Hand Grips
No special servicing tools needed

Locking Grab Handles
Cleaner, easier servicing

RadialSeal™ Sealing Technology
- *No metal-to-metal contact – upstream flow*
- *Easy-to-torque, error proof sealing*
- *Robust, reliable seal on upstream side of filter*

Anti-dust Seal
- *Keeps threads free from contamination*
- *Easier to remove and reassemble during service*

Synteq XP™ Media Technology
Delivers high performance – lower pressure drop, superior cold-start filtration and extended filter life

Closed End Cap
Eliminates the possibility of contamination to clean side of assembly during servicing

Oil Drain Port
Oil drain port used to drain oil during servicing

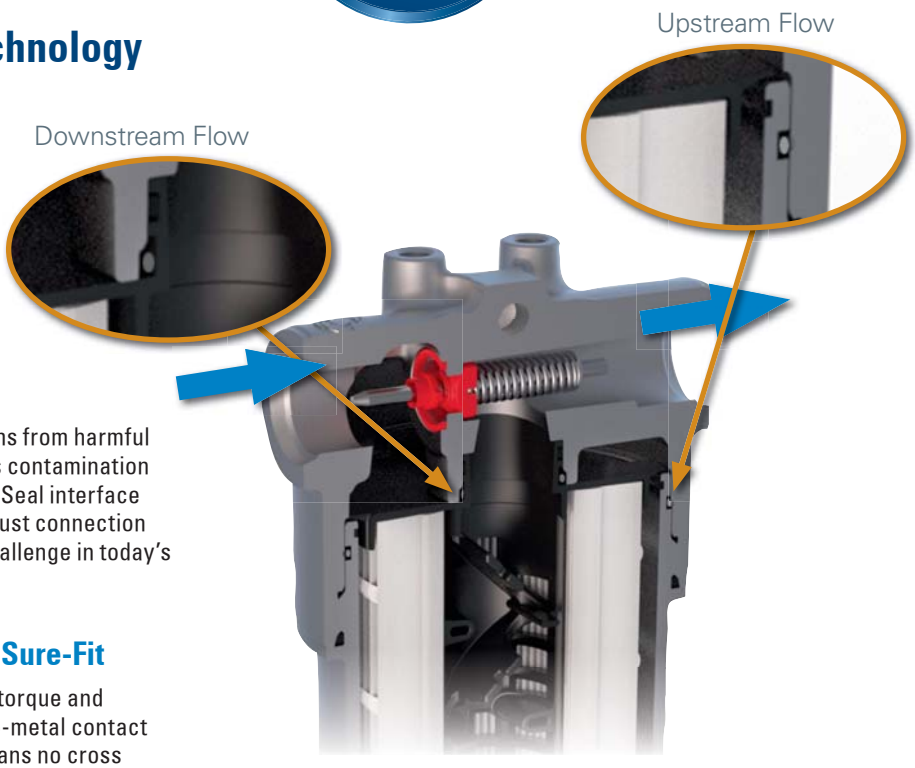
Environmental Care

Donaldson offers an optional metal-free, high-capacity cartridge that can be easily crushed or fully incinerated.

Donaldson
FILTRATION SOLUTIONS

NEW PRODUCT

Industry Proven Sealing Technology



Enhanced Reliability

Donaldson pioneered RadialSeal™ sealing technology for air filtration more than 20 years ago. We've applied this proven design to hydraulic filtration in order to create a clean, leak-resistant seal – with no metal-to-metal contact for a new standard in system cleanliness.

This improved sealing technique protects systems from harmful ingressed contaminants and also prevents cross contamination of oil. By moving the threads outward, the RadialSeal interface increases the surface area which provides a robust connection with superior vibration resistance, a common challenge in today's heavy-duty applications.

RadialSeal™ Guarantees a Reliable, Sure-Fit

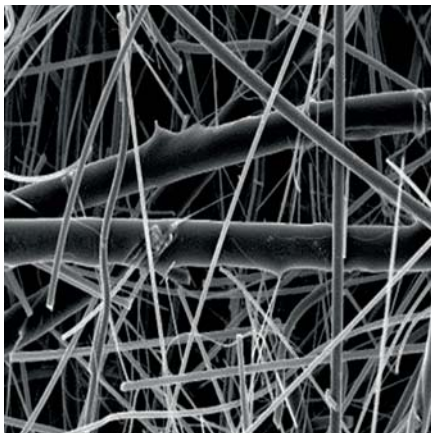
Robust seal on the clean side of filter is easy-to-torque and provides error-proof filter servicing. No metal-to-metal contact on both the downstream and upstream sides means no cross contamination of oil.

Industry Shaping Media Technology

Synteq XP™ Media Technology for Optimal Filtration Performance

Donaldson's breakthrough in synthetic filter media technology takes hydraulic filtration performance to a whole new level. This resin-free bonded media provides improved filtration to increase filter dirt holding capacity and reduce pressure drop, resulting in enhanced system performance and protection.

Synteq XP™



Synteq XP™ Media

Synteq XP is thermally bonded together to create small, consistent fibers – increasing the filter capacity. The pores remain unobstructed, resulting in reduced pressure drop and more surface area for capturing and retaining smaller particles.

Synteq XP Delivers:

- Lower operating pressure drop
- Higher efficiency for optimal hydraulic system protection
- Superior cold-start filtration
- Extended filter life (up to 2 to 3 times that of traditional media)

See brochure No. F111379. For more technical information, consult p. 113.

Donaldson
FILTRATION SOLUTIONS

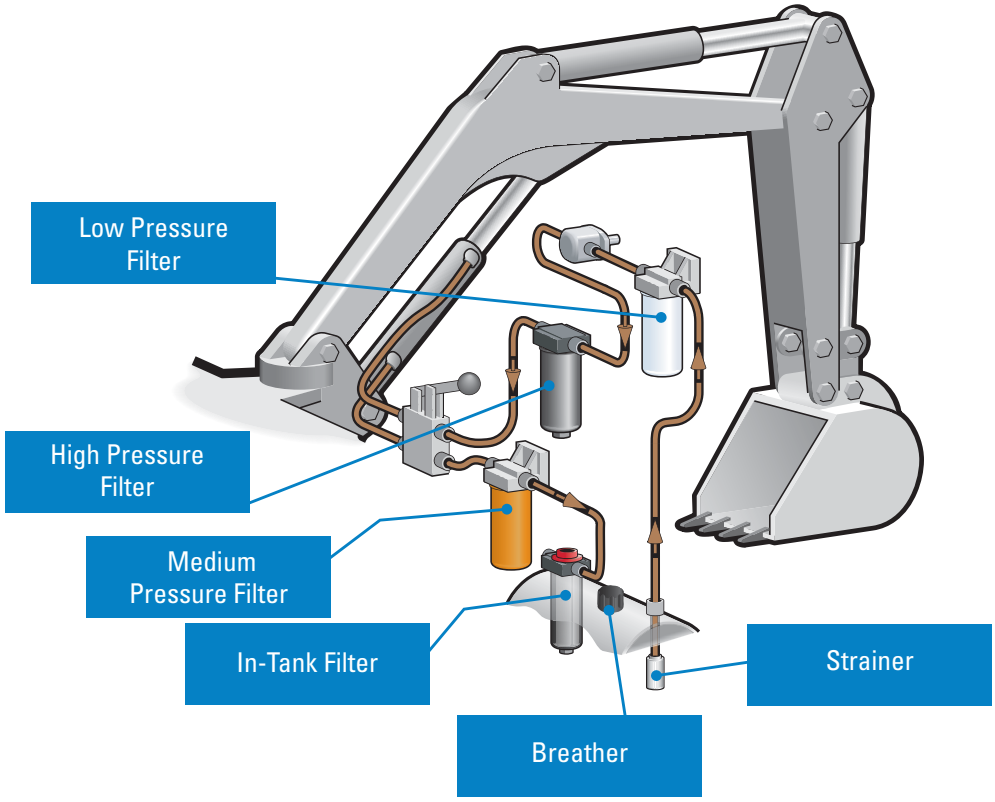
Hydraulic filtration solutions
Engineered for today's industrial & mobile equipment





The best solutions for clean, dry oil.

Count on Donaldson to have the right filters, contamination control products and services to protect critical components in hundreds of applications – in the factory and on heavy-duty mobile equipment.
When you need hydraulic filtration, Donaldson delivers.



Full product range

The industry's largest selection of in-stock filters and accessories – manufactured with consistent, high-quality performance.

Expert technical support

Prompt, accessible and knowledgeable customer service experts.

High-performance filtration

Increase dirt-holding capacity and lower ΔP with Donaldson high-performance DT filters.

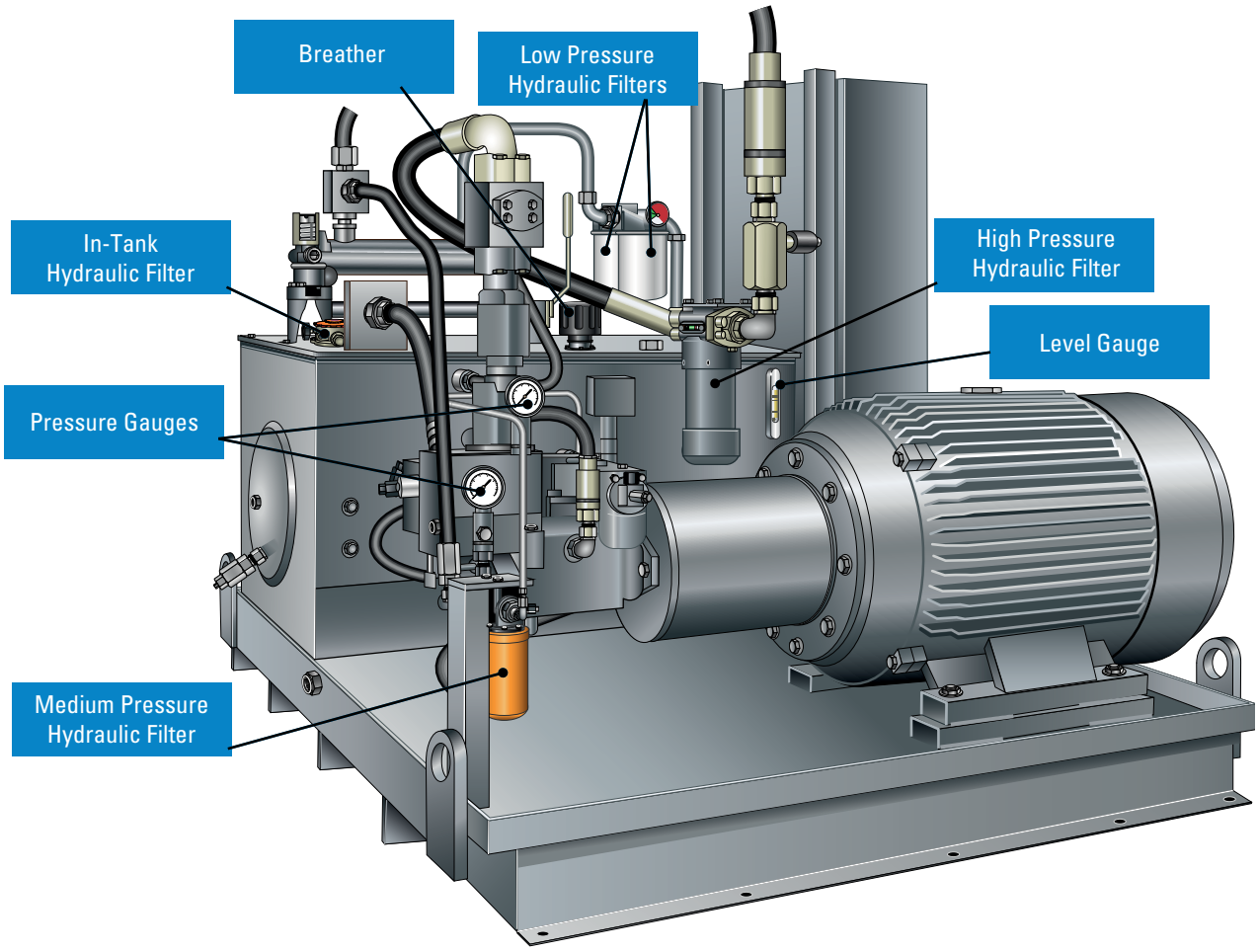
Hydraulic filtration solutions
Engineered for today's industrial & mobile equipment





Performance under any pressure

- Low, medium and high pressure filtration
- Spin-on, cartridge and in-tank style filters



Off-line filtration

Filter carts, filter panels and Filter Buddy™ handheld filtration.

See Catalog No. F112100 ENG

Water removal

Systems and products designed to prevent water ingression and remove entrained water.

Vacuum dehydrators & coalescers

Quick removal of free water, dissolved water, particles and gases.

Industry shaping technology
Global design & logistic capabilities

Donaldson has pioneered the use of a wide range of engineering, design and testing tools used during the product development and validation process.

Engineering capabilities

- Design centers in three key regions – Europe, United States and Asia

Prediction and simulation

- CAD
- Media modeling
- Fluid mechanics
- Structural analysis
- Thermal analysis

Development and validation

Filter durability

- Filtration performance testing per applicable SAE and ISO standards
- Fabrication integrity
- Environmental conditions
- Salt spray and thermal cycling
- Pressure fatigue
- Flow fatigue
- Hydrostatic burst
- Flow benches
- Vibration benches
- Gravimetric analysis

Rapid prototyping

- SLA, SLS
- Investment casting
- RTV molding

Test & evaluation tools

Structural Analysis

- Per SAE, ISO, and NFPA standards
- Burst
- Collapse
- Pressure impulse and fatigue

Tensile compression

- Used to test material, component and assembly properties

Environmental chambers

- Allows testing at hot or cold temperature, with humidity control

Flow test benches

- Allows measurement of static and dynamic flow and restriction for a device
- Allows calculation of device restriction at varying flows and temperatures
- System simulation

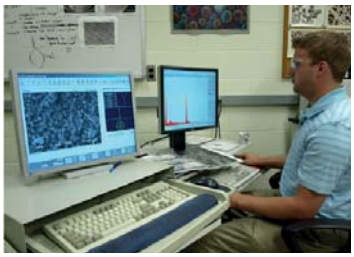
Filtration performance testing

- ISO, SAE, NFPA
- Customer standards
- Contaminant (particle or water) removal efficiency
- Contaminant capacity

Analytical chemistry laboratory

- Optical microscopy
- Scanning electron microscopy (SEM)
- Chemical analysis
- Fourier transform infrared (FTIR)
- Gas chromatography (GC/MS)
- Thermal analysis (DSC, TGA)
- Liquid chromatography

Industry shaping technology
Global design & logistic capabilities



Design validation

- Test cell locations in three key regions – United States, Asia and Europe
- High viscosity ΔP
- High temperature
- Flow fatigue
- Used oil analysis
- Component durability
- 24/7 durability testing
- Web-based test cell monitoring access
- Fluid compatibility

Vibration/shaker

- Multiple benches
- Performance vibration with flow test
- Can apply random, shock or custom variable vibration profiles
- Capable of hot or cold tests

Field testing

- On and off highway
- Heavy-duty
- Tests conducted on both end user and OEM applications

Field data acquisition

- Real time measurements
- Remote communications
- On-line collection tools
- Review daily, weekly and monthly reports to analyze operational trends

Quality certified

- All facilities are ISO/TS certified

Quality controls

- Consistent, reliable product
- On-site verification test units and equipment
- Part number specific PLC controls
- Manufacturing dates for tracking and warranty

Manufacturing

Locations for liquid filtration

- Europe, United States, Canada, Mexico and Asia-Pacific
- Located strategically with global partners

Base component materials

- Built for long-life, durability, corrosion resistance and liquid compatibility
- Metal and non-metal materials
- Methods to enhance media durability include oven-curing, wire backing and multiple layered media

Packaging options

- Returnable packaging
- Heavy-duty packaging
- Pallets ISPM-15 compliant for international routing

Logistics / distribution

Donaldson has established a global distribution network to serve our customers locally and around the world. We operate as a global company with a network of primary distribution locations that support a mature hub of regional distribution centers and warehouses.

Donaldson distribution centers are strategically located around the globe to quickly and accurately deliver filtration and exhaust products wherever replacement products are needed. We work with a network of transportation, third party logistics companies, consolidators and cross-docking facilities to meet or exceed our customers' requirements.

Customers around the world benefit from our umbrella of distribution centers. We focus our efforts on local support and the capabilities of our staff. We continue to make significant investments in facilities, systems, supply chain relationships and staffing to offer the best order fulfillment options available.

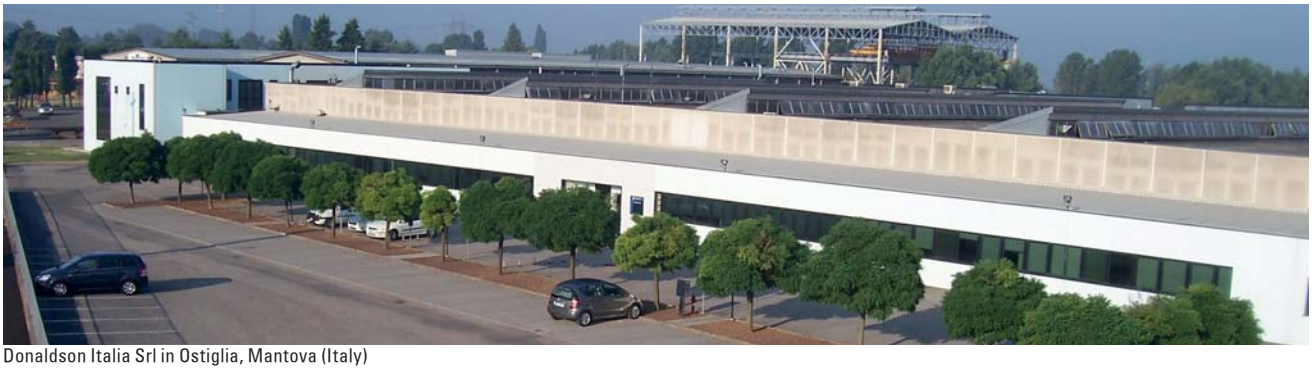
Industry shaping technology
Donaldson Italy capabilities

Leader in designing and manufacturing liquid filters

Donaldson Italia Srl was established in 1992, when DCI bought the existing Italian filter manufacturing company FBO, specialized in hydraulic filtration (industrial & mobile).

The company grew during the last 20 years, passing from 50 up to 210 employees. Over the years, Donaldson Italia Srl was and is able to develop new synthetic media, spin-ons and high pressure filters. This mainly thanks to the synergy with DCI and by supplying a huge number of OEM's. One of our main characteristics is the big flexibility and the capacity to develop customized products.

As all Donaldson factories, Donaldson Italia srl achieved the quality certification according to ISO 9001/2 and ISO 14000 as well as quality certification of our major OEM customers.



Donaldson Italia Srl in Ostiglia, Mantova (Italy)

Donaldson Italy Srl manufacturing means quality production

Most of the filter production process is automated, this enables us to build filters faster and with higher precision.

Daily plant production capacity (10.000m²):
- 4.000-8.000 Duramax hydraulic spin-ons
- 3.000-5.000 hydraulic cartridges
- 1.000 hydraulic filter assemblies
- 4.000 low pressure spin-on filters and liquid filters.

Recent investments in a new liquid lab and the engineering and sales office doubled the production facility.

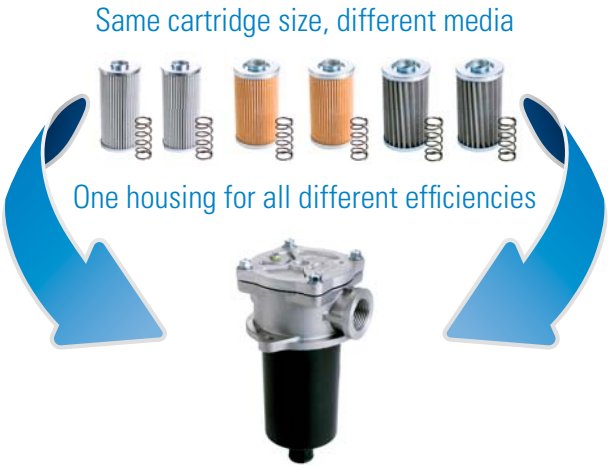
Industry shaping technology
Mix&Match – your flexible hydraulic solutions

History

Mix&Match is introduced to provide you more flexibility and a higher availability of hydraulic products.

You can create your own complete filter by selecting separately a housing, a cartridge and an indicator. The majority of these components will be stocked to provide you fast with the products you need.

The idea of Mix&Match



How to create your hydraulic product via the catalog?

The tables are composed in such a way that all components that fit together are on 1 row.

1. Pick the product series depending from the position in the hydraulic system, the working pressure and the required flow
2. Pick the required element based upon flow and efficiency
3. Follow this row to the right and the available (empty) housing is shown
4. Pick the indicator of your choice (make sure that it fits the predrilled hole).

	/9		/6		/3	
	90µm		60µm		$\beta_{x(c)} \geq 1000$	
Family	RMF		RMF		RMF	
FIO20	20	P171500	20	P171505	15	P171504
FIO30	30	P171500	30	P171505	20	P171504
FIO50	50	P171518	50	P171523	35	P171522

Standard Housing without Cartridge					CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	X	Y	Z	
		mm	mm	mm	mm	mm	mm	
P766446	G3/8	67	78	132	67	52	25.5	P171953 P171958 P171966 P173104
P766447	G1/2	67	78	132	67	52	25.5	
P766448	G1/2	90	100	172	75	70	29	

All cartridges are delivered with a sticker, with the Donaldson cartridge spare part number, that will mark the housing from the outside. All complete Mix&Match filters need to have this sticker attached to the outer housing.

Hydraulic Filter Locations

Comprehensive Selection of Filtration Solutions

Typical Hydraulic Circuit and Filter Locations

Filter Symbol in a Circuit

Pressure Line Filter
Protects high-pressure side components. Helps prevent component wear or failure brought about by debris in the system.

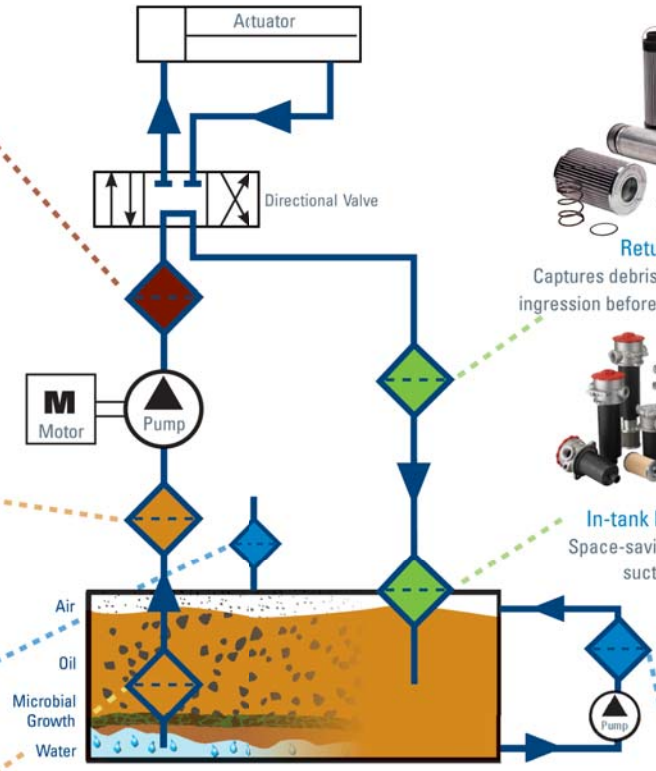
In-Line Accessories
Pressure gauges for monitoring system pressure. Hoses and test points for sampling oil and determining ISO cleanliness levels. Flanges and valves for system control.

Suction Line Filter
Designed to remove particles in the 5 to 150 micron range. Easy to service and less expensive than other types of filters. Low by-pass valve use recommended to prevent pump starvation.

Return Line Filter
Captures debris from component wear or ingression before it travels into the reservoir.

In-tank Return Line Filter
Space-saving in-tank return and suction line filters.

Reservoir Air Breather
Prevents ingression of airborne contaminants from entering the reservoir tank.



Reservoir Tank
Water in reservoir tanks is a serious threat to hydraulic systems. Dirt, particles and microbial growth are also common contaminants existing in tanks.

Suction Strainer
Removes large particles or objects built into the system during assembly or introduced during standard maintenance. Prevents catastrophic failure.

Reservoir Accessories
Sight and level gauges available. Diffusers are used for effectively reducing aeration,foaming, turbulence and noise caused by return lines.

Kidney Loop Filters
Off-line filtration supplements system cleanliness. Use with industrial and mobile equipment to achieve and maintain proper ISO cleanliness levels.

Donaldson provides this technical reference as a short course in "Hydraulic Filtration" – for those who want to gain a better understanding of hydraulic filtration.

In industrial and mobile applications at factories all over the world, we too often see hydraulic circuits that don't include proper fluid filtration, or include it as an afterthought. Good filtration needs to be an integral part of the hydraulic circuit to ensure the long life and proper operation of the pumps, valves and motors.
A €100 filter protects your €100,000 equipment.

This section is offered to aid in choosing the filter that will help you achieve the ideal cleanliness levels and longest life for your critical components.

Topics

Symbols Used

ß	Beta Ratio
cSt	Centistokes
DP	Pressure Drop or Differential Pressure
ISO	International Standards Organization
µm	Micron or micrometer
ppm	Parts per million
SSU SUS	Saybolt Seconds Universal

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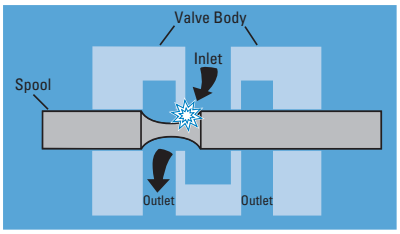
Hydraulic Components Need Protection

Fluid power circuits are designed in all shapes and sizes, both simple and complex in design, and they all need protection from damaging contamination. Abrasive particles enter the system and, if unfiltered, damage sensitive components like pumps, valves and motors. It is the job of the hydraulic filter to remove these particles from the oil flow to help prevent premature component wear and system failure. As the sophistication of hydraulic systems increases, the need for reliable filtration protection becomes ever more critical.

How Contamination Damages Precision Parts



This illustration of a simple hydraulic valve illustrates how particles damage components. In normal operation, the spool slides back and forth in the valve body, diverting oil to one side of the valve or the other. If a particle lodges between the spool and valve body, it will erode small wear particles from the metal surfaces. As these wear particles are moved back and forth by the action of the spool, they can roll into a burr that jams the spool and disables the valve.

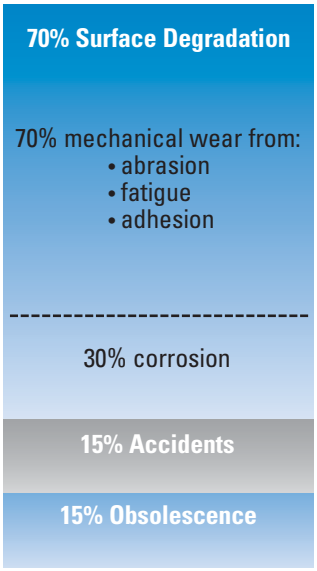
Types of Contaminant

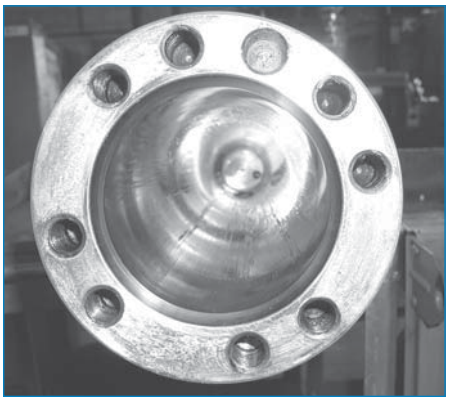
- Many different types of contamination may be present in hydraulic fluid, causing various problems. Some are:
- Particulate (dust, dirt, sand, rust, fibers, elastomers, paint chips)
- Wear metals, silicon, and excessive additives (aluminum, chromium copper, iron, lead, tin, silicon, sodium, zinc, barium, phosphorous)
- Water
- Sealants (Teflon®* tape, pastes)
- Sludge, oxidation, and other corrosion products
- Acids and other chemicals
- Biological, microbes (in high water based fluids)

* Teflon is a registered trademark of E.I.Dupont de Nemours & Co., Inc.

Typical Factors in Component Life

Studies show that most (typically 70%) of hydraulic component replacement is necessary because of surface degradation, and most of that is due to mechanical wear. Proper filtration of hydraulic fluids can lengthen component life.





Component Damage

Looking down the barrel of an hydraulic cylinder, we can see the scratches along the inside surface. Don't cut costs by eliminating hydraulic filters. It could cost you more in the long run in major component repairs.

Disaster Strikes

When filters are not a main component of the hydraulic circuit, disaster awaits. Here, piston rings were eaten away by contaminants.

Where Contamination Comes From

There are a surprising number of contaminated sources in a hydraulic system or circuit.

New Hydraulic Fluid

Adding new fluid can be a source; even though it's fresh from the drum, new hydraulic fluid isn't clean. (It may look clean, but, remember, the human eye can only see a particle the size of about 40 µm.) Oil out of shipping containers is usually contaminated to a level above what is acceptable for most hydraulic systems: typically, new fluid has a cleanliness level about the same as ISO Code 23/21/19, and water content is typically 200 to 300 ppm. Never assume your oil is clean until it has been filtered. One very effective way of ensuring thorough fluid conditioning is with a dedicated off-line circulation loop, or "kidney" loop filtration.

Built-In

Built-in contamination, also called primary contamination, is caused during the manufacture, assembly and testing of hydraulic components. Metal filings, small burrs, pieces of Teflon tape, sand and other contaminants are routinely found in initial clean up filtration of newly manufactured systems.

Ingressed

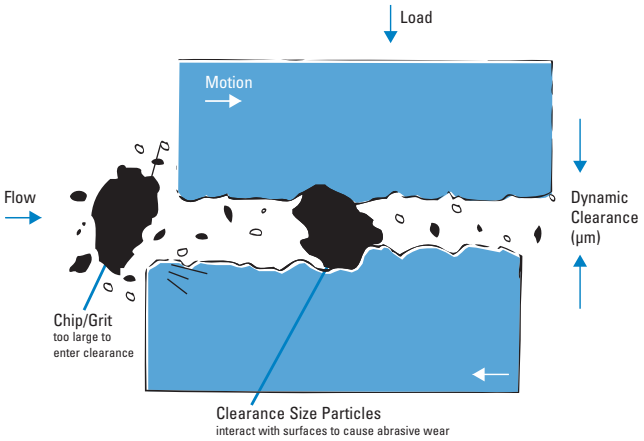
Ingressed or external contamination comes from the environment surrounding the system. Dirt can enter the hydraulic fluid supply through leaking seals, reservoir breather caps, and worn cylinder rod seals. Ingressed moisture, particularly, can cause long-term problems. As a hot system cools at night, cool moisture-laden air can be drawn into the reservoir; as the air condenses, water is released into the reservoir. Water in excess of 0.5% by volume in a hydrocarbon-based fluid accelerates the formation of acids, sludge and oxidation that can attack internal components, cause rust, and adversely affect lubrication properties. The severity of ingression and type of contaminant are dictated by the applications and environment.

Induced

Maintenance procedures can introduce contamination into the system. Opening the system allows airborne particles to enter. Leaving the system open during operation provides continuous ambient particle ingression. Keep your system closed as much as possible.

In-Operation

The major source of contamination are the pump and actuators, the hydraulic cylinder, or the hydraulic motor. Wear-generated contaminants are a hazard during normal hydraulic system operation. The circuit actually generates additional particles as the fluid comes into contact with the precision machined surfaces of valves, motors and pumps. Contaminant levels can keep doubling with every new particle generated. The result can be catastrophic if these contaminants are not properly filtered out of the system.



Rubber & Elastomers

Due to temperature, time, and high-velocity fluid streams, rubber compounds and elastomers degrade – thus releasing particulates into the fluid. This may be from hoses, accumulator bladders, seals, or other elastomer products.

High Water Based Fluids

The water in HWBF tends to support biological growth and generate organic contamination and microbes.

Replacement of Failed Components

Failure to thoroughly clean fluid conductor lines after replacing a failed hydraulic pump will cause premature catastrophic failure.
Donaldson recommends frequent oil sampling to ensure proper contamination control. Sample test points should be close to hydraulic pumps and at other key locations that provide safe, reliable access to the fluid while under full system pressure.

Fluid Conditioning

Fluid Conditioning is the term for the overall conditioning of the fluid in the hydraulic system, and encompasses particulate removal via filters along with other various methods for removing silt, air, water, heat, acid, sludge or chemicals.

Particulate Removal

Particulate removal is usually done with mechanical filters. A well designed reservoir that allows settling will also help in keeping particulates out of the mainstream fluid. For ferrous particulates and rust, reservoir magnets or strainer band magnets can also be used. Other methods such as centrifuging or electrostatic filtration units can also be used, particularly in continuous batch processing and fluid reclamation.

Removal of Silt

Silt, defined as very fine particulate under 5 µm in size, requires very fine filtration or "oil polishing."

Air Removal

Getting air out of the system is best done by adding 100 mesh screen in the reservoir, approximately 30° from horizontal to coalesce entrained air and allow larger bubbles to rise to the surface when reservoir velocities are low.

Water Removal

A number of techniques exist to prevent water or moisture ingression or to remove water once it is present in a hydraulic or lube oil system. The best choice of technique for removal is dependent on the whether or not the water exists as a separate phase (dissolved or free), and also on the quantity of water present. For example, the presence of water or moisture can be reduced or prevented from entering a fluid reservoir through the use of absorptive breathers or active venting systems. However once free water is present in small quantities, water absorbing filters or active venting systems usually provide adequate removal means. For large quantities of water, vacuum dehydration, coalescence, and centrifuges are appropriate techniques for its removal. However, as each of these techniques operates on different principles, they have various levels of water removal effectiveness. The chart below provides comparative information on these techniques and their relative effectiveness. Care should be taken to apply the best technique to a given situation and its demands for water removal.

Chemical Removal

Removal of acids, sludge, gums, varnishes, soaps, oxidation products and other chemicals generally requires an adsorbent (active) filter with Fuller Earth, active type clays, charcoal, or activated alumina.

Heat Removal

Removing heat is important to maintain viscosity and prevent fluid breakdown. Usually performed with heat exchangers, including air-to-oil and water-to-oil types, finned coolers, or refrigerated units.

Heat Addition

Added heat is used for cold temp start-up to get fluid viscosities within operational limits. Use heaters, immersion or in-line.

Kidney Loop Filtration

One very effective way of ensuring thorough fluid conditioning is with a dedicated off-line circulation loop, or "kidney" loop. This system uses a separate circulation pump that runs continuously, circulating and conditioning the fluid. Multiple stages and types of filters can be included in the circuit, as well as heat exchangers and in-line immersion heaters.

Water Prevention and Removal Techniques

	Usage	Prevents Humidity Ingression	Removes Dissolved Water	Removes Free Water	Removes Large Quantities of Free Water	Limit of Water Removal
Adsorptive Passive Breather	prevention	Y				n/a
Active Venting System	prevention and removal	Y	Y	Y		down to <10% saturation
Water Absorbing Cartridge Filter	removal			Y		only to 100% saturation
Centrifuge	removal			Y	Y	only to 100% saturation
Coalescer	removal			Y	Y	only to 100% saturation
Vacuum Dehydrator	removal		Y	Y	Y	down to ~20% saturation

Proper Filter Application

When selecting a new filter assembly or replacement filter, it's important to first answer some basic questions about your application. Where will the filter be used? What is the required cleanliness level (ISO code) of your system? What type of oil are you filtering? Are there specific problems that needed to be addressed?

It's also important to think about the viscosity of the fluid in your system. In some machinery lubrication applications, for example, the oil is very thick and has a tougher time passing through the layer of media fibers. Heating techniques and the addition of polymers can make the liquid less viscous and therefore easier to filter. Another option is to install a filter with larger media surface area, such as the Donaldson W041 or HRK10 low pressure filters, that can accommodate more viscous fluids. (see Catalog No. F112100)

Next, think about duty cycle and flow issues. Working components such as cylinders often create wide variations in flow – also called pulsating flow – that can be problematic for filters with higher efficiency ratings. On the other hand, dedicated off-line filtration (also called "kidney loop") produces a very consistent flow, so it makes sense to use a more efficient filter.

Filters used in applications with steady, continuous operation at lower pressures will last longer than filters that must endure cycles of high pressure pulsating flow. Generally, the lower the micron rating of a filter, the more often it needs to be changed since it is trapping more particles.

Finally, it's wise to ask yourself, "How much is my equipment worth?" Calculate how much it would cost to replace the equipment in your system, in case of component failure, and make sure those areas are well protected with proper filtration. (For example, high performance servo valves are very sensitive, costly components that need to be protected with finer filtration media.)

Minimizing maintenance costs through good contamination control practices requires proper filter application based on the specific contamination problems. Good contamination control means cost-effective filtration. When looking for a filter, first assess the needs of your system and any problem areas.

Characteristics to Consider When Specifying a Filtration System

1. Oil Viscosity
2. Flow
3. Pressure
4. What Components will be protected by the filter
5. Cleanliness level required (expressed in ISO code
6. Type of oil/fluid
7. Environment (the system, the surrounding conditions, etc.)
8. Duty cycle
9. Operating Temperature

Fluid Properties

Lubricity The property of the fluid that keeps friction low and maintains an adequate film between moving parts.

Viscosity The thickness of the fluid as measured by resistance to flow. The fluid must be thin enough to flow freely, heavy enough to prevent wear and leakage. Hydraulic fluids thicken when they cool and thin out as they heat up. Because some hydraulic systems work under wide temperature extremes, viscosity can be an important factor.

Viscosity Index (VI) The rate of viscosity change with temperature: the higher the index, the more stable the viscosity as temperature varies. VI can sometimes be improved by additives, usually polymers.

Rust Resistance Rust inhibiting chemicals in hydraulic fluids help overcome the effects of moisture from condensation.

Oxidation Resistance Oxidation inhibitors delay the sludgy/acidic effects of air, heat, and contamination in the system.

Foaming Resistance Although control of foaming depends largely on reservoir design, anti-foaming additives in the fluid also help.

Types of Hydraulic Fluid

There are many kinds of fluids used for power, but they can basically be called petroleum-based fluids, biodegradable fluids, and fire-resistant fluids. A brief description of some of the types in each category are listed below; for details on these or others, consult your filter supplier or refer to a reputable manual on hydraulics, such as the Lightning Reference Handbook, published by Berendsen Fluid Power, Whittier, CA 90601.

Petroleum Based (Hydrocarbon)

These are the most commonly used fluids in hydraulic systems. Their major advantages are low cost, good lubricity, relatively low/non-toxicity, and common availability. This type of fluid is not just plain oil; rather, it is a special formulation with additives that make it suitable for hydraulic systems. Mostly, the additives inhibit or prevent rust, oxidation, foam and wear.

Variations:

- Straight oils: same as petroleum-based oil but without the additives.
- Automatic transmission fluids (ATF): excellent low temp viscosity and very high VI.
- Military hydraulic fluids (ie: MIL-H-5606 and MIL-H-83282): also called 'red oil' because of the color. Low viscosity, good for cold temp operations, but may have to be modified for pumps.

Fire Resistant Fluids

There are two types of fire-resistant fluids commonly used in hydraulic applications: Phosphate Esters and High Water Based Fluids (HWBF). Although generally not as viscous at cold temperatures as petroleum-based fluids, they are fire resistant due to their high content of noncombustible material. Very useful in overcoming the likelihood of fire caused by a broken hydraulic line spraying petroleum fluid into a pit of molten metal, onto a hot manifold, into a heat-treating furnace, or other ignition source.

Some types of HWBF:

- Oil-in-water emulsions (HFA): typically 95% water and 5% oil, with the oil droplets dispersed throughout the water. Provide some fire resistance, but due to oil content, other fluids are superior.
- Water-in-oil emulsions (invert emulsion HFB): typically 40% water and 60% oil, with the water dispersed in the oil. Provide some fire resistance, but due to oil content, other fluids are superior.
- Water-glycol (HFC): typically 40% water and 60% glycol. Excellent fire resistance. Since glycol is an antifreeze, water-glycol can be used at lower temps.

NOTE: HWBF may require reduced pressure rating of pumps and other components.

HFD Fluids

The HFD group is a classification giben to several different types of synthetic products that do not contain petroleum oil or water. Phosphate ester fluids were the first HFD fluids and are the most fire resistant within the HFD family. Not as popular today, their use declined due to poor environmental performance, limited compatibility, and high cost.
Certain phosphate esters have very high auto-ignition temperatures and are still used in specific applications, such as aircraft and power generation.

A common brand is known as Skydrol® (registered trademark of Solution, Inc.). Skydrol requires EPR seal for chemical compatibility. Today most phosphate esters have been replaced by polyol esters. Based on organic esters, polyol esters are the most common HFD fluids used today. They offer good inherent fire resistance, good compatibility with system materials, excellent hydraulic fluid performance, and easy conversion from petroleum oil. In addition, the organic nature of these fluids gives them good environmental performance in biodegradability and aquatic toxicity. Another type of synthetic, fire resistant fluids have been formulated for certain niche markets.

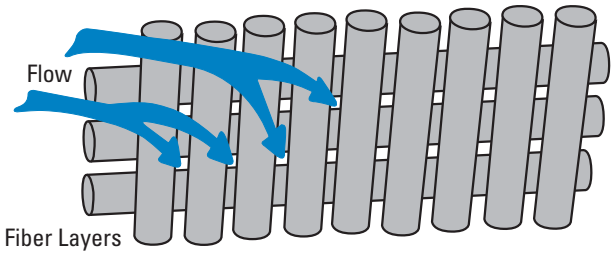
Water free polyalkylene glycols (PAGs) feature extended fluid life and good environmental performance. Technically an HFD fluid, PAGs (also known as polyalphaolefins (PAOs) are more often used for their biodegradability and overall environmental friendliness. This group also contains the synthetic silicone (siloxane) oils, known for their anti-foaming properties.

Biodegradable

With increasing concern about the environmental impact of hydraulic system leaks and spills, biodegradable fluids are receiving expanded usage, particularly in Europe. There are two types of common biodegradable hydraulic fluids:
1) vegetable-based oils, such as sunflower or rapeseed oils, and 2) synthetic oils like diesters, etc. Generally, systems using biodegradable fluids are derated for maximum and minimum temperatures. Users who replace standard hydraulic oils with biodegradable oils must check with filtration component manufacturers to confirm that the fluid and components are compatible.

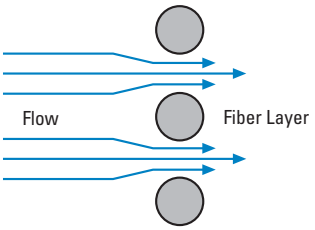
How Filter Media Functions in a Filtration System

The job of the media is to capture particles and allow the fluid to flow through. For fluid to pass through, the media must have holes or channels to direct the fluid flow and allow it to pass. That's why filter media is a porous mat of fibers that alters the fluid flow stream by causing fluid to twist, turn and accelerate during passage.



The fluid changes direction as it comes into contact with the media fibers, as illustrated above. As the fluid flows through the media, it changes direction continuously as it works its way through the maze of media fibers. As it works its way through the depths of the layers of fibers, the fluid becomes cleaner and cleaner. Generally, the thicker the media, the greater the dirt-holding capacity it has.

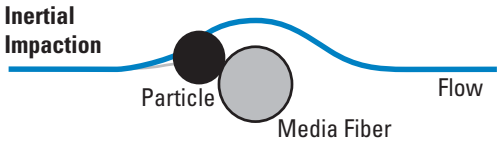
Looking at a cross-section view of the fibers, we can see how the flowstream is accelerated as it flows into the spaces between the fibers.



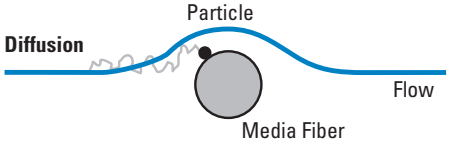
How Filter Media Collects Particles

There are four basic ways media captures particles

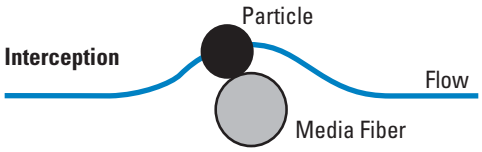
The first, called **inertia**, works on large, heavy particles suspended in the flow stream. These particles are heavier than the fluid surrounding them. As the fluid changes direction to enter the fiber space, the particle continues in a straight line and collides with the media fibers where it is trapped and held.



The second way media can capture particles is by **diffusion**. Diffusion works on the smallest particles. Small particles are not held in place by the viscous fluid and diffuse within the flow stream. As the particles traverse the flow stream, they collide with the fiber and are collected.

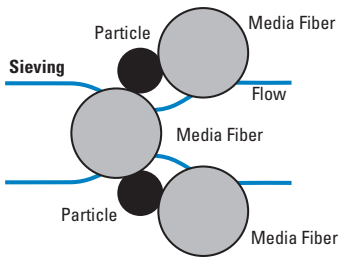


The third method of particle entrapment is call **interception**. Direct interception works on particles in the mid-range size that are not quite large enough to have inertia and not small enough to diffuse within the flow stream. These mid-sized particles follow the flow stream as it bends through the fiber spaces. Particles are



intercepted or captured when they touch a fiber.

The fourth method of capture is called **sieving** and is the most common mechanism in hydraulic filtration. As shown at right, this is when the particle is too large to fit between the fiber spaces.



Basic Types of Hydraulic Filter Media

Filter Media

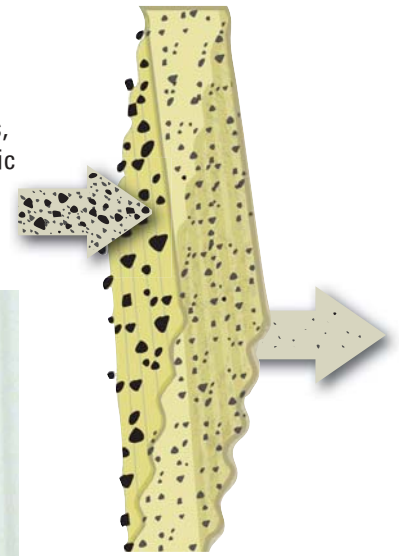
Media is a term used to describe any material used to filter particles out of a fluid flow stream. There are four basic types used to remove contamination in hydraulic applications:

Cellulose Media (Traditional)

Cellulose fibers are actually wood fibers, microscopic in size and held together by resin. Fibers are irregular in both shape and size. Cellulose often has lower beta ratings, which means there are smaller pores in the media. Smaller media pores cause more flow resistance, resulting higher pressure drop.

While cellulose provides effective filtration for a wide variety of petroleum-base fluids, in certain applications it results in poor filtration performance as compared to synthetic media.

HOW IT WORKS



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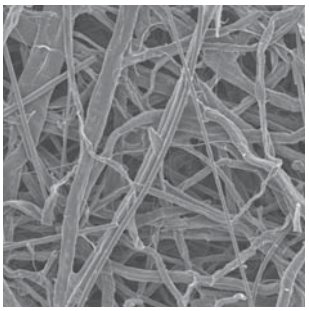
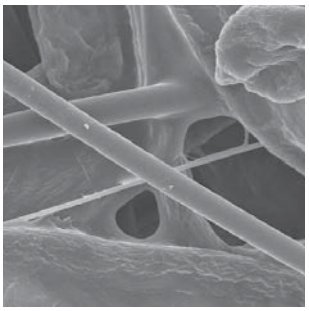


SEM 600X



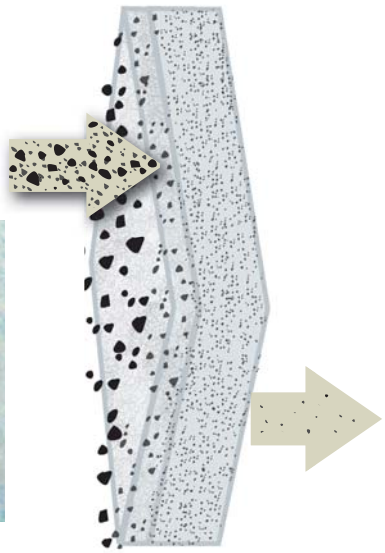
MEDIA IMAGE

Synteq™ Media (Full Synthetic)

Synthetic fibers are man-made, smooth, rounded and provide the least resistance to flow. Their consistent shape allows for control of the fiber size and distribution pattern throughout the media mat to create the smoothest, least inhibited fluid flow. Consistency of fiber shape allows the maximum amount of contaminant-catching surface area and specific pore size control. The result is media with predictable filtration efficiencies removing specified contaminants and maximum dirt holding capacity.

The low resistance of synthetic media to fluid flow makes it ideal for use with synthetic fluids, water glycols, water/oil emulsions, HWCF and petroleum-based fluids.

HOW IT WORKS



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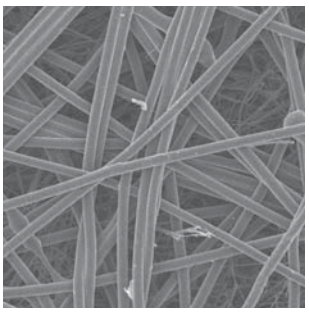

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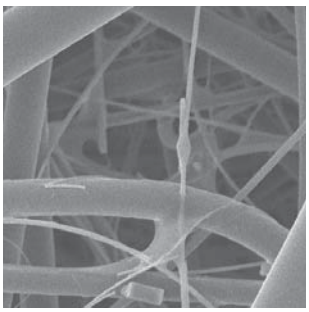


MEDIA IMAGE

Wire-Mesh Media

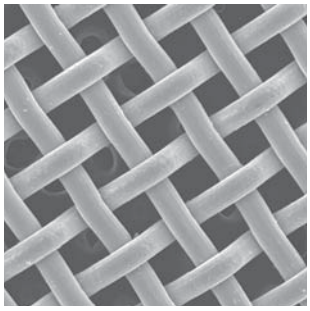
Wire-mesh media consists of stainless steel, epoxy-coated wire mesh available in 3 mesh sizes:

- 100 mesh yields 150 µm filtration
- 200 mesh yields 74 µm filtration
- 325 mesh yields 44 µm filtration

Typically wire-mesh filters will be applied to catch very large, harsh particulate that would rip up a normal filter. You may also find this media useful as a coarse filter in viscous fluid applications.

HOW IT WORKS

SEM 60X



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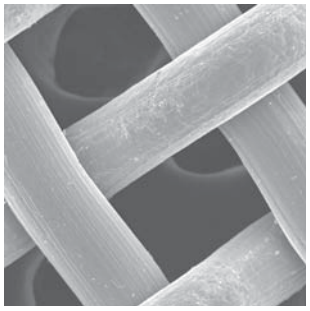

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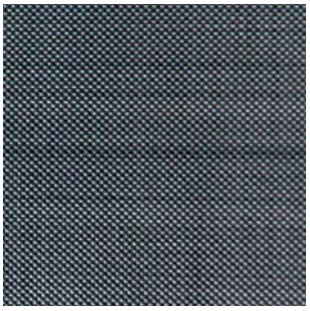
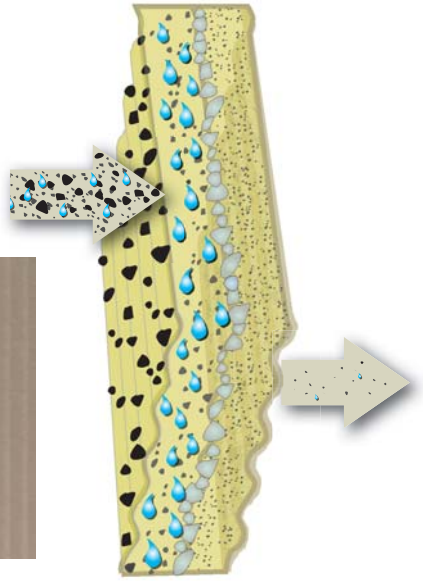


Water Absorbing Media

Water absorption media quickly and effectively removes free water from hydraulic systems. Using super-absorbent polymer technology with a high affinity for water absorption, this media alleviates many of the problems associated with water contamination found in petroleum-based fluids.

HOW IT WORKS



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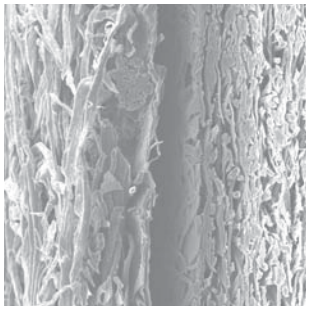

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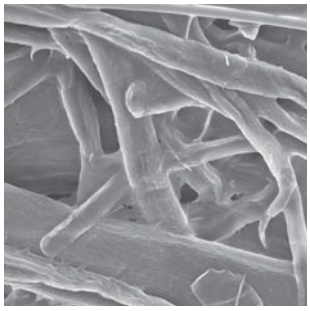


MEDIA IMAGE

Hydraulic Filtration Pressure Drop

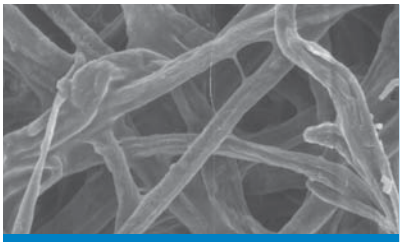
The difference between the inlet pressure and the outlet pressure is called pressure drop or differential pressure. It's symbolized by ΔP. ΔP is an irrecoverable loss of total pressure caused by the filter, and is mostly due to frictional drag on the fibers in the media.

Differential drop drop may increase as the particulate rating or efficiency of the filter (as expressed by its beta ratio) gets better. ΔP also increases as the filter is being loaded with contaminant.

Four Major Factors Contribute to Pressure Drop

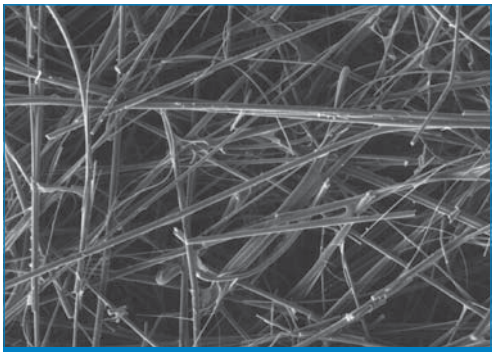
1. Filter Media

Media is, of course, the main factor influencing pressure drop; indeed, it causes pressure drop. That's why having a low-friction, high-flowing media is so important. The natural cellulose or paper fibers (shown at left) typically used in filtration are large, rough, and as irregular as nature made them.



Natural Fiber Cellulose media, as seen under the scanning electron microscope.

Donaldson developed a synthetic media with smooth, rounded fibers, consistently shaped so that we can control the fiber size and distribution pattern throughout the media mat, and still allow the smoothest, least inhibited fluid flow. Our synthetic media is named Synteq™.



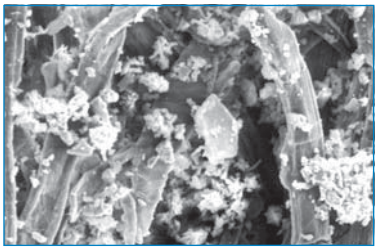
Donaldson's synthetic Synteq filter media — photo from scanning electron microscope — magnified hundreds of times.

Synteq fibers offer the least amount of resistance to fluid passing through the media. Consistency of fiber shape allows the maximum amount of contaminant-catching surface area and specific pore size control. The result is media with predictable filtration efficiencies at removing specified contaminants (i.e., 4 µm) and maximum dirt holding capacity.
Natural cellulose fibers are larger than synthetic fibers and jagged in shape, so controlling size of the pores in the media mat is difficult and there is less open volume. In most applications this results in higher ΔP as compared to synthetic filters. Higher beta ratings mean there are smaller pores in the media; smaller media pores cause more flow resistance, in turn causing higher pressure drop.

2. Dirt, Contaminant

As dirt gets caught in the media, it eventually begins to build up and fill the pore openings. As the pore openings shrink, the differential pressure (pressure drop) increases. This is called restriction. This photo from our scanning electron microscope shows actual dirt particles building up in the media pores.

Excessive dirt in the media can cause dirt migration or even filter failure. Dirt migration occurs when the restriction is so great that the differential pressure pushes dirt deeper into the media and, eventually, through the media and back into the system. Filter failure occurs when the restriction becomes so high that the filter cartridge collapses (outside-in flow) or bursts (inside-out flow) to relieve the upstream pressure.



To avoid such catastrophe, use of a filter service indicator is recommended. It measures the pressure drop across the filter, then signals when the filter is 'full' and needs to be changed.

3. Flow

Higher flows create higher pressure drop. WitH fast moving fluid, there will be more friction causing higher pressure drop across the media.

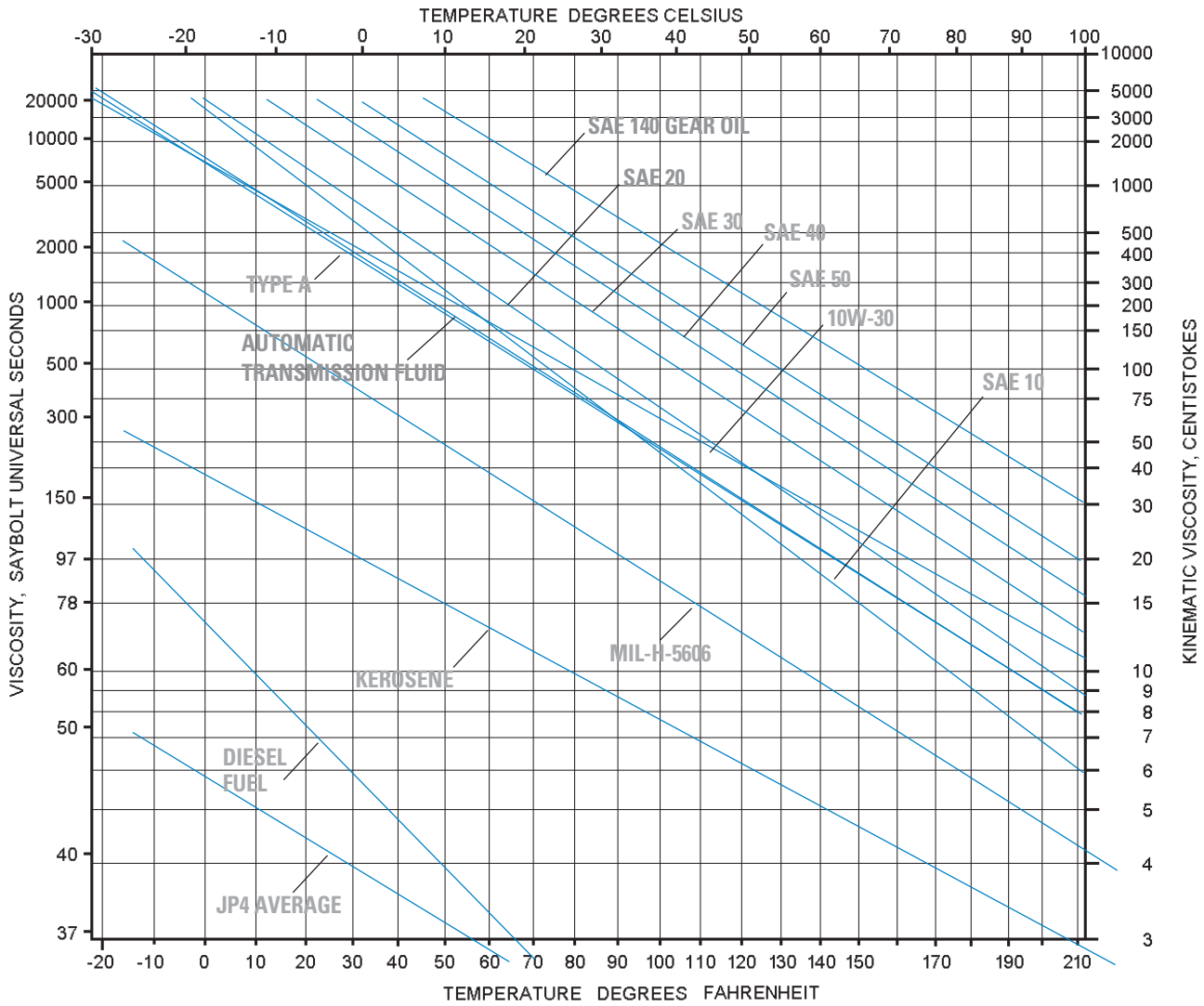
4. Fluid Viscosity

Measured in centistokes (cSt) or Saybolt Seconds Universal (SSU or SUS), fluid viscosity is the resistance of a fluid to flow. As fluid viscosity increases, the cSt rating increases. Higher fluid viscosities also mean higher pressure drop because the thicker oil has a tougher time passing through the layer of media fibers. Cold start fluid is a good example of highly viscous fluid. See chart below.

Filter media, amount of contamination, the flow rate, and fluid viscosity are all factors in the importance of sizing the filter for the system requirements. Filters that are too small won't be able to handle the system flow rate and will create excessive pressure drop from the start. The results could be filter operation in the bypass mode, filter failure, component malfunction, or catastrophic system failures. Filters that are too large for the system can be too costly. Oversized filters require more system oil and higher cost replacement filters. Optimal sizing is best.

Viscosity/Temperature Chart

A.S.T.M. Standard Viscosity-Temperature Chart for Liquid Petroleum Products (D 341-43) Saybolt Universal Viscosity



How Donaldson Displays Filter Flow versus Pressure Loss Data

Pressure Drop (ΔP) Correction Formulae

To properly calculate pressure loss for viscosity and/or specific gravity, use the filter and housing formulae below to determine the clean filter assembly pressure drop.

Filter Correction Calculation

$$\Delta P \text{ Filter} = \Delta P \text{ from graph} \times \frac{\text{New Saybolt Seconds Universal Viscosity (SSU)}}{150} \times \frac{\text{New Specific Gravity (S.G.)}}{.90}$$

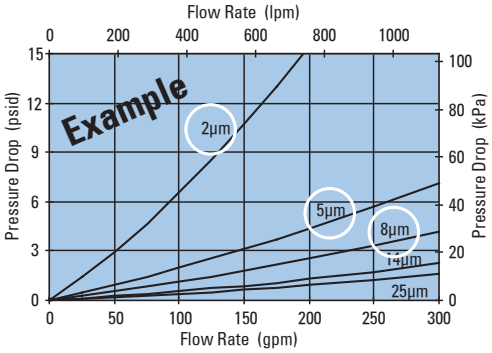
- or -

$$\Delta P \text{ Filter} = \Delta P \text{ from graph} \times \frac{\text{New Centistokes Viscosity (cSt)}}{32} \times \frac{\text{New Specific Gravity (S.G.)}}{.90}$$

Clean Filter Assembly Pressure Drop (ΔP) Calculation

ΔP Clean Filter Assembly = ΔP head + ΔP filter

Filter, Head or Housing/Assembly Reference



Performance Curve Notes

- All flow measurements were made with 32cSt [150 SSU] hydraulic oil at 100°F (37.7°C), fluid specific gravity of 0.9.
- The performance curves displayed are for the filter, head or housing assembly.
- Filter performance curves will either list media numbers or beta ratings (see circled areas on chart above). These labels correspond with the filter choice tables.

The Importance of Temperature in Determining Pressure Drop

Fluid viscosity plays an important role in restricting the flow through filters. It's crucial to select the proper filter to maintain adequate flow and avoid excessive pressure drops. Measured in centiStokes (cSt) or Saybolt Seconds Universal (SSU or SUS), fluid viscosity is the resistance of a fluid to flow (thickness of fluid). Low viscosity fluids pass through filters with less resistance than high viscosity fluids. Higher fluid viscosities have higher pressure drops due to higher resistance passing through the media. The colder the fluid, the higher the viscosity, so the lowest potential temperature of the fluid is the best measure for calculating pressure drop.

Use the chart below to determine the viscosity of the fluid to be filtered at its lowest potential temperature.

Oil Kinematic Viscosity Combined With Temperature in centiStokes (cSt)

SAE Gear Oil			75W			80W	85W	90W		140W		
Hydraulic Oil ISO Grade		15	22	32	46	68	100	150	220	320	460	680
°F	°C											
248°	120°			3.7	3.5	5.7	7.3	9.3	11.7	14.7	18.2	22.9
230°	110°			4.4	5.5	7.0	9.0	11.7	14.9	18.9	23.7	30.2
212°	100°	1	4.5	5.4	6.8	8.8	11.4	15.0	19.4	25.0	31.8	41.1
194°	90°	3	5.3	6.7	8.5	11.2	14.8	19.8	26.0	34.1	44.0	57.9
176°	80°	5	6.5	8.5	11.0	14.8	19.9	27.1	36.2	48.2	63.3	84.8
158°	70°	6.2	8.5	11.1	14.8	20.2	27.7	38.5	52.4	71.1	95.2	130
140°	60°	8	12	15.1	20.6	28.7	40.2	57.2	79.6	110	151	211
122°	50°	11	15	21.5	29.9	42.9	61.5	98.7	128	181	254	365
104°	40°	15	22	32	46	68	100	150	220	320	460	680
86°	30°	21	32	50.7	75.6	116	175	271	409	613	907	1380
68°	20°	33	51	86.7	135	214	334	536	838	1290	1980	3130
50°	10°	52	87	162	264	438	711	1190	1920	3070	4870	8020
32°	0°	85	180	340	585	1020	1720	2990	5060	8400	13900	23900
14°	-10°	185	375	820	1500	2770	4880	8890	15700	27200	47000	85000
-4°	-20°	400	800	2350	4650	9120	16800	32300	60000			

Filter Design and Construction

There are two main differences in a filter. The first is the design of the filter itself, and the second is the type of media that is used in the filter.

Filter

Filters have some attributes that are immediately obvious to the casual observer, such as height, inside diameter, outside diameter, media concentration, type of liner, seal design, and the way the media and components are glued or potted together.

Liners

Liners must be structurally sturdy to withstand pressure variance, yet open enough to allow good flow.

Seals

The top seal design must be leak-free, with a gasket or sealing device that ensures a good seal throughout the life of the filter. Standard seals are made of Buna-N® material, which is fine for most applications. However, if the filtered fluid is diester or phosphate ester fluid, you'll need a seal made of a fluoroelastomer such as Viton®.

Buna-N® and Viton® are registered trademarks of E. I. DuPont de Nemours and Company.

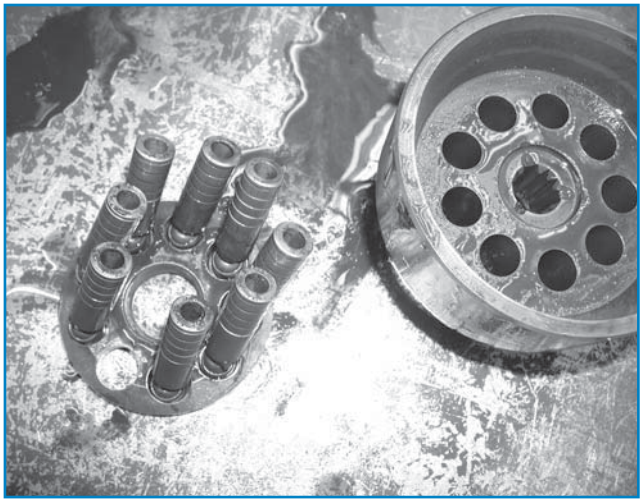
Media Potting

Media potting is key since it holds the media in place in between the end caps (not visiable). Not only should the potting be fully around the ends of the media to prevent leaks, it should also be of a material that can withstand the application. For instance, epoxy potting should be used in filters that must perform in higher temperature environments, phosphate ester fluids and some high water based fluids.

Inside the filter, the media can vary in thickness, pleat depth and pleat concentration.

For example, Donaldson hydraulic filters are generally equipped with either white ("Synteq™" our synthetic material) or natural brown (paper or cellulose material) media. **It is important to note that media colors vary according to each manufacturer – it should not be assumed that any white-colored media is made of synthetic material.**

Some of the most important characteristics of filter media (structure, fiber diameter, volume solidity, basis weight, thickness, layering) can only be detected under a microscope.



Damaged Equipment

Damage happens when key filtration points are ignored! The pistons in this pump are severely damaged from contamination in the oil.

Donaldson FILTRATION SOLUTIONS

Combining the ISO Rating and Filter Performance Ratings

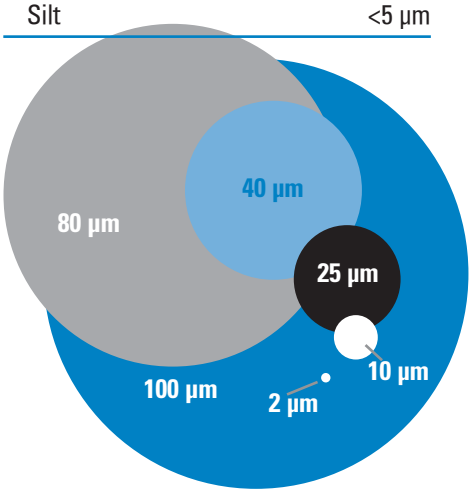
While filter manufacturers publish beta ratings for filter media to describe efficiency performance levels, a direct connection between the beta rating scale and the ISO rating scale cannot be made.

The solution is monitoring filter media performance at removing particles in the 4 µm, 6 µm, and 14 µm ranges. Fluid analysis and field monitoring are the only ways to get these measurements. Combine data from several tests to form a range of performance. Remember, actual filter performance will vary between applications.

Here's how to determine which filter media will best protect your hydraulic components: plot any media performance range on the Application Guide to Donaldson Filter Media (page 158), then connect the dots to make a line. On the same graph, plot your component requirement. (Reference chart below for some popular components, or ask your supplier for the recommended ISO rating.) If the line of the media falls below the ISO line, or if the bottom line of the filtration range does not intersect the ISO line, the component will be protected.

Micron Sizes of Familiar Particles

Grain of table salt	100 µm
Human hair	80 µm
Lower limit of visibility	40 µm
White blood cell	25 µm
Talcum powder	10 µm
Red blood cell	8 µm
Bacteria	2 µm
Silt	<5 µm



Typical ISO Cleanliness

Here are some typical ISO cleanliness recommendations from component manufacturers. (These are guidelines; always check the ratings specified by the manufacturer of your specific components.)

Pressure	<3000 PSI ≤210 Bar	>3000 PSI >210 Bar
Pumps	--- ISO RATINGS ---	
Fixed Gear Pump	19/17/15	18/16/13
Fixed Vane Pump	19/17/14	18/16/13
Fixed Piston Pump	18/16/14	17/15/13
Variable Vane Pump	18/16/14	17/15/13
Varibale Piston Pump	17/15/13	16/14/12
Valves		
Directional (solenoid)	20/18/15	19/17/14
Pressure (modulating)	19/17/14	19/17/14
Flow Controls (standard)	19/17/14	19/17/14
Check Valves	20/18/15	20/18/15
Cartridge Valves	20/18/15	19/17/14
Load-sensing Directional Valves	18/16/14	17/15/13
Proportional Pressure Controls	18/16/13	17/15/12*
Proportional Cartridge Valves	18/16/13	17/15/12*
Servo Valves	16/14/11*	15/13/10*
Actuators		
Cylinders	20/18/15	20/18/15
Vane Motors	19/17/14	18/16/13
Axial Piston Motors	18/16/13	17/15/12
Gear Motors	20/18/15	19/17/14
Radial Piston Motors	19/17/15	18/16/13

* Requires precise sampling practices to verify cleanliness levels.
Source: Vickers

Media Application Guide and ISO Rating System

The Application Guide for Donaldson Filter Media on page 158 provides a data format for rating fluid contamination level and plotting filter media performance.

The vertical numbers on the left side of the chart represent particle counts in a logarithmic progression of ten: .01, .1, 1,10, 102, 103, 104, 105 and 106. (This represents the number of particle in the oil sample at the given size.) The numbers across the bottom of the chart represent particle size in microns.

Donaldson media efficiency performance levels are derived from the ISO 16889 test standard with NIST-certified on-line automatic particle counters and ISO medium test dust. The Donaldson media efficiency performance levels shown are based on test averages under steady flow conditions. Actual performance levels may vary by application, viscosity, flow variance and contamination differences. Contact Donaldson or your Donaldson distributor for specific application calculations.
The international rating system for fluid contamination levels is called the ISO contamination code and it is detailed in the ISO 4406 document. Most component manufacturers publish filtration level recommendations using the ISO code. The ISO code, located on the right side of the media application guide on page 158, is easy to use if you remember the 4 µm, 6 µm and 14 µm numbers along the bottom of the chart.
Manufacturer's ISO contamination levels are based on controlling the particle counts of 4 µm, 6 µm and 14 µm particles in hydraulic system oil. This level is identified by measuring the number of particles 4µm and greater, 6 µm and greater, and 14 µm and greater in one milliliter of the system hydraulic oil sample.

ISO 4406 Contamination Code

Range of number of particles per milliliter:

Code	More Than	Up to & Including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	.64	1.3
6	.32	.64

How to Use the ISO Rating

Example: A cartridge valve manufacturer recommends an ISO cleanliness level of 18/16/13.

1) On the Application Guide for Donaldson Filter Media on page 158, place a dot on the vertical 4 µm line, horizontally even with the 18 box of the ISO code.

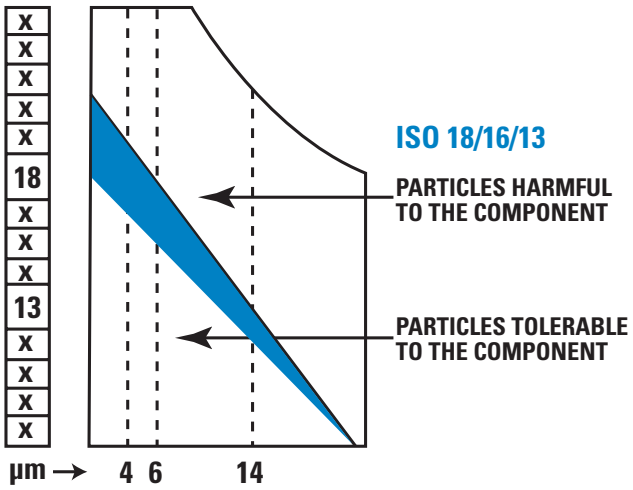
2) Place a dot on the vertical 6 µm line horizontally even with the16 box of the ISO code.

3) Place a dot on the vertical 14 µm line horizontally even with the13 box of the ISO code.

4) Connect the dots to get the ISO cleanliness level 18/16/13.

As illustrated below, particle counts falling on and above the 18/16/13 line are damaging to the component and exceed the 18/16/13 specification set by the manufacturer.

Select a Donaldson media that falls below 18/16/13 to achieve cleanliness level tolerable to the component.



Donaldson FILTRATION SOLUTIONS

Filter Efficiency Standards

Understanding the Beta Rating System

This information is provided as an aid to understanding fluid filter efficiency terminology based on current ISO, ANSI and NFPA test standards. It is not proprietary and may be reproduced or distributed in any manner for educational purposes.

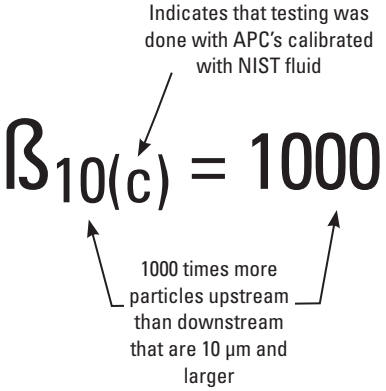
What is Beta Ratio?

Beta ratio (symbolized by ß) is a formula used to calculate the filtration efficiency of a particular fluid filter using base data obtained from multi-pass testing.

In a multi-pass test, fluid is continuously injected with a uniform amount of contaminant (i.e., ISO medium test dust), then pumped through the filter unit being tested. Filter efficiency is determined by monitoring oil contamination levels upstream and downstream of the test filter at specific times. An automatic particle counter is used to determine the contamination level. Through this process an upstream to downstream particle count ratio is developed, known as the beta ratio. The formula used to calculate the beta ratio is:

$$\text{Beta ratio}_{(x)} = \frac{\text{particle count in upstream oil*}}{\text{particle count in downstream oil*}}$$

where (x) is a given particle size
* off all particles of size x and bigger



Why the Efficiency Rating Test Standard was Updated

The International Industry Standard (ISO) for multi-pass testing provides a common testing format for filter manufacturers to rate filter performance. This standardization gives you the ability to reliably compare published filter ratings among different brands of filters.

ISO test standards were updated in 1999 to reflect the improved technology available in particle counters and other test equipment. The newer particle counters provide more precise counting and greater detail – reflecting a truer indication of filter performance.

The National Fluid Power Association (NFPA), the National Institute of Standards & Technology (NIST), and industry volunteers, including several engineers from Donaldson, helped revise the ISO standard. ISO 16889 has been in force since late 1999 and ISO 4572 is officially discontinued.

Better Test Dust

The old test dust (AC fine test dust or ACFTD) was "ball milled," which produced dust particles of varying size and shape. Particle distribution was often different from batch to batch. The accuracy of ACFTD distribution and previous APC calibration procedure was questioned by industry, due to lack of traceability and certification. ACFTD hasn't been produced since 1992.

Now, the new test dust (ISO medium test dust) is "jet milled" to produce consistent particle size, shape, and distribution from batch to batch. See dust size comparison chart below.

Liquid Automatic Particle Counters (APC's)

In the old test standard (ISO 4572), fluid samples obtained in bottles and off-line particle counting were allowed. Now, in the updated standard (ISO 16889), on-line, laser-based automatic particle counters, especially made for measuring liquids, are required and bottle counting methods are disallowed, as illustrated on next page.

Find further information on ISO 16889 at www.NFPA.com or your ISO document source. Ask for ISO/TR16386: 1999 "The Impact of Changes in ISO Fluid Power Particle Counting – Contamination Control and Filter Test Standards."

The old particle counter calibration was based on only one dimension of an irregularly-shaped particle (the longest cord). Today, the particle counter calibration is based on equivalent spherical area of an irregularly-shaped particle.

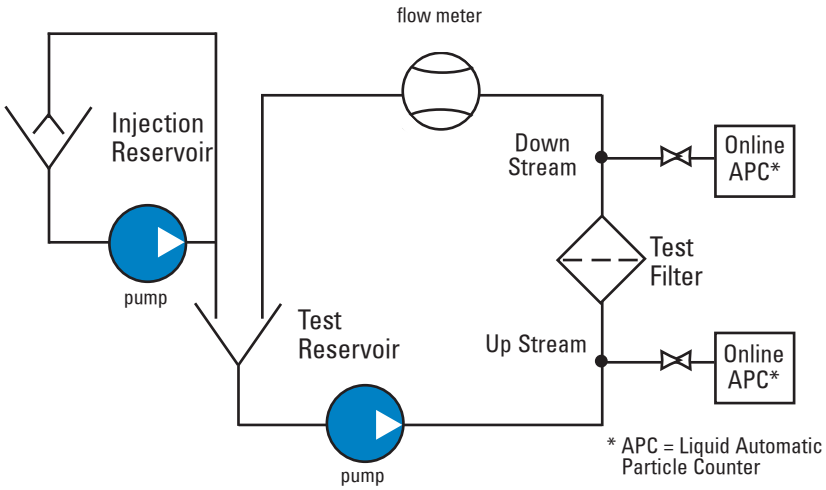
NIST provides calibration suspension, which is certified with X number of particles at a certain size. This is verified by NIST. The new way to list beta ratios includes a subscript (c) to indicate NIST certified test suspension and assures you of traceability and repeatability.

Overall, you can have strong confidence in filter ratings resulting from tests per ISO 16889, as they are highly accurate. As always, keep in mind that beta ratings are laboratory measurements under steady flow conditions with artificial contaminants – the real proof of the performance is how clean the filter keeps the fluids in the application. A good oil analysis program that checks the cleanliness of the oil periodically will verify that the proper filters are being used.

Test Dust Size Comparisons

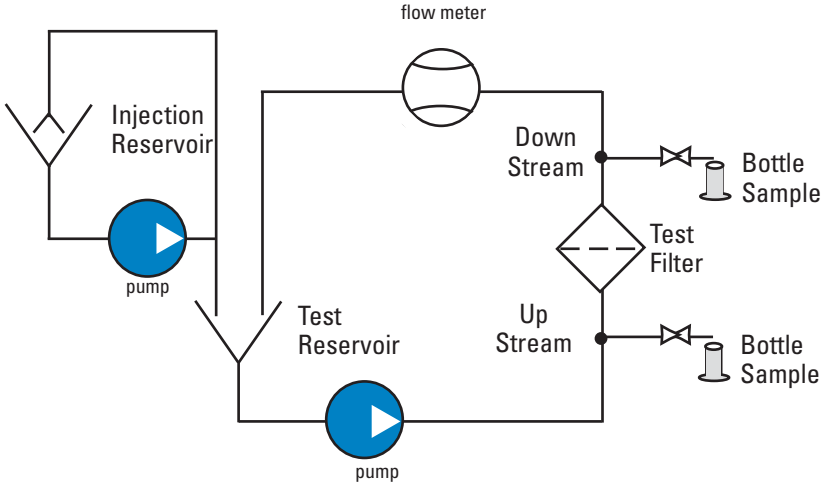
ACFTD calibrated size (µm) per ISO 4402 corresponds to a NIST-calibrated size [µm(c)] per ISO 11171

ACFTD	0.8	1	2	2.7	3	4.3	5	7	10	12	15	15.5	20	25	30	40	50
NIST	4	4.2	4.6	5	5.1	6	6.4	7.7	9.8	11.3	13.6	14	17.5	21.2	24.9	31.7	38.2



ISO 16889

- In-Line Liquid Automatic Particle Counters (APC) are now required for proper testing.
- APC calibration follows ISO 11171 procedures
- ISO 11171 uses NIST (National Institute of Standards & Technology) certified calibration fluid



ISO 4572

(Discontinued)

- Either bottle samples or APC's were allowed.
- APC calibration followed ISO4402 ACFTD (Discontinued)

Highlights of ISO 16889

- ISO 4572 is now replaced by ISO 16889 as the international standard for Multi-Pass Tests to determine the efficiency (beta rating or beta ratio) and the dirt-holding capacity of the filter.
- The test bench for ISO 16889 must have On-Line Liquid Automatic Optical Particle Counters (APC) calibrated using NIST (National Institute of Standards & Technology)-certified calibration fluid. This includes added enhancements to APC's, to allow for better resolution, accuracy, repeatability and reproducibility.
- ISO 12103-1,A3 (ISO Medium, 5µm-80µm)
- Test Dust was selected as replacement dust for calibration and testing procedures.
- APC's are calibrated by passing a sample of calibration fluid with a known particle size distribution and producing a calibration curve to match the known count distribution.
- NIST used the Scanning Electron Microscope analysis and statistical analysis techniques to certify the particle size distribution.
- Particle counts, upstream and downstream, are taken every minute of the test.
- Beta ratios are reported with (c) to designate NIST traceability.

ISO 16889 recommends reporting beta ratings at:

Rating	Efficiency
2	50%
10	90%
75	98.7%
100	99%
200	99.5%
1000	99.9%

Example: ß4(c) =200 signifies that there are 200 times as many particles that are 4 µm and larger upstream as downstream. This is 99.5% efficiency.

Example: ß5(c) =1000 indicates that there are 1000 times as many particles that are 5 µm and larger upstream as downstream. This is 99.9% efficiency.

Donaldson Hydraulic Filter Media Beta Ratings

Donaldson hydraulic filter media beta ratings are average ratings obtained from multi-pass tests performed per the new ISO 16889 standard.

According to the ISO standard, each filter manufacturer can test a given filter at a variety of flow rates and terminal pressure drop ratings that fit the application, system configuration and filter size. Your actual performance may vary depending on the configuration of the filter tested and test conditions.

NEW Donaldson Filter Media Efficiency Ratings per ISO 16889 Test Standards

Media No	Former Rating	Efficiency Rating
	Beta x µm = 2/75 per ISO 4572	**Beta x µm(c) = 200/1000 per ISO 16889**
Donaldson Synteq® XP Synthetic Media		
XP05		5/7
XP10		9/11
Donaldson Synteq® Synthetic Media		
# 7	7/22	25/33
# 20	20/40	42/>50
/00	<2/3	5/6
/03	7/22	18/23
Donaldson Cellulose Media		
# 10	10/25	19/23
/1	10/30	32/36
/3	25/45	46/>50

Cleanliness Level Correlation Table

Conversion of cleanliness specifications to filter performance is not an exact science because the contamination level in a hydraulic system is a function of the ingression and generation rate as well as the filter performance.

Factors That Affect Cleanliness Levels in a Hydraulic System

- Abrasive wear in space between adjacent moving surfaces of components.
- Erosive wear at component edges or direction changes where there is high fluid velocity.
- Fatigue wear by particles trapped between moving surfaces.

Identification of the Most Sensitive Component

- Required cleanliness level is dominated by the component with smallest clearances and/or highest loading on the lubricating film.
- Best source for determining this level is the specification published by the component manufacturer.
- Higher pressures reduce component life, unless contamination level is decreased accordingly.
- Operating at half the rated pressure of component will increase its life by more than four times.
- Percent of operating time at maximum pressure depends on individual machines and application.

ISO Code	Particles Per Milliliter >10 microns	ISO FTD* Gravimetric Level (mg/l)	Mil Std 1236A (1967)	NAS 1638 (1964)	SAE Level (1963)
30/26/23	140,000	1000			
29/25/23	85,000		1000		
26/25/20	14,000	100	700		
23/21/18	4,500			12	
2220/18	2,400		500		
22/20/17	2,300			11	
21/20/17	1,400	10			
21/19/16	1,200		10		
20/18/15	580			9	6
19/17/14	280		300	8	5
18/16/13	140	1		7	4
17/15/12	70			6	3
16/14/12	40		200		
16/14/10	35			5	2
15/13/10	14	0.1		4	1
14/12/9	9			3	0
13/11/8	5			2	
12/10/8	3		100		
12/10/7	2.3			1	
11/10/6	1.4	0.01			
11/9/6	1.2			0	
10/8/5	0.6			0	
9/7/5	0.3		50		
8/6/3	0.14	0.001			
7/5/2	0.04		25		
6/2/.8	0.01		10		

* SAE Fine Test Dust – ISO approved test and calibration contaminant.
Source: Milwaukee School of Engineering Seminar, Contamination & Filtration of Hydraulic Systems

Cleanliness Code ISO 4406: 1999	System type	Suggested Efficiency ISO 16889	Suggested media
15/13/10	servo-valves for pressure >20MPa, laboratory & aerospace	ß 2 µm(c) = 200	/00
14/16/11	high perf. & high press. long life components, i.e. small gearbox	ß 2 µm(c) = 200 ß 5 µm(c) = 200	/00 XP5
17/15/12	i.e. servo-valves, general power transmission gearbox	ß 7 µm(c) = 200	XP5
18/16/13	high quality reliable, general purpose mach., vane & piston pumps, prop. valves, large gearbox	ß 7 µm(c) = 200 ß 10 µm(c) = 200	XP5 XP10
19/17/14	gear pumps	ß 10 µm(c) = 200 ß 12 µm(c) = 200	XP10
20/18/15	mobile equipment, medium pressure i.e. motors, valves & control	ß 12 µm(c) = 200 ß15 µm(c) = 200	XP10
21/19/16	low-medium pressure systems, heavy industry, cylinders, steering unit (load sens.)	ß 15 µm(c) = 200 ß 20 µm(c) = 200	/03
22/20/17	low pressure systems	ß 25 µm(c) = 200	/03
23/21/18	low pressure systems with large clearance	ß 25 µm(c) = 200 ß 10 µm(c) = 2	/03 /1 # 10
26/24/20	low pressure systems with large clearance	ß 40 µm(c) = 200 ß 23 µm(c) = 2	/3 # 20

Compatibility of Donaldson Filter Media with Hydraulic Fluids

While Donaldson has developed many formulations of media, they can be divided into two broad categories: natural fibers, usually cellulose, and synthetic or man-made fibers.

	Recommended Filter Media		
Petroleum-Based (Hydrocarbon) Fluids	Cellulose	Synteq	DT Synteq
Straight oils	Yes	Yes	Yes
ATFs	Yes	Yes	Yes
Military hydraulic fluids	Yes	Yes	Yes
#2 Diesel fuel	Yes	Yes	Yes
Gasoline	Yes	Yes	Yes
E85 (85/15 Ethanol/Gasoline)	No	No	Yes
Fire Resistant Fluids	**Cellulose**	**Synteq**	**DT Synteq**
HFA - Oil-in-water emulsion	No	<150°F	Yes
HFB - Water-in-oil emulsion	No	<150°F	Yes
HFC - Water glycol	No	<150°F	Yes
HFD Synthetics - Polyol esters, Esters, Diesters, & blends	No	Yes	Yes
HFD Synthetics - Phosphate esters	No	No	Yes
HFD Synthetics - Polyalkylene glycols (PAG), Polyalphaolefins (PAO), & blends	No	Yes	Yes
HFD Synthetics - Silicone (siloxane) oil	No	Yes	Yes
Biodegradable Fluids	**Cellulose**	**Synteq**	**DT Synteq**
Vegetable-based oils - sunflower, rapeseed oils	No	Yes	Yes
Synthetic oils - PAG / PAO	No	Yes	Yes
Synthetic oils - Esters, Diesters	No	Yes	Yes

Threads

- Gas per ISO 228/1
- M per UNI 4534-5545
- Flange connections per SAE J518 3000 PSI or 6000 PSI
- UN-UNC-UNF-UNS per ANSI/ASME B1.1
- SAE per SAE J1926-1
- NPT per ANSI/ASME 1.20.1
- NPTF per ANSI/ASME 1.20.3

Piston Pump Damage

The severe score marks on the piston slippers leave no question about why good hydraulic filtration is important.

Donaldson
FILTRATION SOLUTIONS

FIK-FIO

Return Line Filters
Low Pressure Filters – In-Tank
up to 10 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Flange per SAE J518: 3000 PSI.

Filter Elements

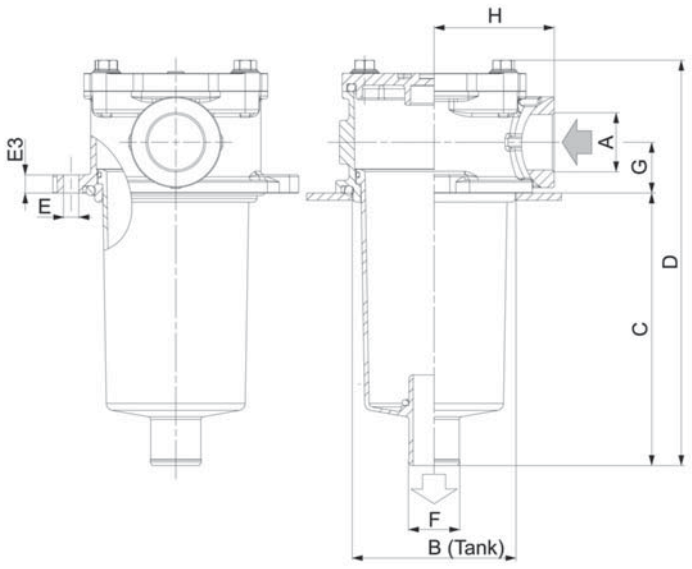
- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

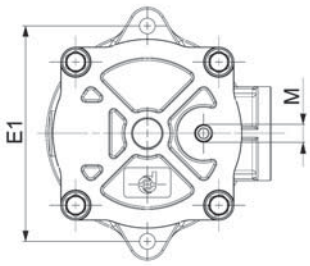
FIK-FIO

Components

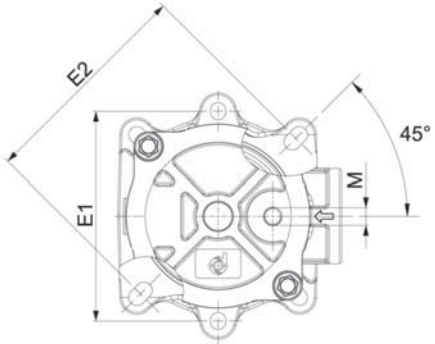
	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FIO20	20	P171500	20	P171505	15	P171504	15	P171503	10	P171502	10	P171501	CR30
FIO30	30	P171500	30	P171505	20	P171504	20	P171503	15	P171502	15	P171501	CR30
FIO50	50	P171518	50	P171523	35	P171522	35	P171521	30	P171520	30	P171519	CR50
FIO60	60	P171524	60	P171529	40	P171528	40	P171527	35	P171526	35	P171525	CR60
FIO80	80	P171530	80	P171535	55	P171534	55	P171533	50	P171532	50	P171531	CR100
FIO100	80	P171530	80	P171535	65	P171534	65	P171533	60	P171533	60	P171531	CR100
FIO140	140	P171831	140	P171834	100	P171837	100	P171840	90	P171843	90	P171846	CR150
FIO150	150	P171536	150	P171541	100	P171540	100	P171539	90	P171538	90	P171537	CR180
FIO180	180	P171536	180	P171541	120	P171540	120	P171539	110	P171538	110	P171537	CR180
FIO200	200	P171542	200	P171547	140	P171546	140	P171545	130	P171544	130	P171543	CR201
FIO250	250	P171548	250	P171553	160	P171552	160	P171551	140	P171550	140	P171549	CR250
FIO325	330	P171554	330	P171559	200	P171558	200	P171557	180	P171556	180	P171555	CR325
FIO330	330	P171560	330	P171565	200	P171564	200	P171563	180	P171562	180	P171561	CR330
FIO500	500	P171566	500	P171571	400	P171570	400	P171569	350	P171568	350	P171567	CR500
FIO600	600	P171572	600	P171577	500	P171576	500	P171575	400	P171574	400	P171573	CR600
FIOF600	600	P171572	600	P171577	500	P171576	500	P171575	400	P171574	400	P171573	CR600
FIO800	800	P171578	800	P171583	600	P171582	600	P171581	500	P171580	500	P171579	CR800
FIOF800	800	P171578	800	P171583	600	P171582	600	P171581	500	P171580	500	P171579	CR800

RMF = Recommended Maximum Flow in liters/minute with use of standard housing
Maintain the filter outlet (ref. diameter F) well below the oil level to avoid foam formation.





FIO 20-30

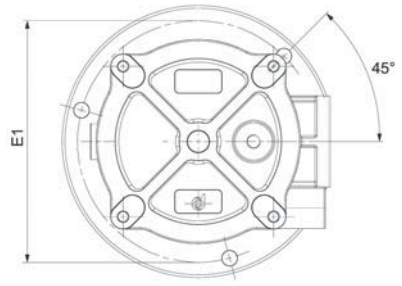


FIO 50-140

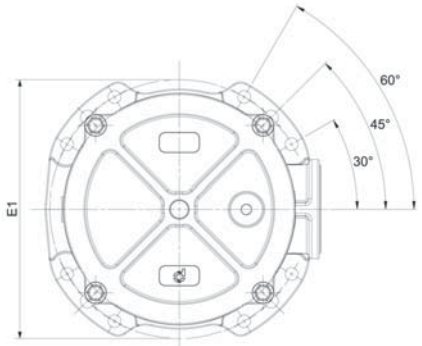
Donaldson FILTRATION SOLUTIONS

FIK-FIO

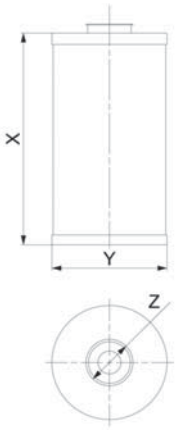
Standard Housing without Cartridge	HOUSING DIMENSIONS															CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	E1	E2	E3	F	G	H	V	W	T	M	N	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		predrilled holes	plugged	mm	mm	mm	
P766446	G3/8	67	78	132	6,4	90		9	25	22	49				G1/8	yes	67	52	25.5	P171953 P171958 P171966 P173104
P766447	G1/2	67	78	132	6,4	90		9	25	22	49				G1/8	yes	67	52	25.5	
P766448	G1/2	90	100	172	8,4	115	126	10	28	28	66				G1/8	yes	75	70	29	
P766449	G3/4	90	100	172	8,4	115	126	10	28	28	66				G1/8	yes	82	70	29	
P766450	G3/4	90	150	222	8,4	115	126	10	28	28	66				G1/8	yes	128	70	29	
P766451	G1	90	150	222	10,5	115	126	10	28	28	66				G1/8	yes	128	70	29	
P766675	G1	90	234	307	8,5	115	126	10	40	29,5	67,7				G1/8	yes	209	70	42	
P766452	G1	130	224	314	10,5	175		10	40	35	95				G1/8	yes	203	95	41	
P766453	G1 1/4	130	224	314	10,5	175		10	40	35	95				G1/8	yes	203	95	41	
P766454	G1 1/4	130	278	368	10,5	175		10	40	35	95				G1/8	yes	250	95	41	
P766455	G1 1/2	174	167	273	10,5	220		10	50	41	120				G1/8	yes	136	140	52	
P766456	G1 1/2	174	242	248	10,5	220		10	50	41	120				G1/8	yes	203	140	52	
P766457	G1 1/2	174	240	346	10,5	220		10	63,5	41	120				G1/8	yes	203	140	65	
P766458	G2	174	240	346	10,5	220		10	63,5	41	120				G1/8	yes	203	140	65	
P766459	G2	174	294	400	10,5	220		10	63,5	41	120				G1/8	yes	250	140	65	
P766460	Flange 2"	174	290	395,5	10,5	220		11	63,5	48,5	120	77,8	42,9	M12	G1/8	yes	250	140	65	
P766461	G2	174	437	543	10,5	220		10	63,5	41	120				G1/8	yes	400	140	65	
P766462	Flange 2"	174	433	538	10,5	220		11	63,5	48,5	120	77,8	42,9	M12	G1/8	yes	400	140	65	

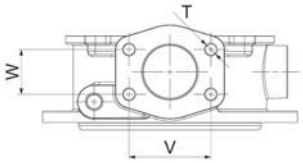


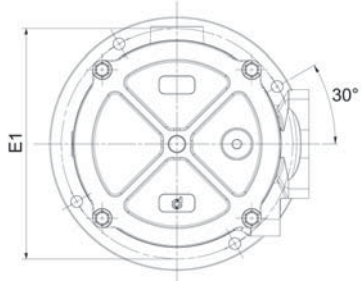
FIO 150-200



FIO 250-800







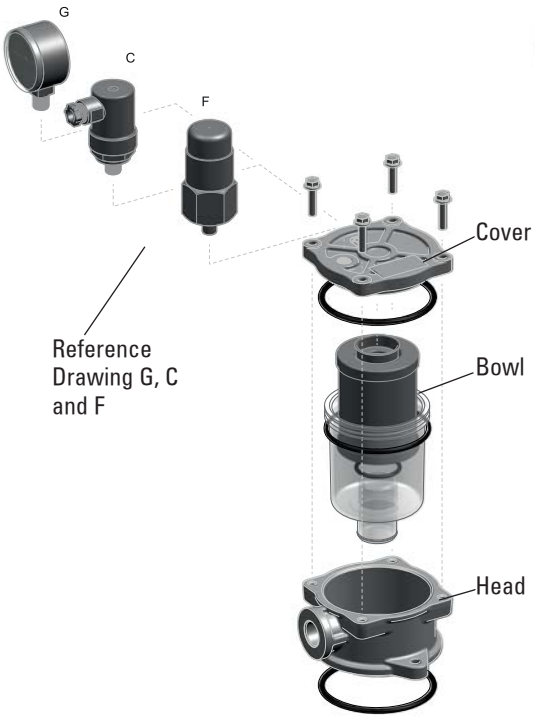
FIOF 600-800

FIK-FIO

Indicator Choices

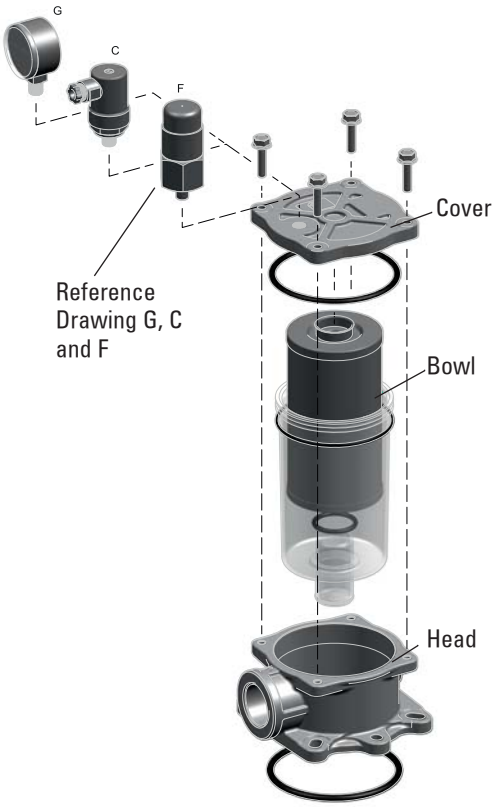
Indicator	Kind	Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171966	Electrical	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P171958	Visual	F	1,2				
P171953	Visual	G	range -1/5				

Installation & Service Guidelines

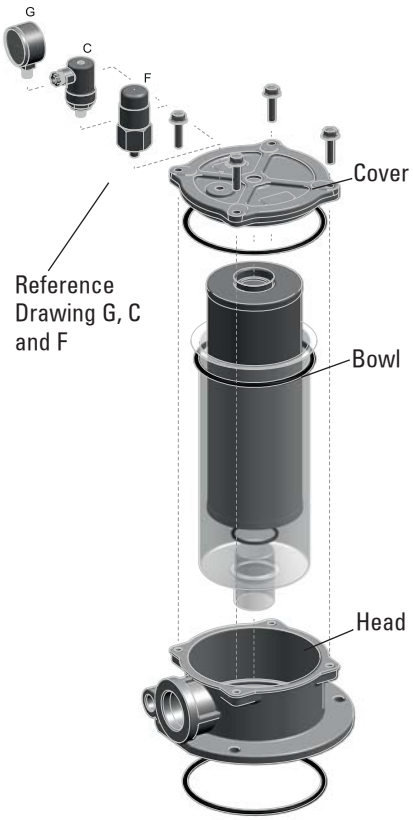


Important
- Oil the O-Rings before assembly.

FIO 20-30



FIO 50-140

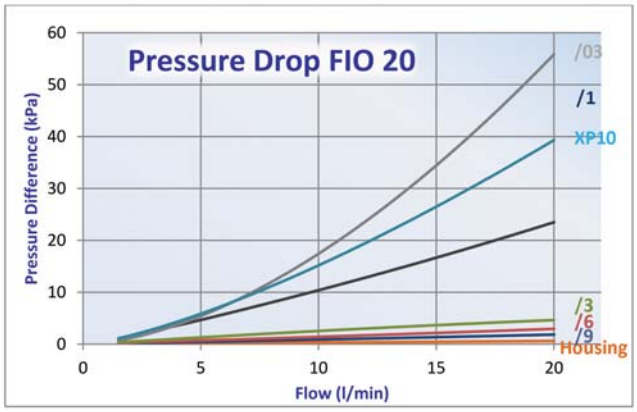


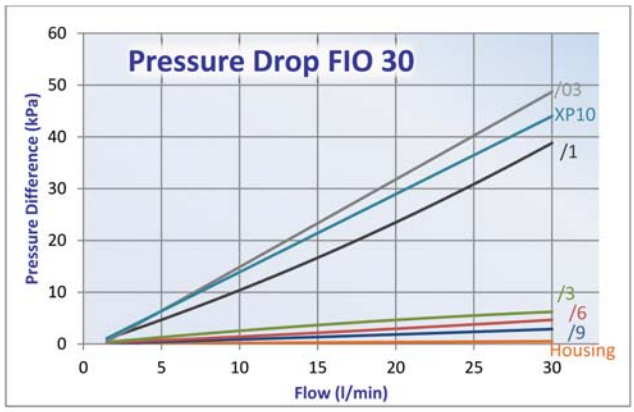
FIO 150-800

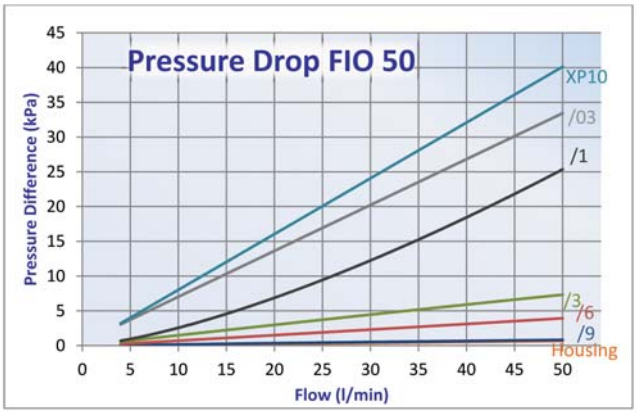
Donaldson FILTRATION SOLUTIONS

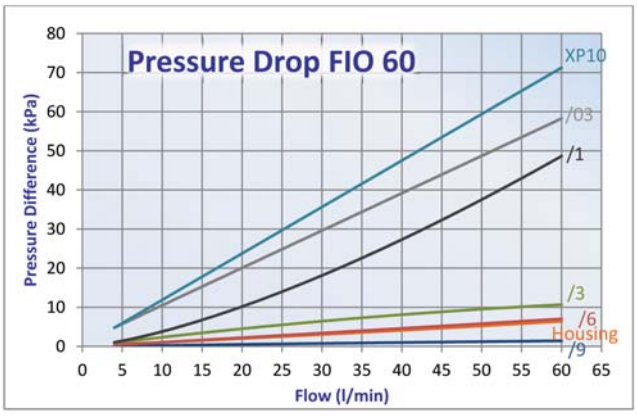
FIK-FIO

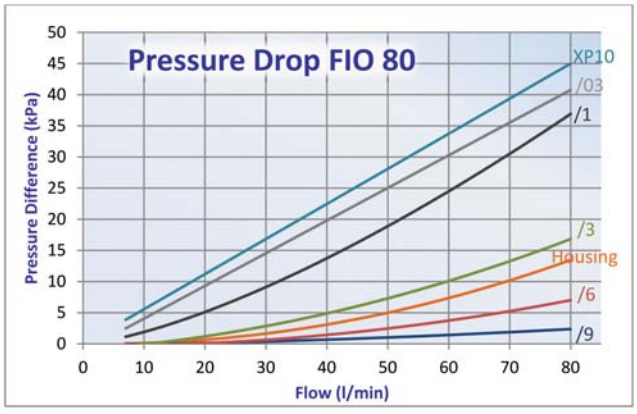
Performance Curves

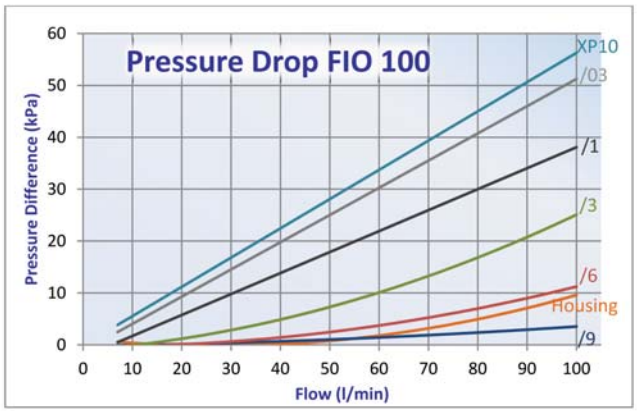


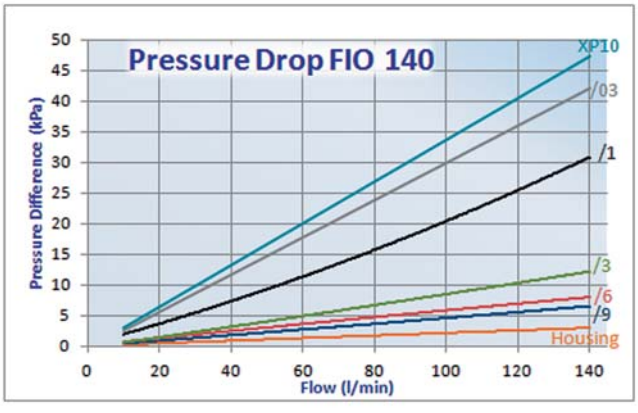


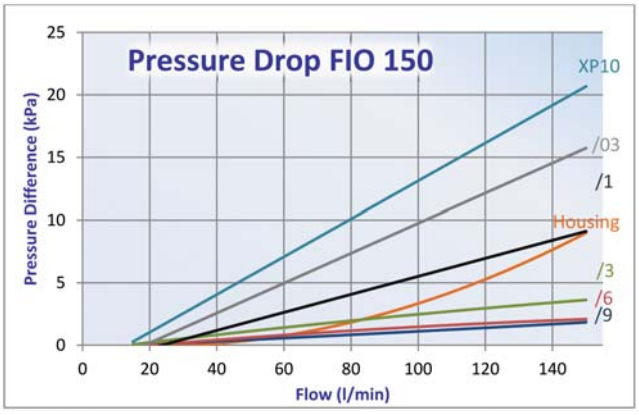












FIK-FIO

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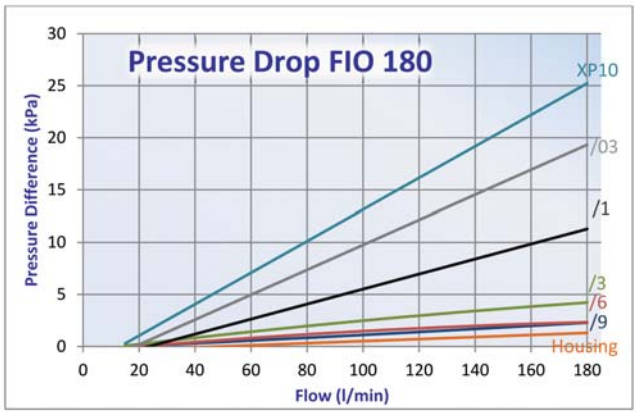
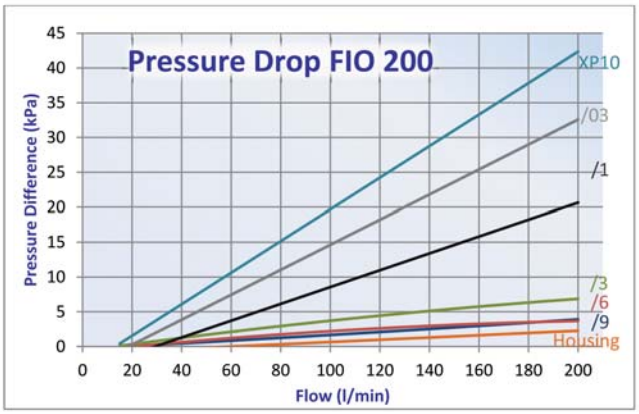
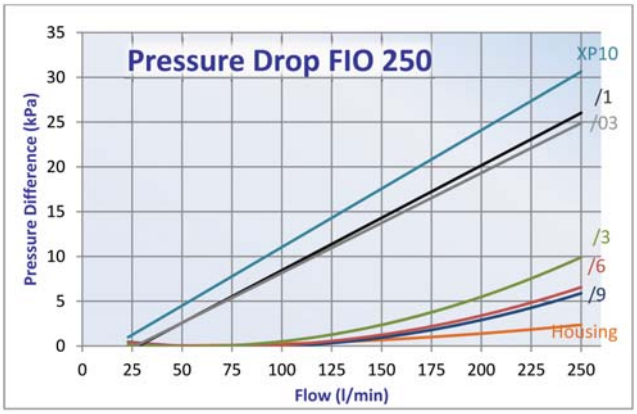
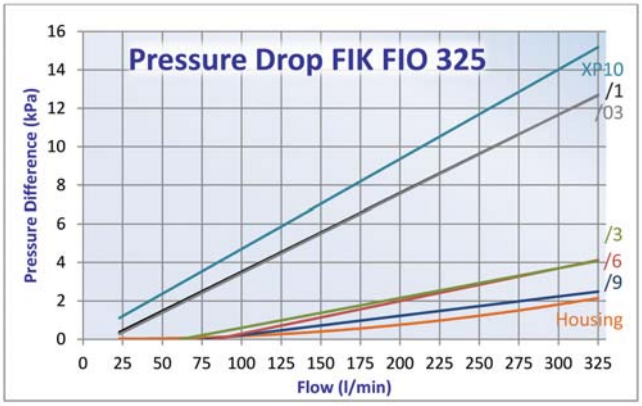
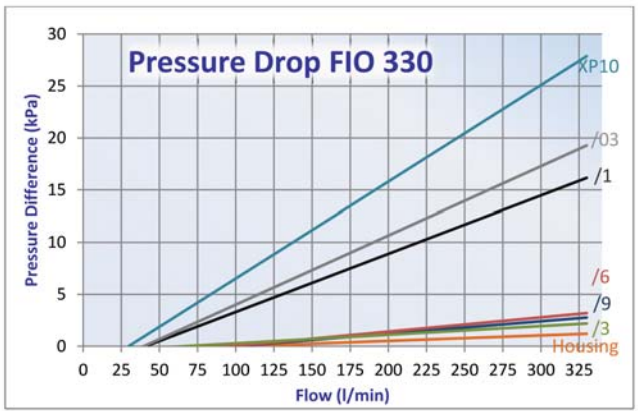
FILTRATION SOLUTIONS

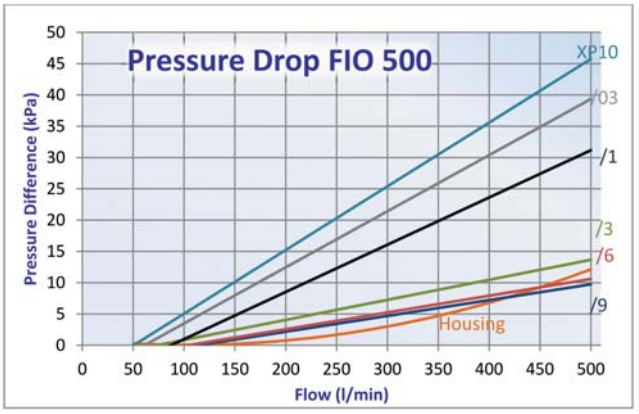


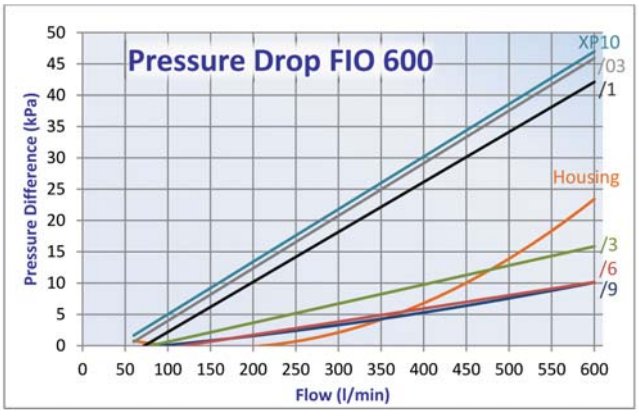


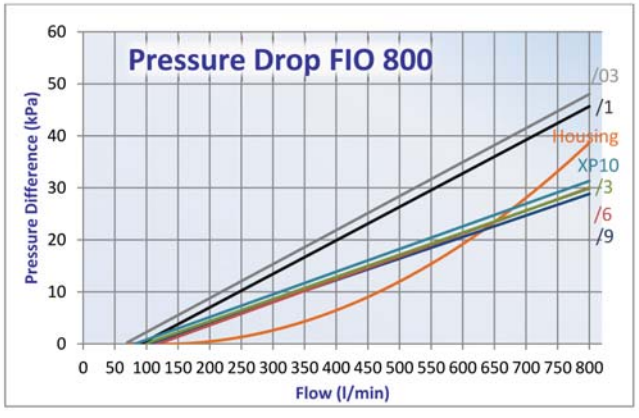






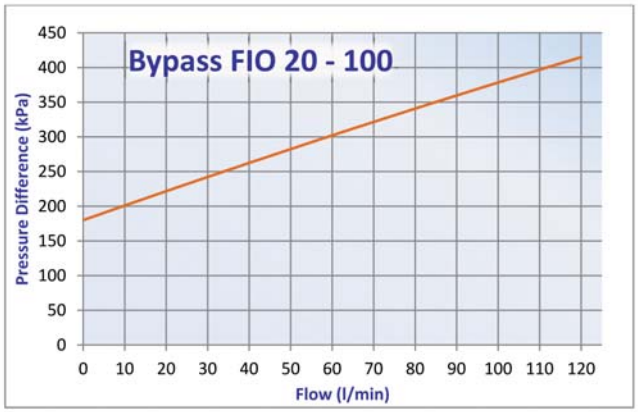


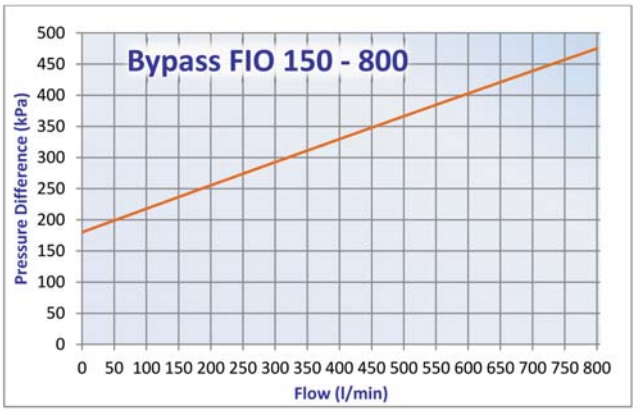




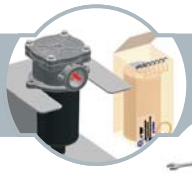
Donaldson FILTRATION SOLUTIONS

FIK-FIO





FIK-FIO(T)
FHK-FIR
SRK-Combo
200 + 300



Open empty housing
in correct order

Remove carton ring
before use

Check if O-ring between
lid and housing is installed and intact

Check if O-Ring on cartridge is installed and
intact

For FIK:
Mount O-ring over stud

For Low Pressure cartridges:
Mount spring on cartridge

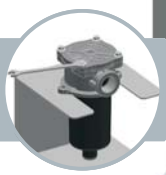
Mount element in
housing

For Combo 120:
Align arrows as shown

Assemble lid on housing

Assemble bolts and
screws in correct order

Tighten screws, bolts or lid until thread ends
For spin-ons: hand tighten until contact
between O-ring and head is made; and then
continue by hand as indicated on spin-on



Degrease surface where sparepart sticker
will be mounted
Only for cartridge type filters

Sparepart sticker in each sparepart box

Fix sparepart sticker in area indicated –
Ready!

Do not forget seals

Donaldson
FILTRATION SOLUTIONS

FIK-FIOT

Return Line Filters
Low Pressure Filters – In-Tank
up to 10 bar

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Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Flange per SAE J518: 3000 PSI.

Filter Elements

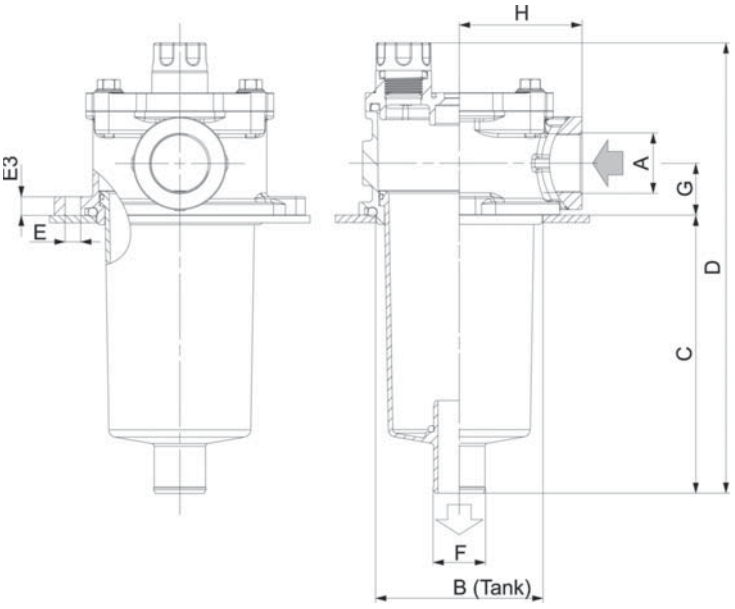
- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

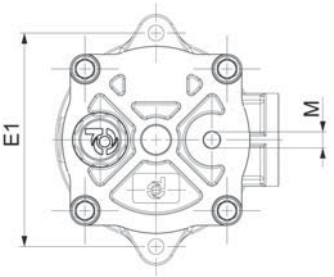
FIK-FIOT

Components

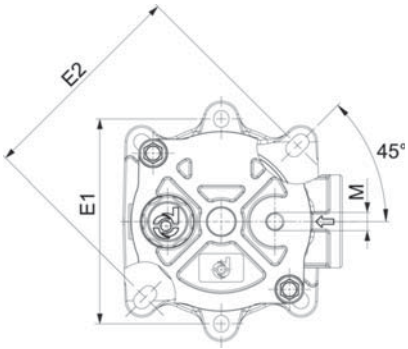
	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FIOT20	20	P171500	20	P171505	15	P171504	15	P171503	10	P171502	10	P171501	CR30
FIOT30	30	P171500	30	P171505	20	P171504	20	P171503	15	P171502	15	P171501	CR30
FIOT50	50	P171518	50	P171523	35	P171522	35	P171521	30	P171520	30	P171519	CR50
FIOT60	60	P171524	60	P171529	40	P171528	40	P171527	35	P171526	35	P171525	CR60
FIOT80	80	P171530	80	P171535	55	P171534	55	P171533	50	P171532	50	P171531	CR100
FIOT100	100	P171530	100	P171535	65	P171534	65	P171533	60	P171532	60	P171531	CR100
FIOT140	140	P171831	140	P171834	100	P171837	100	P171840	60	P171843	60	P171846	CR150
FIOT150	150	P171536	150	P171541	100	P171540	100	P171539	90	P171538	90	P171537	CR180
FIOT180	180	P171536	180	P171541	120	P171540	120	P171539	110	P171538	110	P171537	CR180
FIOT200	200	P171542	200	P171547	140	P171546	140	P171545	130	P171544	130	P171543	CR201
FIOT250	250	P171548	250	P171553	160	P171552	160	P171551	140	P171550	140	P171549	CR250
FIOT325	330	P171554	330	P171559	200	P171558	200	P171557	180	P171556	180	P171555	CR325
FIOT330	330	P171560	330	P171565	200	P171564	200	P171563	180	P171562	180	P171561	CR330
FIOT500	500	P171566	500	P171571	400	P171570	400	P171569	350	P171568	350	P171567	CR500
FIOT600	600	P171572	600	P171577	500	P171576	500	P171575	400	P171574	400	P171573	CR600
FIOTF600	600	P171572	600	P171577	500	P171576	500	P171575	400	P171574	400	P171573	CR600
FIOT800	800	P171578	800	P171583	600	P171582	600	P171581	500	P171580	500	P171579	CR800
FIOTF800	800	P171578	800	P171583	600	P171582	600	P171581	500	P171580	500	P171579	CR800

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
Maintain the filter outlet (ref. diameter F) well below the oil level to avoid foam formation.





FIOT 20-30

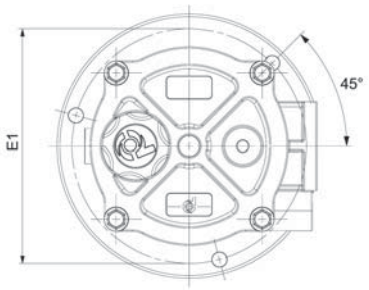


FIOT 50-140

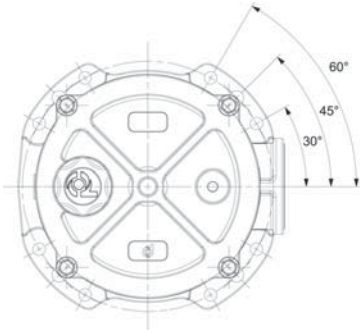
Donaldson FILTRATION SOLUTIONS

FIK-FIOT

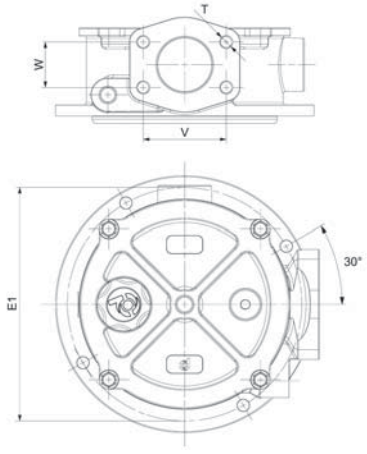
Standard Housing without Catridge	HOUSING DIMENSIONS																CARTRIDGE ELEMENT			POSSIBLE INDICA-TOR
	A	B	C	D	E	E1	E2	E3	F	G	H	M	N	V	W	T	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	predrilled holes	plugged	mm	mm		mm	mm	mm	
P766463	G3/8	69	78	132	6,4	90		9	25	22	49	G1/8	yes				67	52	25,5	P171953 P171958 P171966 P173104
P766464	G1/2	69	78	132	6,4	90		9	25	22	49	G1/8	yes				67	52	25,5	
P766465	G1/2	92	100	172	8,4	115	126	10	28	28	66	G1/8	yes				75	70	29	
P766466	G3/4	92	100	172	8,4	115	126	10	28	28	66	G1/8	yes				82	70	29	
P766467	G3/4	92	150	222	8,4	115	126	10	28	28	66	G1/8	yes				128	70	29	
P766468	G1	92	150	222	8,4	115	126	10	28	28	66	G1/8	yes				128	70	29	
P766674	G1	92	226	320	8,5	115	126	10	40	29,5	67,7	G1/8	yes				209	70	42	
P766469	G1	132	224	314	10,5	175		10	40	35	95	G1/8	yes				203	95	41	
P766470	G1 1/4	132	224	314	10,5	175		10	40	35	95	G1/8	yes				203	95	41	
P766471	G1 1/4	132	278	368	10,5	175		10	40	35	95	G1/8	yes				250	95	41	
P766472	G1 1/2	176	167	273	10,5	220		10	50	41	120	G1/8	yes				136	140	52	
P766473	G1 1/2	176	242	348	10,5	220		10	50	41	120	G1/8	yes				203	140	52	
P766474	G1 1/2	176	240	346	10,5	220		10	63,5	41	120	G1/8	yes				203	140	65	
P766475	G2	176	240	346	10,5	220		10	63,5	41	120	G1/8	yes				203	140	65	
P766476	G2	176	294	400	10,5	220		10	63,5	41	120	G1/8	yes				250	140	65	
P766477	Flange 2	176	290	395,5	10,5	220		11	63,5	48,5	120	G1/8	yes	77,8	42,9	M12	250	140	65	
P766478	G2	176	437	543	10,5	220		10	63,5	41	120	G1/8	yes				400	140	65	
P766479	Flange 2	176	433	538	10,5	220		11	63,5	48,5	120	G1/8	yes	77,8	42,9	M12	400	140	65	



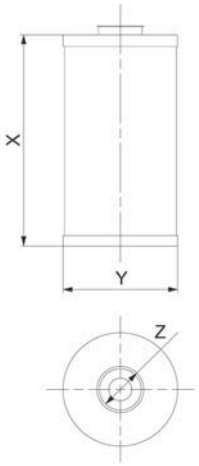
FIOT 150-200



FIOT 250-800



FIOTF 600-800

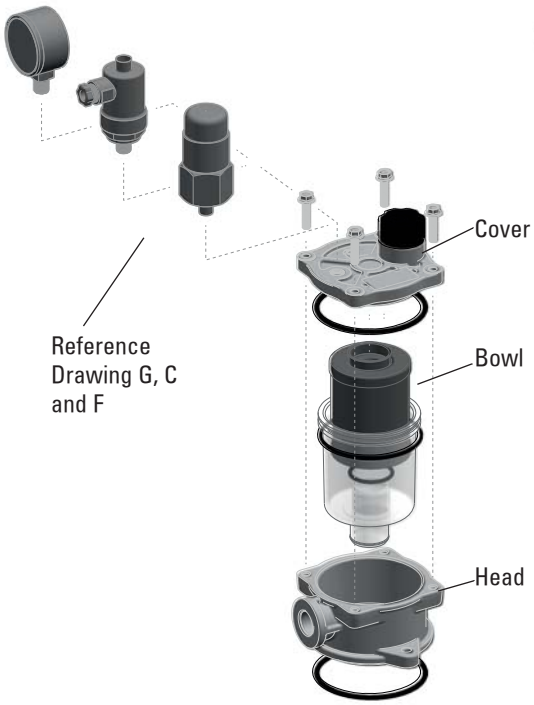


FIK-FIOT

Indicator Choices

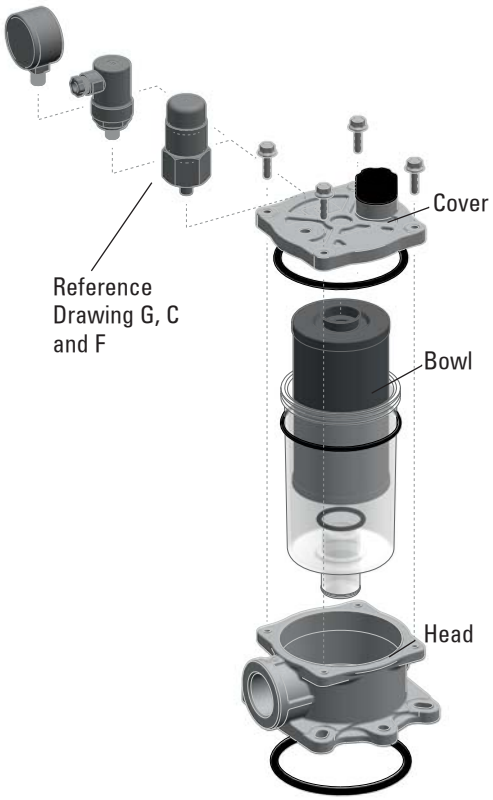
Indicator	Kind	Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171966	Electrical	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P171958	Visual	F	1,2				
P171953	Visual	G	range -1/5				

Installation & Service Guidelines

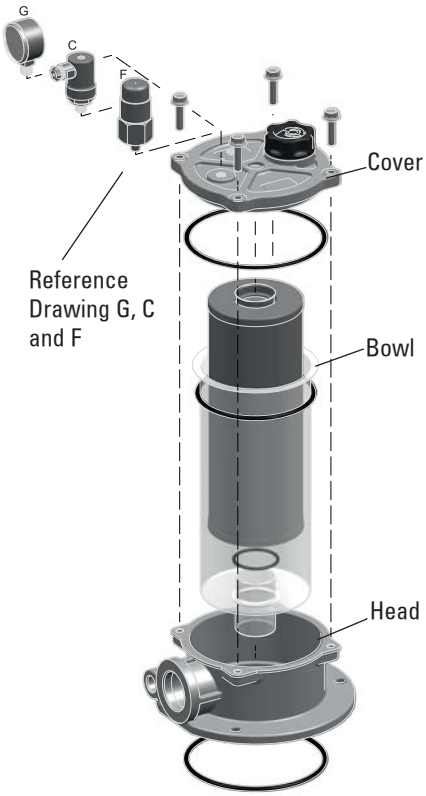


Important
- Oil the O-Rings before assembly.

FIOT 20-30



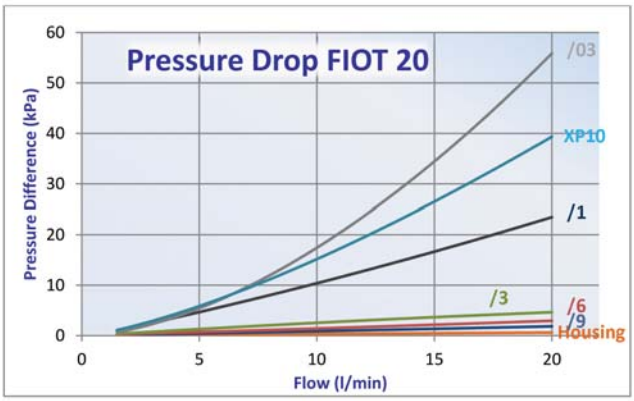
FIOT 50-140

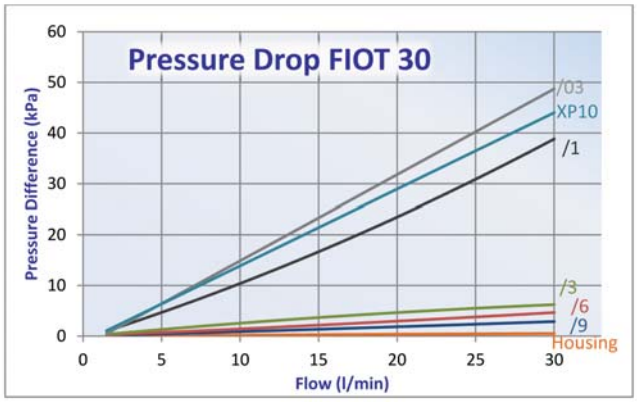


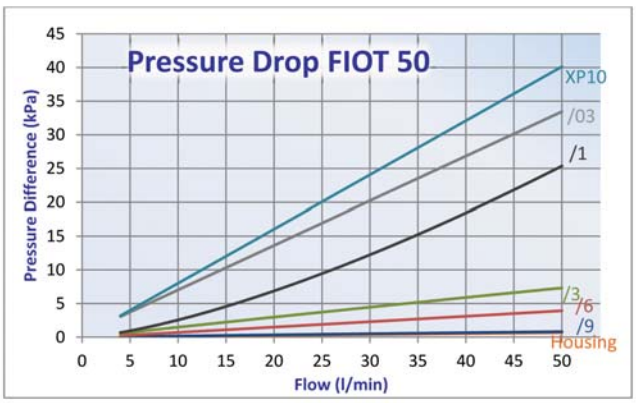
FIOT 150-800

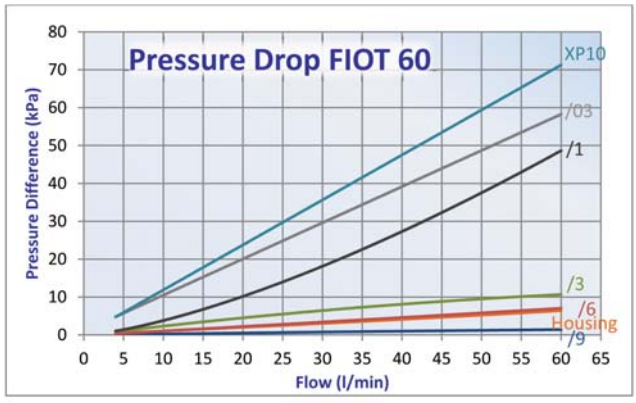
Donaldson FILTRATION SOLUTIONS

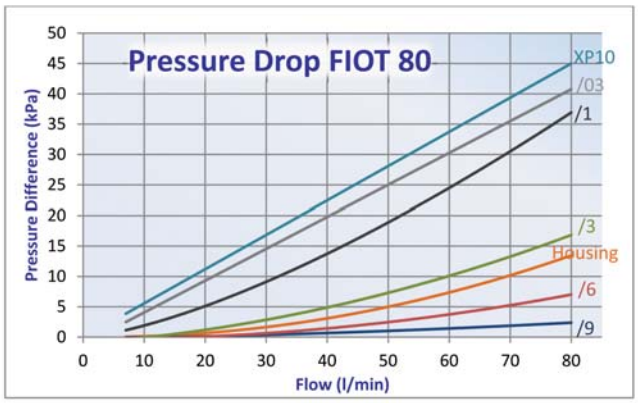
Performance Curves

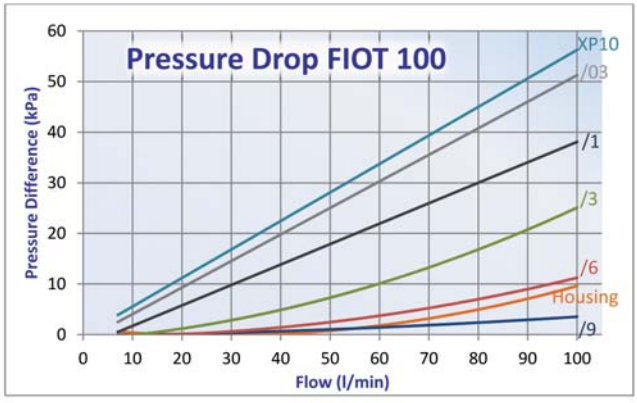


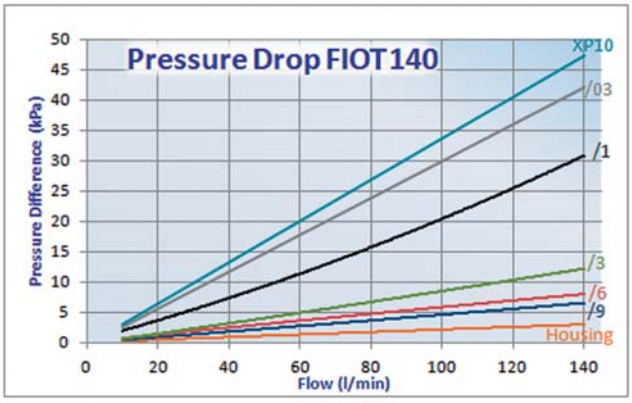


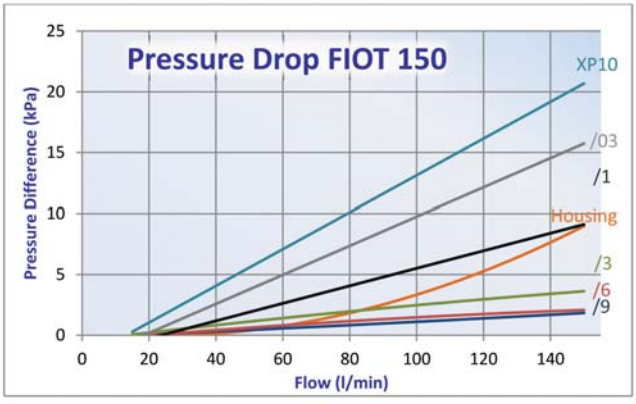




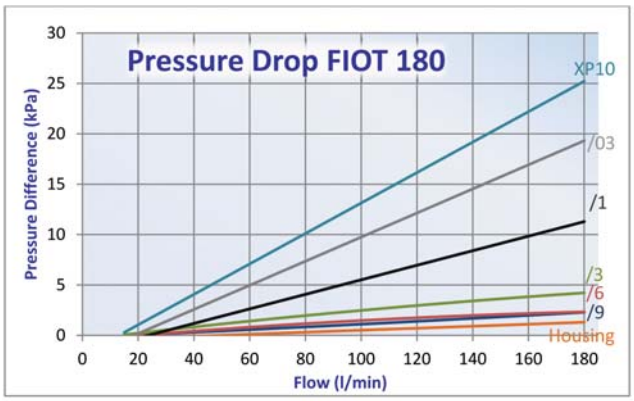


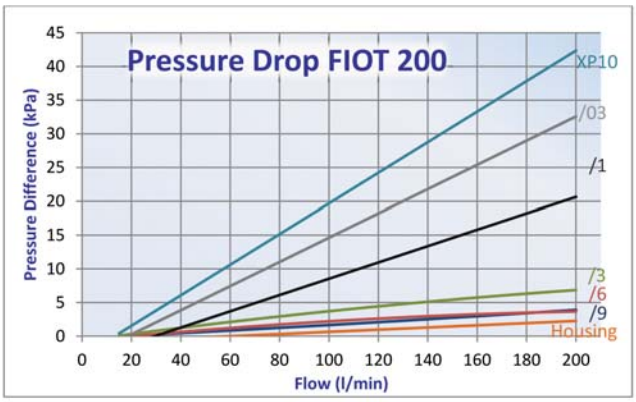


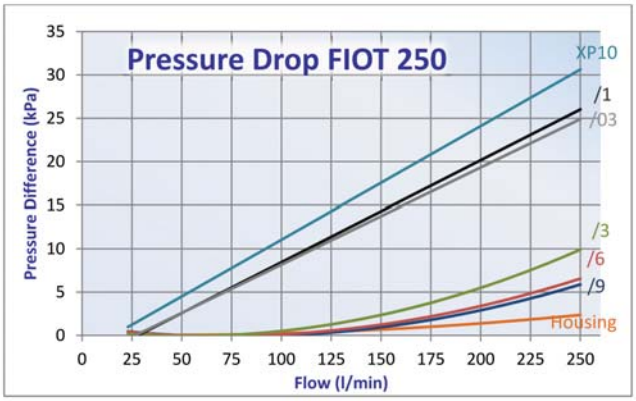


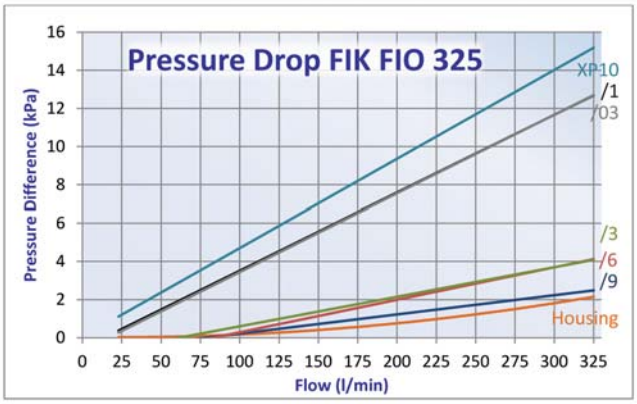


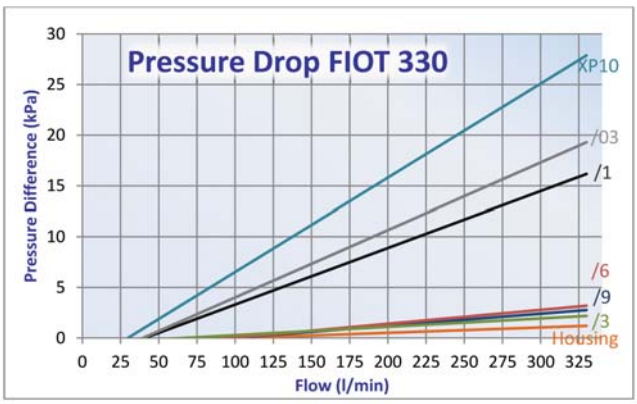
FIK-FIOT

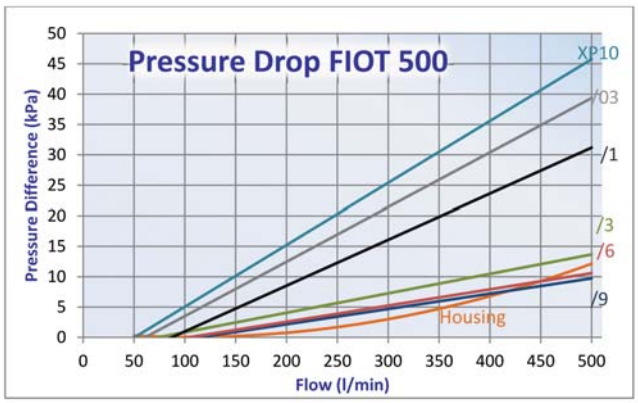

Pressure Drop FIOT 180
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
/3
/6
/9
Housing


Pressure Drop FIOT 200
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
/3
/6
/9
Housing


Pressure Drop FIOT 250
Pressure Difference (kPa)
Flow (l/min)
XP10
/1
/03
/3
/6
/9
Housing


Pressure Drop FIK FIO 325
Pressure Difference (kPa)
Flow (l/min)
XP10
/1
/03
/3
/6
/9
Housing


Pressure Drop FIOT 330
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
/6
/9
/3
Housing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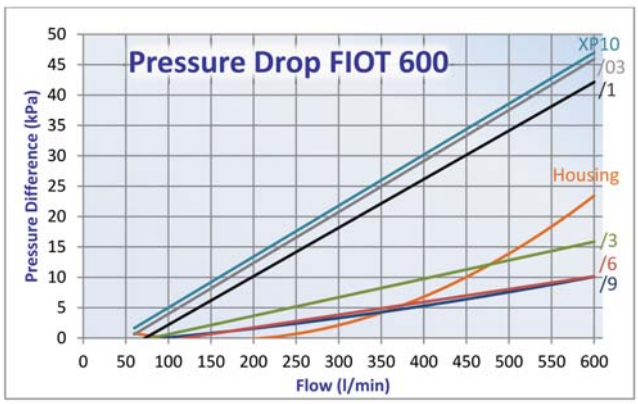
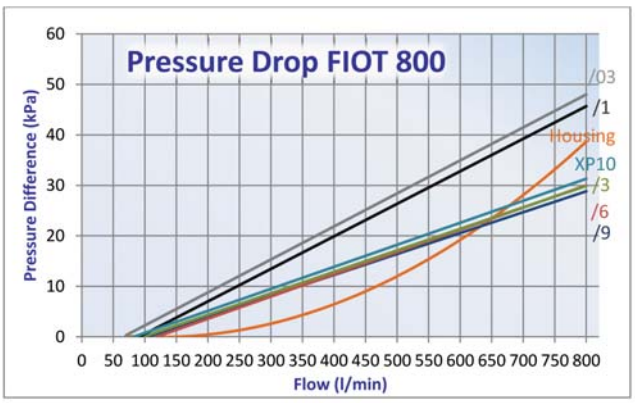
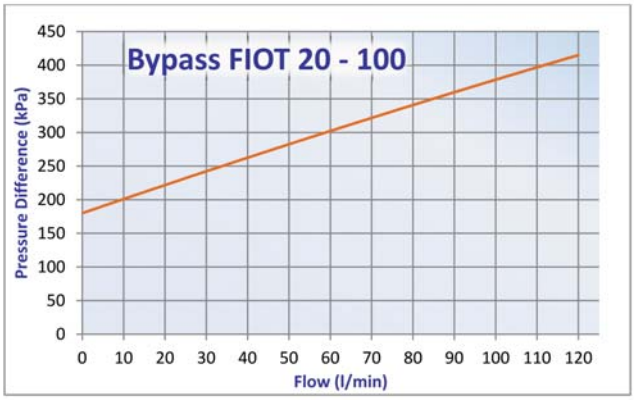
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
/3
/6
/9
Housing

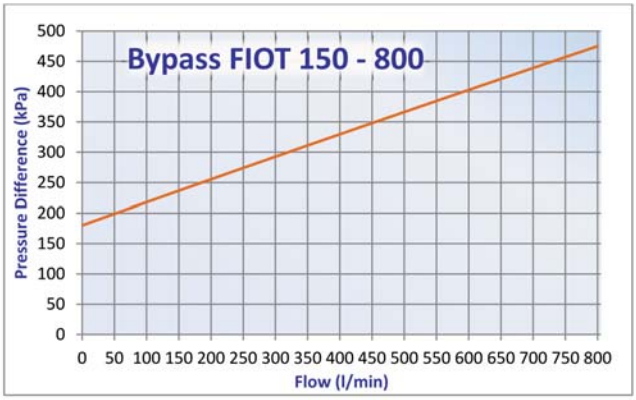

Pressure Drop FIOT 600
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
Housing
/3
/6
/9


Pressure Drop FIOT 800
Pressure Difference (kPa)
Flow (l/min)
/03
/1
Housing
XP10
/3
/6
/9

Donaldson FILTRATION SOLUTIONS

FIK-FIOT





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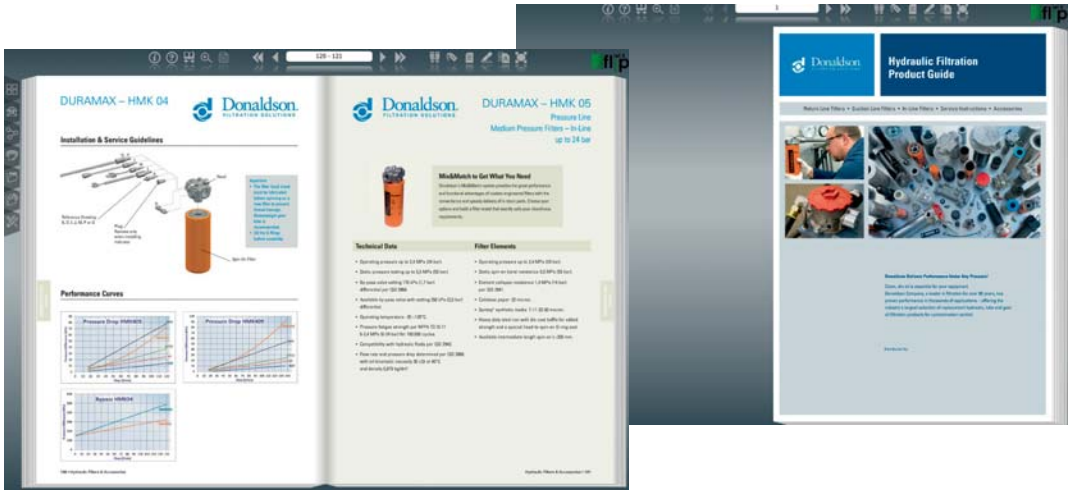

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Donaldson
FILTRATION SOLUTIONS

FIK-FIS

Return Line Filters
Low Pressure Filters – In-Tank
with Service Cover and Breather
up to 10 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

FIK-FIS

Components

	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FIS20	20	P171829	20	P171832	15	P171835	15	P171838	10	P171841	10	P171844	CR20
FIS40	40	P171830	40	P171833	30	P171836	30	P171839	25	P171842	25	P171845	CR40
FIS50	40	P171830	40	P171833	30	P171836	30	P171839	25	P171842	25	P171845	CR50
FIS60	60	P171524	60	P171529	40	P171528	40	P171527	35	P171526	35	P171525	CR60
FIS100	100	P171530	100	P171535	65	P171534	65	P171533	60	P171532	60	P171531	CR100
FIS150	150	P171831	150	P171834	120	P171837	120	P171840	110	P171843	110	P171846	CR150
FIS200	200	P766606	200	P766607	150	P766608	150	P766609	130	P766610	130	P766611	CR200

RESTYLED

NEW

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
S= Service Clearance
Maintain the filter outlet (ref. diameter G) well below the oil level to avoid foam formation.

Breather Choices

	NO MEDIA	CELLULOSE MEDIA				REMARK
		Without pressurization		With pressurization relief setpoint at 0.4 bar		
	closes of breather hole	10µm		10µm		
Family		RMF		RMF		
FIS20, 40, 50	P766927 (plug)	150	P567392 (black)	150	not available	Breather with T.R.A.P.™ Technology
FIS60, 100, 150, 200	P766528 (black)	150	P766530 (blue)	150	P766538 (red)	Breather with T.R.A.P.™ Technology

The head is open, to avoid contamination entering the tank, you have to install a breather.

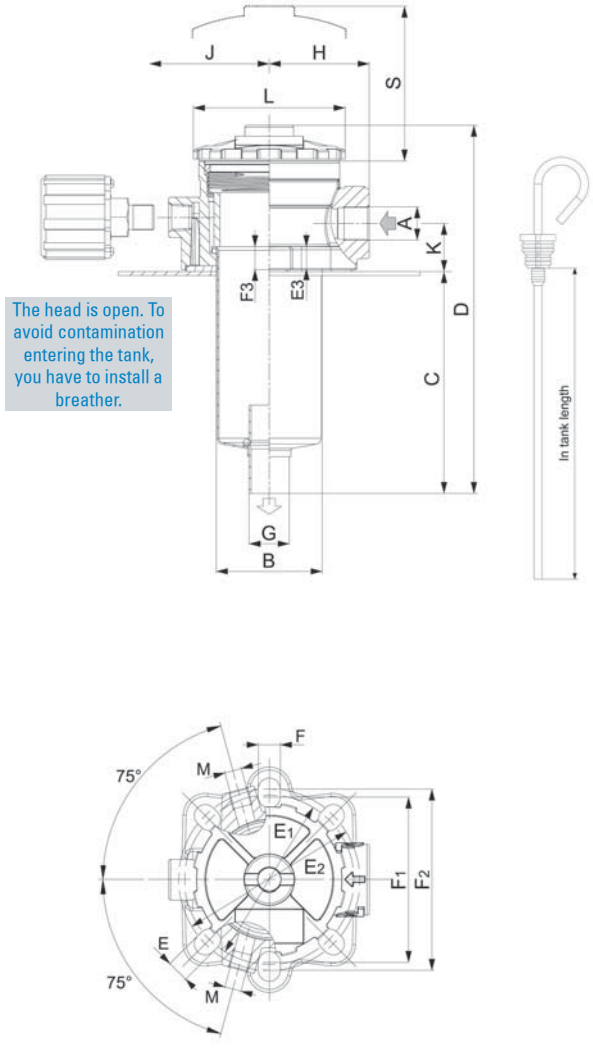
Dipstick Choices

For Family	DIPSTICK	IN TANK LENGTH	USE HOLE DIAMETER
FIS20	P766623	138	M10
FIS40, 50	P766624	293	M10
FIS60, 100	P766552	150	E or F
FIS150, 200	P766621	305	E or F

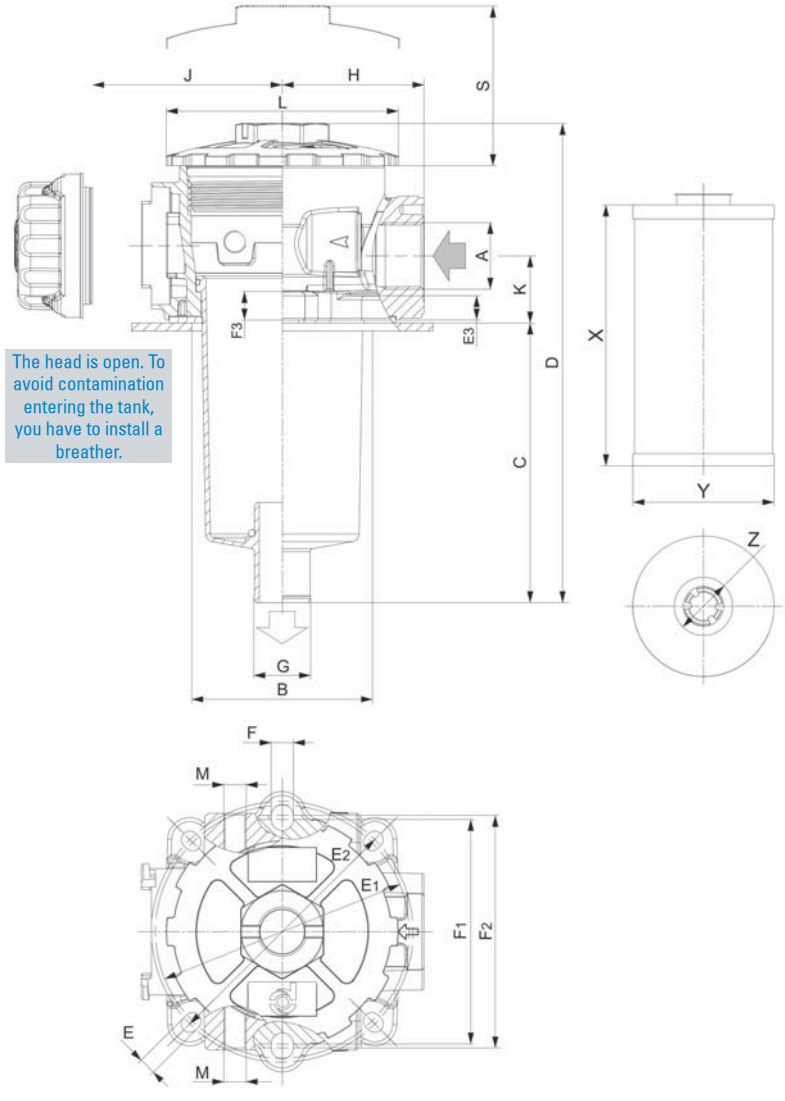
Donaldson FILTRATION SOLUTIONS

FIK-FIS

Standard Housing without Cartridge and without breather	HOUSING DIMENSIONS																				CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS
	A	B	C	D	E	E1	E2	E3	F	F1	F2	F3	G	H	J	K	L	M	N	S	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	predrilled holes	plugged	mm	mm	mm	mm	
P766618	G3/8	59	115	183	11	84	90	11	11	82	90	11	20	48	65	21	74	2x G1/8	YES	100	43	98	22	P171953 P171958 P171966 P173104
P766619	G1/2	59	180	248	11	84	90	11	11	82	90	11	20	48	65	21	74	2x G1/8	YES	164	43	162	22	
NEW	G3/4	59	180	248	11	82	90	11,5	11	84	90	11,5	20	50	50	21	74	2x G1/8	YES	164	43	162	22	
P766597	G3/4	90	91	189	8,5	126	130	12	11	112	116	14	27,6	70,5	94,5	32	116	2x G1/8	YES	84	70	82	29	
P766598	G1	90	141	239	8,5	126	130	12	11	112	116	14	27,6	70,5	94,5	32	116	2x G1/8	YES	130	70	128	29	
P766599	G1 1/4	90	218	316	8,5	126	130	12	11	112	116	14	39,6	70,5	94,5	32	116	2x G1/8	YES	212	70	210	42	
P766595	G1 1/2	90	400	432	8,5	126	130	12	11	112	116	14	39,6	70,5	94,5	32	116	2x G1/8	YES	289	70	287	42	



FIS 20-40



FIS 60-200

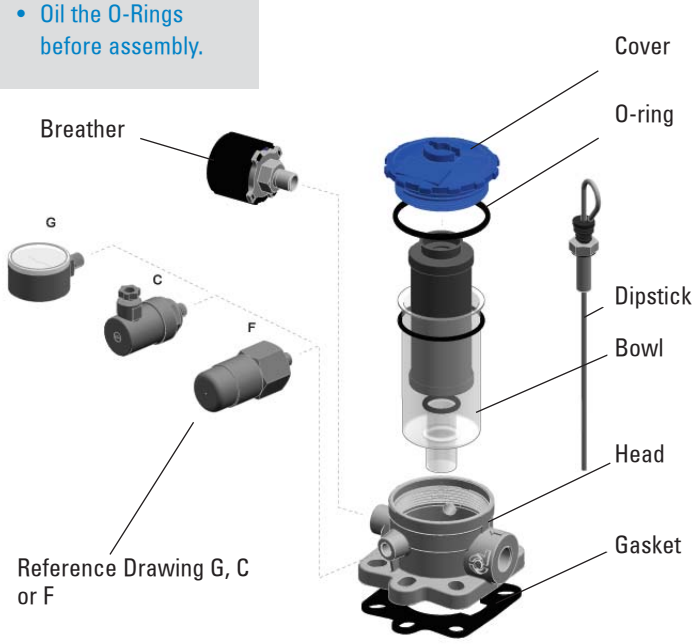
FIK-FIS

Indicator Choices

Part	Kind	Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171966	Electrical	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P171958	Visual	F	1,2				
P171953	Visual	G	range -1/5				
P171954	Visual	G	range -1/3				

Installation & Service Guidelines

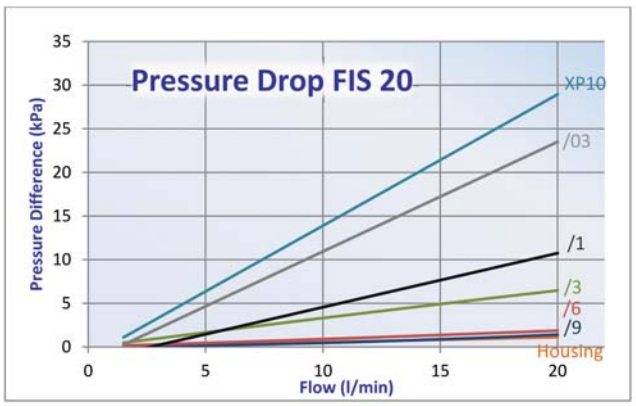
Important
- Oil the O-Rings before assembly.

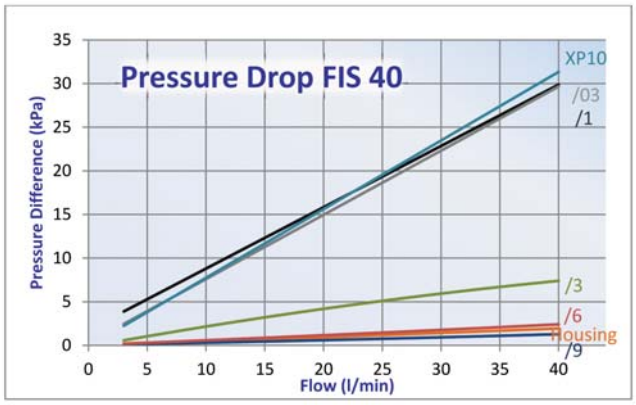


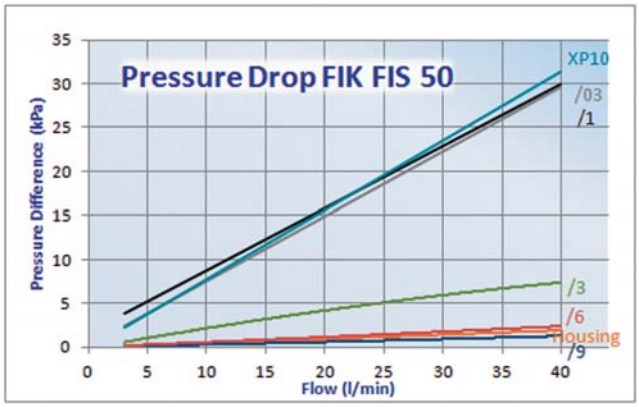
FIS 20-50

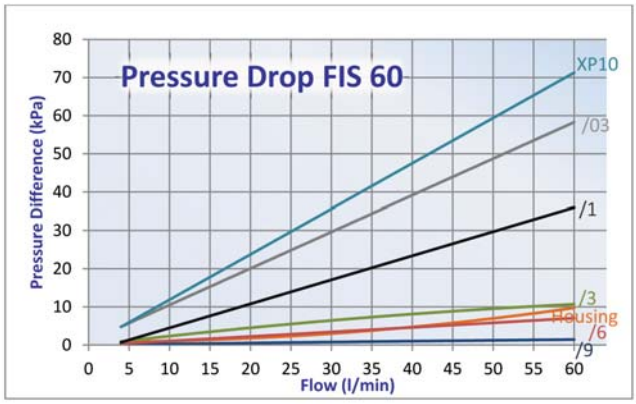
FIS 60-200

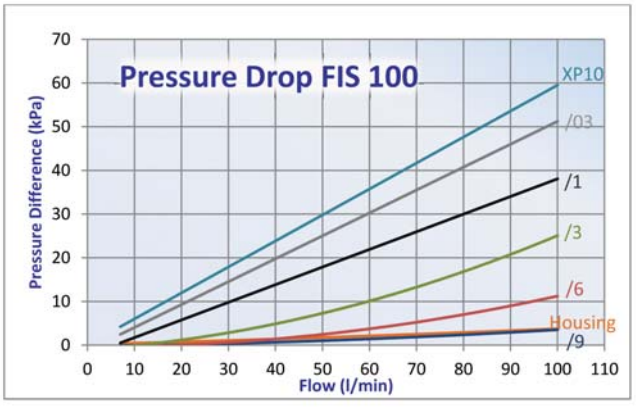
Performance Curves

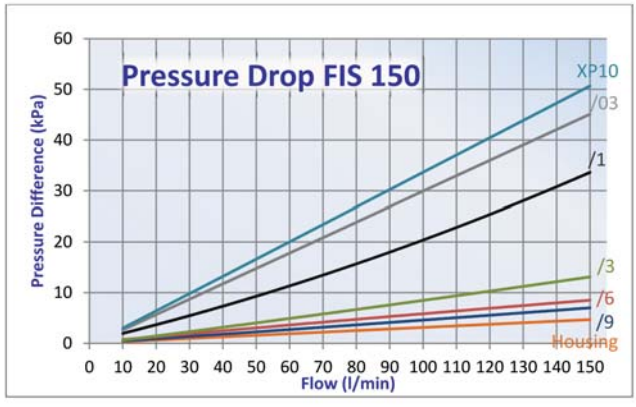


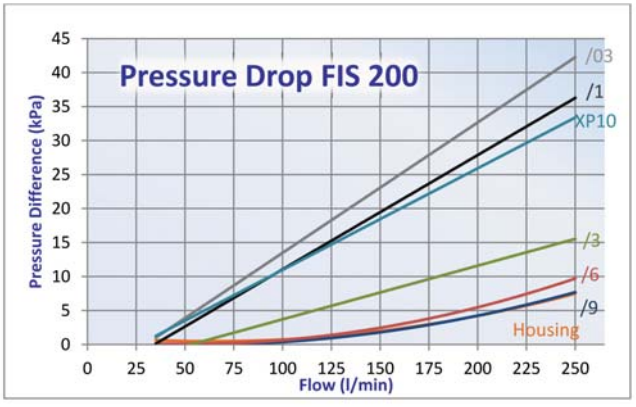


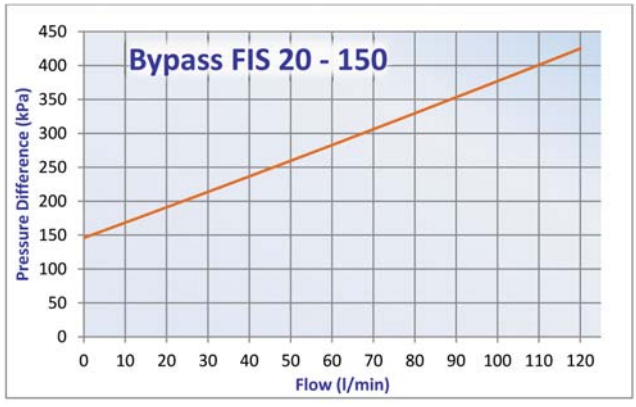




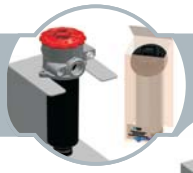




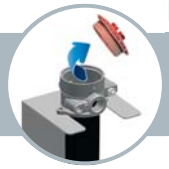




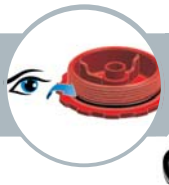
FIK-FIS
SRK-Combo 120



Open empty housing
in correct order



Remove carton ring
before use



Check if O-ring between
lid and housing is installed and intact

Check if O-Ring on cartridge is installed and
intact

For FIK:
Mount O-ring over stud

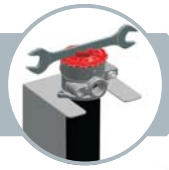
For Low Pressure cartridges:
Mount spring on cartridge

Mount element in
housing

For Combo 120:
Align arrows as shown

Assemble lid on housing

Assemble bolts and
screws in correct order



Tighten screws, bolts or lid until thread ends
For spin-ons: hand tighten until contact
between O-ring and head is made; and then
continue by hand as indicated on spin-on

Degrease surface where sparepart sticker
will be mounted
Only for cartridge type filters

Sparepart sticker in each sparepart box

Fix sparepart sticker in area indicated –
Ready!

Do not forget seals

FLK-FLS

Return Line Filters
Low Pressure Filters – In-Line
up to 30 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 3000 kPa (30 bar).
- Static pressure testing up to 4500 kPa (45 bar).
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Flange per SAE J518: 3000 PSI.

Filter Elements

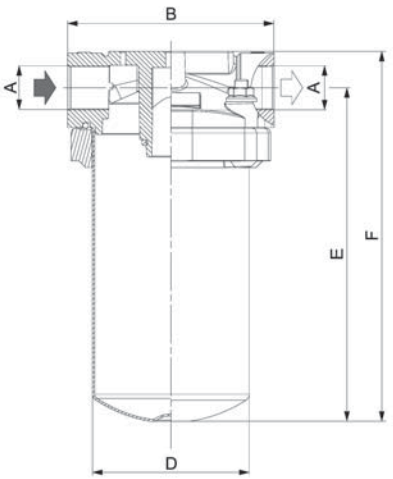
- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

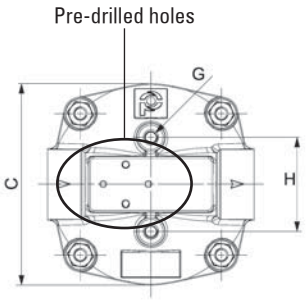
Components

	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$ß_{50µm(c)} \geq 1000$		$ß_{36µm(c)} \geq 1000$		$ß_{23µm(c)} \geq 1000$		$ß_{11µm(c)} \geq 1000$		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FLS50	40	P171518	40	P171523	35	P171522	35	P171521	30	P171520	30	P171519	CR50
FLS100	80	P171530	80	P171535	65	P171534	65	P171533	60	P171532	60	P171531	CR100
FLS150	130	P171584	130	P171589	110	P171588	110	P171587	90	P171586	90	P171585	CR125
FLS180	180	P171536	180	P171541	130	P171540	130	P171539	110	P171538	110	P171537	CR180
FLS200	200	P171596	200	P171601	140	P171600	140	P171599	120	P171598	120	P171597	CL200
FLS250	250	P171590	250	P171595	160	P171594	160	P171593	140	P171592	140	P171591	CR220
FLSF250	250	P171590	250	P171595	160	P171594	160	P171593	140	P171592	140	P171591	CR220
FLS330	330	P171560	330	P171565	220	P171564	220	P171563	180	P171562	180	P171561	CR330
FLSF330	330	P171560	330	P171565	220	P171564	220	P171563	180	P171562	180	P171561	CR330
FLS500	500	P171566	500	P171571	400	P171570	400	P171569	350	P171568	350	P171567	CR500
FLSF500	500	P171566	500	P171571	400	P171570	400	P171569	350	P171568	350	P171567	CR500
FLSF800	600	P171578	600	P171583	500	P171582	500	P171581	400	P171580	400	P171579	CR800

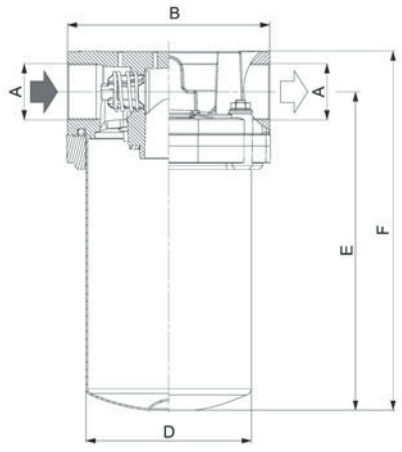
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
BPV = Bypass Valve Setting.
* only FLS200 has the Bypass valve installed in the head, for all other sizes the bypass valve is included in the cartridge.

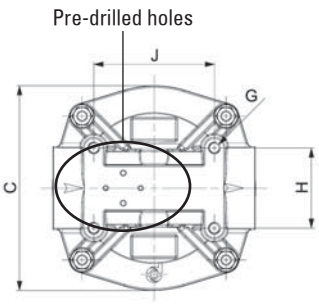
FLS 50-180





FLS 200

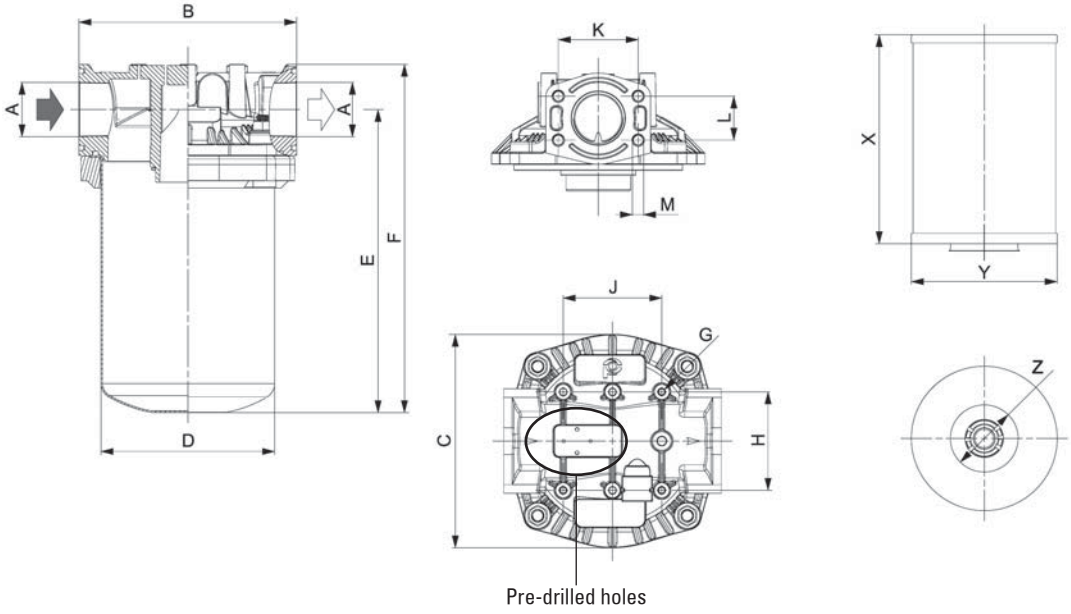




Standard housing **with** pre-drilled holes without cartridge	Standard housing **without** pre-drilled holes without cartridge	HOUSING DIMENSIONS													CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS Only applicable if housing is with pre-drilled holes.
		A	B	C	D	E	F	G	H	J	K	L	M	N	BPV	X	Y	Z	
			mm	mm	mm	mm	mm		mm	mm	mm	mm		mm	bar	mm	mm	mm	
P766672	P766995	G1/2	119	116	90	140	161	M8	54	-	-	-	-	-	1,5	75	70	29	
P766673	P766996	G3/4	119	116	90	192	213	M8	54	-	-	-	-	-	1,5	128	70	29	
P766671	P766997	G1	140	135	109	246	277	M8	68	-	-	-	-	-	1,5	169	95	41	
P766670	P766998	G1 1/4	140	135	109	284	314	M8	68	-	-	-	-	-	1,5	203	95	41	
P766666	P766999	G1 1/4	151	153	123	238	268	M8	60	90	-	-	-	-	1,5*	180	112	46	
P766667	P767000	G1 1/2	212	208	169	225	269	M8	96	96	-	-	-	-	1,5	136	140	65	P171950 P171961 P171963
P766663	P767001	Flange 1" 1/2	212	208	169	225	269	M8	96	96	70	36,7	M12	22	1,5	136	140	65	
P766669	P767002	G1 1/2	212	208	169	295	339	M8	96	96	-	-	-	-	1,5	203	140	65	
P766662	P767003	Flange 1" 1/2	212	208	169	295	339	M8	96	96	70	36,7	M12	22	1,5	203	140	65	
P766665	P767004	G2	212	208	169	295	339	M8	96	96	-	-	-	-	1,5	203	140	65	
P766668	P767005	Flange 2"	212	208	169	295	339	M8	96	96	77,8	42,8	M12	22	1,5	203	140	65	
P766664	P767006	Flange 2"	212	208	171	495	539	M8	96	96	77,8	42,8	M12	22	1,5	400	140	65	

If housing with pre-drilled holes selected, you have to install an indicator. Because pre-drilled holes are not plugged.

FLS 250-800

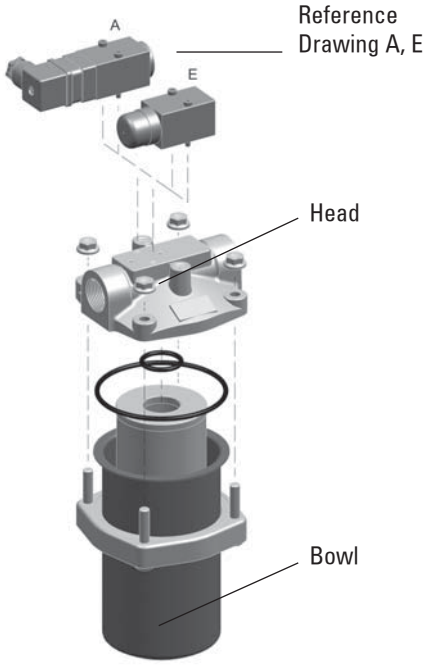


Indicator Choices

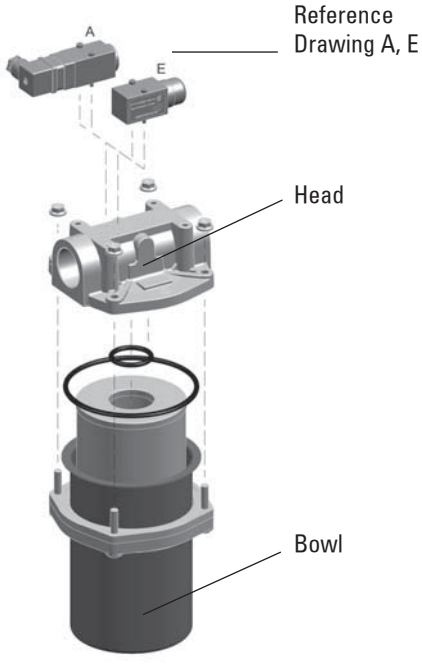
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171961	Electrical	Differential	A	1,4	Normally Open	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171963	Electrical	Differential	A	1,4	Normally Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171950	Visual	Differential	E	1,4				

Installation & Service Guidelines

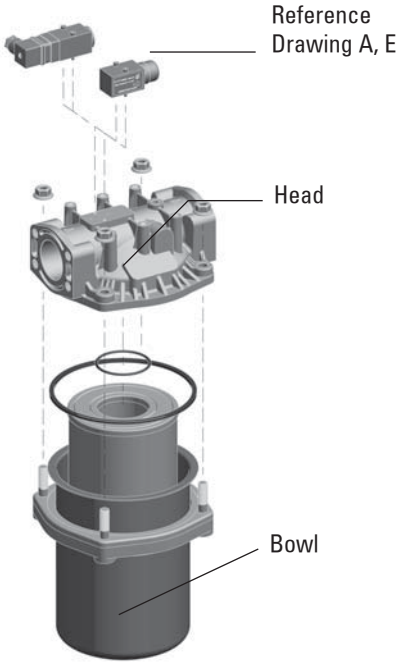
Important
- Oil the O-Rings before assembly.



FLS 50-180

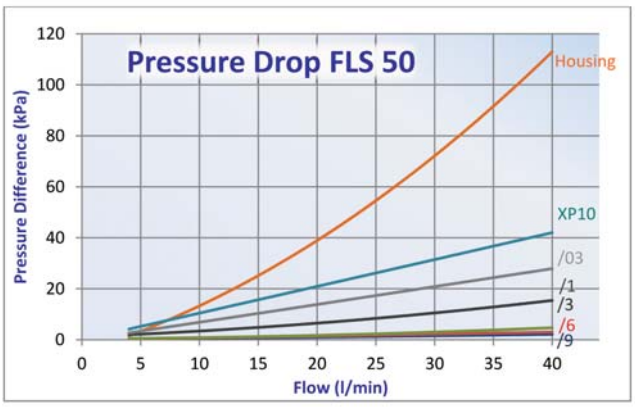


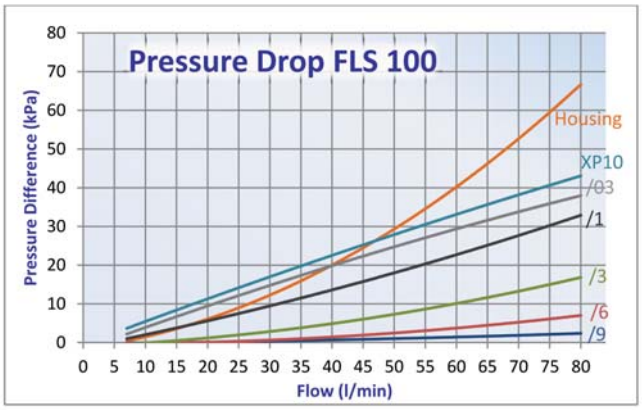
FLS 200

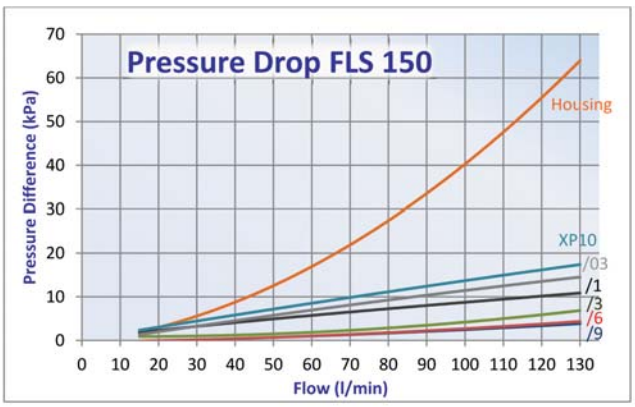


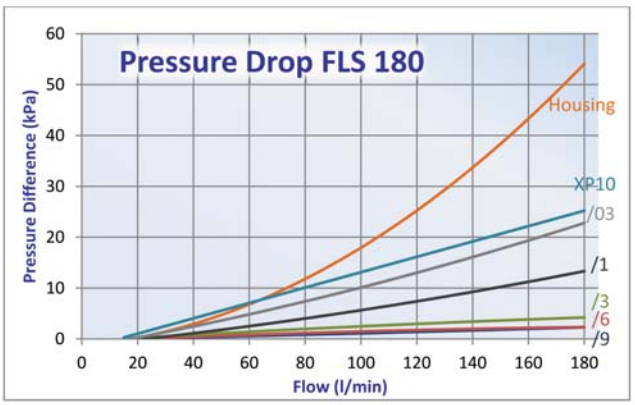
FLS(F) 250-800

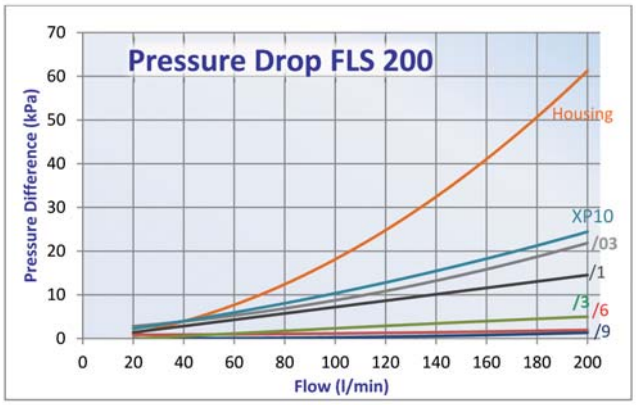
Performance Curves

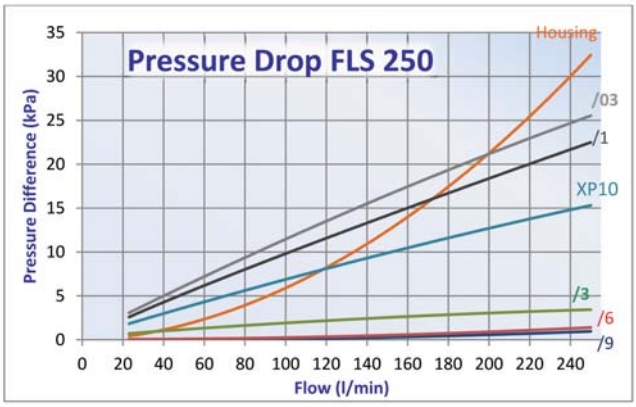


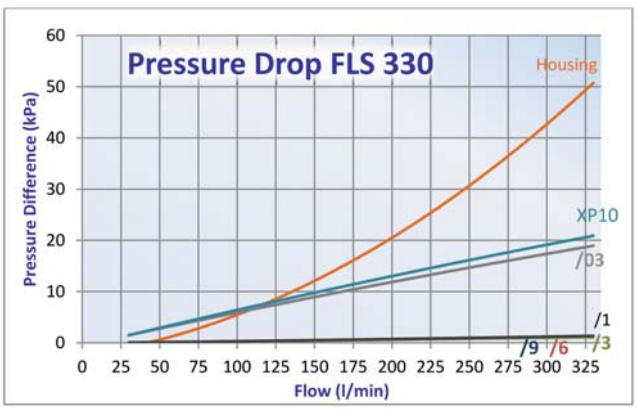


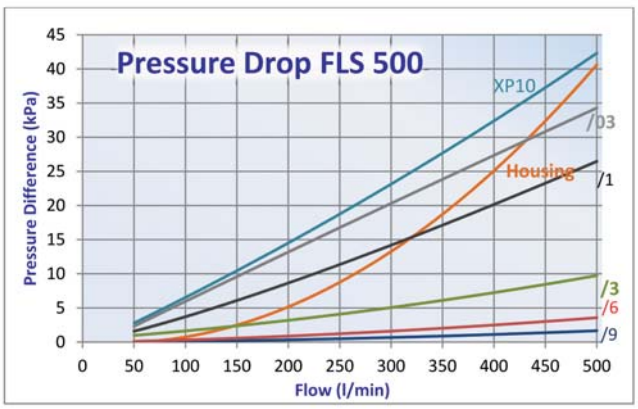




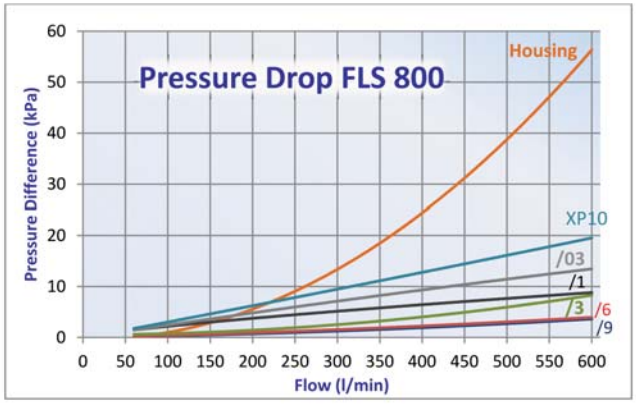


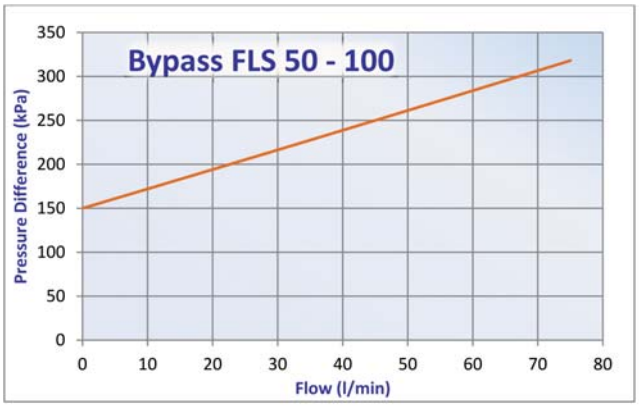


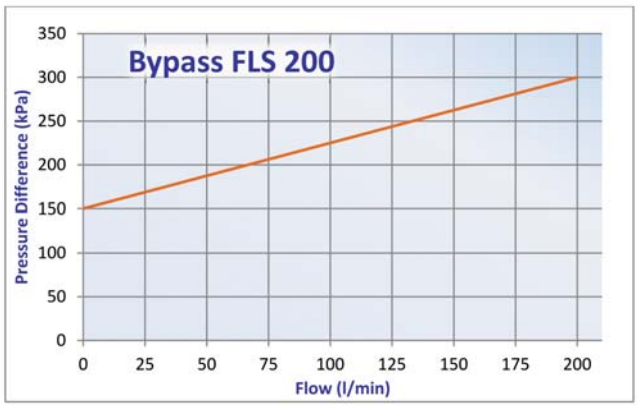


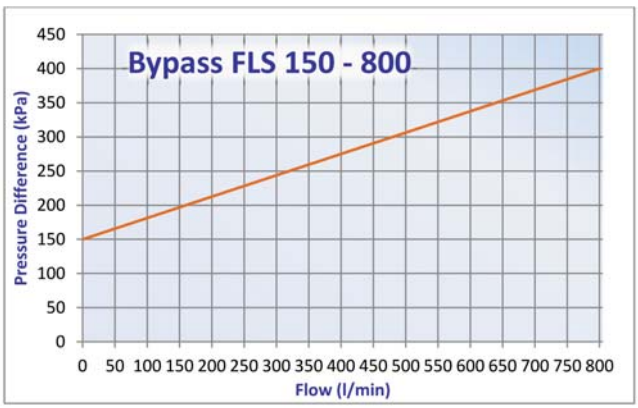


FLK-FLS


Pressure Drop FLS 800
Housing
XP10
/03
/1
/3
/6
/9
Pressure Difference (kPa)
Flow (l/min)
0 10 20 30 40 50 60
0 50 100 150 200 250 300 350 400 450 500 550 600


Bypass FLS 50 - 100
Pressure Difference (kPa)
Flow (l/min)
0 50 100 150 200 250 300 350
0 10 20 30 40 50 60 70 80


Bypass FLS 200
Pressure Difference (kPa)
Flow (l/min)
0 50 100 150 200 250 300 350
0 25 50 75 100 125 150 175 200


Bypass FLS 150 - 800
Pressure Difference (kPa)
Flow (l/min)
0 50 100 150 200 250 300 350 400 450
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800

FBK-FRCA

Return Line Filters
Low Pressure Filters – In-Line
up to 10 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- By-pass valve setting 150 kPa (1,5 bar) or 170 kPa (1,7 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm^3.

Filter Elements

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Wire mesh: 60 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.

FBK-FRCA

Components

	WIRE MESH MEDIA		CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/6		/3		/1		/03		XP10		
	60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		
FRCA60	60	P171607	60	P171606	50	P550268	40	P171604	40	P171602	CA60
FRCA80	80	P171612	70	P171611	60	P171610	50	P171609	50	P171608	CA80
FRCA108			100	P764638							CA108
FRCA118			100	P763987							CA108
FRCA160	160	P171617	150	P171616	140	P550148	120	P171614	120	P171613	CA160
FRCA200	200	P171622	190	P171621	160	P171620	140	P171619	140	P171618	CA200
FRCA380	380	P171617	340	P171616	300	P550148	280	P171614	280	P171613	CA160
FRCA400	400	P171622	360	P171621	320	P171620	300	P171619	300	P171618	CA200
FRCA220			200	P764410					150	P764411	CA220
FRCA250			230	P764409					170	P763668	CA250

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
BPV = Bypass Valve Setting.

Heads Choices

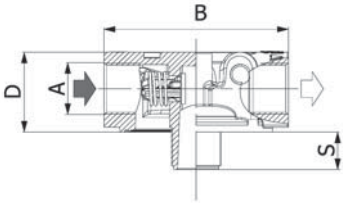
Head for Size	Part	Ports	Bypass Valve Setting	Indicator Info			Snout	Mounting holes
				Drilled holes for indicator	Side	Indicator to use		
FRCA 60/80	P563279	1 1/16 SAE	1 bar	no	-	none	1-12 UNF	1/4-20 UNC
	P563287	1 1/16 SAE	1 bar	no	-	none	1-12 UNF	M6
	P563280	1 1/16 SAE	1,7 bar	plugged	left + right	P563297,P563298,P563978 or P563296	1-12 UNF	1/4-20 UNC
	P561141	1 1/16 SAE	1,7 bar	no	-	none	1-12 UNF	1/4-20 UNC
	P765539	1 1/16 SAE	2,5 bar	no	-	none	G3/4	M8
	P562261	1/2-14 NPTF	no opening	no	-	none	1-14 UNS	1/4-20 UNC
	P562262	7/8-14 UNF	no opening	no	-	none	1-14 UNS	1/4-20 UNC
	P175017	G3/4	1,7 bar	plugged	left + right	P171954, P171958, P171966 or P173104	G3/4	M8
	P173441*	G3/4	1,7 bar	no	-	none	G3/4	M8
	P765584	G3/4	no opening	used	left	P162696 (installed)	G3/4	M8
FRCA 160/200	P764407	G1 1/4	1,5 bar	plugged	left	P162400 or P163839	G1 1/4	M8
	P761314	G1 1/4	1,5 bar	plugged	top	P171954, P171958, P171966 or P173104	G1 1/4	M8
	P762638	G1 1/4	1,5 bar	plugged	right	P171954, P171958, P171966 or P173104	G1 1/4	M8
	P176846*	G1 1/4	1,5 bar	no	-	none	G1 1/4	M8
	P765583	G1 1/4	no opening	used	left	P162696 (installed)	G1 1/4	M8
	P760071	G1 1/4	1,5 bar	drilled, not plugged	top	P171961, P171963 or P171950	G1 1/4	M8
	P764408	G1 1/4	1,5 bar	drilled, not plugged	left	P162696	G1 1/4	M8
	P762641	G1 1/4	3 bar	no	-	none	G1 1/4	M8
	P176965	G1 1/4	no opening	plugged	left + right	-	G1 1/4	M8
	P173403	G1 1/4	no opening	plugged	left + right	P171954, P171958, P171966 or P173104	G1 1/4	M8
	P765639	G1 1/4	no opening	drilled, not plugged	left	P162696	G1 1/4	M8
FRCA 220/250	P764414	G1 1/4	1,5 bar	drilled, not plugged	left	P162400 or P163839	1 1/2-16 UN	M8
	P764413	G1 1/4	1,5 bar	plugged	top	P171954, P171958, P171966 or P173104	1 1/2-16 UN	M8
	P764412*	G1 1/4	1,5 bar	no	-	none	1 1/2-16 UN	M8
	P764415	G1 1/4	1,5 bar	drilled, not plugged	left	P162696	1 1/2-16 UN	M8
	P764421	G1 1/4	no opening	plugged	right	P171954, P171958, P171966 or P173104	1 1/2-16 UN	M8
FRCA 380/400	P761264	G1 1/2	1,7 bar	drilled, not plugged	front	P171961, P171963 or P171950	G1 1/4	M10
	P766293*	G1 1/2	1,7 bar	no	-	none	G1 1/4	M10

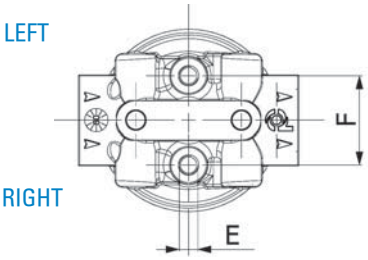
FBK Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.
Unless otherwise mentioned, the usage of indicators is mandatory, because the drilled holes for indicators are not plugged.

* Standard Head

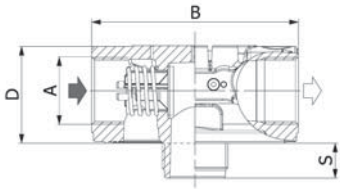
Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P173441	G3/4	95	13	41,5	M8	38		20	1,7	146	96	G3/4
										209	96	G3/4
NA										183	108	M40x2
										230	108	M40x2
P176846	G1 1/4	132	28,5	61,5	M8	50		24	1,5	181	128	G1 1/4
										226	128	G1 1/4
P766293	G1 1/2	138	35	70	M10		65	24	1,5	181	128	G1 1/4
										226	128	G1 1/4
P764412	G1 1/4	132	28,5	61,5	M8	50		25	1,5	236	136	1 1/2-16UN
										306	136	1 1/2-16UN

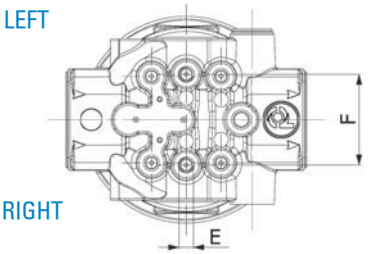
FRCA 60/80

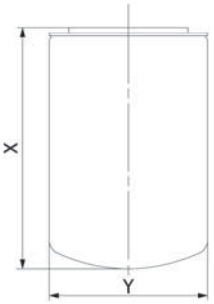




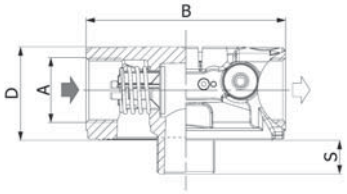
FRCA 160/200

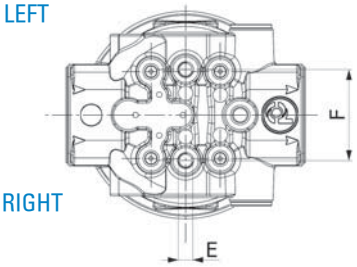


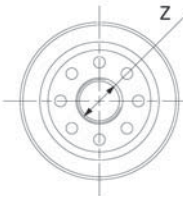




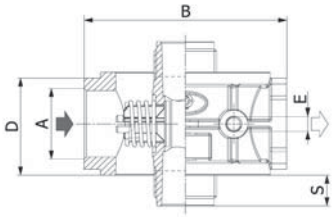
FRCA 220/250

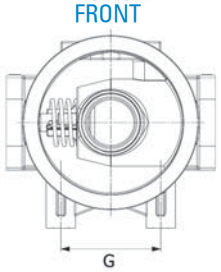






FRCA 380/400

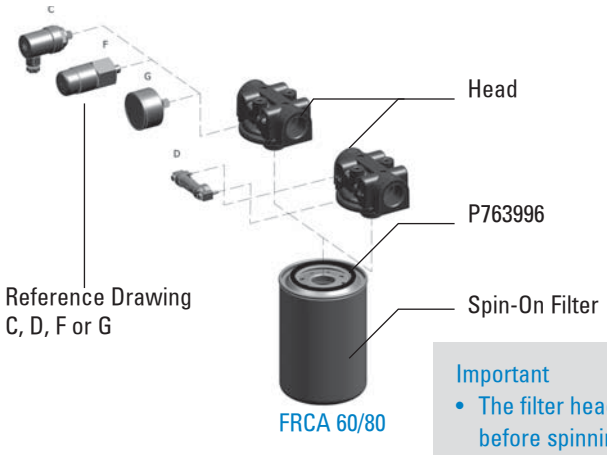




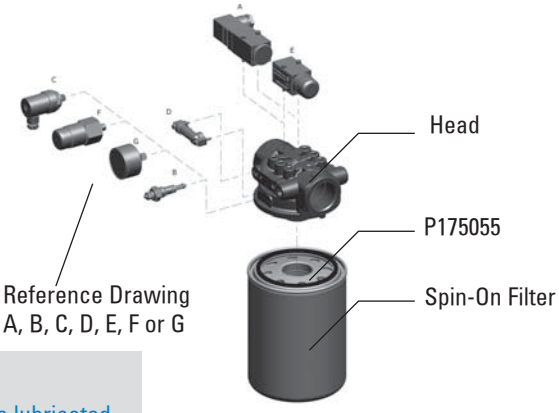
Indicator Choices

Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171961	Electrical	Differential	A	1,4	Normally Open/Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171963	Electrical	Differential	A	1,4	Normally Open/Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P162400	Electrical	Differential	B	1,25	Normally Open			6-30 V DC; 200 mA
P163839	Electrical	Differential	B	1,25	Normally Closed			6-30 V DC; 200 mA
P171966	Electrical	Differential	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	Differential	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P162696	Visual	Differential	D	1,7				
P171950	Visual	Differential	E	1,4				
P171958	Visual	Differential	F	1,2				
P171954	Visual	Vacuum	G	-1/3				

Installation & Service Guidelines

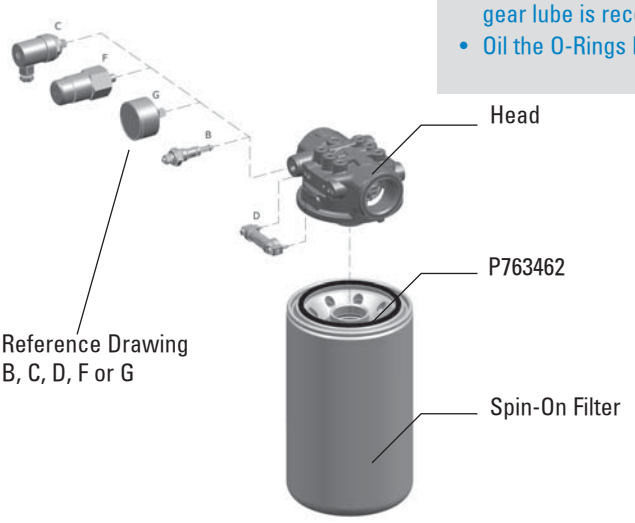


FRCA 60/80

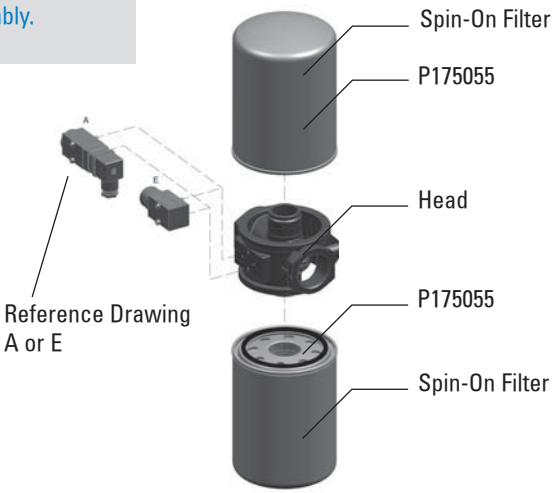


FRCA 160/200

Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

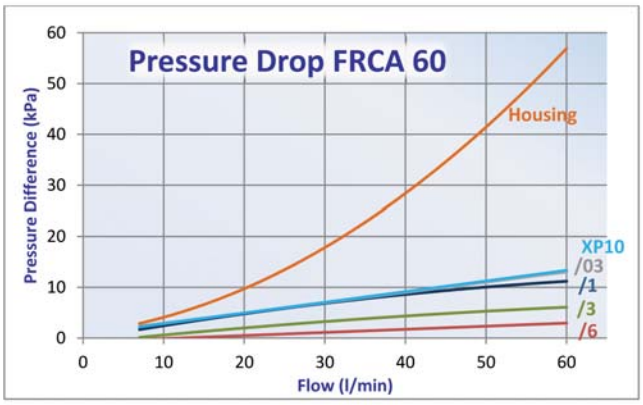


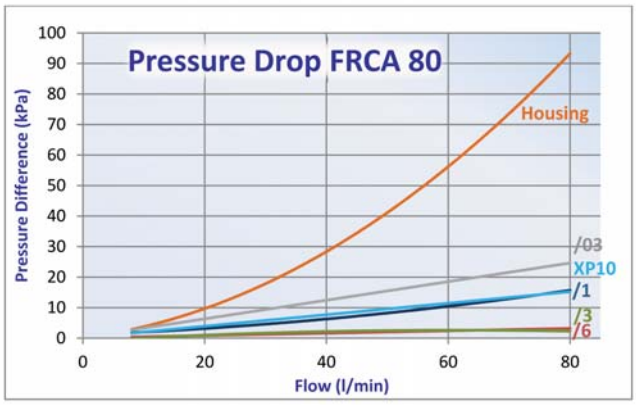
FRCA 220/250

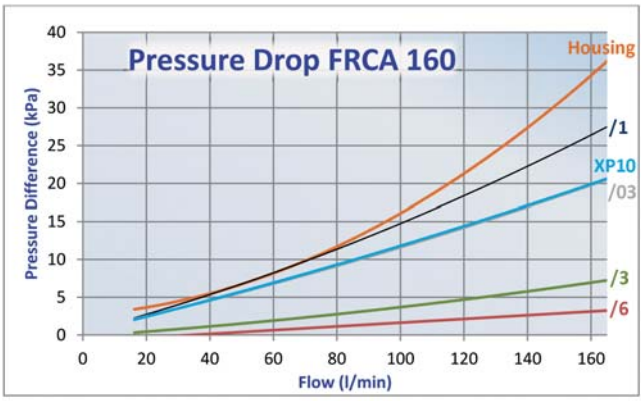


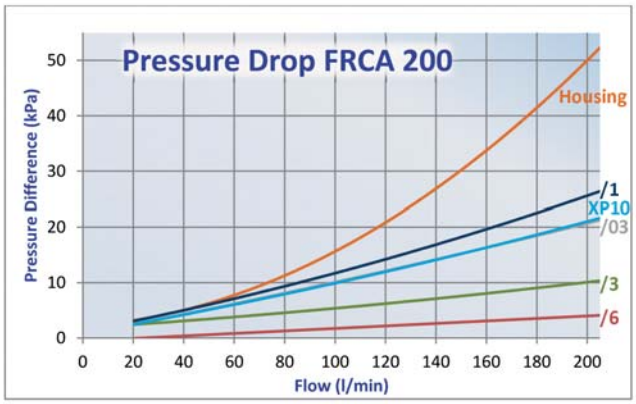
FRCA 380/400

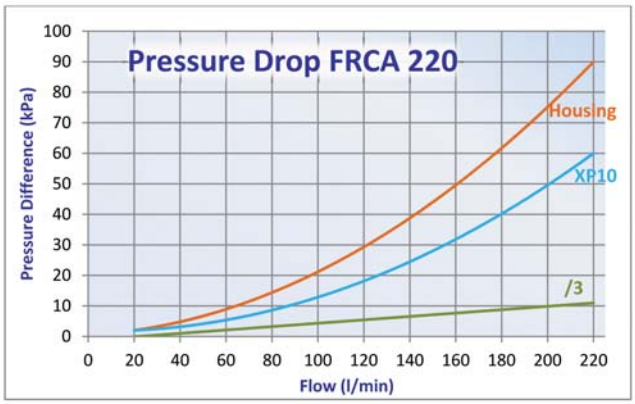
Performance Curves

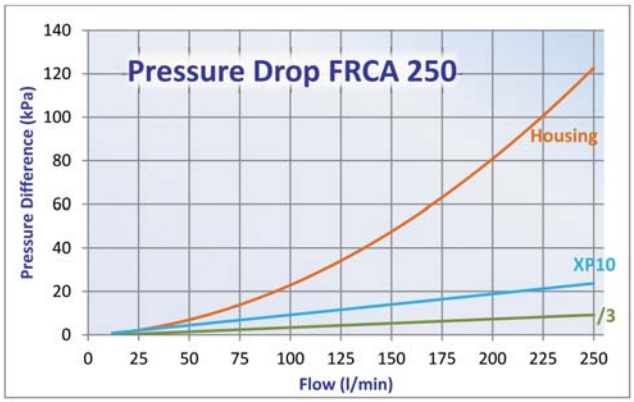


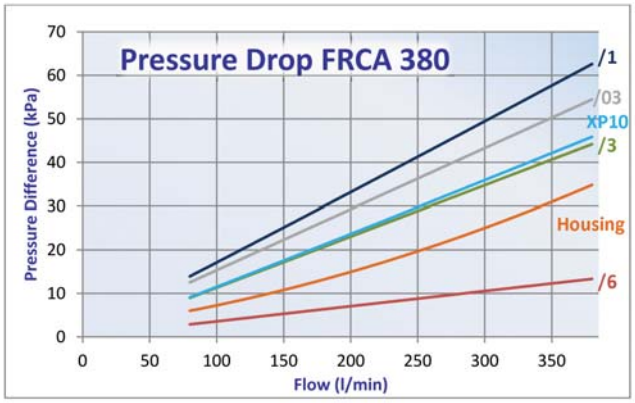


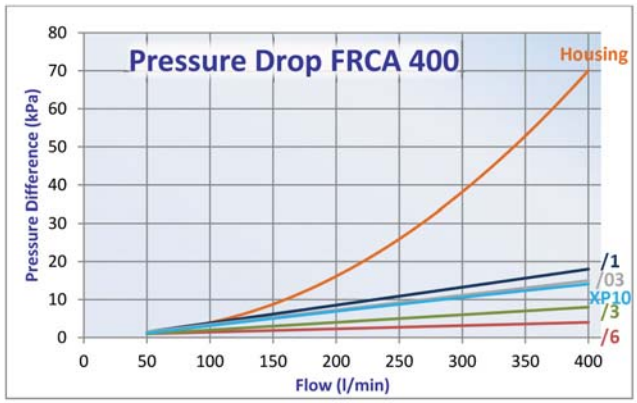




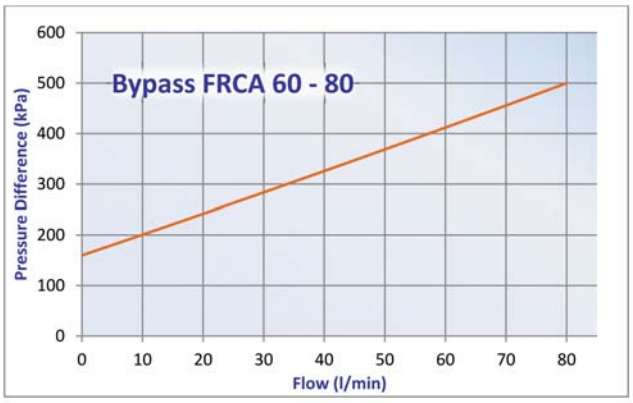


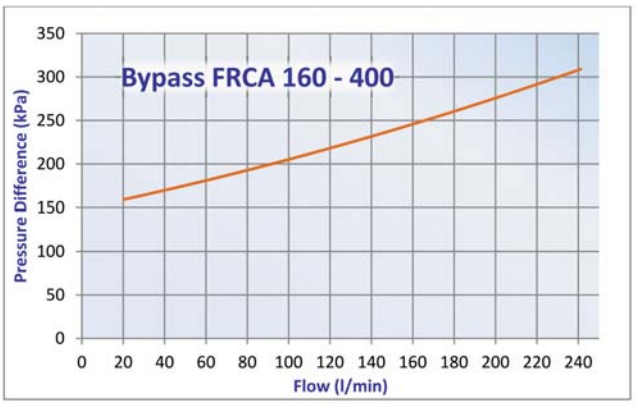






FBK-FRCA


Bypass FRCA 60 - 80
Pressure Difference (kPa)
600
500
400
300
200
100
0
0 10 20 30 40 50 60 70 80
Flow (l/min)


Bypass FRCA 160 - 400
Pressure Difference (kPa)
350
300
250
200
150
100
50
0
0 20 40 60 80 100 120 140 160 180 200 220 240
Flow (l/min)

FHK-FIR

Return & Suction Filters
Low Pressure Filters – In-Tank
with In Tank Connections

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- By pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

Components

	WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA						CARTRIDGE CODE
	/9			/6			/3			/1			/03			XP10			
	90µm			60µm			$ß_{50µm(c)} \geq 1000$			$ß_{36µm(c)} \geq 1000$			$ß_{23µm(c)} \geq 1000$			$ß_{11µm(c)} \geq 1000$			
Family	RMF Return	RMF Suction		RMF Return	RMF Suction		RMF Return	RMF Suction		RMF Return	RMF Suction		RMF Return	RMF Suction		RMF Return	RMF Suction		
FIR 30	30	15	P171500	30	15	P171505	20	10	P171504	20	10	P171503	15	8	P171502	15	8	P171501	CR30
FIR 60	60	30	P171524	60	30	P171529	40	20	P171528	40	20	P171527	35	15	P171526	35	15	P171525	CR60
FIR 100	100	50	P171530	100	50	P171535	65	35	P171534	65	35	P171533	60	30	P171532	60	30	P171531	CR100
FIR 180	180	90	P171536	180	90	P171541	120	60	P171540	120	60	P171539	110	55	P171538	110	55	P171537	CR180
FIR 500	500	250	P171566	500	250	P171571	400	200	P171570	400	200	P171569	350	180	P171568	350	180	P171567	CR500

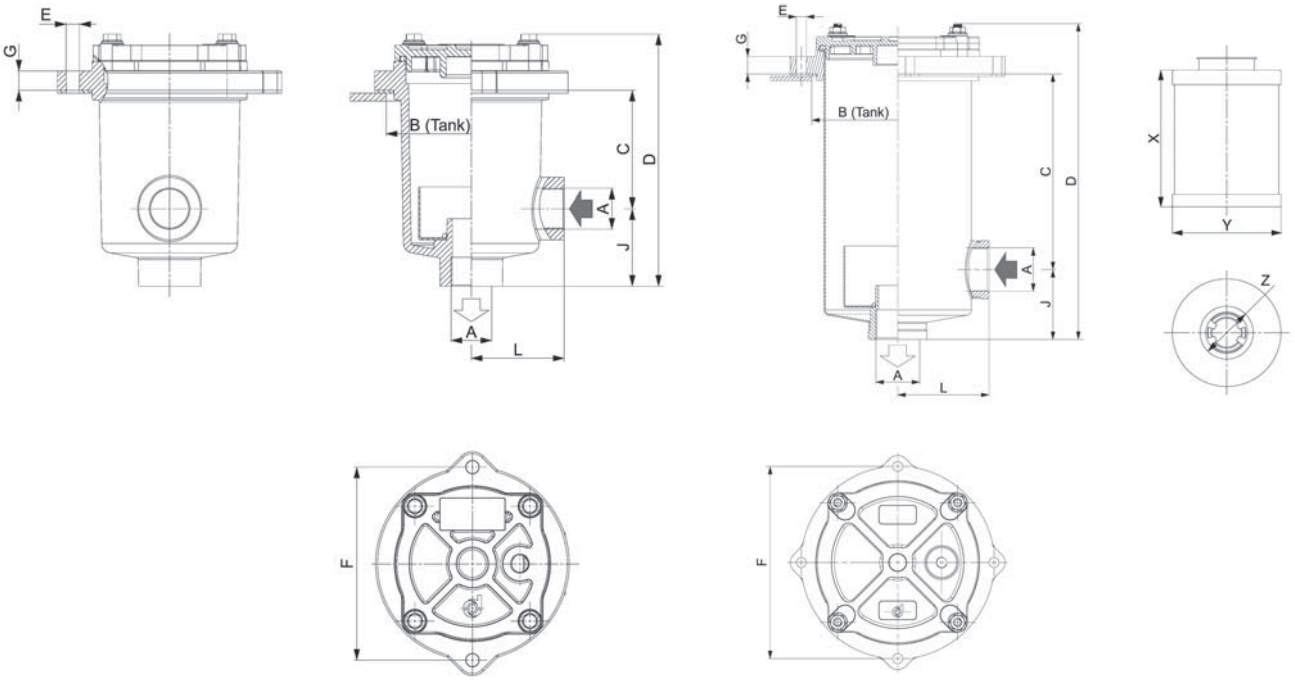
RMF = Recommended Maximum Flow in liters/minute with use of standard head.
Standard head is with predrilled holes for indicator, but plugged.

Indicator Choices

Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171953	Visual	Vacuum	G	-1/5				
P171958	Visual	Differential	F	1,2				
P171966	Electrical	Differential	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	Differential	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.

Use indicators only on return line applications!

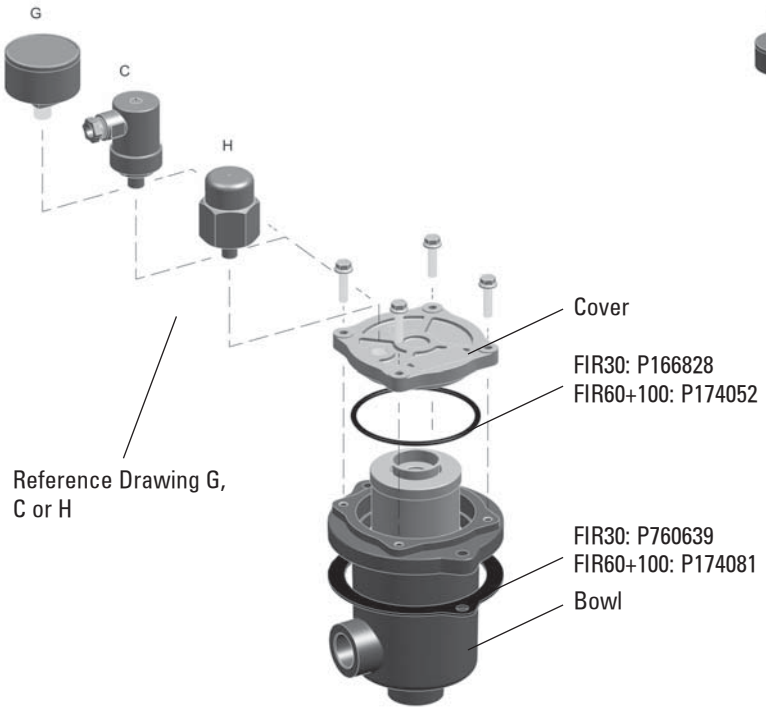
Standard Housing without Catridge	DIMENSIONS HOUSING											DIMENSIONS ELEMENT			POSSIBLE INDICATOR
	A	B	C	D	E	F	G	J	L	M	N	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	predrilled holes	plugged	mm	mm	mm	
P766679	G1/2	88	61	130	7	100	10	40	48	G1/8	YES	52	67	26	P171953 P171958 P171966 P173104
P766481	G3/4	110	67,5	155	9	126	14,5	52	58	G1/8	YES	70	82	29	
P766482	G1	110	109,5	199	9	126	14,5	56	59	G1/8	YES	70	128	29	
P766678	G1 1/4	156	176	288	9	175	16	64	83	G1/8	YES	95	203	41	
P766483	G2	204	167	297,5	9	220	20	77,5	107	G1/8	YES	140	203	65	



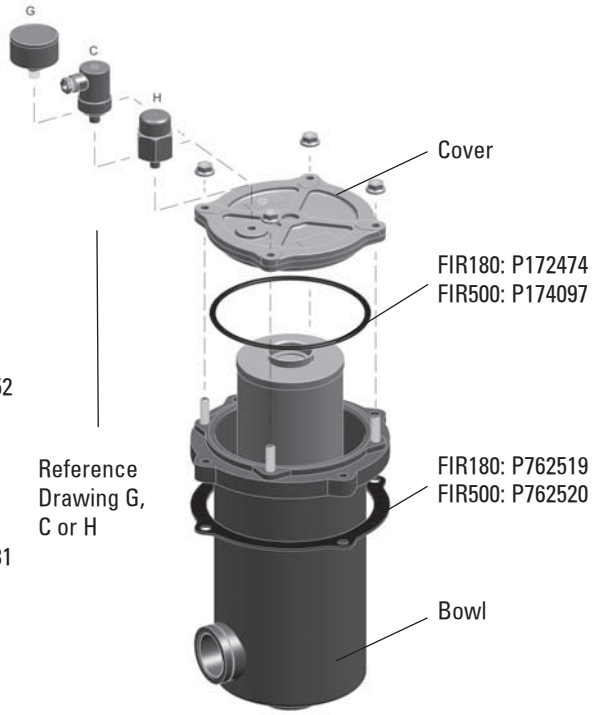
Size 30-100

Size 180-500

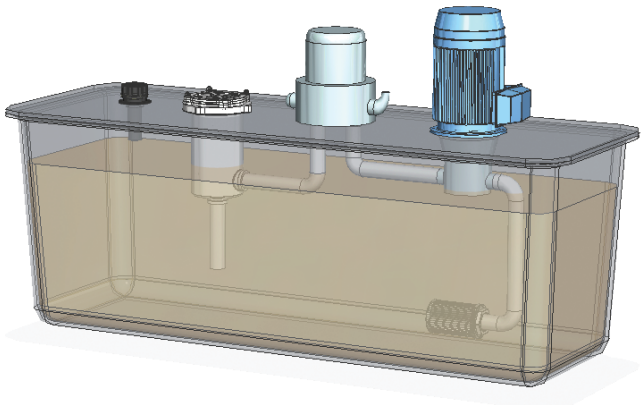
Installation & Service Guidelines



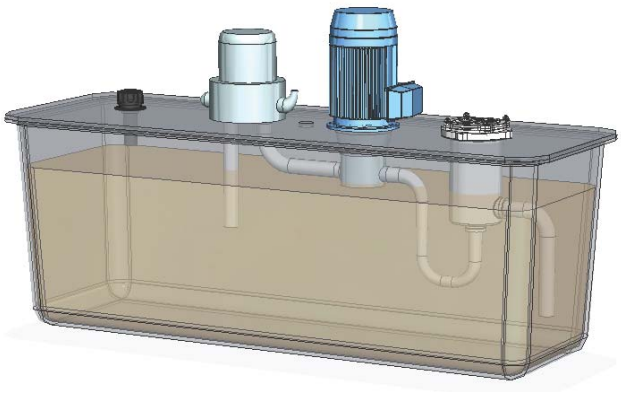
FIR 30-100



FIR 180-500

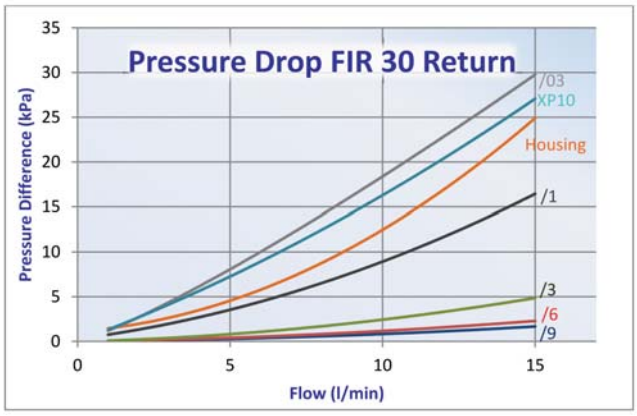


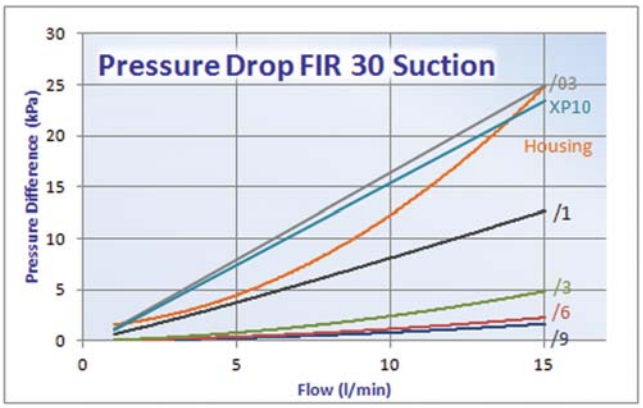
Example of how the filter is mounted in a return flow.

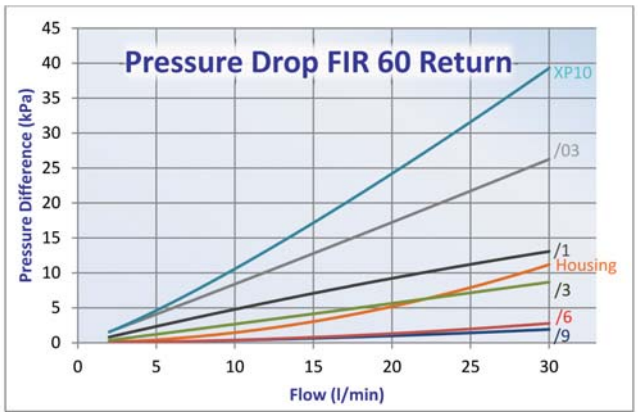


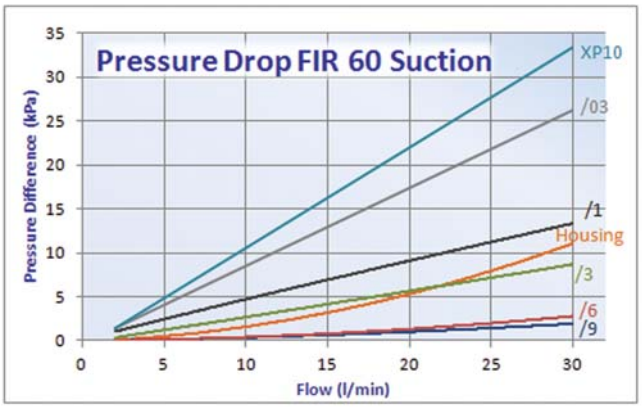
Example of how the filter is mounted in a suction flow.

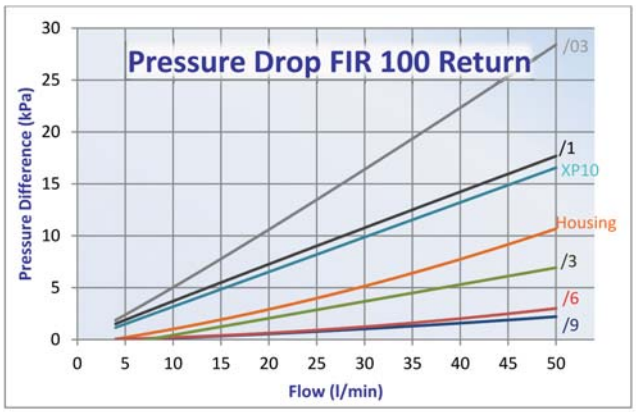
Performance Curves

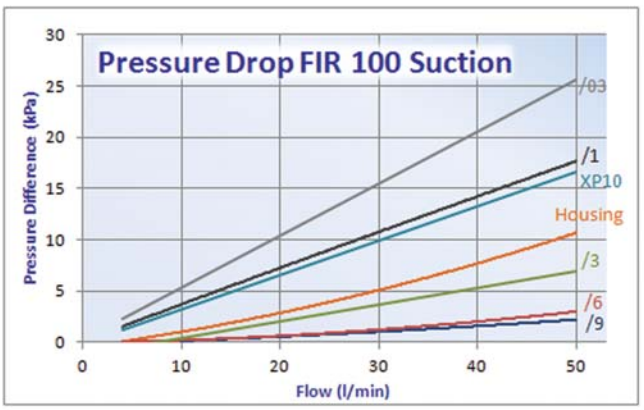


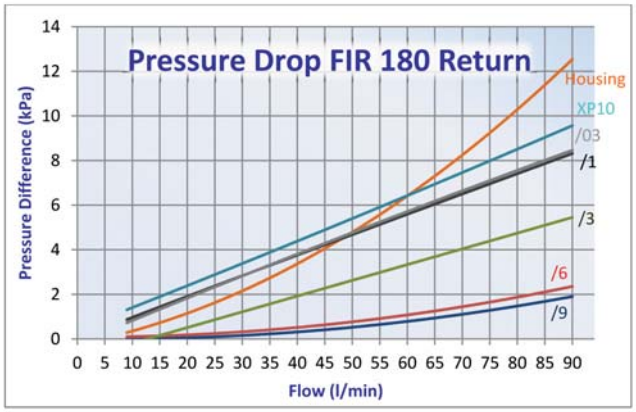


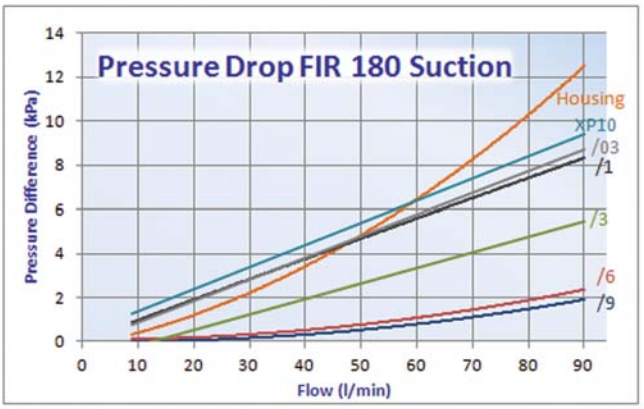


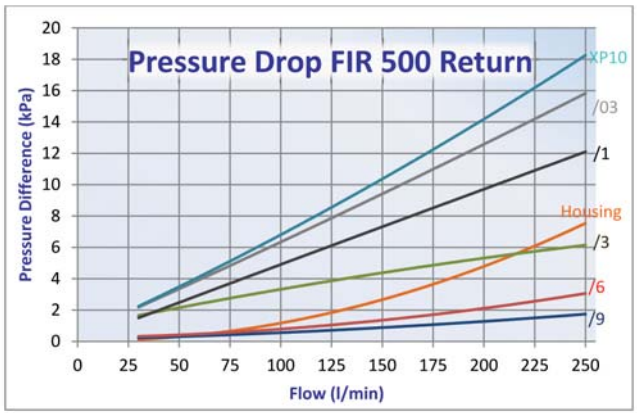


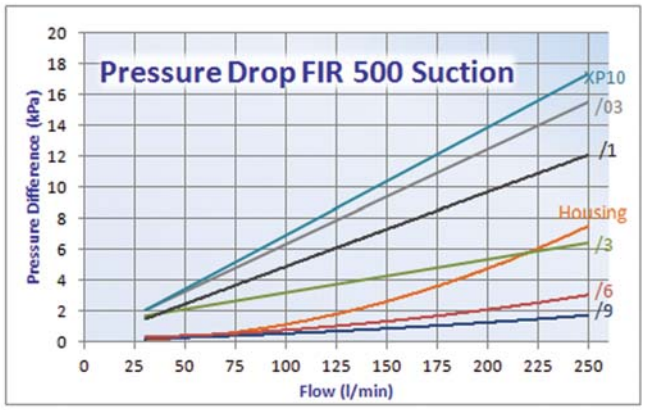


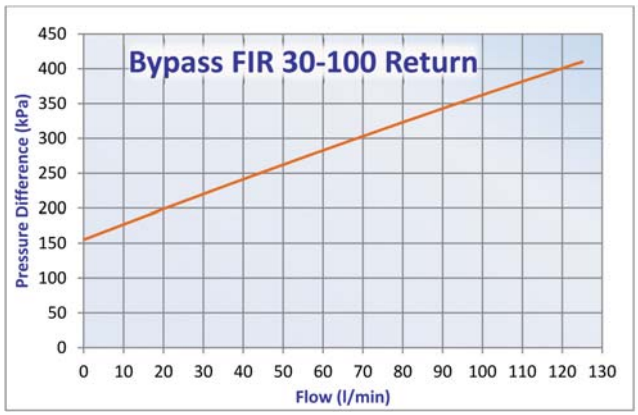


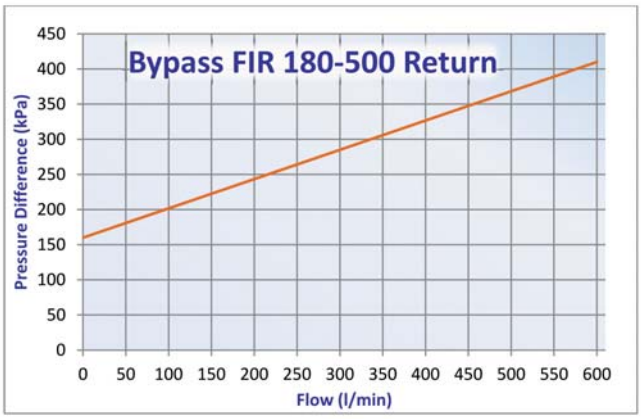





Pressure Drop FIR 500 Return
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
Housing
/3
/6
/9


Pressure Drop FIR 500 Suction
Pressure Difference (kPa)
Flow (l/min)
XP10
/03
/1
Housing
/3
/6
/9


Bypass FIR 30-100 Return
Pressure Difference (kPa)
Flow (l/min)


Bypass FIR 180-500 Return
Pressure Difference (kPa)
Flow (l/min)

SRK-COMBO

Return & Suction Filters
Low Pressure Filter – In-Tank
up to 10 bar

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Back pressure valve setting: 0,5 bar per ISO 3968.
- By-pass valve setting: 2,5 bar per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875kg/dm³.

Filter Elements Main

- Synthetic media.
- Filtration efficiency according to ISO 16889: $ß_{11µm(c)}$=200, $ß_{13µm(c)}$=1000.
- Unique interface with filter assembly.
- By-pass strainer integrated into the main element 125 micron wire mesh.
- Collapse resistance 1000 kPA (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

Filter Elements Emergency Suction

- Emergency filtered suction from the tank (125 µm).
- By-pass filtered and pressurized.

Components

				Main Element		Suction Element	
				Synthetic Media		Wire Mesh	
				$ß_{13µm(c)} \geq 1000$		125 µm	
Family	Style 1	Style 2	Style 3	RMF		RMF	
COMBO 120	with Emergency suction	Ports on same axis**		120	P763652	60	P763643
		Ports on same side					
	without Emergency suction*	Ports on same axis**		120	P762421	-	Not applicable
		Ports on same side					
COMBO 200	with Emergency suction	Without extra inlet	no predrilled holes	200	P764198	70	P764183
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
		With extra inlet G1	no predrilled holes				
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
	without Emergency suction*	Without extra inlet	no predrilled holes	200	P764198	-	Not applicable
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
		With extra inlet G1	no predrilled holes				
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
COMBO 300	with Emergency suction	Without extra inlet	no predrilled holes	300	P765457	70	P764183
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
		With extra inlet G1	no predrilled holes				
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
	without Emergency suction*	Without extra inlet	no predrilled holes	300	P765457	-	Not applicable
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				
		With extra inlet G1	no predrilled holes				
			predrilled holes a1				
			predrilled holes a2				
			predrilled holes b				

* use the option of no emergency suction only if the returning flow rate is always bigger than the suction flow rate
** Additional inlet port G3/8 available on request
NA = Not Applicable
BPV= Bypass Valve Setting

Complete Filters (including Elements)	HOUSING DIMENSIONS																CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS
	A1	A2	B	C	D	E	F	G	H	I	J	K	L	BPV	Back Pressure Valve	M	N	X	Y	Z	
			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	bar	bar	predilled holes	plugged or indicator	mm	mm	mm	
K041511	G1	G3/4	80	308	414	11	115	11	68	68	32	32	72	2,5	0,5	9/16-18 UNF	P165194	91	265	45	P165194, P167455, P173893
K041595	G1	G3/4	80	308	414	11	115	11	90	69	30,3	42,3	72	2,5	0,5	9/16-18 UNF	P165194				P165194, P167455, P173893
K041301	G1	G3/4	80	227	333,5	11	115	11	68	68	32	32	NA	2,5	0,5	9/16-18 UNF	P165194	91	233	36	P165194, P167455, P173893
K041610	G1	G3/4	80	227	333,5	11	115	11	90	69	30,3	42,3	NA	2,5	0,5	9/16-18 UNF	P165194				P165194, P167455, P173893
K041535	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	50	2,5	0,5	NA	NA				none
K041598	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041602	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041606	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P171954
K041596	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	NA	NA				none
K041599	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041603	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041607	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P171954
K041528	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	NA	NA	88	361	42	none
K041600	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041604	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041608	G1 1/4	2x G1	100	375	505	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P171954
K041597	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	NA	NA				none
K041601	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041605	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041609	G1 1/4 + G1	2x G1	100	375	505	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P171954
K041674	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	50	2,5	0,5	NA	NA				none
K041659	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041660	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041661	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	50	2,5	0,5	G1/8	YES				P171954
K041662	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	NA	NA				none
K041663	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041664	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041665	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	50	2,5	0,5	G1/8	YES				P171954
K041666	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	NA	NA	88	431	42	none
K041667	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041668	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041669	G1 1/4	2x G1	100	445	575	11	81/94	13	94,5	86	35	63	NA	2,5	0,5	G1/8	YES				P171954
K041670	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	NA	NA				none
K041671	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041672	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P764431,P764613,P764612
K041673	G1 1/4 + G1	2x G1	100	445	575	11	81/94	13	94,5 / 85,5	86	35	63	NA	2,5	0,5	G1/8	YES				P171954

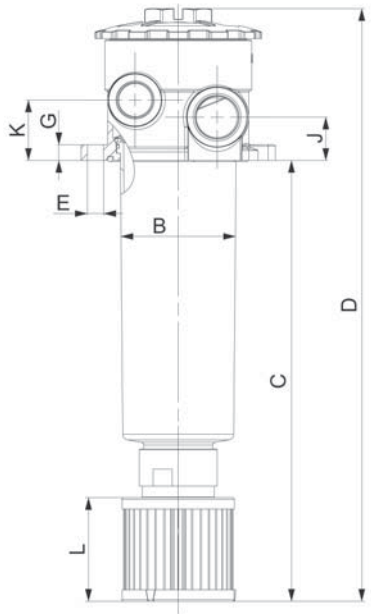
Stock item (check e-commerce for availability)

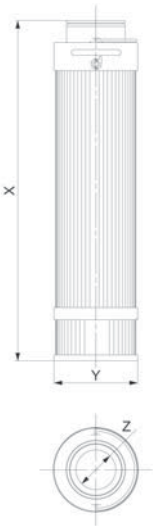
Indicator Choices

Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171954	Visual	Vacuum	G	-1/3				
P764612	Visual	Differential	F	2,5				max 30 DCV; 0,5 A res. and 0,2 A ind.
P764431	Electrical	Differential	C	2,5	Normally Open	IP65	PG7	max 30 DCV; 0,5 A res. and 0,2 A ind.
P764613	Electrical	Differential	C	2,5	Normally Closed	IP65	PG7	max 30 DCV; 0,5 A res. and 0,2 A ind.
P165194	Electrical	Differential	B	2,76	Normally Open			30 V DC; 0,2A
P167580	Visual	Differential	D	3,4				

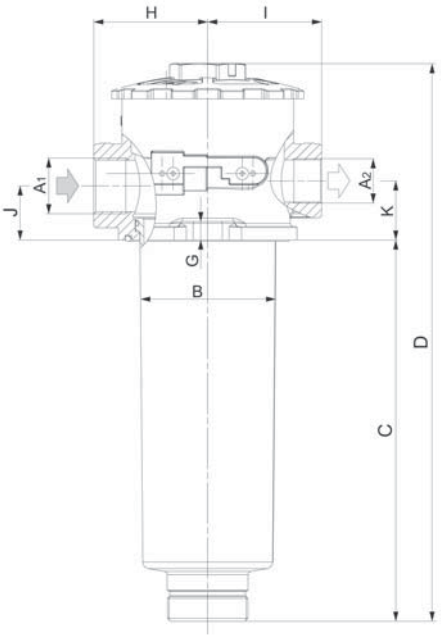
Combo 120

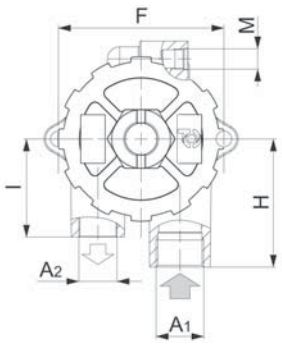
Ports on same Side

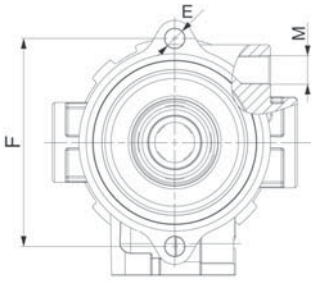




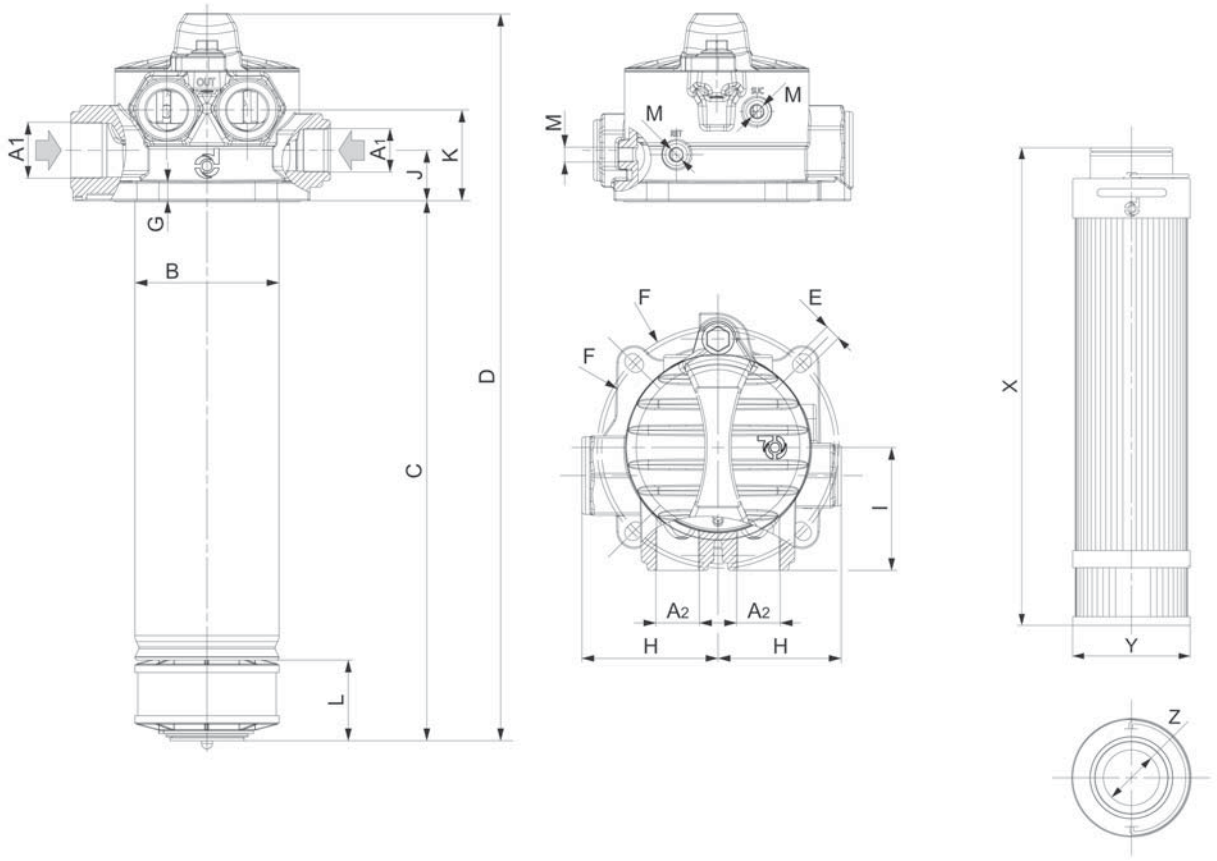
Ports on same Axis







Combo 200/300



Additions

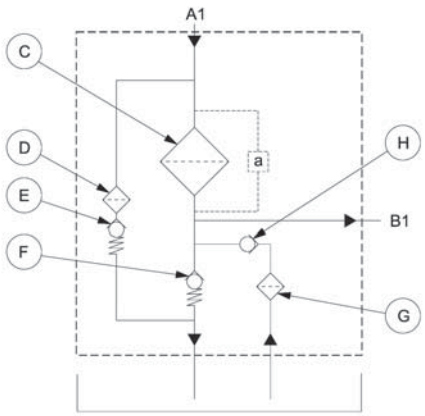
Additional Indicator for SRK 120 (if mounting holes are predrilled) - only on request
P167580

Additional extension tube for SRK 120 - only on request
Extends lenght of SRK with 178 mm
P763642

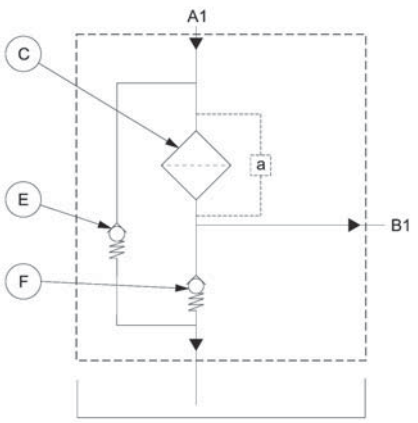
Hydraulic Filter Schematics

Combo 120

With Emergency Suction

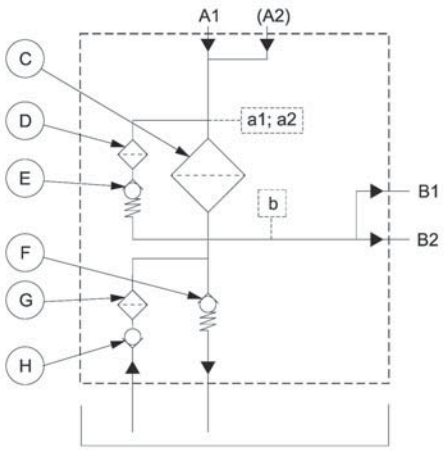


Without Emergency Suction

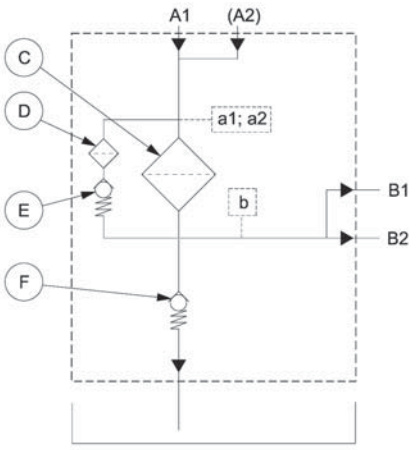


Combo 200/300

With Emergency Suction



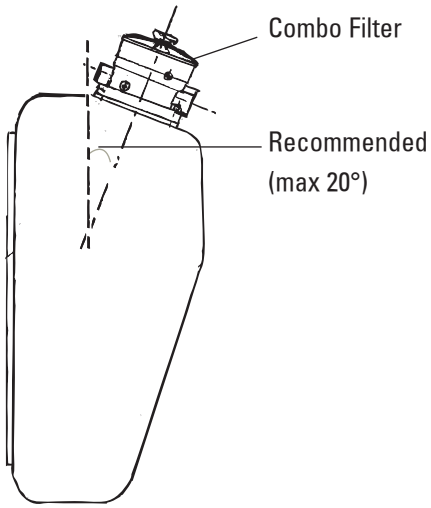
Without Emergency Suction



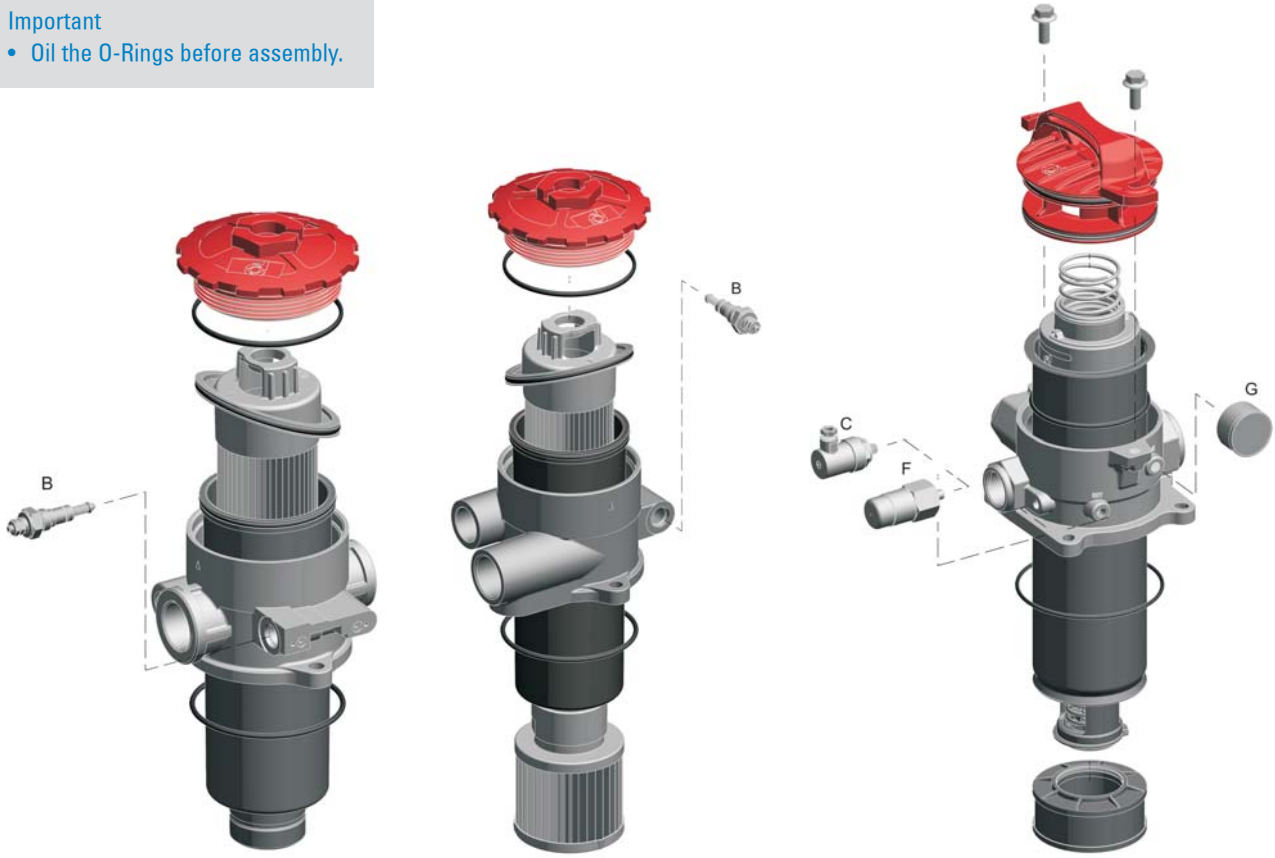
A1 - A2:	from hydraulic users
B1 - B2:	to boost pump
a, a1, a2, b:	pressure indicator ports
C:	main cartridge
D:	by-pass strainer
E:	by-pass valve
F:	back pressure valve
G:	suction strainer
H:	suction valve

Installation & Service Guidelines

- Minimum oil level in the tank must be sufficient to cover completely the emergency suction cartridge or the housing end.
- Extension kit (X770576) is optional for Combo 120 (+178mm).
- Important for the Combo without emergency Suction.
  The suction port always gets clean oil. When the element becomes clogged, oil that reaches the suction port is gradually reduced, so the use of an electrical clogging indicator (P165194) is recommended. Return flow must always be higher than suction flow.
- Maximum slope on the installation: 20°.

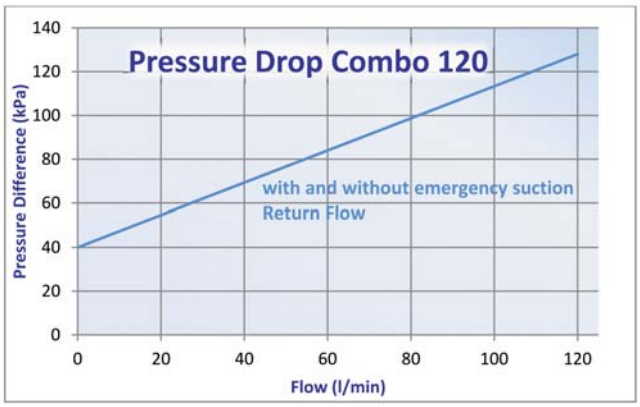


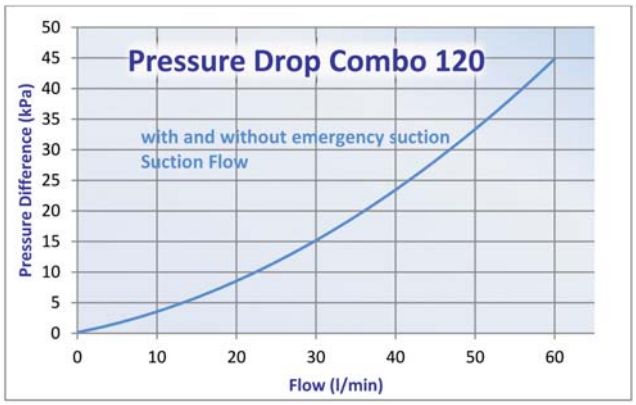
Important
- Oil the O-Rings before assembly.



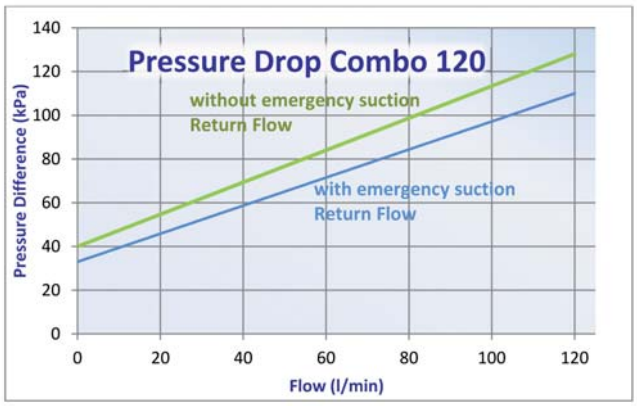
Performance Curves

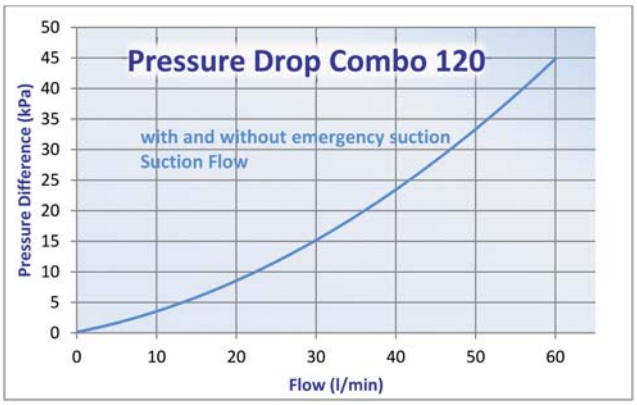
Ports on same Axis

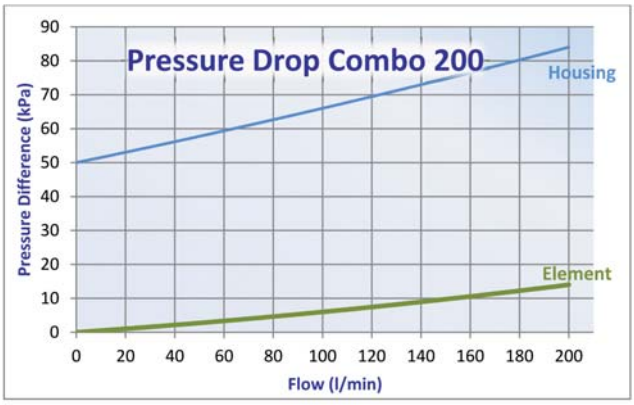


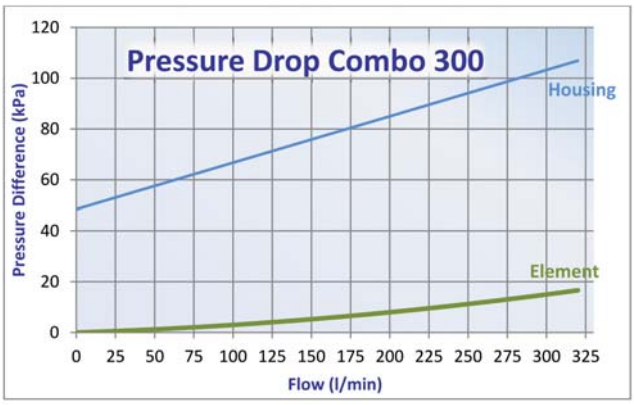


Ports on same Side









FIOA

Suction Line Filters

Threaded Suction Strainers – In-Tank

Technical Data

- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop dertemined per ISO 3968 with oil kinematic viscosity 30cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Wire mesh: 60-90-250 micron.
- Cellulose media: 50 micron.
- Collapse resistance 500 kPa (5 bar) per ISO 2941.

Donaldson FILTRATION SOLUTIONS

Strainers

	WIRE MESH			CELLULOSE MEDIA		CARTRIDGE CODE
	/9		/6	/3		
		90µm	60µm	$ß_{50µm(c)}$=1000		
Family	RMF			RMF		
FIOA20	10	P171861	P171863	5	P171862	FIOA20
FIOA35	17	P171865	P171867	9	P171866	FIOA35
FIOA50	25	P171869	P171871	13	P171870	FIOA50
FIOA85	43	P171873	P171875	20	P171874	FIOA85
FIOA90	45	P171877	P171879	25	P171878	FIOA90
FIOA130	65	P171885	P171887	35	P171886	FIOA130
FIOA160	80	P763478	P764370	40	P764371	FIOA160
FIOA175	85	P171889	P171891	45	P171890	FIOA175
FIOA180	90	P172452	P172454	50	P172453	FIOA180
FIOA220	110	P760151	P760173	55	P760175	FIOA220
FIOA230	116	P171893	P171895	60	P171894	FIOA230
FIOA360	186	P171897	P171899	90	P171898	FIOA360
FIOA500	250	P171901	P171903	120	P171902	FIOA500
FIOA600	300	P171905	P171907	150	P171906	FIOA600
FIOA800	400	P171909	P171911	200	P171910	FIOA800

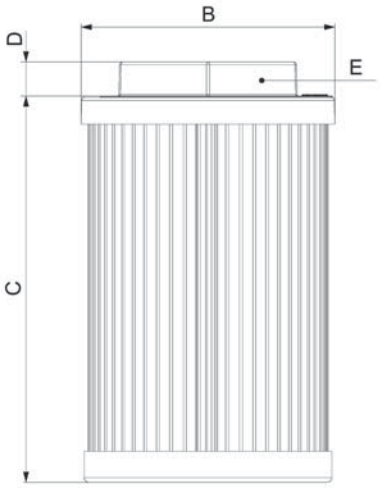
RMF = Recommended Maximum Flow in liters/minute

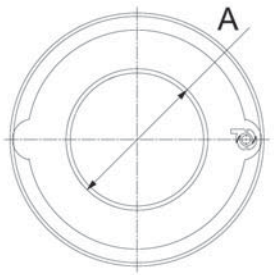
Strainer Dimensions Thread per ISO 228/1				
A	B	C	D	E
	mm	mm	mm	mm
G 3/8	52	68	9	22
G 1/2	69	76	12	27
G 3/4	75	83	12	36
G 1	95	83	14	46
G 1	75	131	10	46
G 1 1/4	95	172	12	60
G 1 1/2	86	130	12	60
G 1 1/2	140	98	15	60
G 1 1/2	95	205	12	60
G 2	101	205	14	80
G 2	140	138	15	80
G 2	140	205	15	80
G 2	140	301	15	80
G 2 1/2	140	301	16	106
G3	140	301	16	106

	WIRE MESH	
Family	RMF	
FIOA90S	45	P765208
FIOA90S	65	P766638

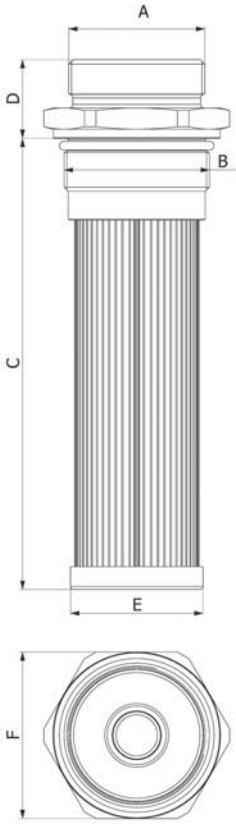
	Strainer Dimensions							
Efficiency	A	B	C	D	E	F	BPV	Reference Drawing
µm		mm	mm	mm	mm	mm	bar	
90	diam 32	M48x1.5	155	48	45	50	NA	B
125	M45x2	M48x2	150	26	44	55	1	A

BPV= Bypass Valve Setting

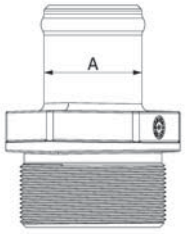




Reference Drawing A



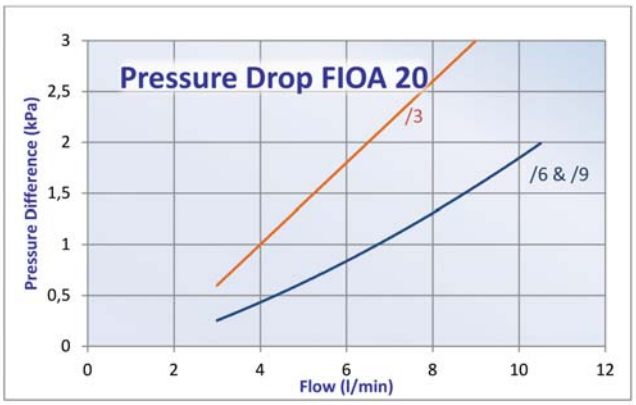
Reference Drawing B

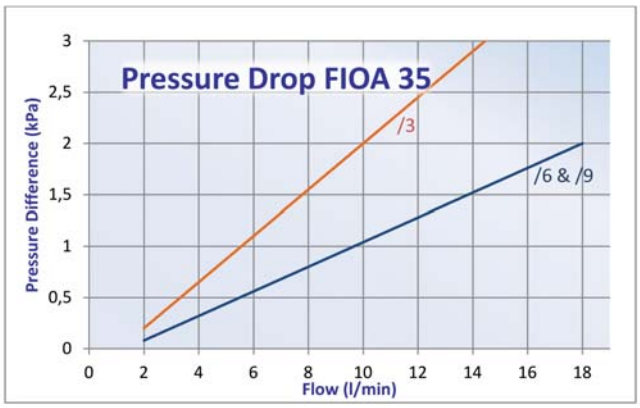


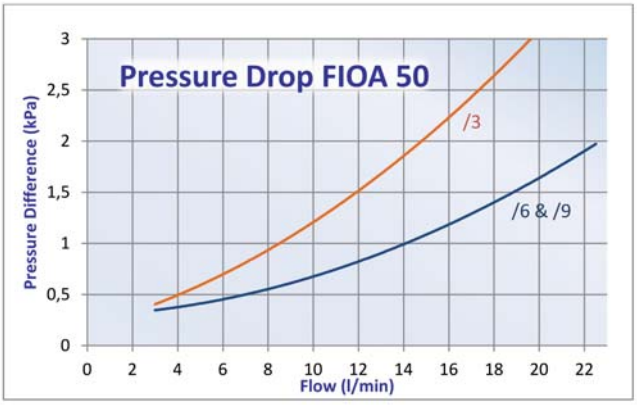
Important

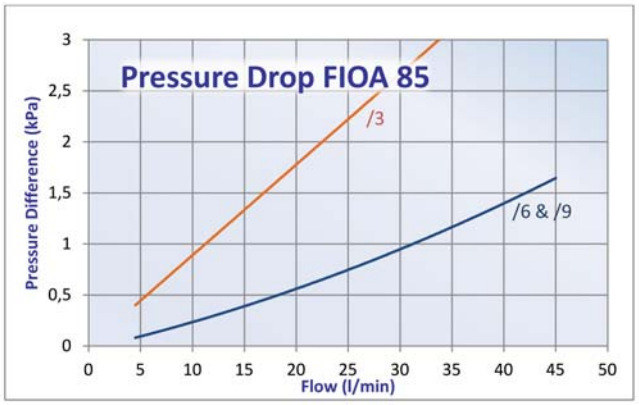
- The strainer thread must be lubricated before spinning on the strainer to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

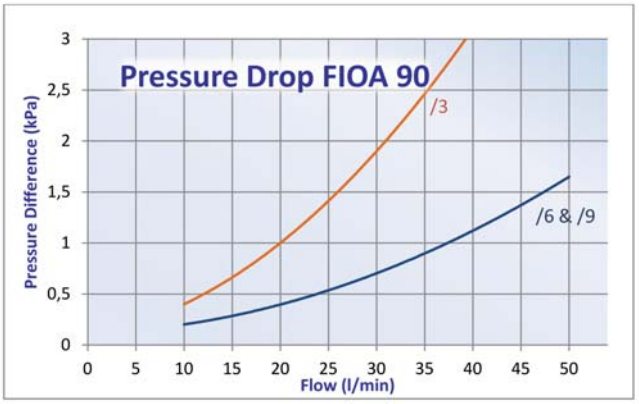
Performance Curves

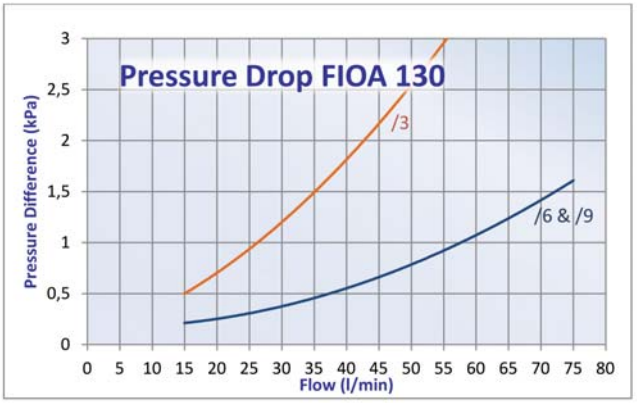


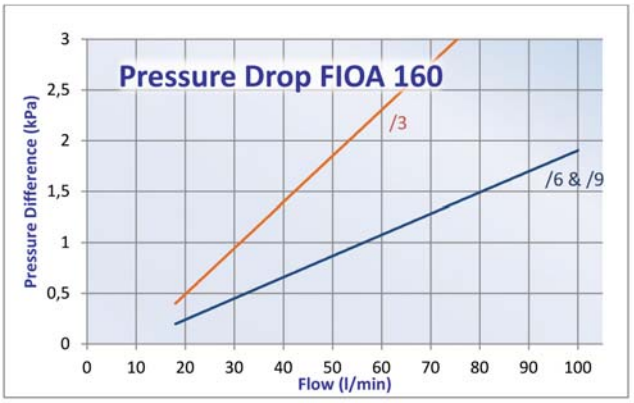


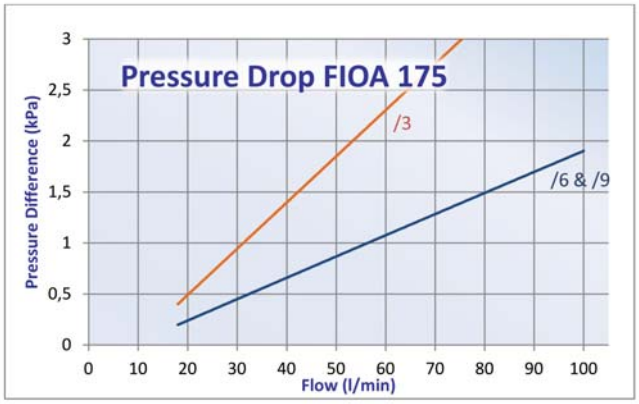


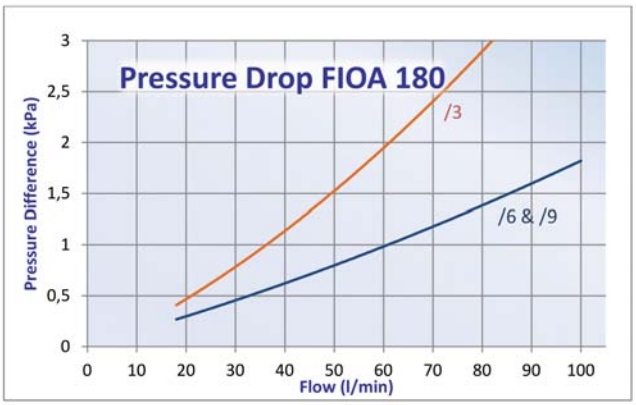


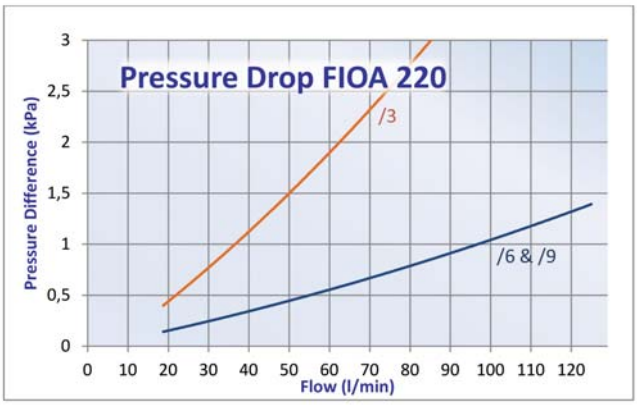


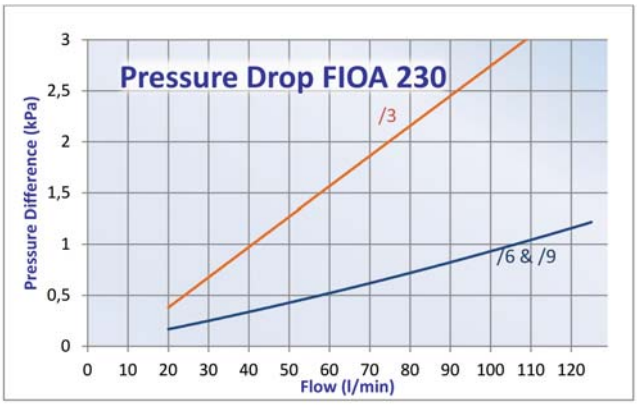


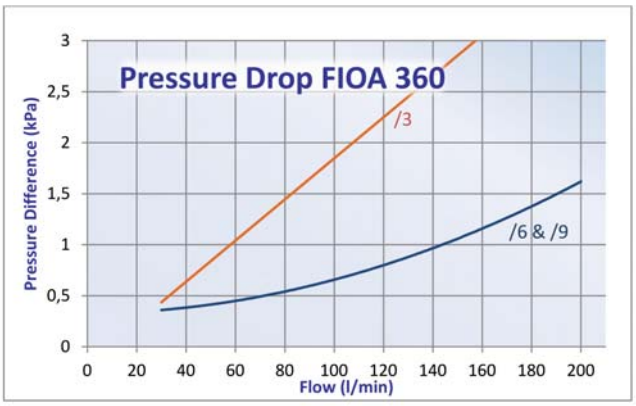


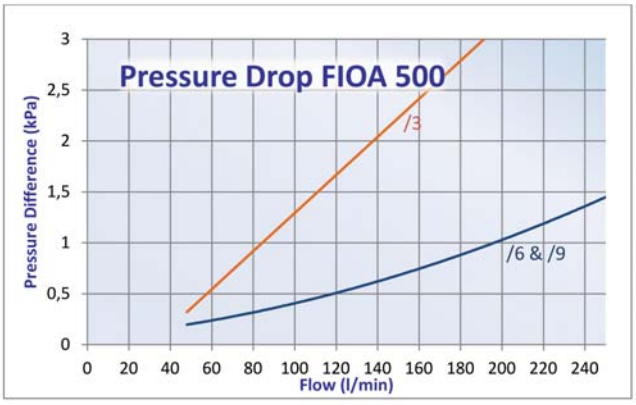


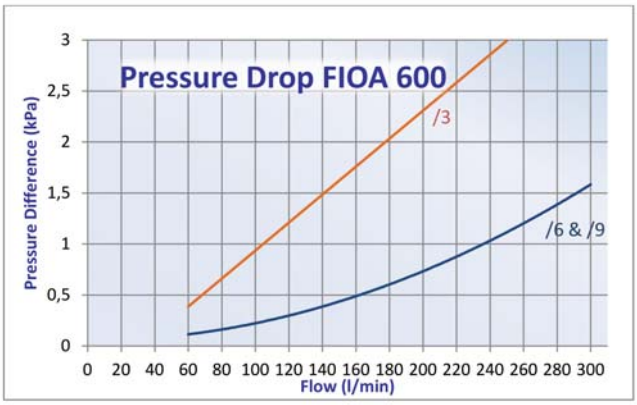

Pressure Drop FIOA 180
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 10 20 30 40 50 60 70 80 90 100
Flow (l/min)

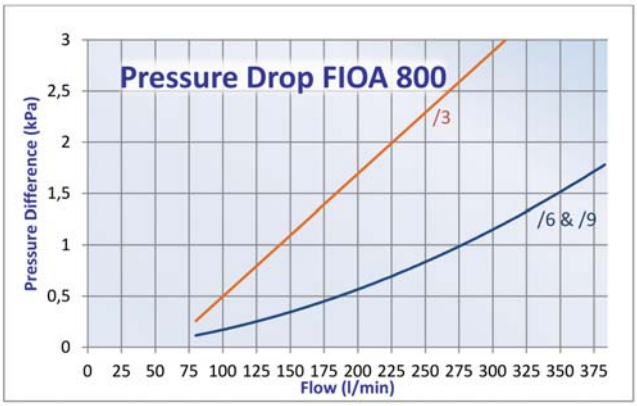

Pressure Drop FIOA 220
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 10 20 30 40 50 60 70 80 90 100 110 120
Flow (l/min)

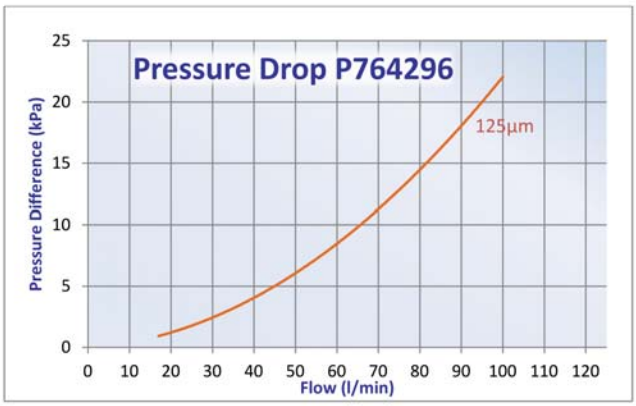

Pressure Drop FIOA 230
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 10 20 30 40 50 60 70 80 90 100 110 120
Flow (l/min)

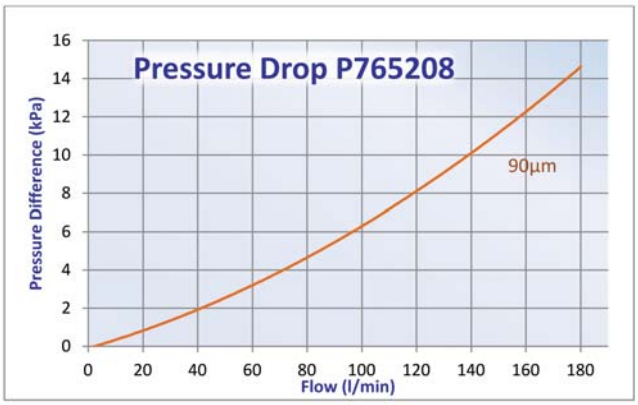

Pressure Drop FIOA 360
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 20 40 60 80 100 120 140 160 180 200
Flow (l/min)


Pressure Drop FIOA 500
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 20 40 60 80 100 120 140 160 180 200 220 240
Flow (l/min)


Pressure Drop FIOA 600
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Flow (l/min)


Pressure Drop FIOA 800
/3
/6 & /9
Pressure Difference (kPa)
0 0,5 1 1,5 2 2,5 3
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375
Flow (l/min)


Pressure Drop P764296
125µm
Pressure Difference (kPa)
0 5 10 15 20 25
0 10 20 30 40 50 60 70 80 90 100 110 120
Flow (l/min)


Pressure Drop P765208
Pressure Difference (kPa)
16
14
12
10
8
6
4
2
0
0
20
40
60
80
100
120
140
160
180
Flow (l/min)
90µm

FAL

Suction Line Filters
Low Pressure Filters – In-Line
to be clamped

Technical Data

- Operating pressure up to 400 kPa (4 bar).
- Static pressure testing up to 600 kPa (6 bar).
- Operating temperature -20 +120° C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm^3.

Filter Elements

- Wire mesh: 160 micron.
- Collapse resistance 500 kPa (5 bar) per ISO 2941.

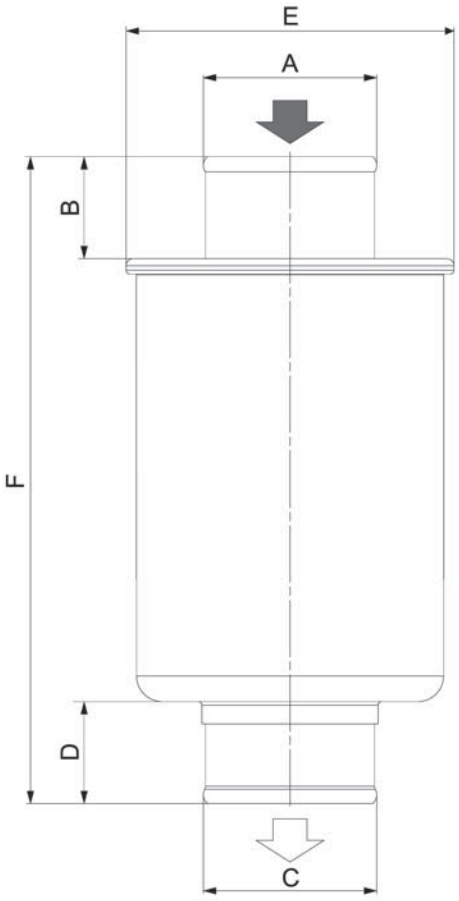
Donaldson FILTRATION SOLUTIONS

Components

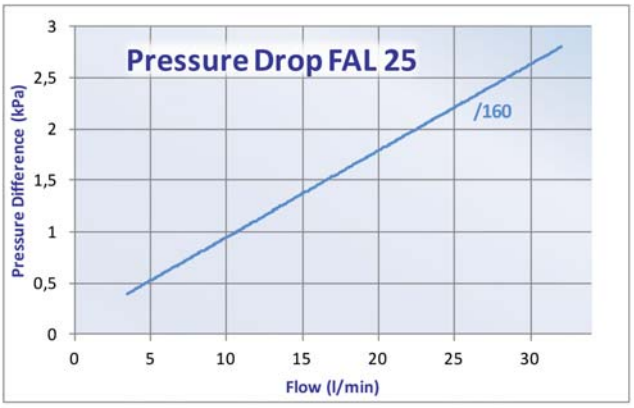
	WIRE MESH MEDIA	
	/160	
	160µm	
Family	RMF	
FAL25	25	P176903
FAL45	45	P175142
FAL65	65	P175143
FAL85	85	P761040
FAL100	100	P176904

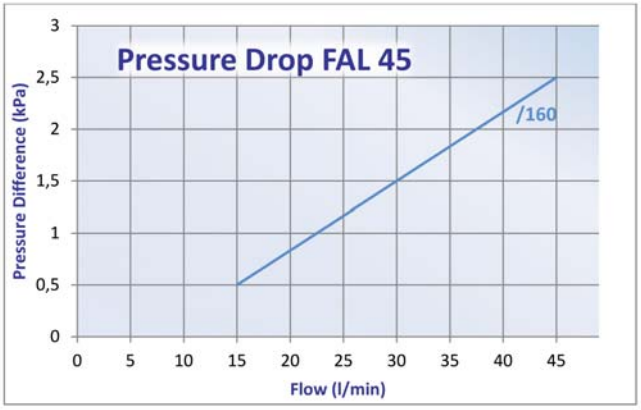
FILTER DIMENSIONS					
A	B	C	D	E	F
mm	mm	mm	mm	mm	mm
19	26	19	20	74	149
30	23	30	18	74	145
38	23	38	18	74	145
38	23	38	20	74	208
50	22	50	22	85	181

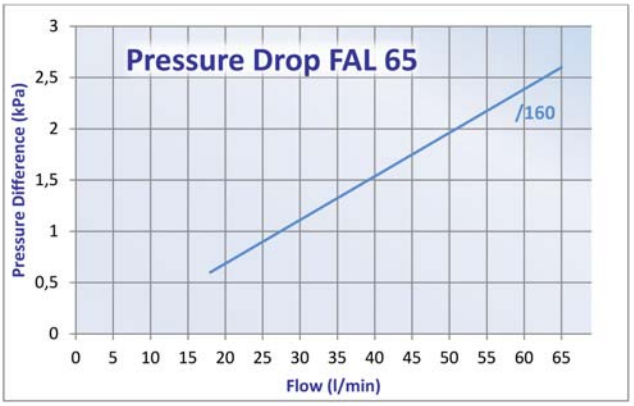
RMF = Recommended Maximum Flow in liters/minute

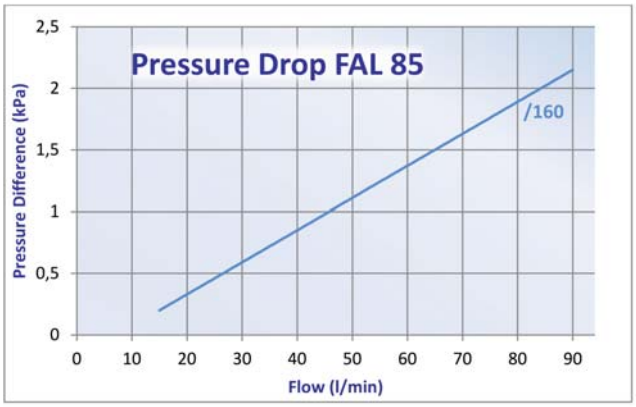


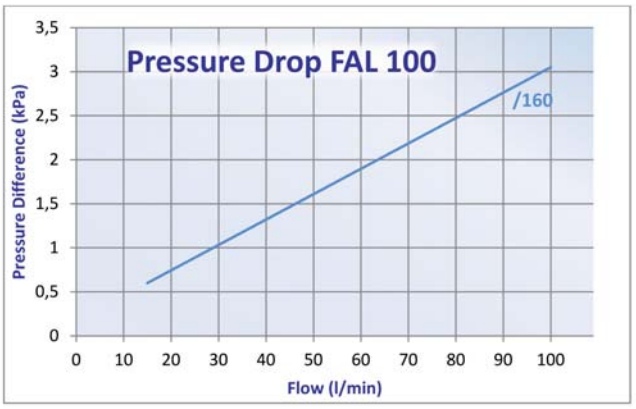
Performance Curves





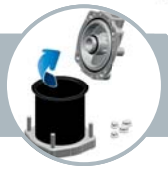






FLK-FLS
FLK-FLA

Open empty housing
in correct order



Remove carton ring
before use

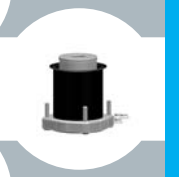
Check if O-ring between
lid and housing is installed
and intact

Check if O-Ring on cartridge
is installed and intact

For FIK:
Mount O-ring over stud

For Low Pressure cartridges:
Mount spring on cartridge

Mount element in
housing



For Combo 120:
Align arrows as shown

Assemble lid on housing

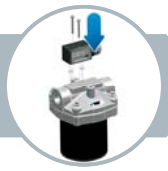
Assemble bolts and
screws in correct order

Tighten screws, bolts or lid until
thread ends
For spin-ons: hand tighten until
contact between O-ring and
head is made; and then continue
by hand as indicated on spin-on

Degrease surface where
sparepart sticker will be
mounted
Only for cartridge type filters

Sparepart sticker in each
sparepart box

Fix sparepart sticker in area
indicated – Ready!



Do not forget seals

FLK-FLA

Suction Line Filters
Low Pressure Filters – In-Line
up to 30 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 3000 kPa (30 bar).
- Static pressure testing up to 4500 kPa (45 bar).
- By-pass valve setting 30 kPa (0,3 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Flange per SAE J518: 3000 PSI.

Filter Elements

- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron.
- Synteq® synthetic media: 11-23 micron.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

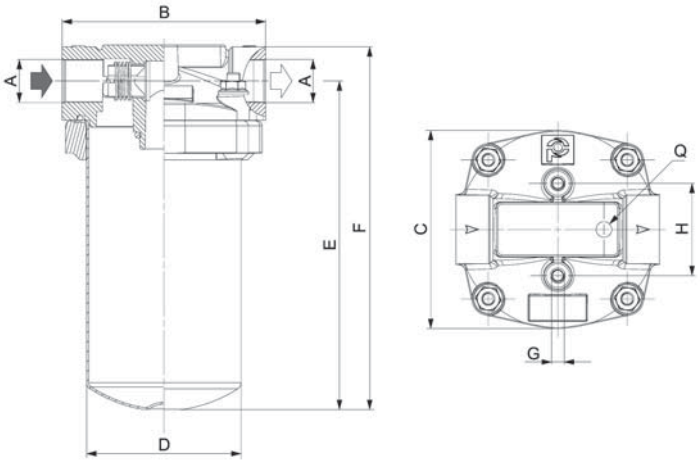
Donaldson FILTRATION SOLUTIONS

Components

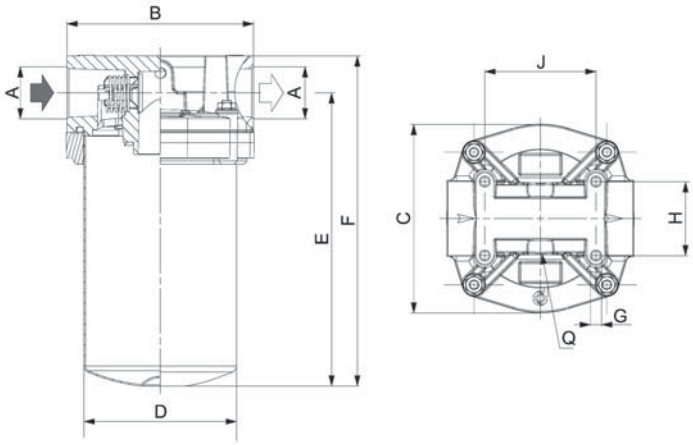
	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FLA50	20	P171518	20	P171523	15	P171522	15	P171521	10	P171520	10	P171519	CR50
FLA100	40	P171530	40	P171535	30	P171534	30	P171533	25	P171532	25	P171531	CR100
FLA150	65	P171584	65	P171589	55	P171588	55	P171587	45	P171586	45	P171585	CR125
FLA180	90	P171536	90	P171541	60	P171540	60	P171539	55	P171538	55	P171537	CR180
FLA200	100	P171596	100	P171601	70	P171600	70	P171599	80	P171598	80	P171597	CL200
FLA250	125	P171590	125	P171595	80	P171594	80	P171593	70	P171592	70	P171591	CR220
FLAF 250	125	P171590	125	P171595	80	P171594	80	P171593	70	P171592	70	P171591	CR220
FLA330	170	P171560	170	P171565	110	P171564	110	P171563	90	P171562	90	P171561	CR330
FLAF 330	170	P171560	170	P171565	110	P171564	110	P171563	90	P171562	90	P171561	CR330
FLA500	250	P171566	250	P171571	200	P171570	200	P171569	170	P171568	170	P171567	CR500
FLAF 500	250	P171566	250	P171571	200	P171570	200	P171569	170	P171568	170	P171567	CR500
FLAF 800	300	P171578	300	P171583	250	P171582	250	P171581	200	P171580	200	P171579	CR800

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
All housings are predrilled and holes are plugged, you are not obliged to install an indicator.
The Bypass valve is installed in the head of the filter. The Cartridges have also a Bypass valve, but at a higher setpoint.

FLA 50-180



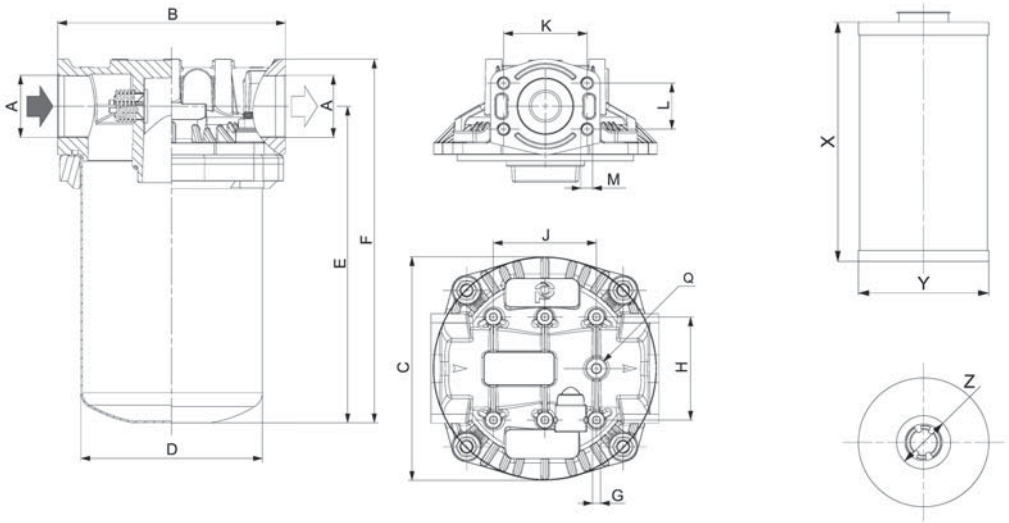
FLA 200



Standard Housing without Cartridge	HOUSING DIMENSIONS																CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	X	Y	Z	
		mm	mm	mm	mm	mm		mm	mm	mm	mm		mm	bar	predrilled holes	plugged	mm	mm	mm	
P766484	G1/2	119	116	90	140	161	M8	54	-	-	-	-	-	0,3	G 1/8	YES	75	70	29	P171954 P171959 P171967 P173105
P766485	G3/4	119	116	90	192	213	M8	54	-	-	-	-	-	0,3	G 1/8	YES	128	70	29	
P766486	G1	140	135	109	246	277	M8	68	-	-	-	-	-	0,3	G 1/8	YES	169	95	41	
P766487	G1 1/4	140	135	109	284	314	M8	68	-	-	-	-	-	0,3	G 1/8	YES	209	95	41	
P766488	G1 1/4	151	153	123	238	268	M8	60	90	-	-	-	-	0,3	G 1/8	YES	180	112	46	
P766489	G1 1/2	212	208	169	225	269	M8	96	96	-	-	-	-	0,3	G 1/8	YES	136	140	65	
P766490	Flange 1" 1/2	212	208	169	225	269	M8	96	96	70	36,7	M12	22	0,3	G 1/8	YES	136	140	65	
P766491	G1 1/2	212	208	169	295	339	M8	96	96	-	-	-	-	0,3	G 1/8	YES	203	140	65	
P766492	Flange 1" 1/2	212	208	169	295	339	M8	96	96	70	36,7	M12	22	0,3	G 1/8	YES	203	140	65	
P766493	G2	212	208	169	296	339	M8	96	96	-	-	-	-	0,3	G 1/8	YES	203	140	65	
P766494	Flange 2"	212	208	169	295	339	M8	96	96	77,8	42,8	M12	22	0,3	G 1/8	YES	203	140	65	
P766495	Flange 2"	212	208	171	495	539	M8	96	96	77,8	42,8	M12	22	0,3	G 1/8	YES	400	140	65	

FLA 250-800

Flange

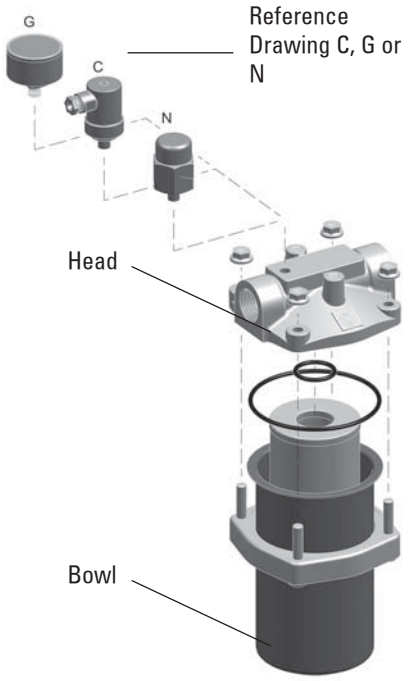


SUCTION FILTERS IN-LINE

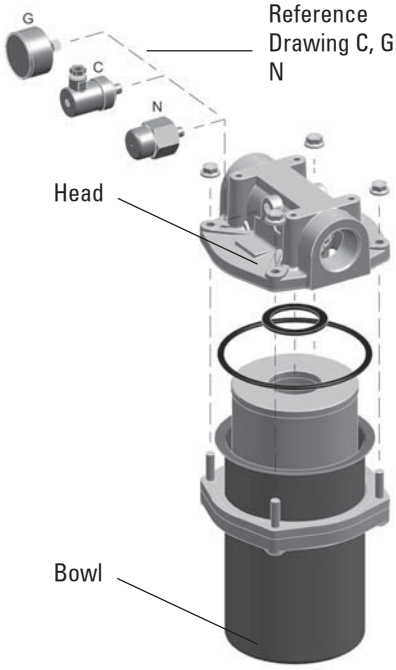
Indicator Choices

Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171954	Visual	Vacuum	G	-0,3				
P171959	Visual	Vacuum	N	-0,3				
P171967	Electrical	Vacuum	C	-0,3	Normally Open	IP65	PG7	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.
P173105	Electrical	Vacuum	C	-0,3	Normally Closed	IP65	PG7	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.

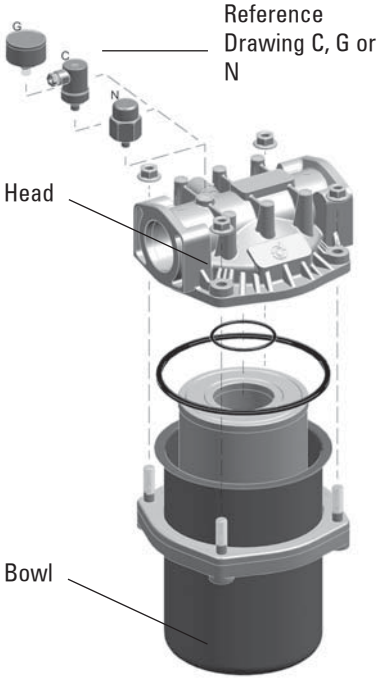
Installation & Service Guidelines



FLA 50-180

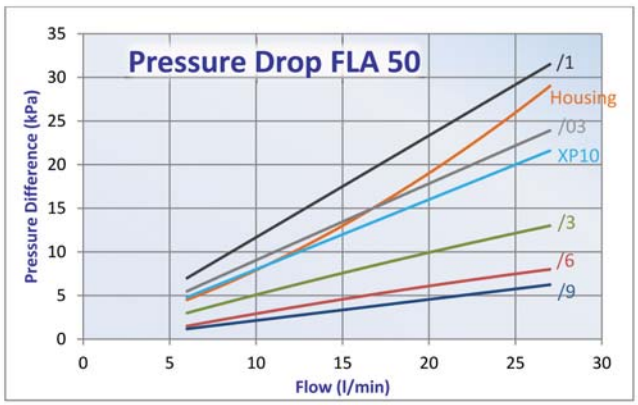


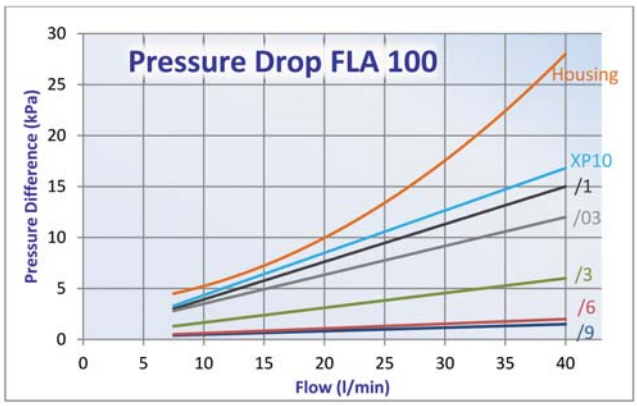
FLA 200

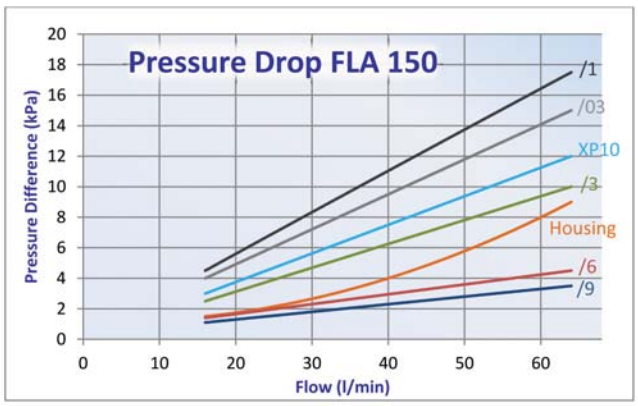


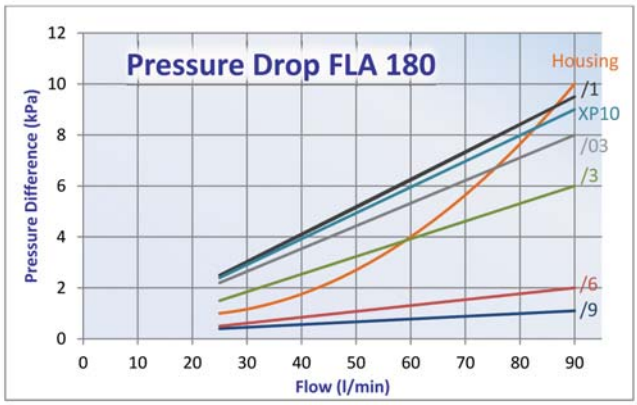
FLA(F) 250-800

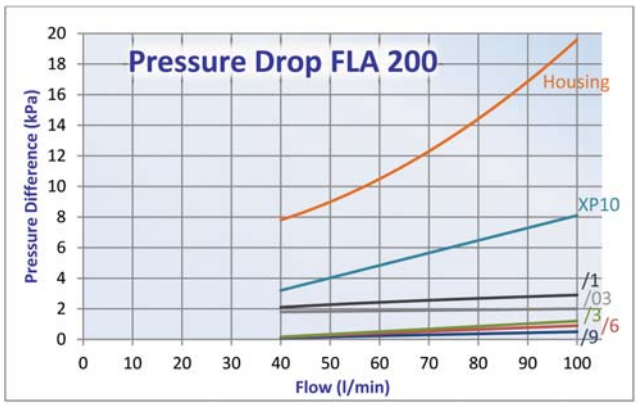
Performance Curves

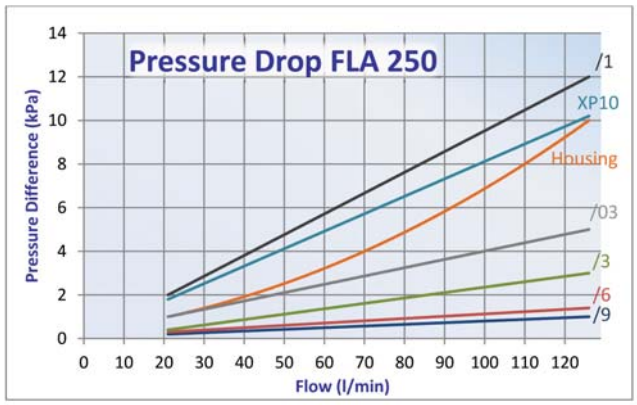


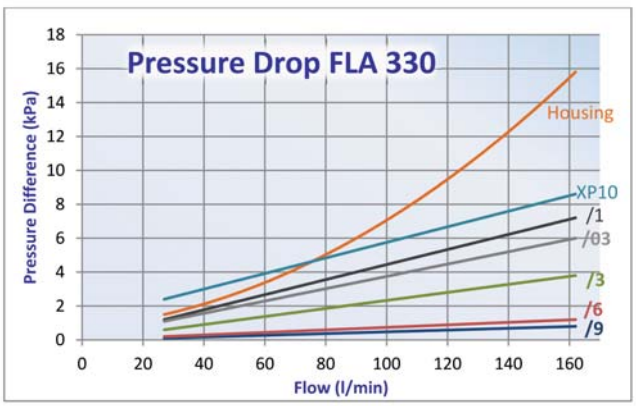


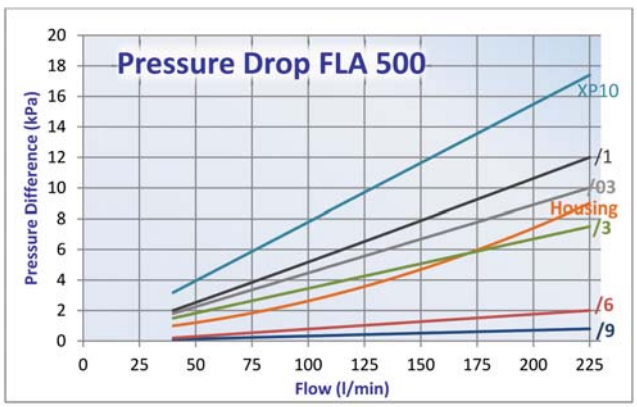


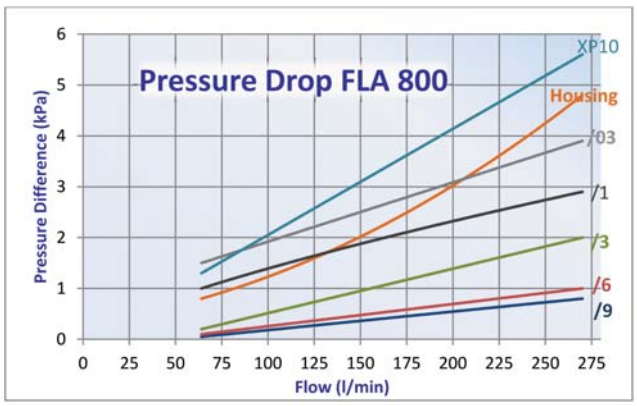


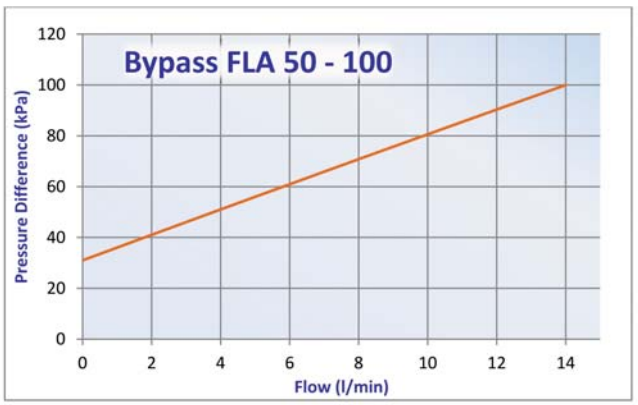


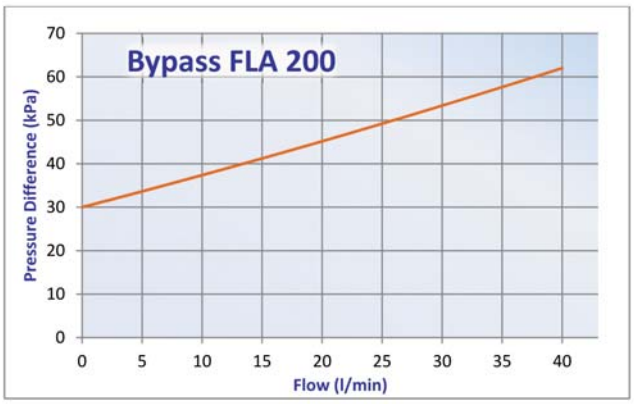


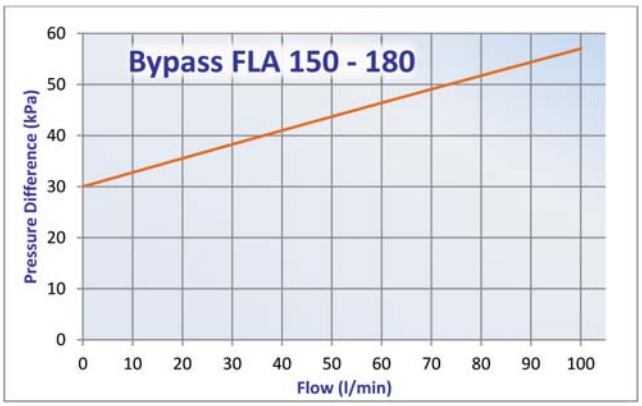





Pressure Drop FLA 800
Pressure Difference (kPa)
Flow (l/min)
XP10
Housing
/03
/1
/3
/6
/9
0 1 2 3 4 5 6
0 25 50 75 100 125 150 175 200 225 250 275


Bypass FLA 50 - 100
Pressure Difference (kPa)
Flow (l/min)
0 20 40 60 80 100 120
0 2 4 6 8 10 12 14


Bypass FLA 200
Pressure Difference (kPa)
Flow (l/min)
0 10 20 30 40 50 60 70
0 5 10 15 20 25 30 35 40


Bypass FLA 150 - 180
Pressure Difference (kPa)
Flow (l/min)
0 10 20 30 40 50 60
0 10 20 30 40 50 60 70 80 90 100

FBK-FACA

Suction Line Filters
Low Pressure Filters – In-Line
up to 10 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- By-pass valve setting 30 kPa (0,3bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Operating pressure up to 1000 kPa (10 bar).
- Static pressure testing up to 1500 kPa (15 bar).
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Wire mesh: 60 micron.
- Cellulose media: 36-50 micron.
- Synteq® synthetic media: 11-23 micron.

FBK-FACA

Donaldson FILTRATION SOLUTIONS

Components

	WIRE MESH MEDIA		CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/6		/3		/1		/03		XP10		
	60µm		$ß_{50µm(c)}$≥1000		$ß_{36µm(c)}$≥1000		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		
Family	RMF		RMF		RMF		RMF		RMF		
FACA60	30	P171607	25	P171606	20	P550268	15	P171604	15	P171602	CA60
FACA80	35	P171612	30	P171611	25	P171610	20	P171609	20	P171608	CA80
FACA108			50	P764638							CA108
FACA118			60	P763987							CA108
FACA160	80	P171617	80	P171616	70	P550148	60	P171614	60	P171613	CA160
FACA200	100	P171622	100	P171621	90	P171620	80	P171619	80	P171618	CA200
FACA380	190	P171617	190	P171616	170	P550148	150	P171614	150	P171613	CA160
FACA400	200	P171622	200	P171621	180	P171620	180	P171619	180	P171618	CA200
FACA220			100	P764410					80	P764411	CA220
FACA250			120	P764409					90	P763668	CA250

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
BPV = Bypass Valve Setting

SUCTION FILTERS IN-LINE

Heads Choices

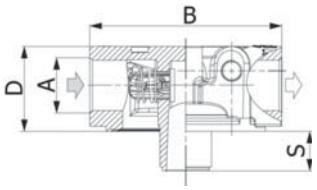
Head for Family	Part	Ports	Bypass Valve Setting	Indicator Info			Snout	Mounting holes
				Drilled holes for indicator	Side	Indicator to use		
FACA 60/80	P561140	1 1/16 SAE	0,3 bar	no	-	none	1-12 UNF	M8
	P563288	1/2-14 NPTF	1 bar	plugged	left + right	P563979 or P563299	1-12 UNF	1/4-20 UNC
	P561138	3/4-16 UNF	1,7 bar	no	-	none	1-12 UNF	1/4-20 UNC
	P761262	G3/4	0,3 bar	plugged	left + right	P171954, P171959, P171967 or P173105	G3/4	M8
	P173442*	G3/4	0,3 bar	no		none	G3/4	M8
	P175001	G3/4	no opening	plugged	left + right	P171954, P171959, P171967 or P173105	G3/4	M8
FACA 160/200	P761259	G1 1/4	0,3 bar	plugged	left + right	P171954, P171959, P171967 or P173105	G1 1/4	M8
	P173203*	G1 1/4	0,3 bar	no	-	none	G1 1/4	M8
	P762638	G1 1/4	1,5 bar	plugged	right	P171954, P171959, P171967 or P173105	G1 1/4	M8
	P173403	G1 1/4	no opening	plugged	left + right	P171954, P171959, P171967 or P173105	G1 1/4	M8
FACA 220/250	P764420	G1 1/4	0,3 bar	plugged	right	P171954, P171959, P171967 or P173105	1 1/2-16 UN	M10
	P764419*	G1 1/4	0,3 bar	no	-	none	1 1/2-16 UN	M8
	P764421	G1 1/4	no opening	plugged	right	P171954, P171959, P171967 or P173105	1 1/2-16 UN	M8
FACA 380/400	P761260	G1 1/2	0,3 bar	plugged	front	P171954, P171959, P171967 or P173105	G1 1/4	M10
	P766294*	G1 1/2	0,3 bar	no	-	none	G1 1/4	M10

FBK Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.
Unless otherwise mentioned, the usage of indicators is mandatory, because the drilled holes for indicators are not plugged.

* Standard Head

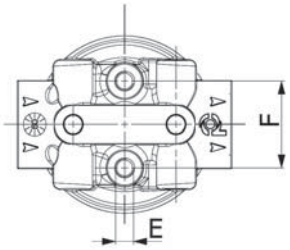
Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P173442	G3/4	95	13	41,5	M8	38		20	0,3	146	96	G3/4
										209	96	G3/4
NA										183	108	M40x2
										230	108	M40x2
P173203	G1 1/4	132	28,5	61,5	M8	50		24	0,3	181	128	G1 1/4
										226	128	G1 1/4
P766294	G1 1/2	138	35	70	M10		65	24	0,3	181	128	G1 1/4
										226	128	G1 1/4
P764419	G1 1/4	132	28,5	61,5	M8	50	50	25	0,3	236	136	1 1/2-16UN
										306	136	1 1/2-16UN

FACA 60/80

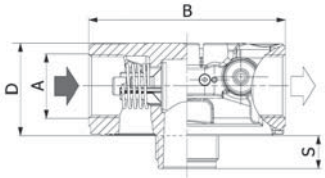


LEFT

RIGHT

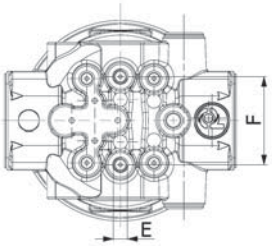


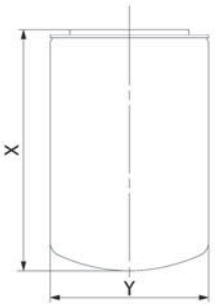
FACA 160/200



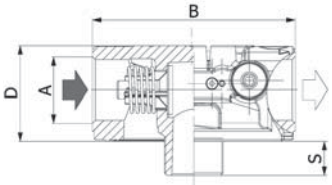
LEFT

RIGHT



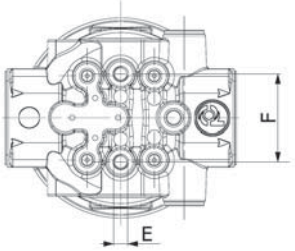


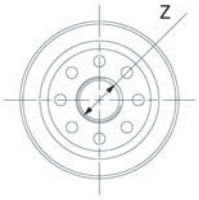
FACA 220/250



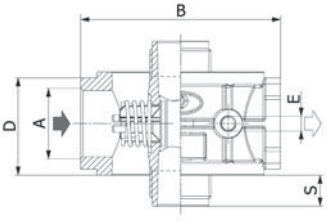
LEFT

RIGHT

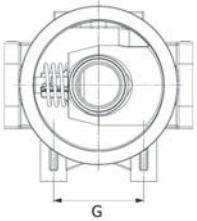




FACA 380/400



FRONT



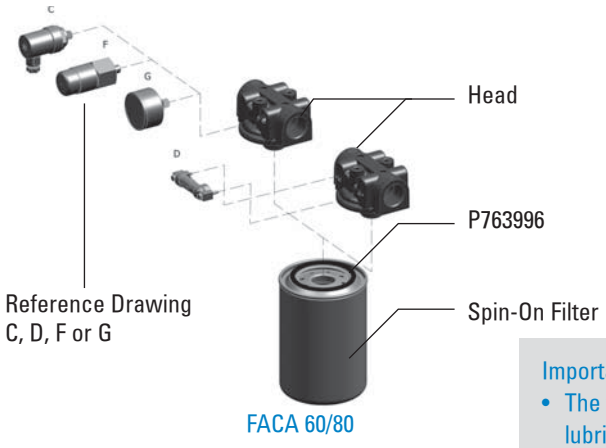
SUCTION FILTERS IN-LINE

Donaldson FILTRATION SOLUTIONS

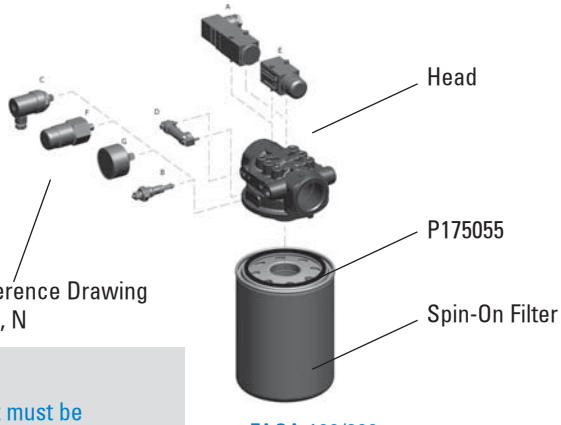
Indicator Choices

Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171967	Electrical	Vacuum	C	-0,3	Normally Open	IP65	PG7	48 V AC - 30 V DC; 0,5 A res. and 0,2 A ind.
P173105	Electrical	Vacuum	C	-0,3	Normally Closed	IP65	PG7	48 V AC - 30 V DC; 0,5 A res. and 0,2 A ind.
P171954	Visual	Vacuum	G	-0,3				
P171959	Visual	Vacuum	N	-0,3				.

Installation & Service Guidelines

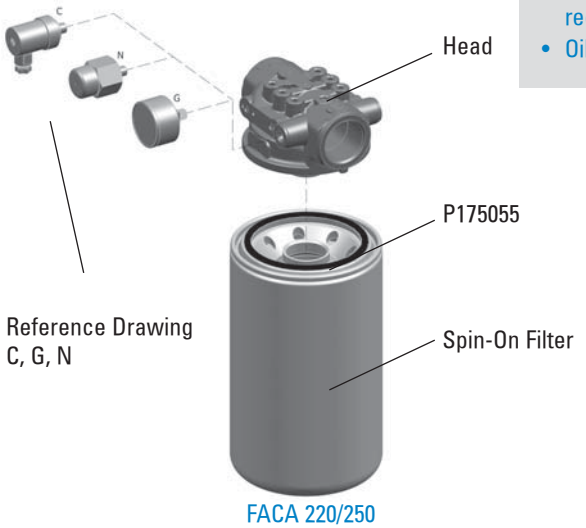


FACA 60/80

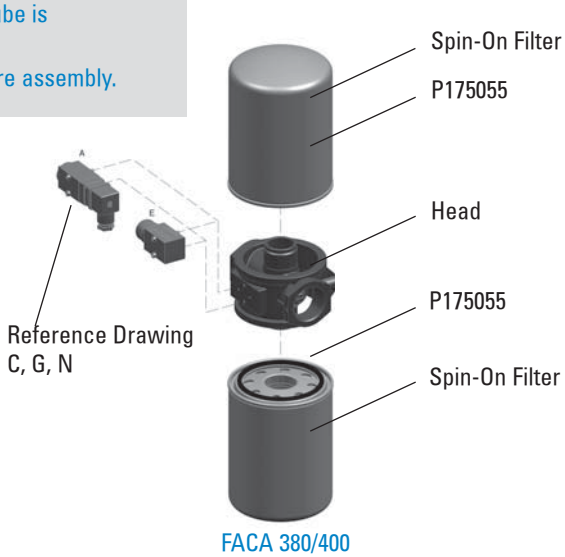


FACA 160/200

Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

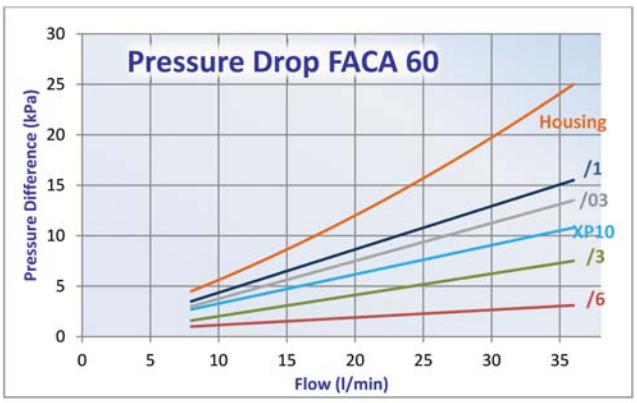


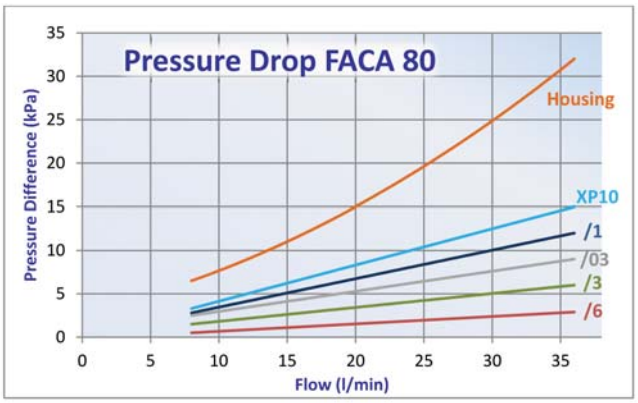
FACA 220/250

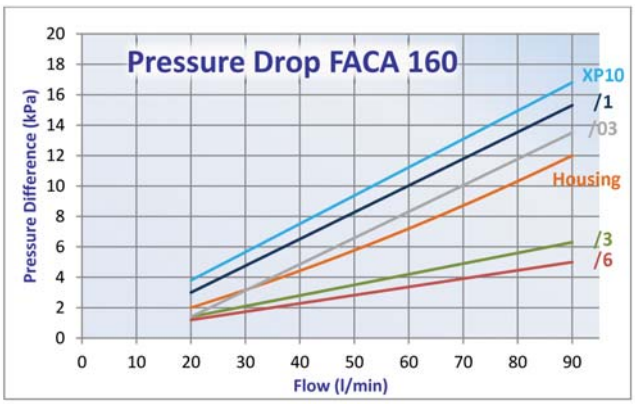


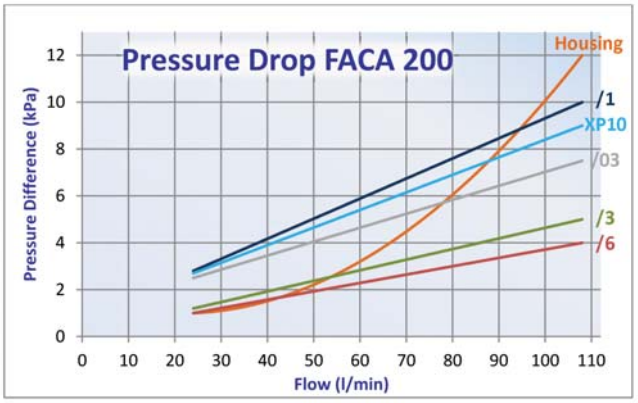
FACA 380/400

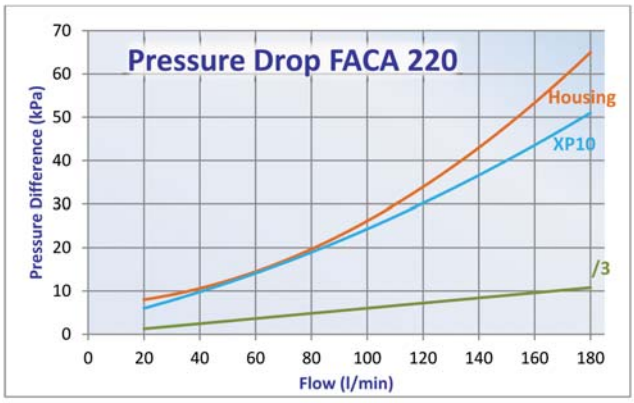
Performance Curves

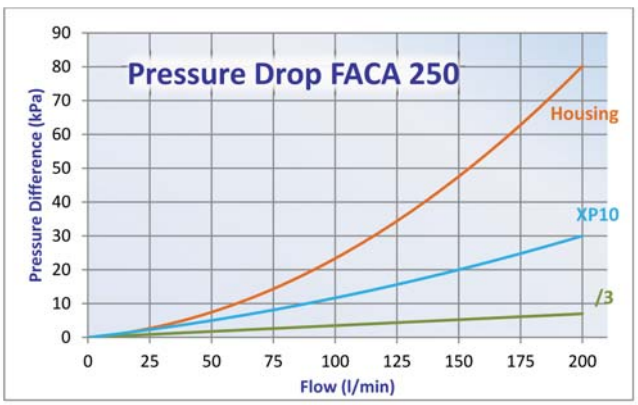


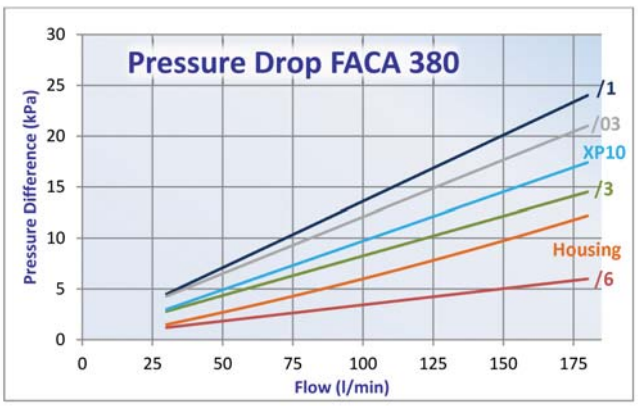


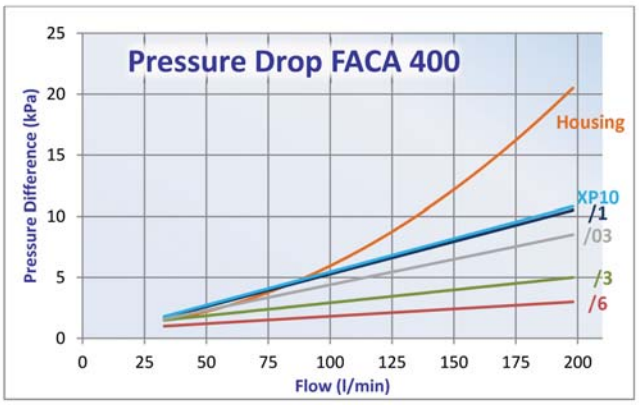




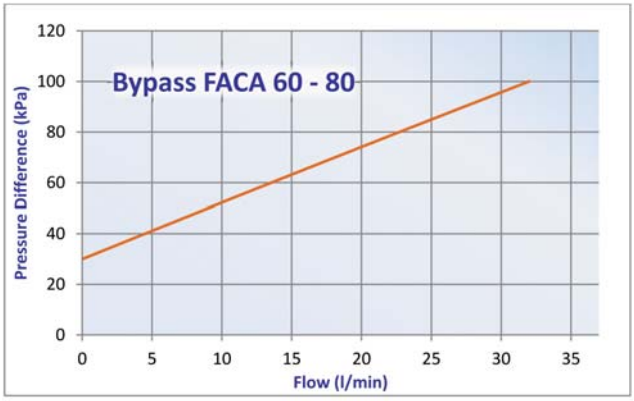


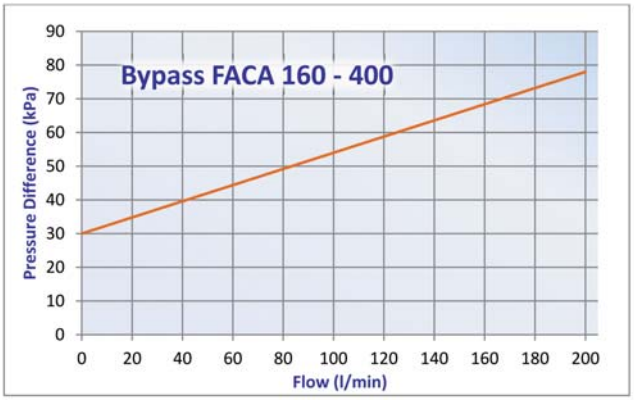






FBK-FACA


Bypass FACA 60 - 80
Pressure Difference (kPa)
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Flow (l/min)


Bypass FACA 160 - 400
Pressure Difference (kPa)
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Flow (l/min)

FMK-FM

Pressure Line
Medium Pressure Filters – In-Line
up to 120 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 12 MPa (120 bar).
- Static pressure testing up to 18 MPa (180 bar).
- Fatigue pressure of 2.000.000 cycles at 0-8 MPa (0-80 bar) per NFPA T 3.10.5 R2:2000.
- By-pass valve integrated in the head setting 600 kPa (6 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Filter head in tempered aluminum.
- Aluminum bowl.

Filter Elements

- Wire mesh: 30-60 micron.
- Cellulose media: 36 micron, reinforced with wire mesh.
- Synteq® synthetic media: 8-11-23 micron, reinforced with wire mesh.
- Collapse resistance 2 MPa (20 bar) per ISO 2941.

Donaldson FILTRATION SOLUTIONS

Components

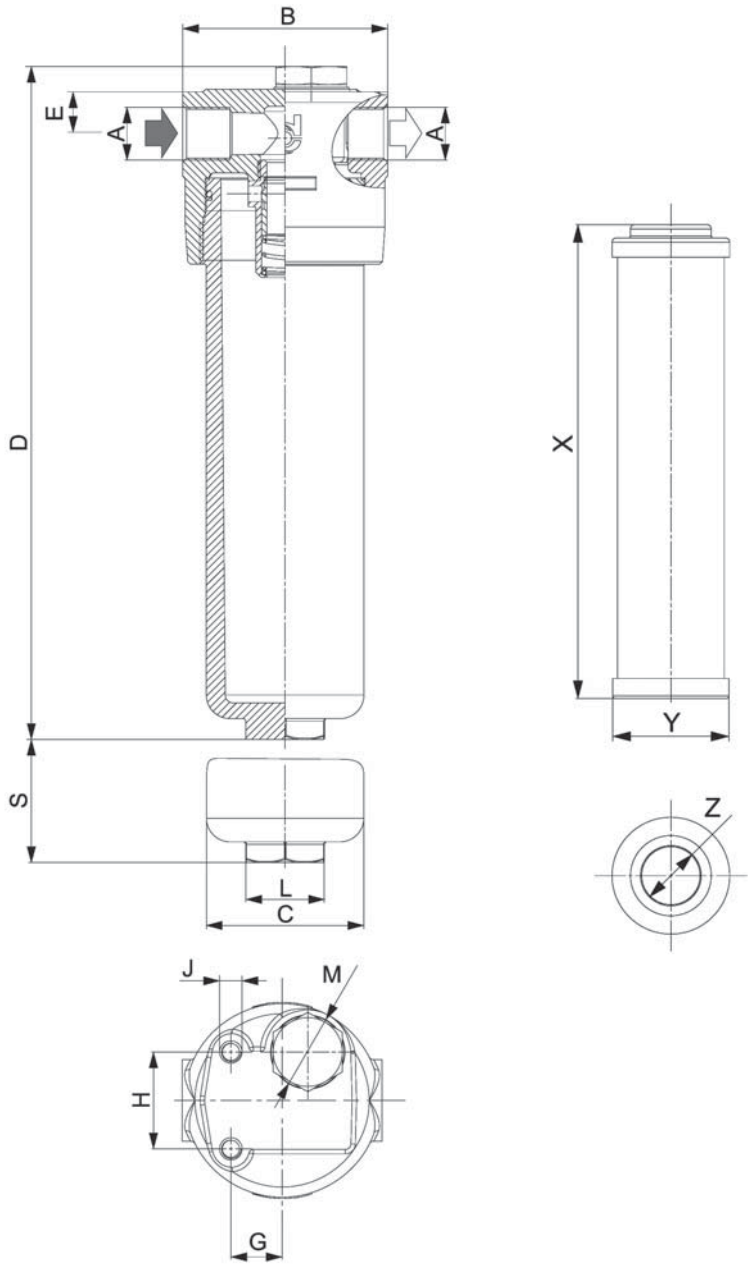
	WIRE MESH MEDIA				CELLULOSE MEDIA		SYNTHETIC MEDIA						CARTRIDGE CODE
	/6		/3M		/1		/03		XP10		XP5		
	60µm		30µm		$ß_{36µm(c)} \geq 1000$		$ß_{23µm(c)} \geq 1000$		$ß_{11µm(c)} \geq 1000$		$ß_{8µm(c)} \geq 1000$		
Family	RMF		RMF		RMF		RMF		RMF		RMF		
FM140	50	P171706	50	P171705	40	P171704	40	P171703	40	P171702	40	P171701	CM140
FM180	80	P171712	80	P171711	60	P171710	60	P171709	60	P171708	60	P171707	CM180

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.

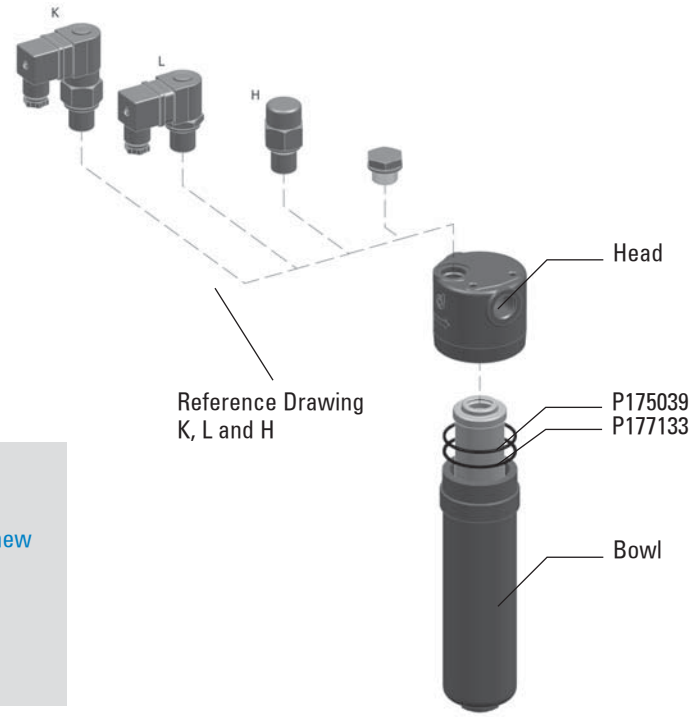
Indicator Choices

Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values	Remark
P171945	Visual	Differential	H	5					
P171947	Electrical	Differential	K	5	Normally Open/ Closed	IP65	PG11	250V AC: 30 V DC; 5A res. and ind.	
P171944	Electrical	Differential	K	5	Normally Open/ Closed	IP65	PG11	250V AC: 30 V DC; 5A res. and ind.	with thermostat at min. temperature at 30°C
P761056	Electrical	Differential	I	5	Normally Open/ Closed	IP65	PG11	30 V DC; 30 V AC; 0,5 A res. and 0,2 A ind.	

Standard Housing	HOUSING DIMENSIONS													CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS
	A	B	C	D	E	G	H	J	L	S	BPV	M	N	X	Y	Z	
		mm	mm	mm	mm	mm	mm		mm	mm	bar	predrilled holes	plugged	mm	mm	mm	
P766661	G1/2	78	60	172	17	20	38	M8x1,25	Hex27	30	6	G1/2	YES	90	43	22,2	P171945, P171947, P171944, P761056
P766660	G1/2	78	60	258	17	20	38	M8x1,25	Hex27	30	6	G1/2	YES	176	43	22,2	

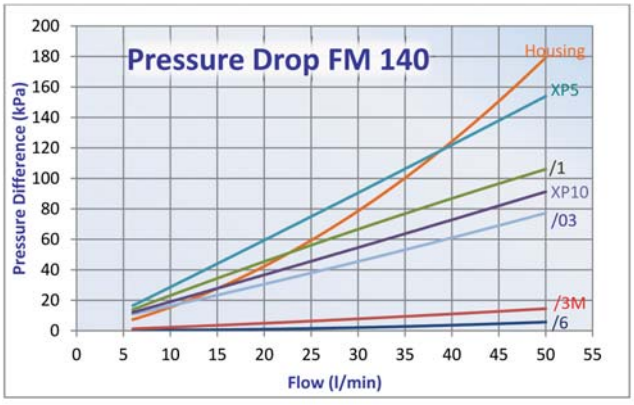


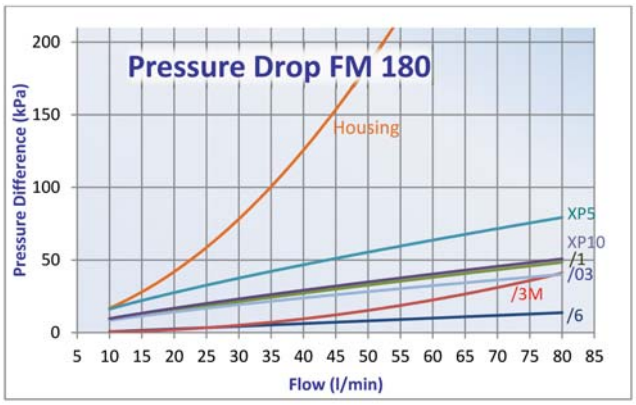
Installation & Service Guidelines

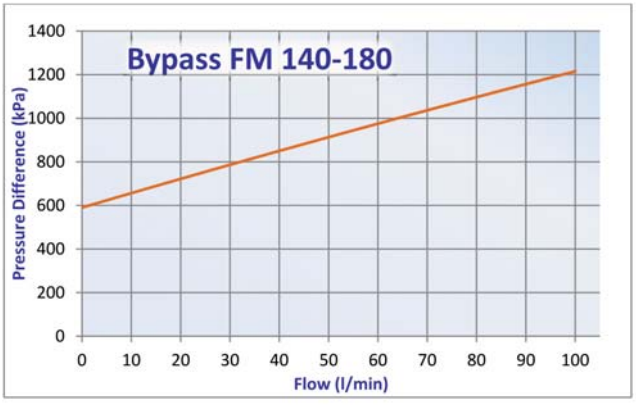


Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

Performance Curves







FCK-LC

Pressure Line

Medium Pressure Filters – In-Line

Last Chance

Technical Data

- Operating pressure up to 6 MPa (60 bar)
- Static pressure testing up to 6 MPa (60 bar).
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Aluminum alloy head and bowl.

Filter Elements

- Wire mesh: 60 micron.
- Collapse resistance 2 MPa (20 bar) per ISO 2941.

FCK-LC

Components

	WIRE MESH MEDIA			CARTRIDGE CODE
	/6			
	60µm			
Family	RMF	Complete Filter	Sparepart	
LC140	30	K020200	P171706	CM140

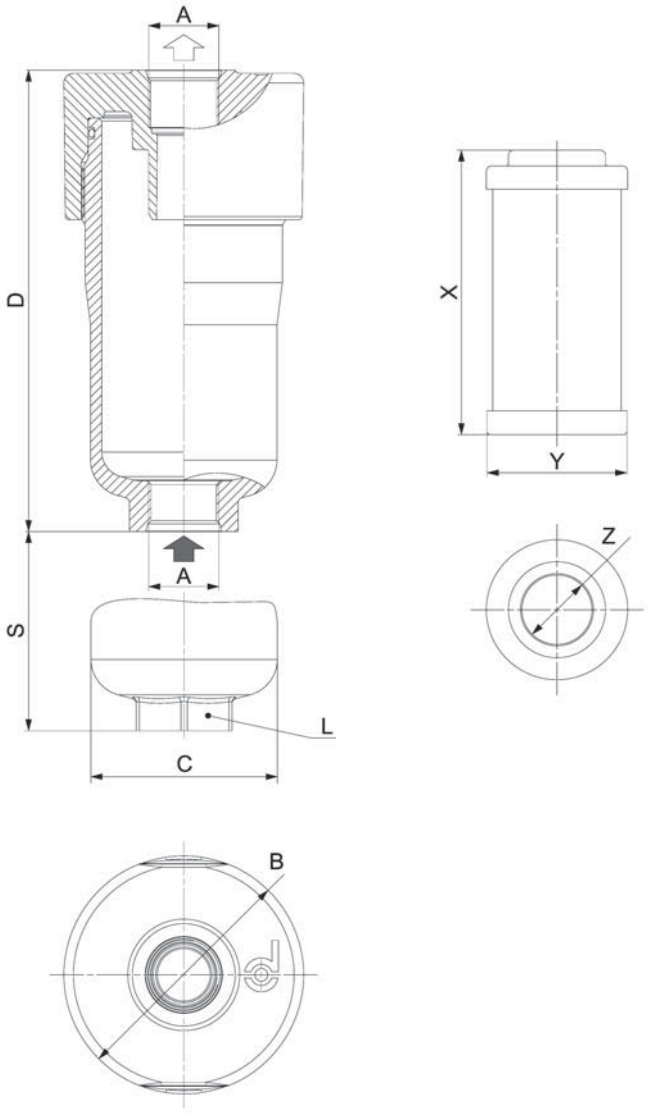
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
Not possible to install an indicator of this filter.

Installation & Service Guidelines

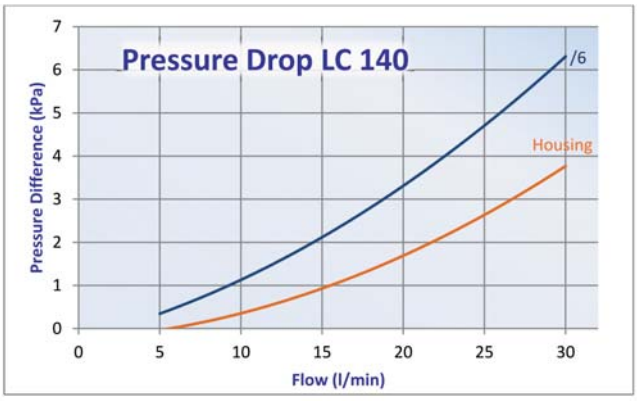
Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

FCK-LC

HOUSING DIMENSIONS						CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
A	B	C	D	L	S	X	Y	Z	
	mm	mm	mm	mm	mm	mm	mm	mm	
M22x1,5	75	58	145	HEX30	100	44	91	23	none



Performance Curves



FLK

Pressure Line
Medium Pressure Filters – In-Line
up to 40 bar

NEW PRODUCT

Technical Data

- Operating pressure up to:
  FLK90 40 bar
  FLK110 30 bar
  FLK125 35 bar
- Fatigue Pressure resistannce according NFPA T 3.10.5.1, R2-2000.
  FLK90 >2 million cycles (0-40 bar @ 2 Hz)
  FLK110 >2 million cycles (0-30 bar @ 2 Hz)
  FLK125 >2 million cycles (0-35 bar @ 2 Hz)
- Static pressure testing up to:
  FLK90 138 bar
  FLK110 90 bar
  FLK125 138 bar
- By-pass valve setting:
  FLK90 3.45 bar
  FLK110 3.45 bar
  FLK125 3.45 bar
- Operating temperature -40 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Synteq® XP media:
  FLK90 12 micron
  FLK110 10 micron
  FLK125 5 micron
- Collapse resistance per ISO 2941:
  FLK90 10 bar
  FLK110 10 bar
  FLK125 15 bar

See p. 6 of this catalogue for more technical highlights about this product line.

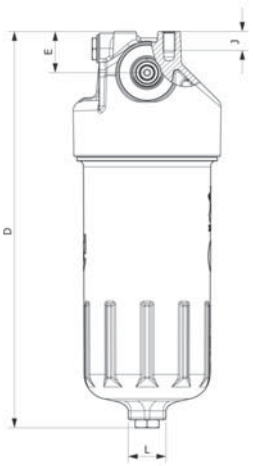
FLK

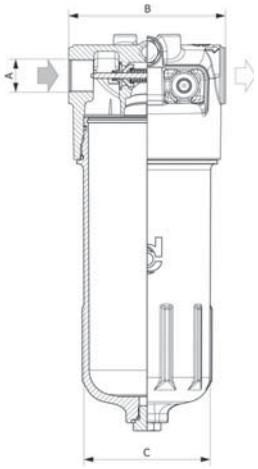
Components

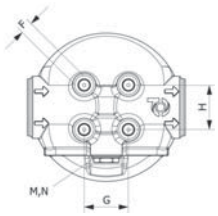
	XP12		XP10		XP5	
	Synthetic Media					
	$ß_{15µ(c)} \geq 1000$		$ß_{11µ(c)} \geq 1000$		$ß_{6µ(c)} \geq 1000$	
Family	RMF		RMF		RMF	
FLK90SA	80	P767129	60	P766987	40	P767128
FLK90SB	95	P767129	75	P766987	55	P767128
FLK90LA	135	P767131	115	P766959	95	P767130
FLK90LB	150	P767131	130	P766959	110	P767130
FLK110MC	140	P767012	120	P766813	100	P766847
FLK110MD	150	P767012	130	P766813	110	P766847
FLK110LC	180	P767011	160	P766811	140	P767010
FLK110LD	210	P767011	190	P766811	170	P767010
FLK125	320	P767106	300	P767104	280	P767084

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
All housings are predrilled and holes are plugged, you are not obliged to install an indicator.
The Bypass valve is installed in the head of the filter. The Cartridges have also a Bypass valve, but at a higher setpoint.

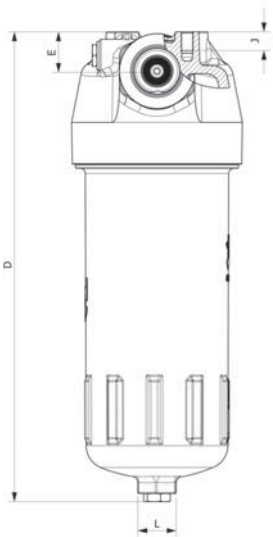
FLK 90

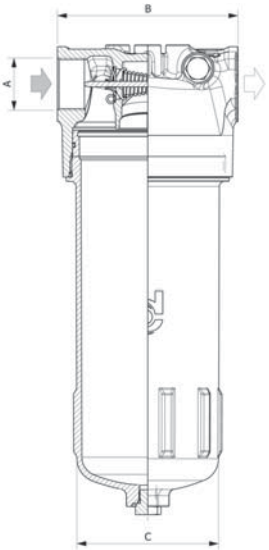


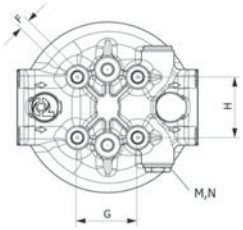




FLK 110

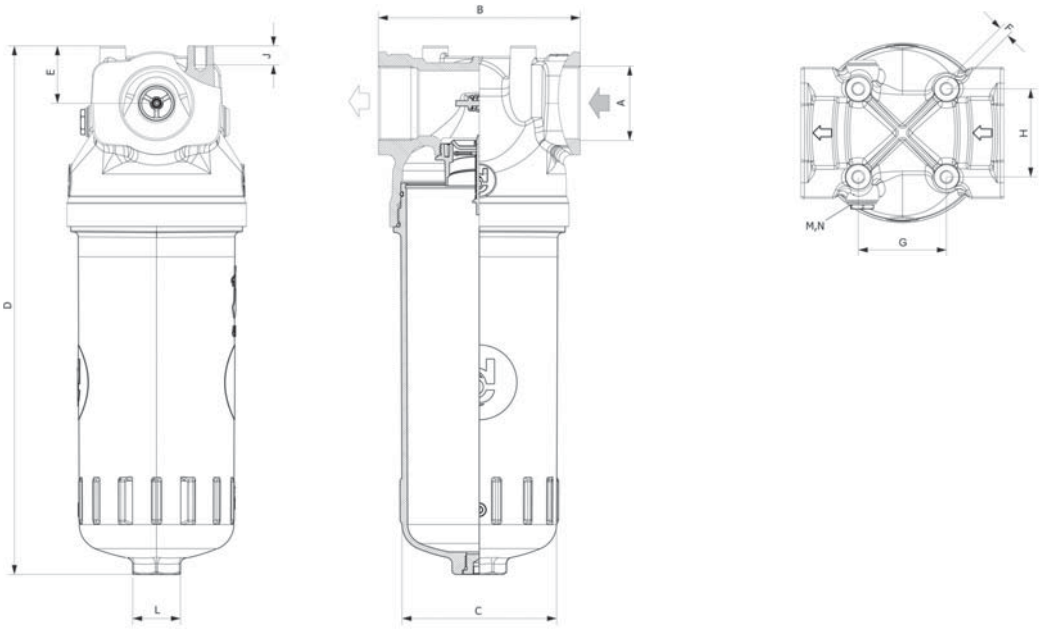






Head	Bowl	HOUSING DIMENSIONS													
		A	B	C	D	E	F	G	H	J	L	M	N	S	BPV
			mm	mm	mm	mm		mm	mm	mm	mm	predrilled holes	plugged	mm	bar
P766960	P766990	G3/4	125	100	215	33	M10	35	35	15	30	yes	yes	50	3,45
P766989	P766990	G1	125	100	215	33	M10	35	35	15	30	yes	yes	50	3,45
P766960	P766961	G3/4	125	100	317	33	M10	35	35	15	30	yes	yes	50	3,45
P766989	P766961	G1	125	100	317	33	M10	35	35	15	30	yes	yes	50	3,45
P766809	P766812	G1 1/4	144	113	300	31,5	M10	48	48	15	30	yes	yes	50	3,45
P766818	P766812	G1 1/2	144	113	300	31,5	M10	48	48	15	30	yes	yes	50	3,45
P766809	P766810	G1 1/4	144	113	376	31,5	M10	48	48	15	30	yes	yes	50	3,45
P766818	P766810	G1 1/2	144	113	376	31,5	M10	48	48	15	30	yes	yes	50	3,45
P767109	P767089	G2	161	124	424	46	M10	70	70	15	38	yes	yes	50	3,45

FLK 125



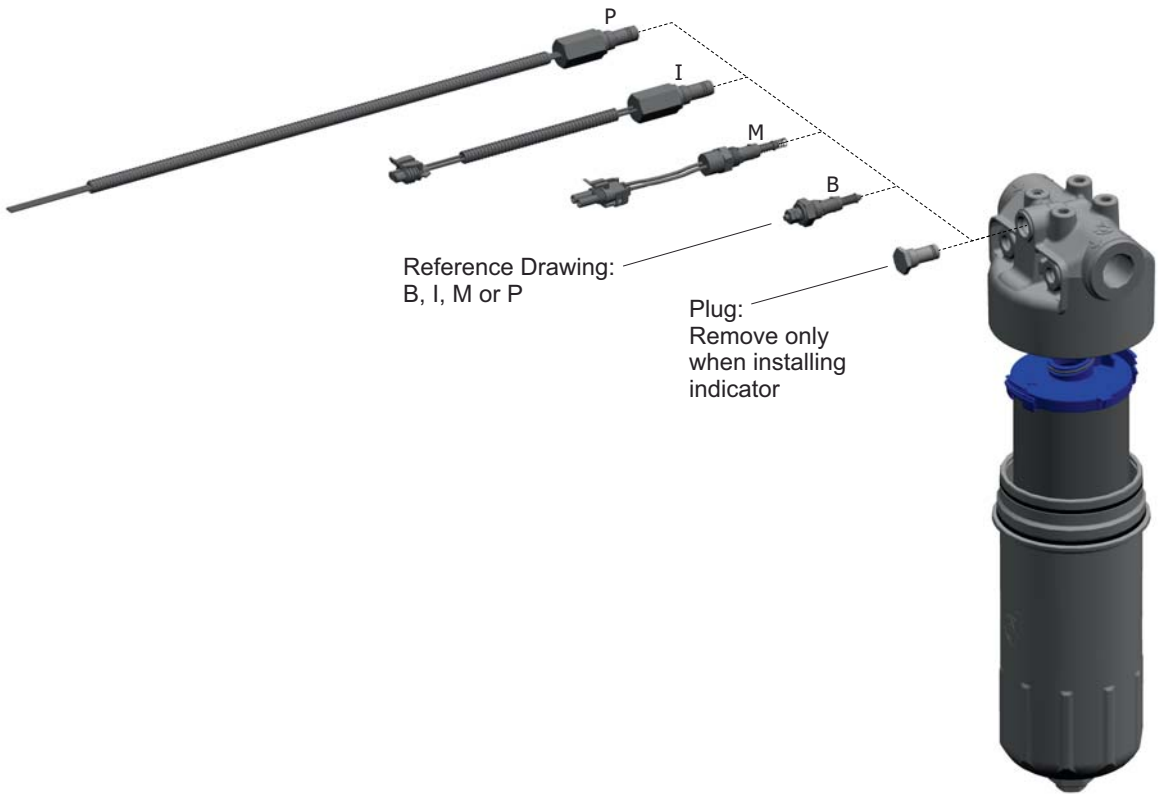
FLK

Indicator Choices

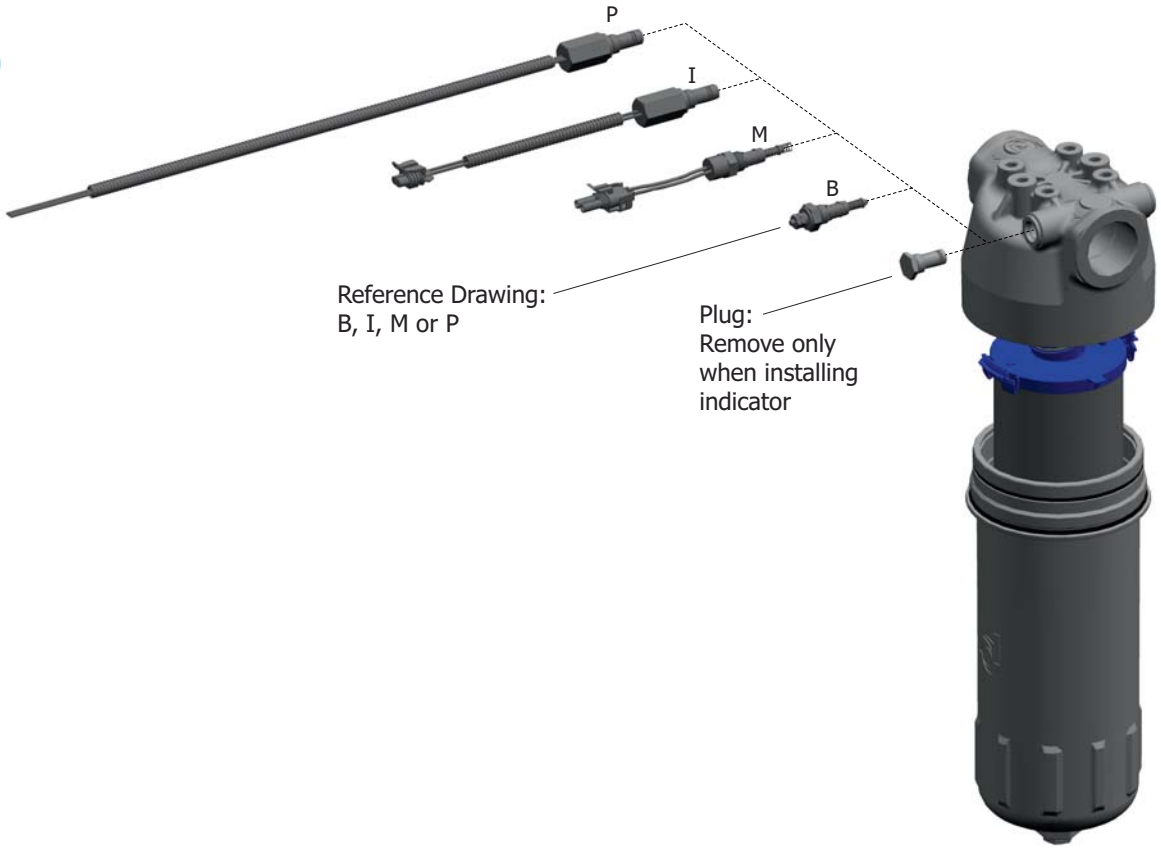
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P763975	Electrical	Differential	B	2,75	Normally Open			6-30V DC; 0,2 A
P763976	Electrical	Differential	B	2,75	Normally Closed			6-30V DC; 0,2 A
P171087	Electrical	Differential	M	2,75	Normally Open		Packard Connector	6-30 V DC; 200 mA
P170926	Electrical	Differential	I	2,75	Normally Closed		Packard Connector	6-30 V DC; 100 mA
P173893	Electrical	Differential	P	2,75	Normally Open or Closed		3 Wires	6-30 V DC; 100 mA

Installation & Service Guidelines

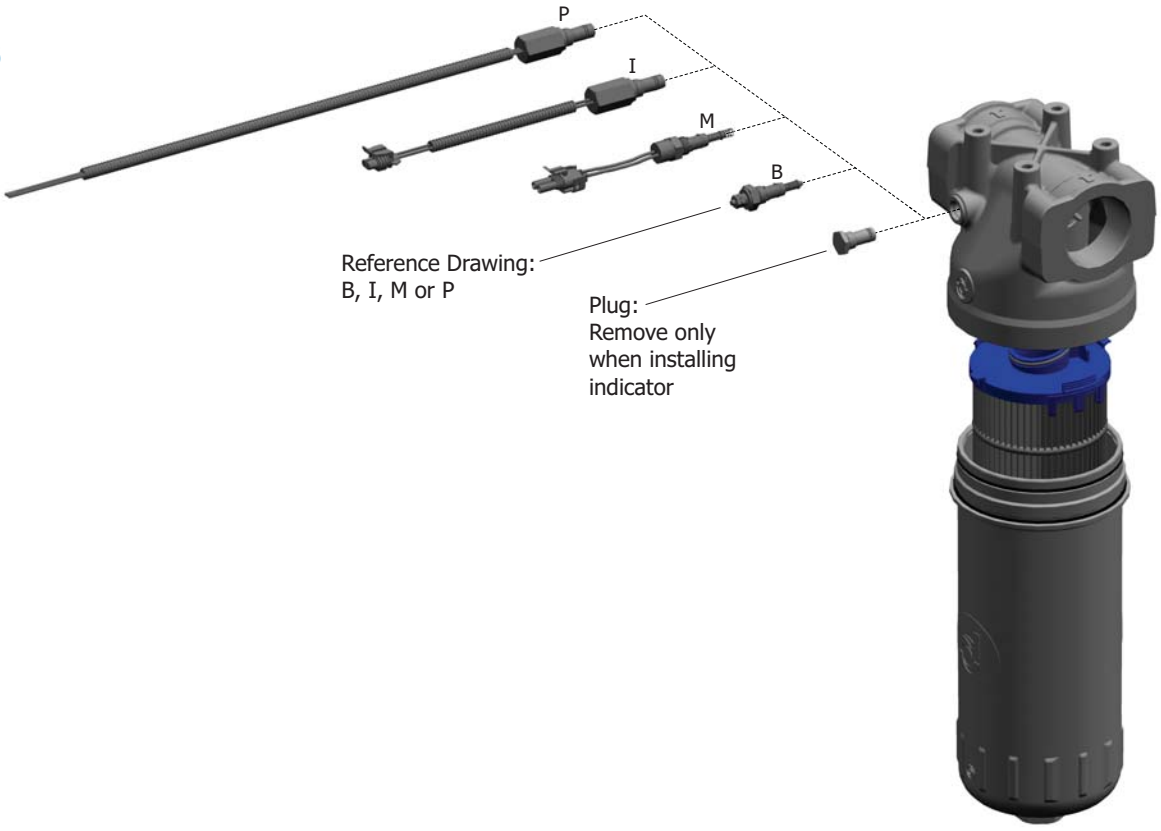
FLK 90



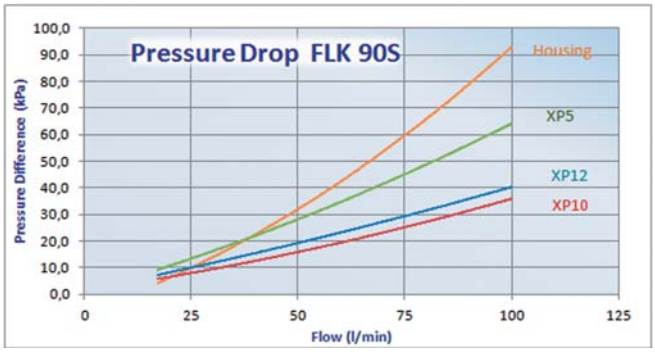
FLK 110

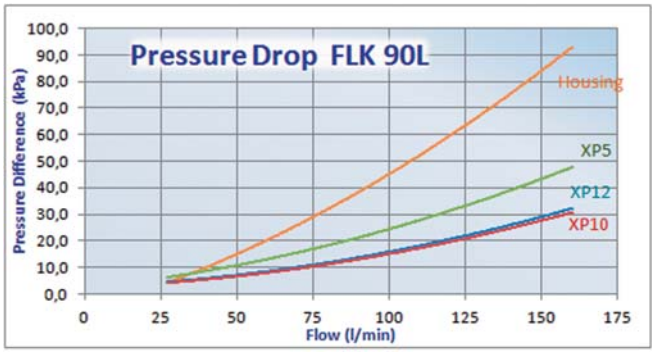


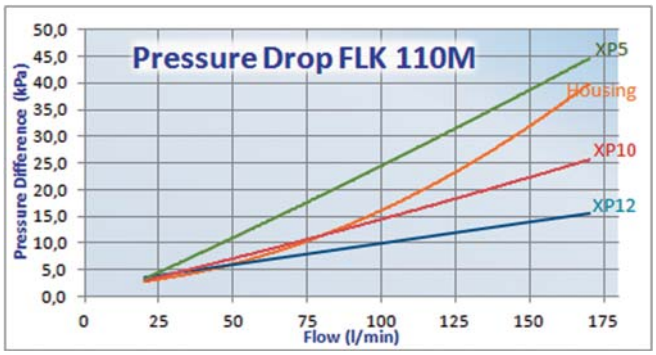
FLK 125

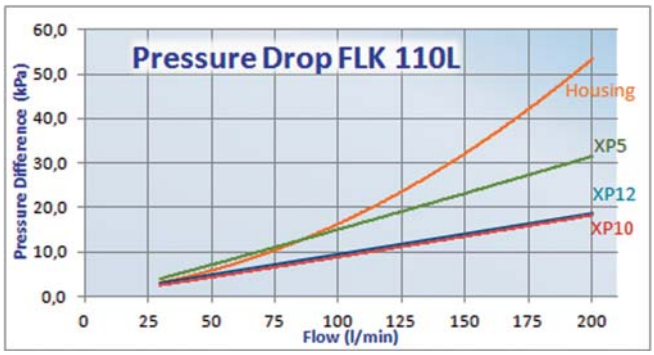


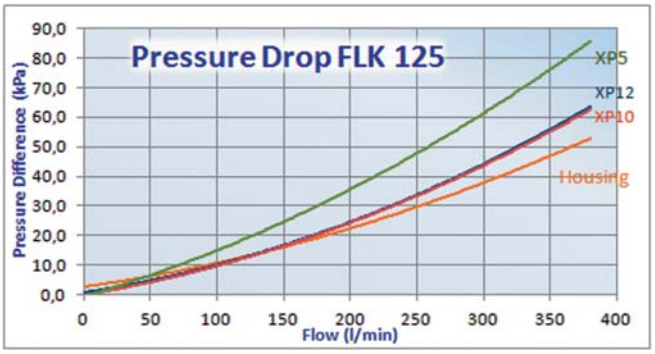
Performance Curves











DURAMAX – HMK 04

Pressure Line
Medium Pressure Filters – In-Line
up to 34 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 3,45 MPa (34,5 bar).
- Static pressure testing up to 6,9 MPa (69 bar).
- By-pass valve setting 170 kPa (1,7 bar) differential per ISO 3968.
- Available by-pass valve with setting 350 kPa (3,5 bar) differential.
- Operating temperature -20 +120°C.
- Pressure fatigue strength per NFPA T3.10.17 0 - 3,45 MPa (0-34,5 bar) for 100.000 cycles.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Operating pressure up to 3,45 MPa (34,5 bar).
- Static spin-on burst resistance 6,9 MPa (69 bar).
- Element collapse resistance 2 MPa (20 bar) per ISO 2941.
- Cellulose paper: 23 micron.
- Synteq® synthetic media: 7-11-33-50 micron.
- Heavy duty steel can with die cast baffle for added strength and a special head-to-spin-on O-ring seal.
- Available intermediate length spin-on L=180 mm.

DURAMAX – HMK 04

Donaldson FILTRATION SOLUTIONS

Components

	CELLULOSE MEDIA		SYNTHETIC MEDIA								CARTRIDGE CODE
	#10		#20		#7		XP10		XP5		
	$ß_{23µm(c)} \geq 1000$		$ß_{50µm(c)} \geq 1000$		$ß_{33µm(c)} \geq 1000$		$ß_{11µm(c)} \geq 1000$		$ß_{7µm(c)} \geq 1000$		
Family	RMF		RMF		RMF		RMF		RMF		
HMK405	100	P163419	120	P165335	110	P164381	110	P164375	100	P165354	K405
HMK409	110	P163324	140	P165338	130	P164384	130	P164378	120	P165332	K409

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
BPV = Bypass Valve Setting.

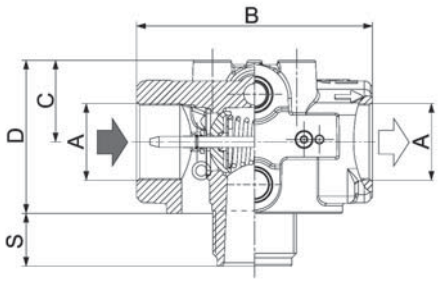
Heads Choices

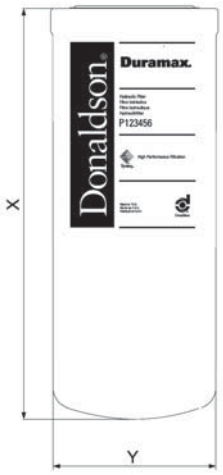
Head for Family	Head	Ports	Bypass Valve Setting	Indicator Info				Snout	Mounting holes
				Drilled holes for indicator	Indicator hole plugged	Side	Indicator to use		
HMK04	P167473	1 1/16-12 UN	1,7 bar	no	-	-	none	1 3/8-12 UNF	3/8-16 UNC
	P173918	1 1/16-12 UN	3,5 bar	plugged	yes	left	P165194, P167455, P171087, P170926 or P173893	1 3/8-12 UNF	3/8-16 UNC
	P764322	1 1/16-12 UN	3,5 bar	used	-	left	P165194 (installed)	1 3/8-12 UNF	3/8-16 UNC
	P762801	1 5/16-12 UN	1,7 bar	plugged	yes	left	P162400, P163839, P171143 or P173944	1 3/8-12 UNF	M10
	P761378	1 5/16-12 UN	2,5 bar	plugged	yes	left	P162400, P163839, P171143 or P173944	1 3/8-12 UNF	M10
	P763139	1 5/16-12 UN	3,5 bar	no	-	-	none	1 3/8-12 UNF	M10
	P173438*	G 1	1,7 bar	plugged	yes	left	P162400, P163839, P171143 or P173944	1 3/8-12 UNF	M10
	P766296	G 1	1,7 bar	plugged used	yes -	left left	P162400, P163839, P171143 or P173944 P162696 (installed)	1 3/8-12 UNF	M10
	P762982	G 1	3,5 bar	plugged	yes	left	P165194, P167455, P171087, P170926 or P173893	1 3/8-12 UNF	M10
	P173132	G 1	3,5 bar	used	no	left	P165194 (installed)	1 3/8-12 UNF	M10
	P760924	G 1	3,5 bar	used	-	left	P167455 (installed)	1 3/8-12 UNF	M10
	P173386*	G 3/4	1,7 bar	plugged	yes	left	P162400, P163839, P171143 or P173944	1 3/8-12 UNF	M10
	P762554	G 3/4	1,7 bar	no	-	-	none	1 3/8-12 UNF	M10
	P766295	G 3/4	1,7 bar	used	-	left	P162696 (installed)	1 3/8-12 UNF	M10
	P173385	G 3/4	3,5 bar	no	-	-	none	1 3/8-12 UNF	M10
	P175029	G 3/4	no opening	used	-	left	P165194 (installed)	1 3/8-12 UNF	M10

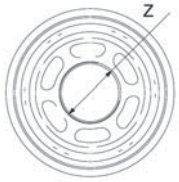
HMK 04 – Duramax Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.
Unless otherwise mentioned, the usage of indicators is mandatory, because the drilled holes for indicators are not plugged.

* Standard Head

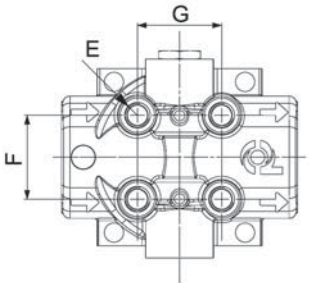
Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P173386	G3/4	98	34	64	M10	35	35	22	1,7	152	94	1 3/8-12 UNF 2B
P173438	G1	98	34	64	M10	35	35	22	1,7	240	94	1 3/8-12 UNF 2B







LEFT

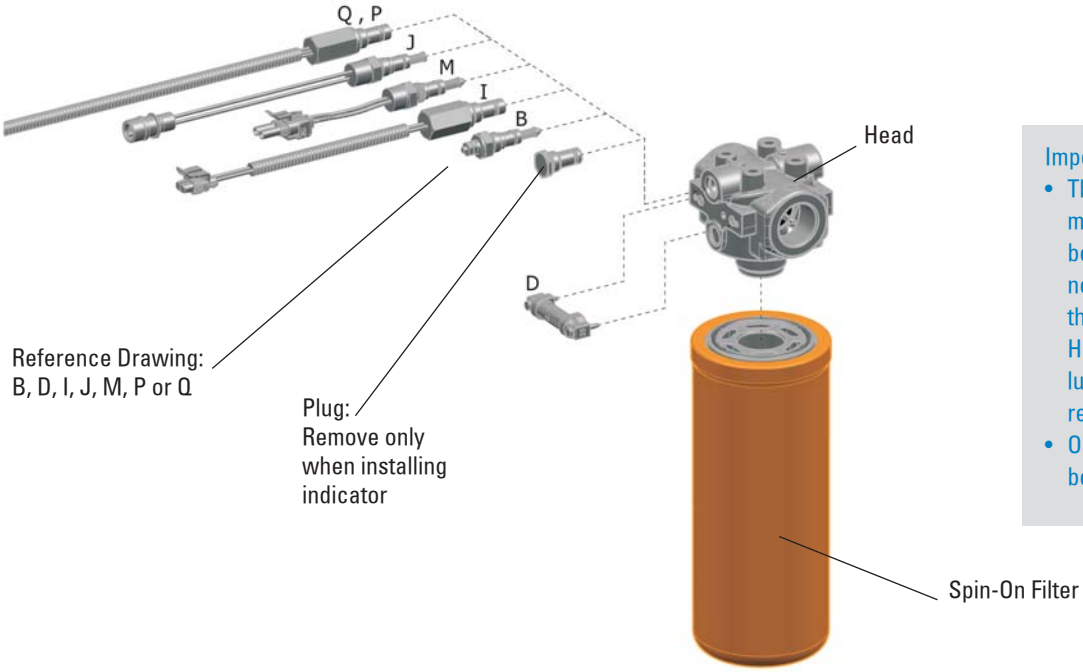


RIGHT

Indicator Choices

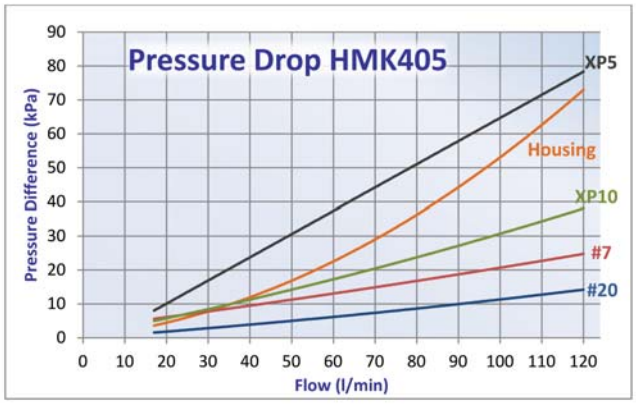
Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Cable Clamp	Max. Values
P162400	Electrical	Differential	B	1,25	Normally Open		6-30 V DC; 200 mA
P163839	Electrical	Differential	B	1,25	Normally Closed		6-30 V DC; 200 mA
P165194	Electrical	Differential	B	2,75	Normally Open		30 V DC; 0,2A
P167455	Electrical	Differential	B	2,75	Normally Closed		30 V DC; 0,2A
P162696	Visual	Differential	D	1,7			
P167580	Visual	Differential	D	3,4			
P170926	Electrical	Differential	I	2,75	Normally Closed	Packard Connector	6-30 V DC; 100 mA
P171087	Electrical	Differential	M	2,75	Normally Open	Packard Connector	6-30 V DC; 200 mA
P171143	Electrical	Differential	J	1,25	Normally Open	Canon Connector	6-30 V DC; 200 mA
P173944	Electrical	Differential	Q	1,4	Normally Open or Closed	3 Wires	24V DC; 110 V AC; 2A
P173893	Electrical	Differential	P	2,75	Normally Open or Closed	3 Wires	6-30 V DC; 100 mA

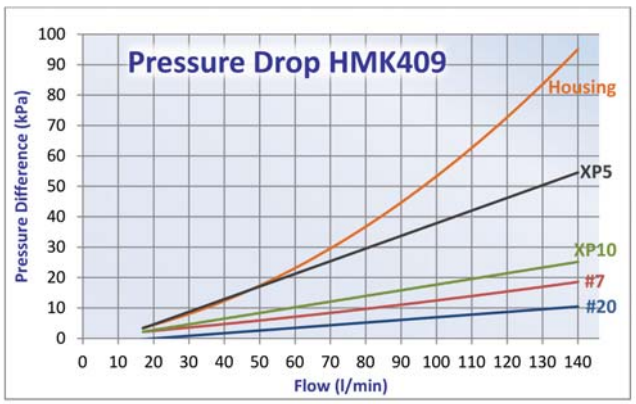
Installation & Service Guidelines

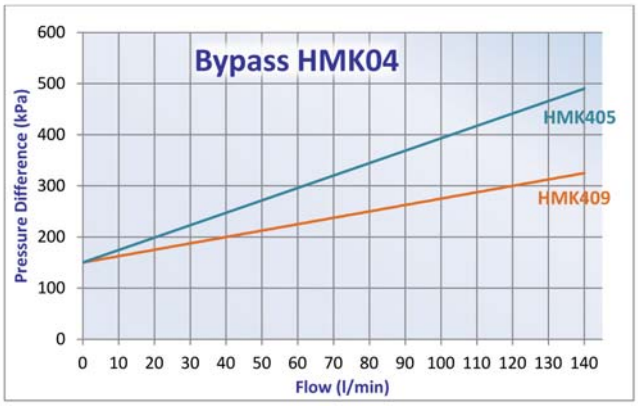


Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

Performance Curves







DURAMAX – HMK 05

Pressure Line
Medium Pressure Filters – In-Line
up to 24 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 2,4 MPa (24 bar).
- Static pressure testing up to 5,5 MPa (55 bar).
- By-pass valve setting 170 kPa (1,7 bar) differential per ISO 3968.
- Available by-pass valve with setting 350 kPa (3,5 bar) differential.
- Operating temperature -20 +120°C.
- Pressure fatigue strength per NFPA T3.10.17 0-2,4 MPa (0-24 bar) for 100.000 cycles.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop determined per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.

Filter Elements

- Operating pressure up to 2,4 MPa (24 bar).
- Static spin-on burst resistance 5,5 MPa (55 bar).
- Element collapse resistance 1,4 MPa (14 bar) per ISO 2941.
- Cellulose paper: 23 micron.
- Synteq® synthetic media: 7-11-33-50 micron.
- Heavy duty steel can with die cast baffle for added strength and a special head-to-spin-on O-ring seal.
- Available intermediate length spin-on L=200 mm.

DURAMAX – HMK 05

Donaldson FILTRATION SOLUTIONS

Components

	CELLULOSE MEDIA		SYNTHETIC MEDIA								CARTRIDGE CODE
	#10		#20		#7		XP10		XP5		
	$ß_{23µm(c)} \geq 1000$		$ß_{50µm(c)} \geq 1000$		$ß_{33µm(c)} \geq 1000$		$ß_{11µm(c)} \geq 1000$		$ß_{7µm(c)} \geq 1000$		
Family	RMF		RMF		RMF		RMF		RMF		
HMK513	160	P165705	200	P165672	180	P165569	170	P165659	160	P165675	K513

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
BPV = Bypass Valve Setting.

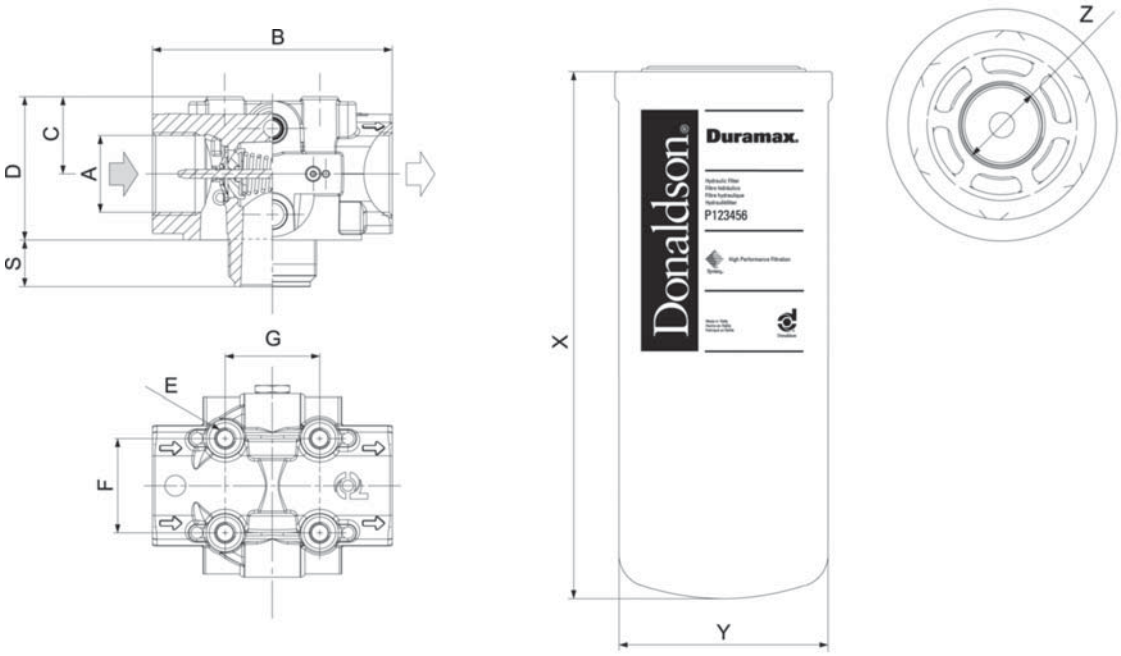
Heads Choices

Head for Family	Part	Ports	Bypass Valve Setting	Indicator Info			Snout	Mounting holes
				Drilled holes for indicator	Side	Indicator to use		
K513	P175095	1 5/8-12 UN	3,5 bar	plugged	left	P165194, P167455, P171087, P170926 or P173893	1 3/4-12 UN	M10
	P173448	G 1 1/4	1,7 bar	plugged used	left left	P162400, P163839, P171143 or P173944 P162696 (installed)	1 3/4-12 UN	M10
	P766297*	G 1 1/4	1,7 bar	no	-	none	1 3/4-12 UN	M10
	P766298	G 1 1/4	1,7 bar	used	left	P162696 (installed)	1 3/4-12 UN	M10
	P766299	G 1 1/4	1,7 bar	plugged	left	P162400, P163839, P171143 or P173944	1 3/4-12 UN	M10
	P761446	G 1 1/4	3,5 bar	used	left	P165194 (installed)	1 3/4-12 UN	M10

HMK 05 – Duramax Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.
Unless otherwise mentioned, the usage of indicators is mandatory, because the drilled holes for indicators are not plugged.

* Standard Head

Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P766297	G1 1/4	121	39	72,6	M10	48	48	21	1,7	295	117	1 3/4-12 UNF 2B

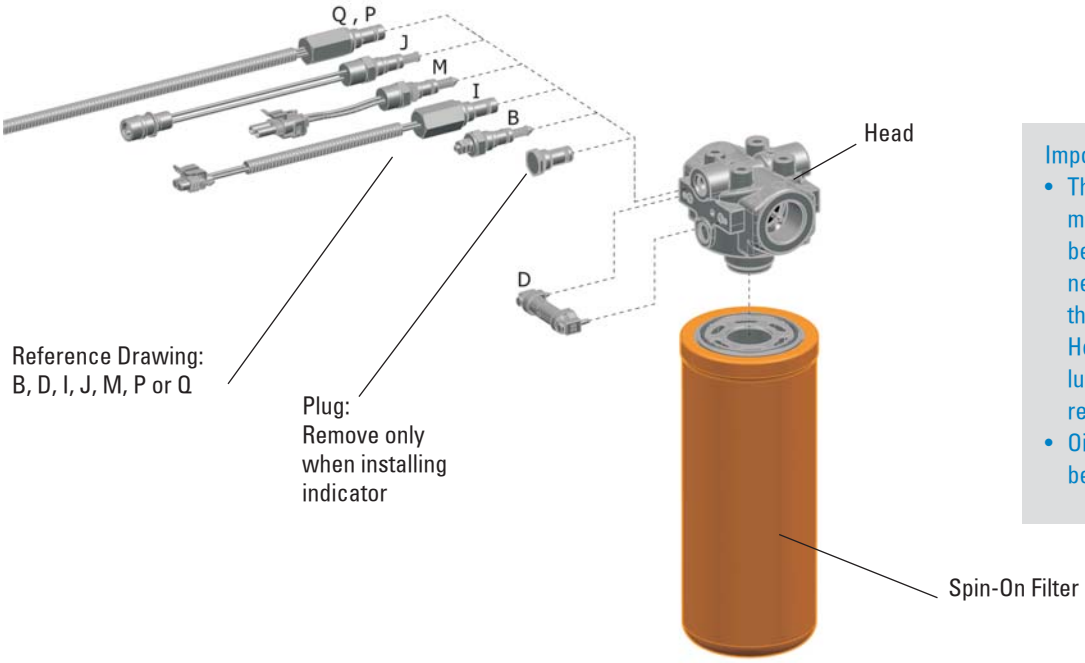


Indicator Choices

Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Cable Clamp	Max. Values
P162400	Electrical	Differential	B	1,25	Normally Open		6-30 V DC; 200 mA
P163839	Electrical	Differential	B	1,25	Normally Closed		6-30 V DC; 200 mA
P165194	Electrical	Differential	B	2,75	Normally Open		30 V DC; 0,2A
P167455	Electrical	Differential	B	2,75	Normally Closed		30 V DC; 0,2A
P162696	Visual	Differential	D	1,7			
P167580	Visual	Differential	D	3,4			
P170926	Electrical	Differential	I	2,75	Normally Closed	Packard Connector	6-30 V DC; 100 mA
P171087	Electrical	Differential	M	2,75	Normally Open	Packard Connector	6-30 V DC; 200 mA
P171143	Electrical	Differential	J	1,25	Normally Open	Canon Connector	6-30 V DC; 200 mA
P173944	Electrical	Differential	Q	1,4	Normally Open or Closed	3 Wires	24V DC; 110 V AC; 2A
P173893	Electrical	Differential	P	2,75	Normally Open or Closed	3 Wires	6-30 V DC; 100 mA

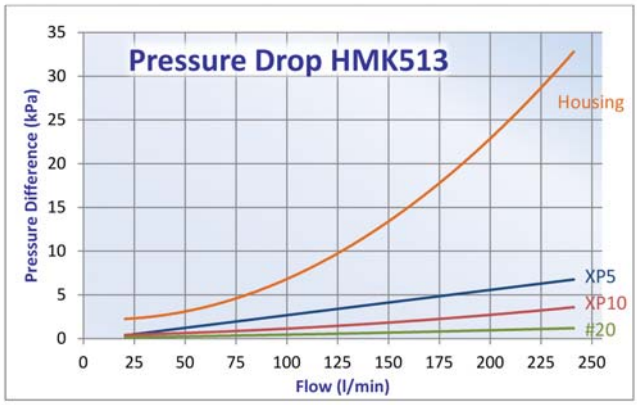
DURAMAX – HMK 05

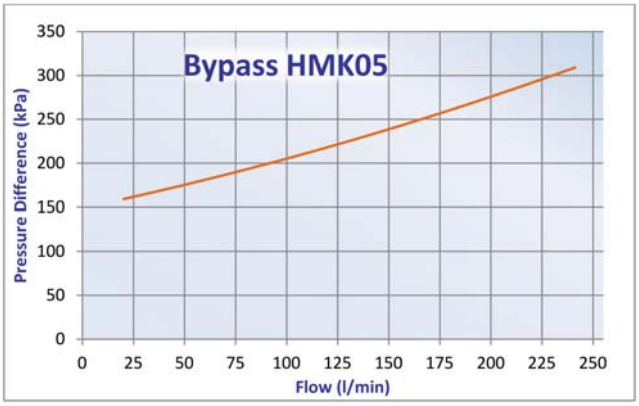
Installation & Service Guidelines



Important
- The filter head snout must be lubricated before spinning on a new filter to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

Performance Curves





FPK 02 – AP280

Pressure Line
High Pressure Filters – In-Line
up to 420 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 42 MPa (420 bar).
- Static pressure testing up to 63 MPa (630 bar).
- Fatigue pressure of 2.000.000 cycles at 0-30 MPa (0-300 bar) per NFPA T 3.10.5.1, R2-2000.
- By-pass valve setting 600 kPa (6 bar) per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Filter head casting in spheroidal cast iron.
- Extruded steel bowl.

Filter Elements

- Synteq® synthetic media: 6-8-11-23 micron, reinforced with wire mesh.
- Collapse resistance 2 MPa (20 bar) per ISO 2941.
- Available high collapse 21 MPa (210 bar) – on customer's request.

FPK 02 – AP280

Donaldson FILTRATION SOLUTIONS

Components

		SYNTHETIC MEDIA								CARTRIDGE CODE
		/03		XP10		XP5		/00		
		$ß_{23µm(c)} \geq 1000$		$ß_{11µm(c)} \geq 1000$		$ß_{8µm(c)} \geq 1000$		$ß_{6µm(c)} \geq 1000$		
Family	Collapse	RMF		RMF		RMF		RMF		
AP358	Standard	30	P171715	30	P171714	20	P171713	20	P761392	CM230
	High		on request		P176939		P173106		on request	CM231
AP359	Standard	50	P165136	50	P165006	40	P165041	40	P169429	CM250
	High		on request		P167181		P176613		on request	CM251
AP360	Standard	90	P165138	90	P165015	70	P165043	70	P167838	CM290
	High		on request		P167183		P176616		on request	CM291

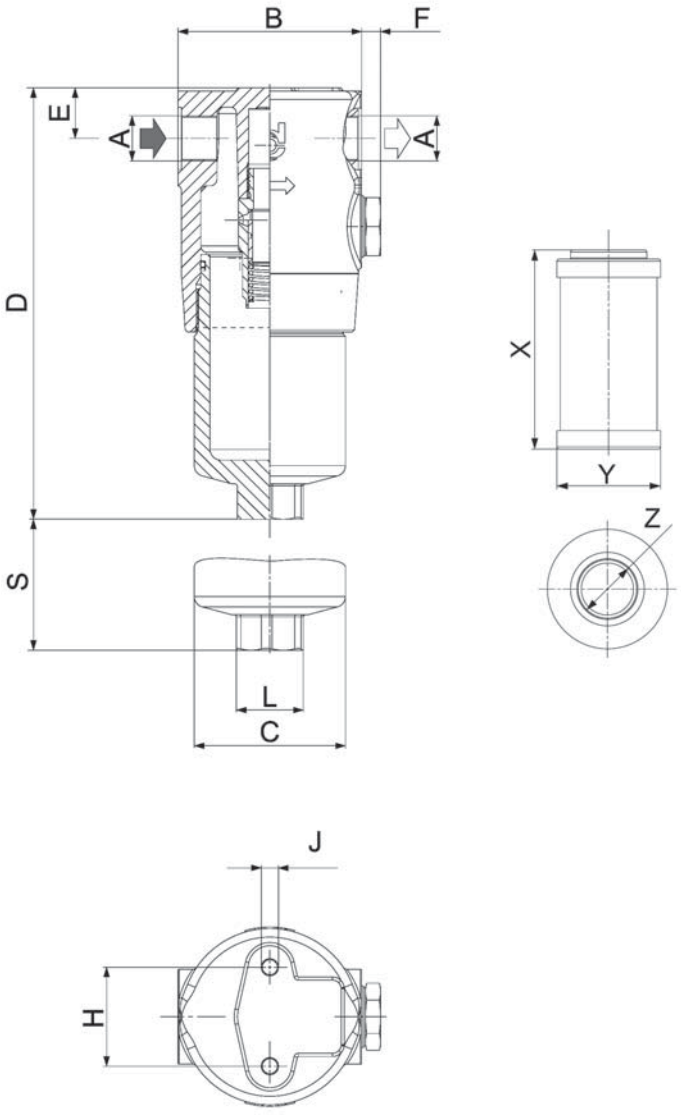
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
BPV = Bypass Valve Setting.
High Collapse elements are non-stock items, request your sales contact for offer and lead-time.
Other medias available on request.

Indicator Choices

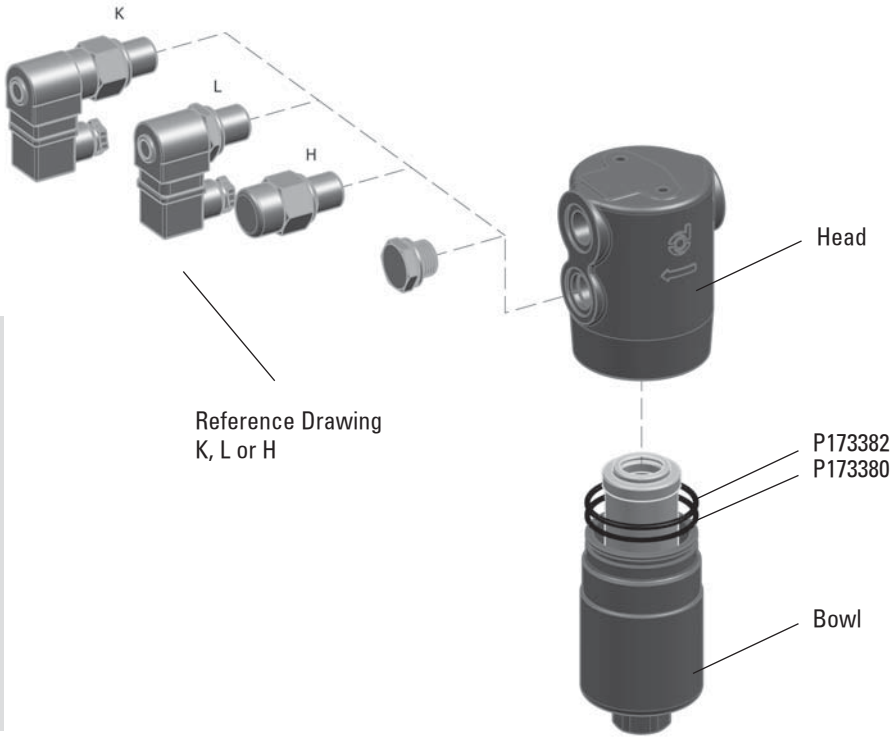
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values	Remark
P171945	Visual	Differential	H	5					
P171947	Electrical	Differential	K	5	Normally Open/Closed	IP65	PG11	250V AC: 30 VDC; 5A res. and ind.	
P171944	Electrical	Differential	K	5	Normally Open/Closed	IP65	PG11	250V AC: 30 VDC; 5A res. and ind.	with thermostat at min. temperature at 30°C
P761056	Electrical	Differential	L	5	Normally Open/Closed	IP65	PG11	30 V DC; 30 V AC; 0,5 A res. and 0,2 A ind.	

FPK 02 – AP280

Standard Housing	HOUSING DIMENSIONS													CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	F	H	J	L	M	N	S	BPV	X	Y	Z	
		mm	mm	mm	mm	mm	mm		mm	predrilled holes	plugged	mm	bar	mm	mm	mm	
P766377	G1/2	85	70	197	23	9	46	M8	Hex30	G1/2	yes	40	6	87	46	25,4	P171945 P171947 P171944 P761056
P766378	G1/2	85	70	223	23	9	46	M8	Hex30	G1/2	yes	40	6	113	46	25,4	
P766379	G3/4	85	70	324	23	9	46	M8	Hex30	G1/2	yes	40	6	280	46	25,4	



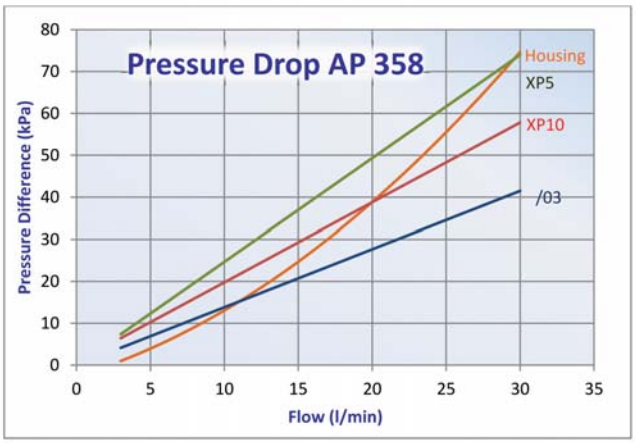
Installation & Service Guidelines

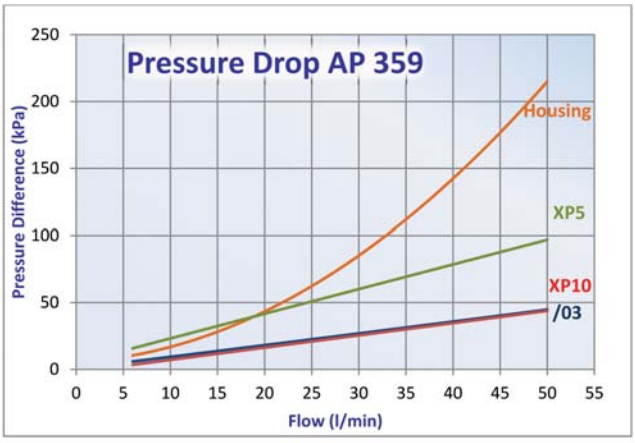


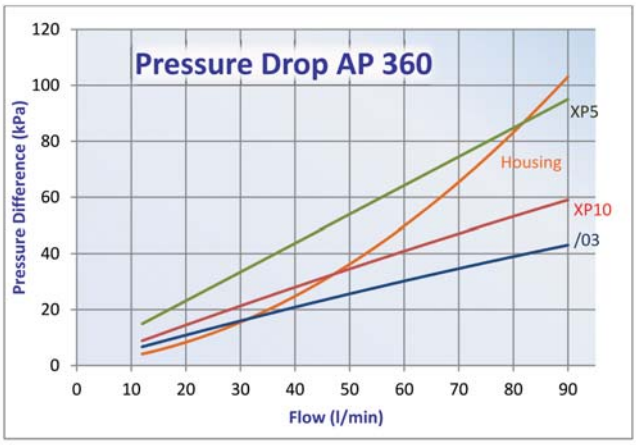
Important

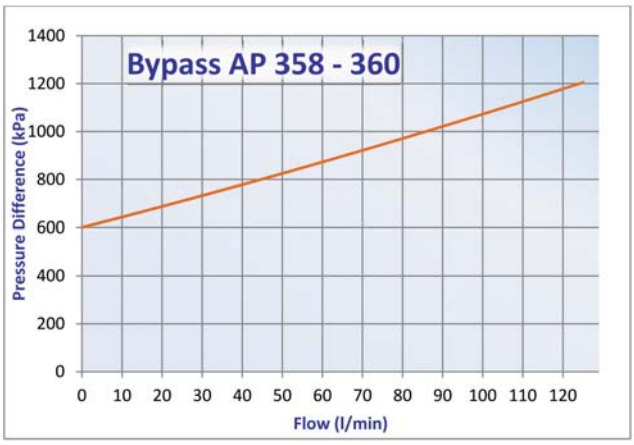
- The bowl thread must be lubricated before spinning on the head to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

Performance Curves









FPK02&04-AP220
FPK02-AP280
FPK03&04-AP420
FMK-FM
FCK-LC

Open empty housing
in correct order

Remove carton ring
before use

Check if O-ring between
lid and housing is installed and intact

Check if O-Ring on cartridge is installed and
intact

For FIK:
Mount O-ring over stud

For Low Pressure cartridges:
Mount spring on cartridge

Mount element in
housing

For Combo 120:
Align arrows as shown

Assemble lid on housing

Assemble bolts and
screws in correct order

Tighten screws, bolts or lid until thread ends
For spin-ons: hand tighten until contact
between O-ring and head is made; and then
continue by hand as indicated on spin-on

Degrease surface where sparepart sticker
will be mounted
Only for cartridge type filters

Sparepart sticker in each sparepart box

Fix sparepart sticker in area indicated –
Ready!

Do not forget seals

FPK 02 & 04 – AP220

Pressure Line
High Pressure Filters – In-Line
up to 420 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure
  AP 221-222: Up to 42 Mpa (420 bar)
  AP 223-224-225: Up to 30 Mpa (300 bar) .
- Static pressure testing
  AP 221-222: Up to 63 MPa (630 bar)
  AP 223-224-225: Up to 45 Mpa (450 bar) .
- Fatique pressure of 2.000.000 cycles at 0-30 MPa (0-300 bar) per NFPA T3.10.5.1 R2-2000.
- By-pass valve setting:
  AP 221-222: 350 kPa (3,5 bar)
  AP 223-224-225: 600 kPa (6 bar) ,
  per ISO 3968.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Filter head casting in spheroidal cast iron.
- Extruded steel bowl.

Filter Elements

- Synteq® synthetic media: 8-11-23 micron, reinforced with wire mesh.
- Collapse resistance 2 MPa (20 bar) per ISO 2941.
- Available high collapse 21 MPa (210 bar) – on customer's request.

FPK 02 & 04 – AP220

Components

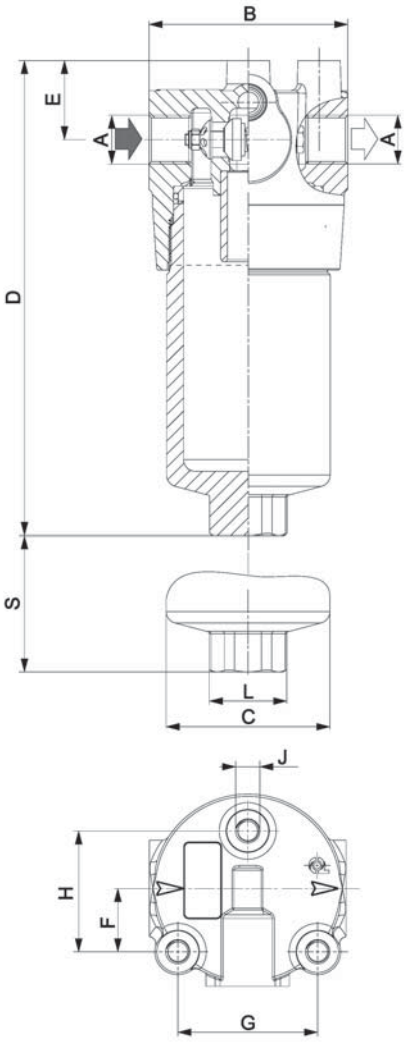
		SYNTHETIC MEDIA						CARTRIDGE CODE
		/03		XP10		XP5		
		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		$ß_{8µm(c)}$≥1000		
Family	Collapse	RMF		RMF		RMF		
AP221	Standard	50	P169797	40	P169447	30	P169446	AP472
	High		on request		P167413		P176637	AP572
AP222	Standard	90	P169450	80	P169449	70	P169798	AP473
	High		on request		P176641		P176640	AP573
AP223	Standard	180	P164172	150	P164164	120	P164592	AP474
	High		on request		P176644		P176643	AP574
AP224	Standard	350	P164174	300	P164166	250	P164594	AP475
	High		P176647		P167186		P176646	AP575
AP225	Standard	450	P164176	400	P164168	350	P164596	AP476
	High		P167412		P176650		P176649	AP576

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
BPV = Bypass Valve Setting
High Collapse elements are non-stock items, request your sales contact for offer and lead-time.
S= Service Clearance

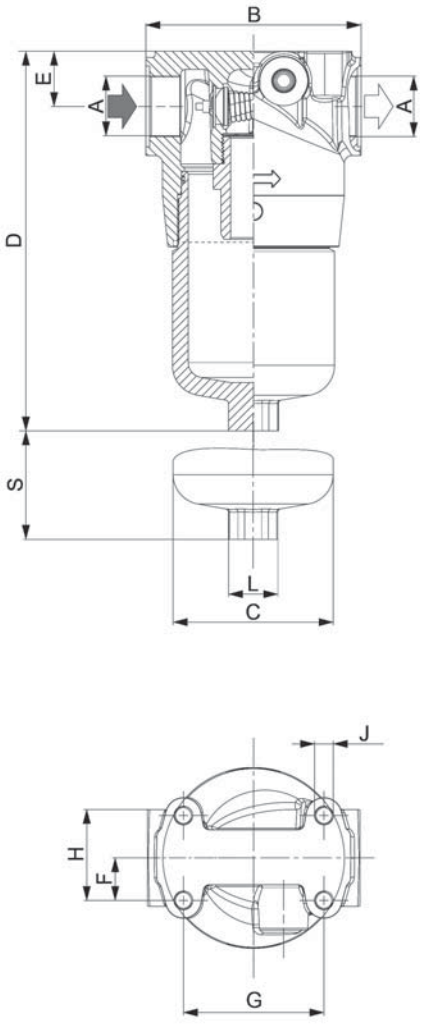
Alternative Housing Choices

	Alternative Housing (see thread for indicator)	DIMENSIONS HOUSING														POSSIBLE INDICATOR
		A	B	C	D	E	F	G	H	J	L	M	N	S	BPV	
Family			mm	mm	mm	mm	mm	mm	mm		mm	predilled holes	plugged	mm	bar	
AP221	P766380	G1/2	85	70	200	34	27,5	60,5	52,5	M10	Hex30	9/16-18 UNF	yes	40	3,5	P763975 P763976 P171087
AP222	P766381	G3/4	85	70	310	34	27,5	60,5	52,5	M10	Hex30	9/16-18 UNF	yes	40	3,5	
AP223	P766387	G1 1/4	140	105	252,5	36,5	28,5	94	57	M12	Hex30	G1/2	yes	47	3,5	P761058 P761057
AP224	P766388	G1 1/4	140	105	345,5	36,5	28,5	94	57	M12	Hex30	G1/2	yes	47	3,5	
AP225	P766389	G1 1/2	140	105	467,5	36,5	28,5	94	57	M12	Hex30	G1/2	yes	47	3,5	

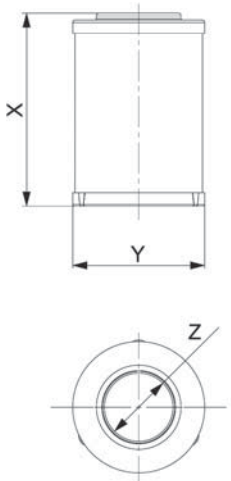
Standard Housing without Cartridge	HOUSING DIMENSIONS														CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	F	G	H	J	L	M	N	S	BPV	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm		mm	predilled holes	plugged	mm	bar	mm	mm	mm	
P766385	G1/2	85	70	200	34	27,5	60,5	52,5	M10	Hex30	G1/2	yes	40	3,5	113	50	24	P761058 P761057
P766386	G3/4	85	70	310	34	27,5	60,5	52,5	M10	Hex30	G1/2	yes	40	3,5	207	50	24	
P766382	G1 1/4	140	105	252,5	36,5	28,5	94	57	M12	Hex30	9/16-18 UNF	yes	47	6	115	78	43	P763975 P763976 P171087
P766383	G1 1/4	140	105	345,5	36,5	28,5	94	57	M12	Hex30	9/16-18 UNF	yes	47	6	208	78	43	
P766384	G1 1/2	140	105	467,5	36,5	28,5	94	57	M12	Hex30	9/16-18 UNF	yes	47	6	330	78	43	



AP 221-222



AP 223-224-225



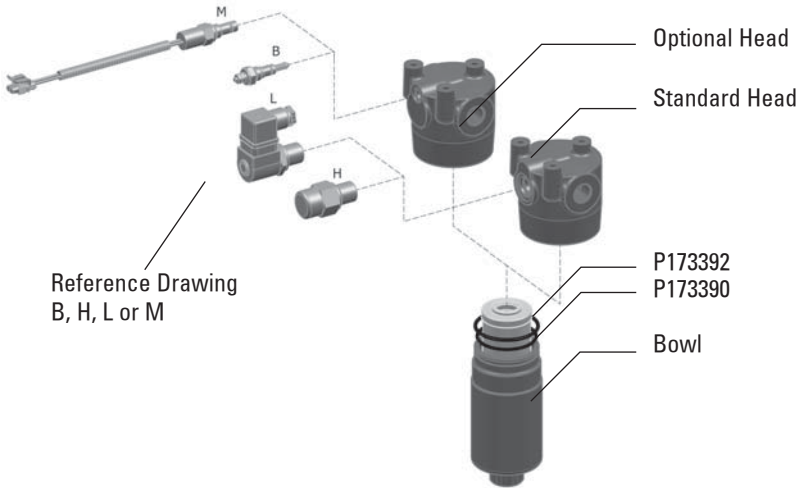
HIGH PRESSURE FILTERS

Indicator Choices

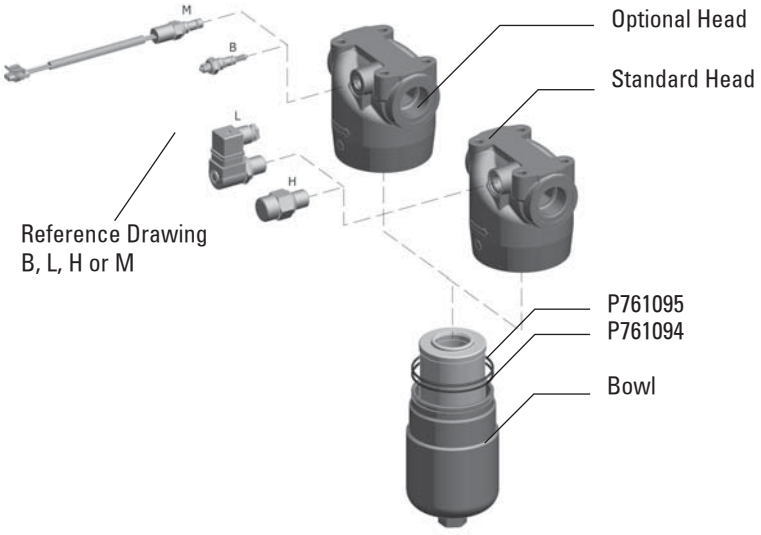
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P763975	Electrical	Differential	B	2,75	Normally Open			6-30V DC; 0,2 A
P763976	Electrical	Differential	B	2,75	Normally Closed			6-30V DC; 0,2 A
P761058	Visual	Differential	H	3				
P761057	Electrical	Differential	L	3	Normally Open/Closed	IP65	PG11	30 V DC; 0,5 A res. and 0,2 A ind.
P171087	Electrical	Differential	M	2,75	Normally Open		Packard Connector	6-30 V DC; 200 mA

Installation & Service Guidelines

AP 221-222



AP 223-224-225

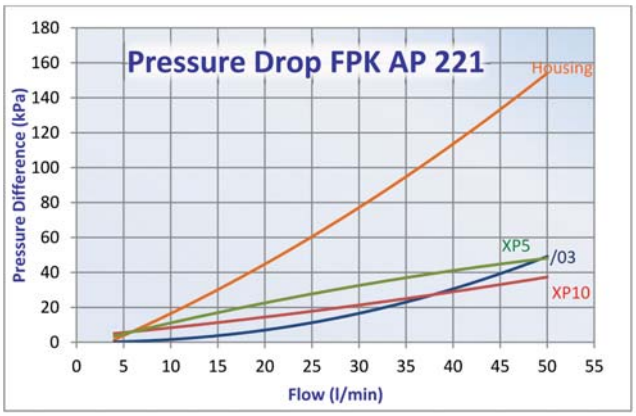


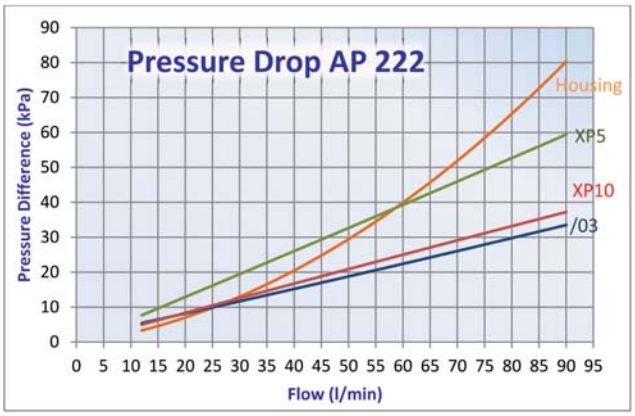
Important

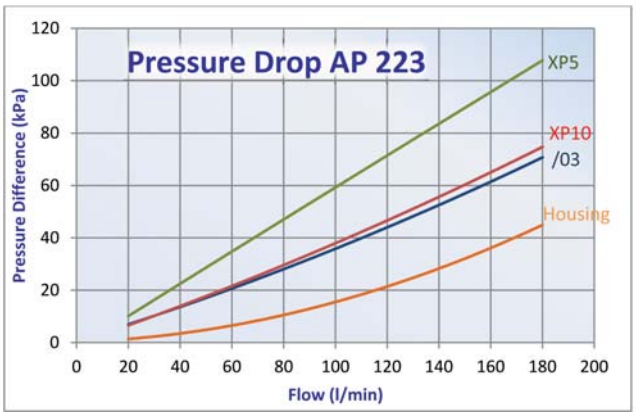
- The bowl thread must be lubricated before spinning on the head to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

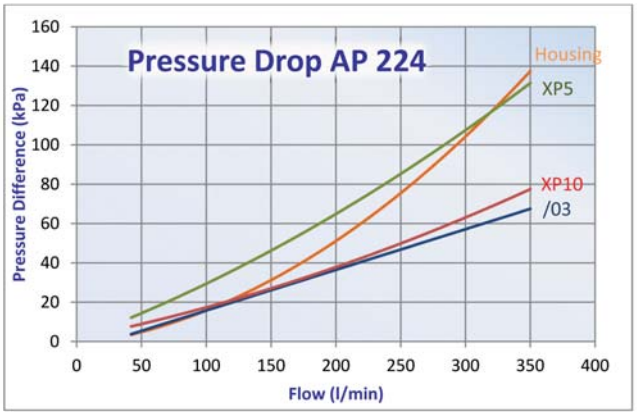
HIGH PRESSURE FILTERS

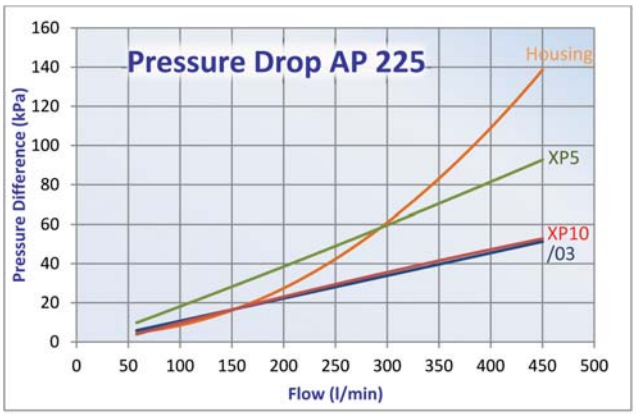
Performance Curves











Donaldson Engine E-Catalogues

Check out Donaldson's Engine E-catalogue by clicking or browsing to one of the below links:

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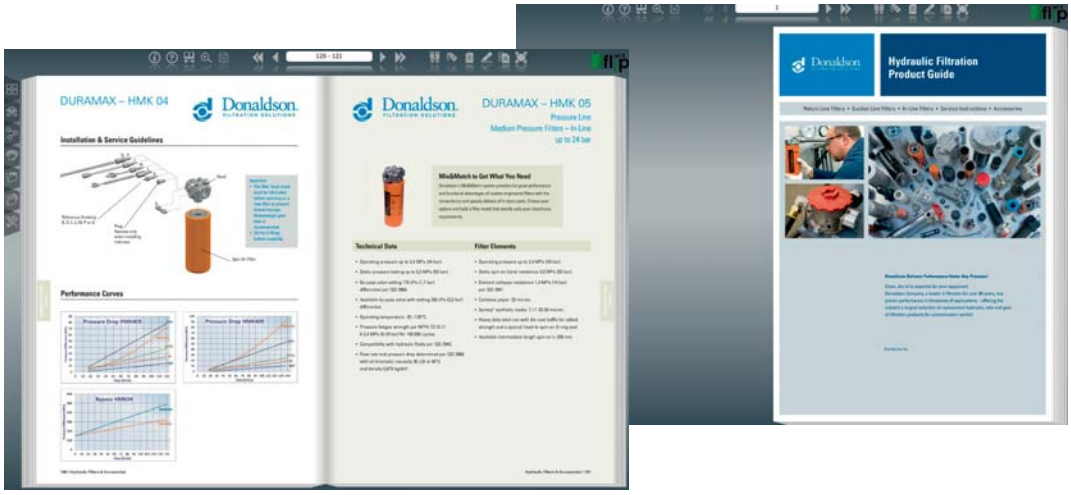

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REMARK: If the E-Catalogue doesn't open, it means that Adobe Flash Player is not installed on your computer.

FPK 03 & 04 – AP420

Pressure Line
High Pressure Filters – In-Line
up to 420 bar

Mix&Match to Get What You Need

Donaldson's Mix&Match system provides the great performance and functional advantages of custom-engineered filters with the convenience and speedy delivery of in-stock parts. Choose your options and build a filter model that exactly suits your cleanliness requirements.

Technical Data

- Operating pressure up to 42 MPa (420 bar).
- Static pressure testing up to 63 MPa (630 bar).
- Fatigue pressure of 2.000.000 cycles at 0-30 MPa (0-300 bar) per NFPA T 3.10.5.1, R2-2000.
- By-pass valve setting 600 kPa (6 bar) per ISO3968.
- Optional: Reverse flow valve which allows fluid to pass through the element in one direction but to by-pass the element when the flow is reversed.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Filter head casting in spheroidal cast iron.
- Extruded steel bowl.
- Flange per SAE J518: 6000 PSI.

Filter Elements

- Synteq® synthetic media: 8-11-23 micron, reinforced with wire mesh.
- Collapse resistance 2 MPa (20 bar) per ISO 2941.
- Available collapse resistance 21MPa (210bar) – on customer request.

FPK 03 & 04 – AP420

Donaldson FILTRATION SOLUTIONS

Components

		SYNTHETIC MEDIA						CARTRIDGE CODE
		/03		XP10		XP5		
		$B_{23\mu(c)} \geq 1000$		$B_{11\mu(c)} \geq 1000$		$B_{8\mu(c)} \geq 1000$		
Family	Collapse	RMF		RMF		RMF		
AP361	Standard	50	P171733	50	P171732	40	P171731	AP451
	High		P176621		P176620		P176619	AP551
AP362	Standard	80	P171736	80	P171735	60	P171734	AP452
	High		P176624		P176623		P176622	AP552
AP363	Standard	120	P171739	120	P171738	80	P171737	AP453
	High		P176627		P176626		P176625	AP553
AP364	Standard	180	P171742	180	P171741	160	P171740	AP454
	High		P176630		P176629		P176628	AP554
AP365	Standard	300	P171745	300	P171744	270	P171743	AP455
	High		P176633		P176632		P176631	AP555
AP366	Standard	400	P171748	400	P171747	320	P171746	AP456
	High		P176636		P176635		P176634	AP556

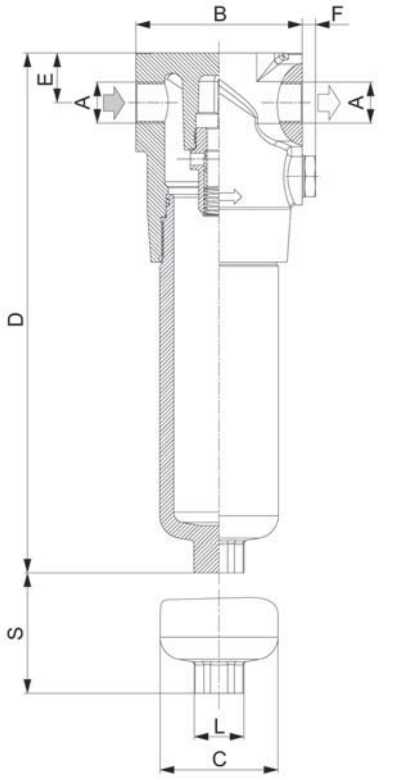
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
BPV = Bypass Valve Setting
S = Additional Service Clearance
High Collapse elements are non-stock items, request your sales contact offer and lead-time

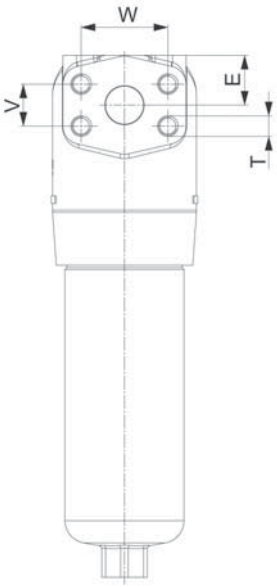
Alternative Housing Choices

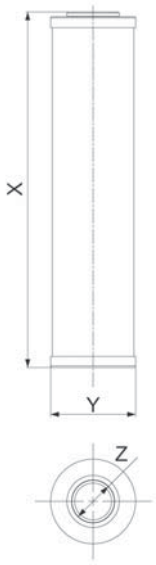
	Alternative Housing (see anti-reverse flow valve or SAE Flange)	DIMENSIONS HOUSING																		POSSIBLE INDICATOR
		A	B	C	D	E	F	G	H	J	L	M	N	T	V	W	S	BPV	Including valve to avoid reverse flow through element	
Family			mm	mm	mm	mm	mm	mm	mm		mm	predilled holes	plugged		mm	mm	mm	bar		
AP361	P766433	G1/2	110	78,5	215	33	9	50	57	M10	Hex 30	G1/2	yes				130	6	yes	P171945 P171947 P171944 P761056
AP362	P766434	G3/4	110	78,5	246	33	9	50	57	M10	Hex 30	G1/2	yes				165	6	yes	
AP363	P766435	G1	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes				270	6	yes	
AP364	P766436	G1 1/4	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes				180	6	yes	
AP365	P766437	G1 1/2	140	107	395	46	9	94	57	M12	Hex 30	G1/2	yes				280	6	yes	
AP366	P766438	G1 1/2	140	107	542	46	9	94	57	M12	Hex 30	G1/2	yes				420	6	yes	
AP362	P766439	Flange 3/4"	110	78,5	246	33	9	50	57	M10	Hex 30	G1/2	yes	M10	23,8	50,8	165	6	no	
AP363	P766440	Flange 1"	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes	M12	27,76	57,15	270	6	no	
AP363	P766444	Flange 1"	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes	M12	27,76	57,15	270	6	yes	
AP364	P766441	Flange 1" 1/4	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes	M14	31,75	66,68	180	6	no	
AP364	P766445	Flange 1" 1/4	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes	M14	31,75	66,68	180	6	yes	
AP365	P766442	Flange 1" 1/2	140	107	395	46	9	94	57	M12	Hex 30	G1/2	yes	M16	36,5	79,38	280	6	no	
AP366	P766443	Flange 1" 1/2	140	107	542	46	9	94	57	M12	Hex 30	G1/2	yes	M16	36,5	79,38	420	6	no	

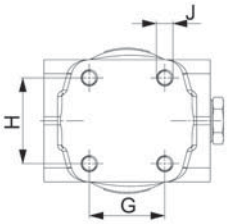
FPK 03 & 04 – AP420

Standard Housing	HOUSING DIMENSIONS															CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	F	G	H	J	L	M	N	S	BPV	Including valve to avoid reverse flow through element	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm		mm	predrilled holes	plugged	mm	bar		mm	mm	mm	
P766427	G1/2	110	78,5	215	33	9	50	57	M10	Hex 30	G1/2	yes	130	6	no	87	54	27	P171945 P171947 P171944 P761056
P766428	G3/4	110	78,5	246	33	9	50	57	M10	Hex 30	G1/2	yes	165	6	no	122	54	27	
P766429	G1	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes	270	6	no	230	54	27	
P766430	G1 1/4	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes	180	6	no	140	78	40	
P766431	G1 1/2	140	107	395	46	9	94	57	M12	Hex 30	G1/2	yes	280	6	no	240	78	40	
P766432	G1 1/2	140	107	542	46	9	94	57	M12	Hex 30	G1/2	yes	420	6	no	380	78	40	







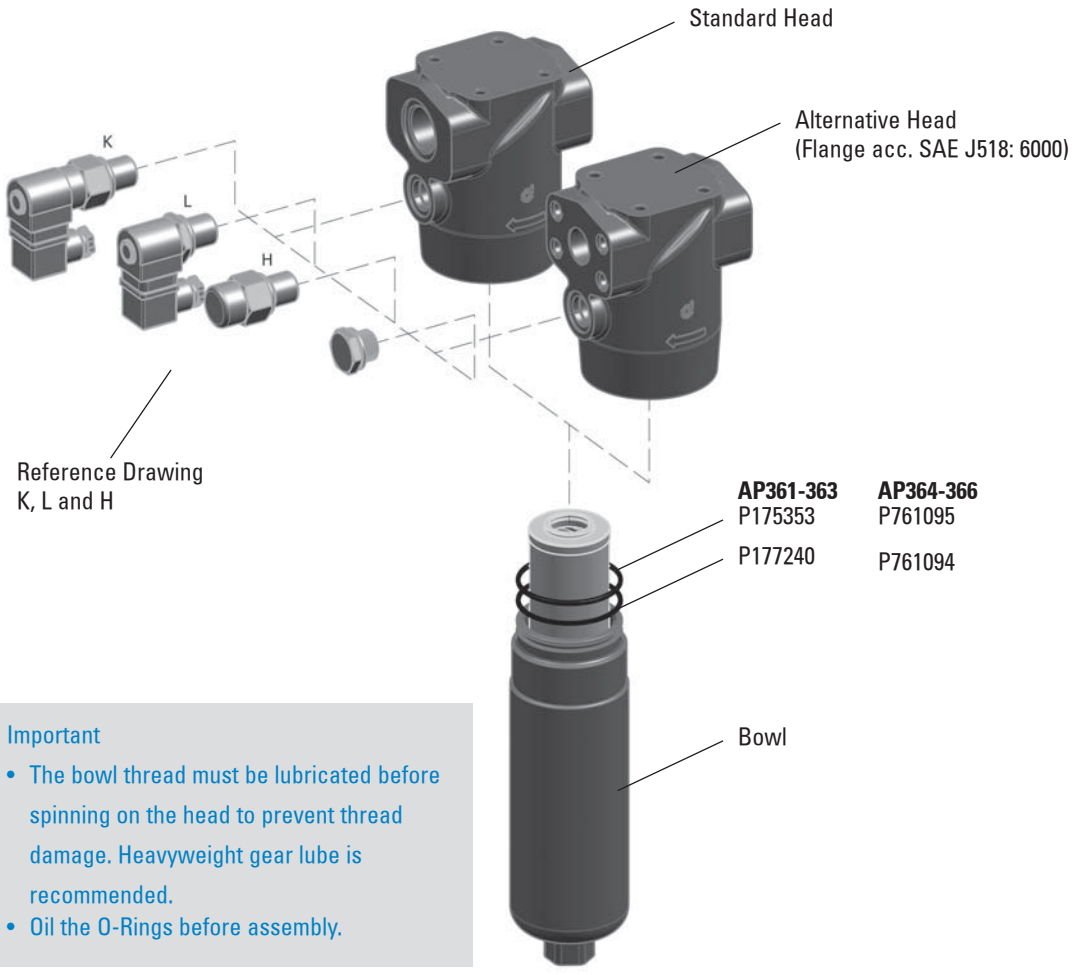


HIGH PRESSURE FILTERS

Indicator Choices

Part	Kind		Reference Drawing	Setting (bar)	Contact	Pro-tection Class	Cable Clamp	Max. Values	Remark
P171945	Visual	Differential	H	5					
P171947	Electrical + Visual	Differential	K	5	Normally Open/ Closed	IP65	PG11	250V AC: 30 VDC; 5A res. and ind.	
P171944	Electrical + Visual	Differential	K	5	Normally Open/ Closed	IP65	PG11	250V AC: 30 VDC; 5A res. and ind.	with thermostat at min. temperature at 30°C
P761056	Electrical	Differential	L	5	Normally Open/ Closed	IP65	PG11	30 V DC; 30 V AC; 0,5 A res. and 0,2 A ind.	

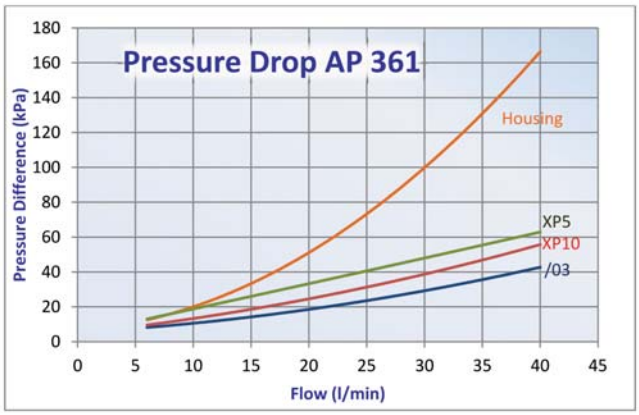
Installation & Service Guidelines

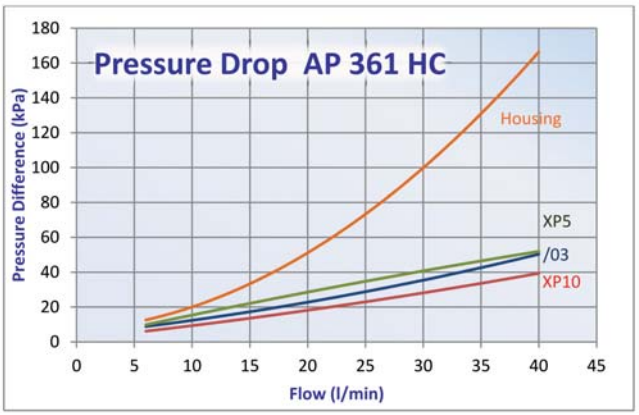


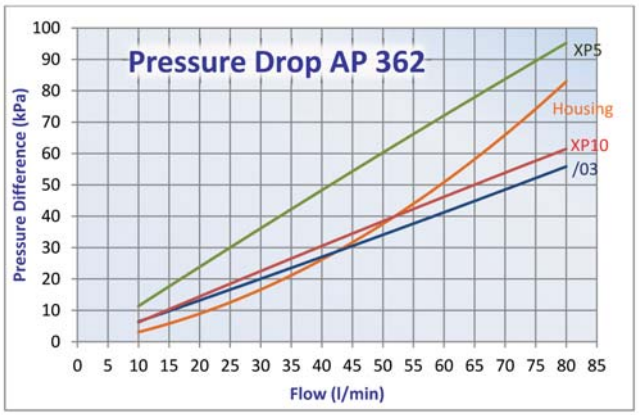
Important

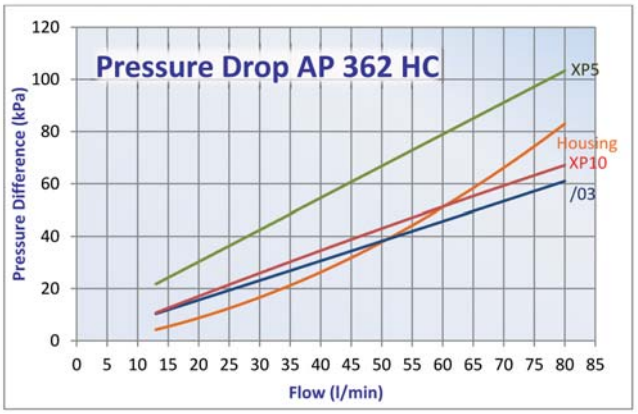
- The bowl thread must be lubricated before spinning on the head to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

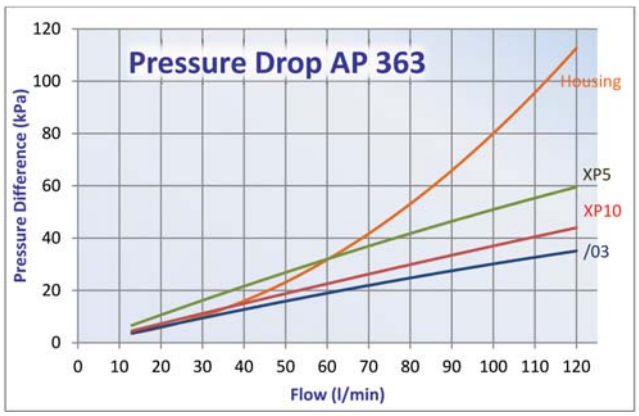
Performance Curves

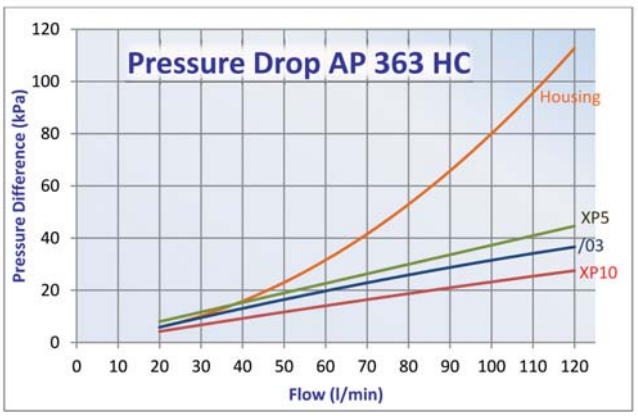


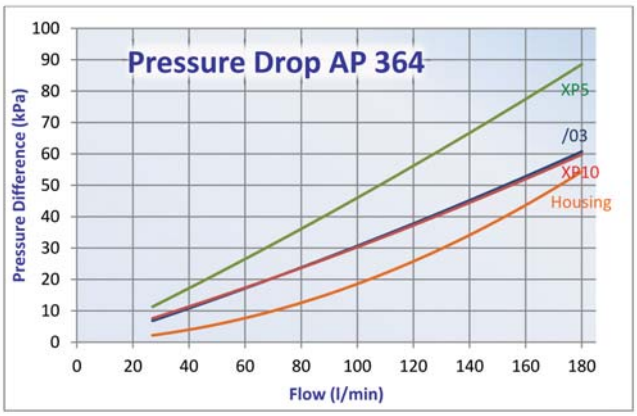


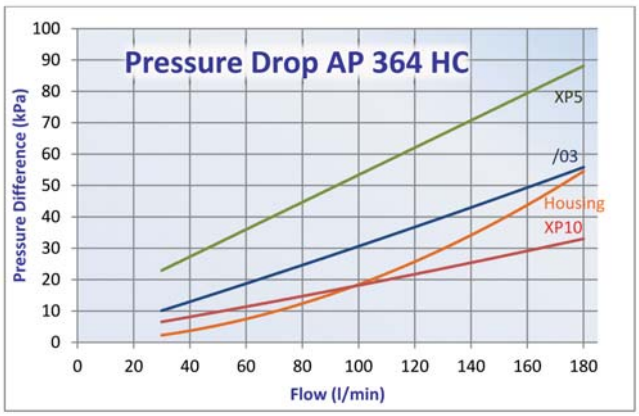




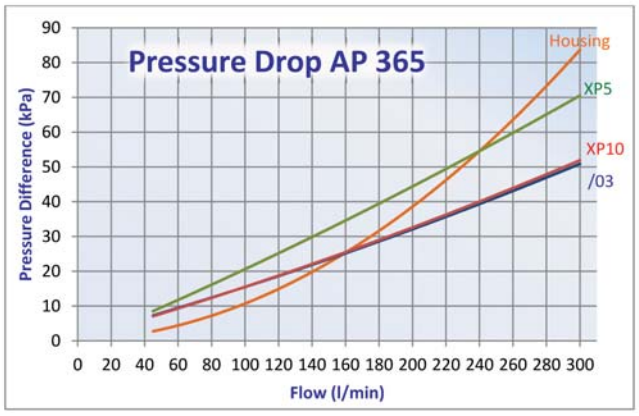


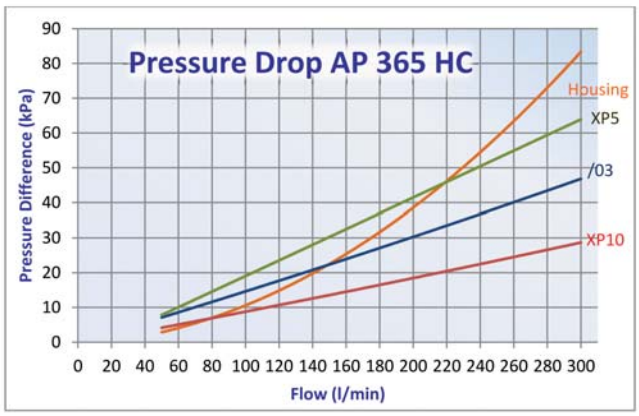


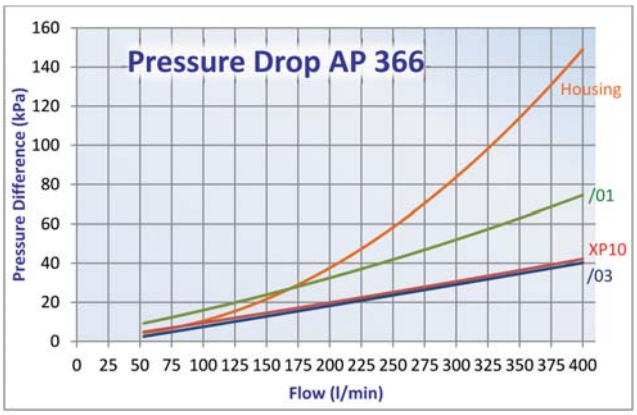


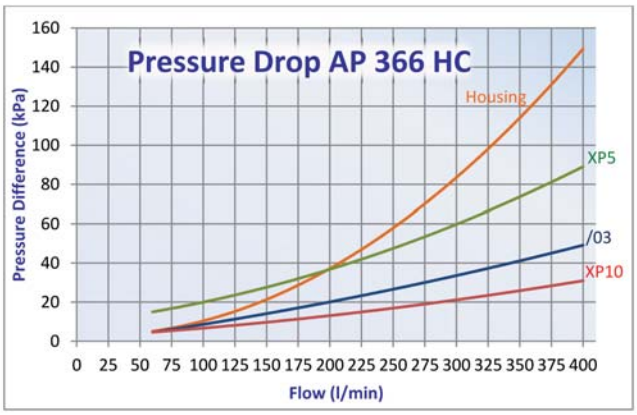


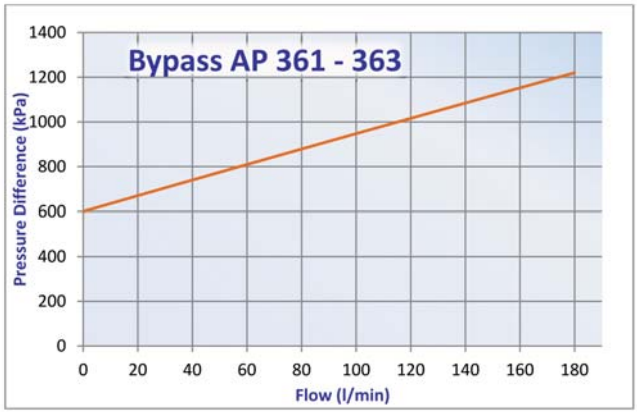
FPK 03 & 04 – AP420

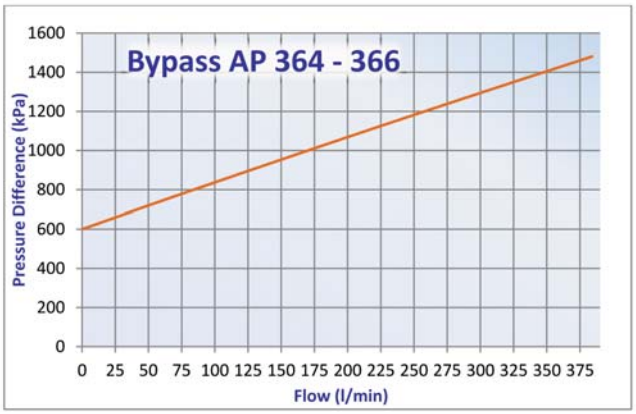












FCK-LC

Pressure Line

High Pressure Filters – In-Line

Last Chance

Technical Data

- Operating pressure up to 42 MPa (420 bar)
- Static pressure testing up to 63 MPa (630 bar).
- Fatigue pressure of 2.000.000 cycles at 0-30 MPa (0-300 bar) per NFPA T 3.10.5.1, R2-2000.
- Operating temperature -20 +120°C.
- Compatibility with hydraulic fluids per ISO 2943.
- Flow rate and pressure drop per ISO 3968 with oil kinematic viscosity 30 cSt at 40°C and density 0,875 kg/dm³.
- Steel head.
- Steel bowl.

Filter Elements

- Wire mesh: 60 micron.
- Synteq® synthetic media: 8-11-23 micron, reinforced with wire mesh.
- Collapse resistance 20 MPa (200 bar) per ISO 2941.

FCK-LC

Components

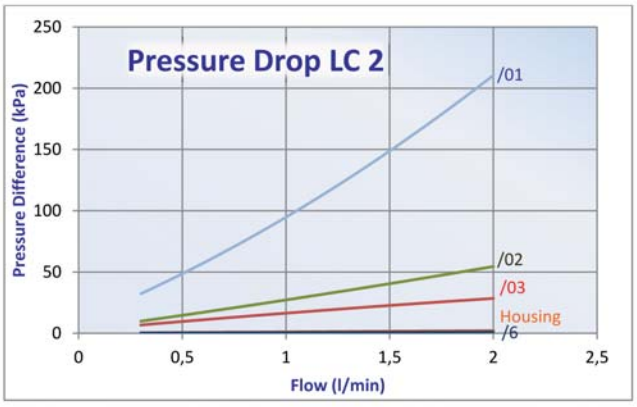
	WIRE MESH MEDIA		SYNTHETIC MEDIA						CARTRIDGE CODE
	/6		/03		/02		/01		
	60µm		$ß_{23µm(c)}$≥1000		$ß_{11µm(c)}$≥1000		$ß_{8µm(c)}$≥1000		
Family	RMF	Sparepart	RMF	Sparepart	RMF	Sparepart	RMF	Sparepart	
LC2	2	P171771	2	P171769	2	P171768	2	P171767	CLC2
LC5	5	P171776	5	P171774	5	P171773	5	P171772	CLC5
LC10	10	P171781	10	P171779	10	P171778	10	P171777	CLC10
LC20	20	P763493	20	P763485	20	P763489	20	P763487	CLC140

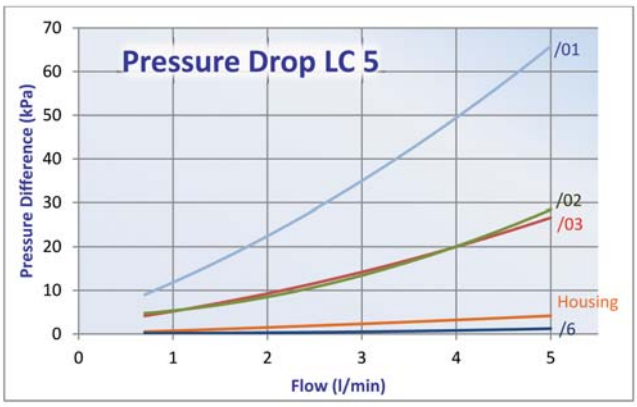
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.

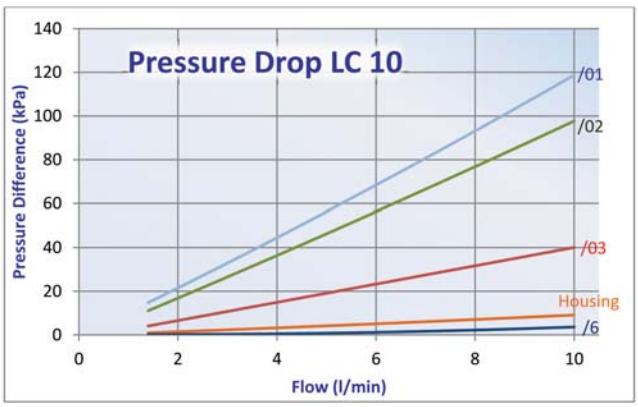
Stocked item (check e-commerce for availability)

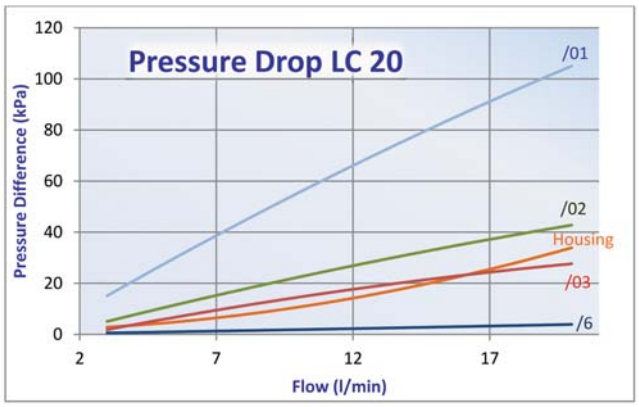
Non highlighted numbers: non-stocked items, request your sales contact for offer and lead-time.

Performance Curves

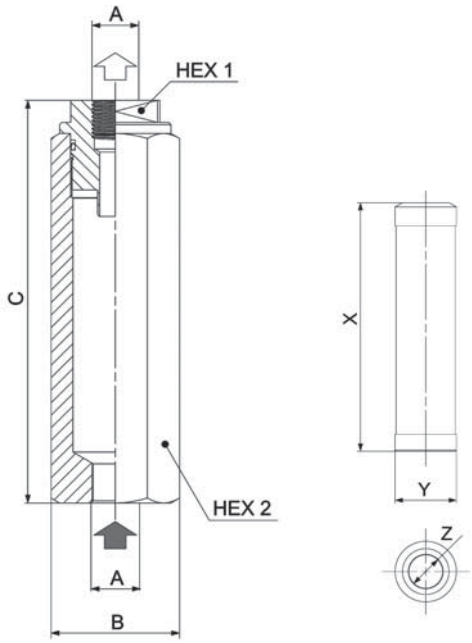








Standard Housing without cartridge	HOUSING DIMENSIONS					CARTRIDGE DIMENSIONS		
	A	B	C	Hex 1	Hex 2	X	Y	Z
		mm	mm	mm	mm	mm	mm	mm
P767138	G3/8	42	103	Hex 27	Hex 36	47	21	9,5
P767139	G1/2	58	135	Hex 30	Hex 50	70	28,6	15,8
P767140	G1/2	58	182	Hex 30	Hex 50	117	28,6	15,8
P767141	G1/2	70	181	Hex 33	Hex 33	90	43	22,2



Installation & Service Guidelines

Important

- The bowl thread must be lubricated before spinning on the head to prevent thread damage. Heavyweight gear lube is recommended.
- Oil the O-Rings before assembly.

FPK02&04-AP220
FPK02-AP280
FPK03&04-AP420
FMK-FM
FCK-LC

Open empty housing
in correct order

Remove carton ring
before use

Check if O-ring between
lid and housing is installed and intact

Check if O-Ring on cartridge is installed and
intact

For FIK:
Mount O-ring over stud

For Low Pressure cartridges:
Mount spring on cartridge

Mount element in
housing

For Combo 120:
Align arrows as shown

Assemble lid on housing

Assemble bolts and
screws in correct order

Tighten screws, bolts or lid until thread ends
For spin-ons: hand tighten until contact
between O-ring and head is made; and then
continue by hand as indicated on spin-on

Degrease surface where sparepart sticker
will be mounted
Only for cartridge type filters

Sparepart sticker in each sparepart box

Fix sparepart sticker in area indicated –
Ready!

Do not forget seals

Hydraulic Accessories

T.R.A.P.™
Breather Technology

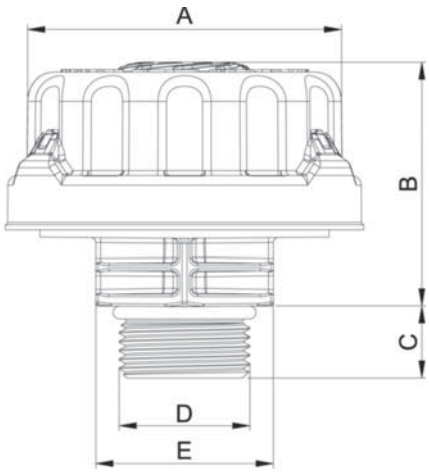
Donaldson FILTRATION SOLUTIONS

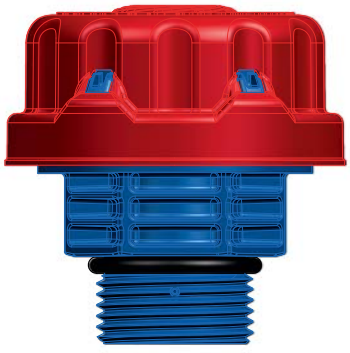
Products

Characteristics	10µm Cellulose Media					
	non-pressurized		Anti-Rollover valve (leakage reduction)		pressurized 0.4 bar	
Color	Blue		Natural		Red	
RMF	Family		Family		Family	
300	FS7	P767027	FS7	P767025	FSP7	P767023
300	FS8	P767029	FS8	P766645	FSP8	P767019
300	FS9	P767031	FS9	P766646	FSP9	P767021

DIMENSIONS				
A	B	C	D	E
	mm	mm	mm	mm
G1/2	72,5	48	14,5	Hex 27
G3/4	72,5	48	14,5	Hex 27
G1	72,5	48	14,5	Hex 27

RMF = Recommended Maximum AIR-Flow in liters/minute





Cap color depending on characteristics

ACCESSORIES

Hydraulic Cart
for Off-Line Filtration

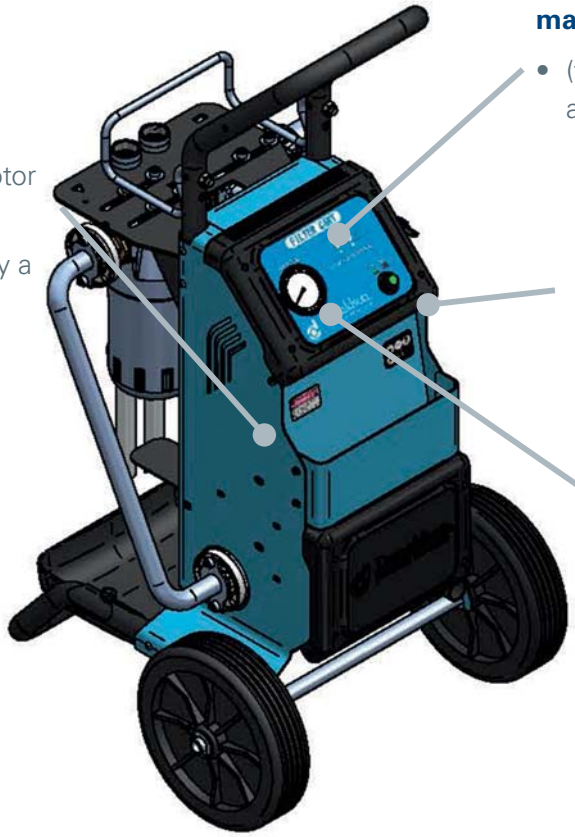
Differential pressure indicators
- Lets you know when to change elements

Two pressure filters mounted in series
- Allows for particulate/water removal or coarse/fine particle removal

Removable angled drip tray
- Easy clean up, fluid will not leak out when tipped back

Dual electrical indicators with flashing on the dashboard + manometer for pump
- (to monitor filter performance and give servicing instructions)

Motor mounted inside
- Better balance
- Fluid will not drip on motor when changing filters
- Main pump protected by a cover



Overload protected switch
- Protects motor and pump from overheating

Integrated safety relief valve
- Protects against over pressurizing

Optional
- Anti-drain suction valve

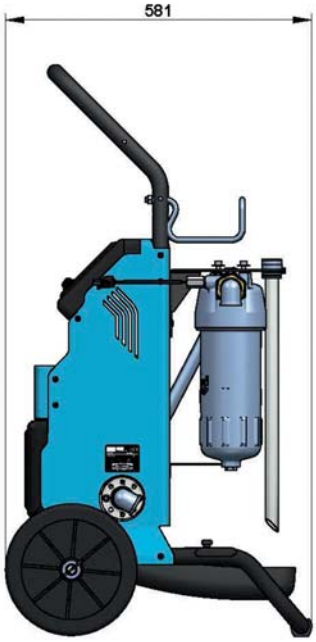
Hydraulic Cart
for Off-Line Filtration

Donaldson FILTRATION SOLUTIONS

Oil filter cart features

Features	Benefits
Rugged and durable frame	Enables long service life
High-efficiency media grades	Cost effective filtration
Two pressure filters	Two-stage filtration – Fine Particulate and/or Water
Safety relief valve	Prevents over pressurizing and damage to pump, hoses and filters
Overload protected switch	Prevents motor/pump from overheating

Applications	
Filter new fluid	New fluids are usually above the recommended ISO cleanliness level
Off-line filtration	Filter cart can be used to supplement existing filtration
Transferring fluid	Fluid is transferred from a storage container (tote, drum, tank, etc.) to a machine's reservoir
Water removal	Using Donaldson water removal elements can help remove free water from the system
Flushing after repairs and rebuilds	After machines are serviced or repaired they need to be flushed thoroughly before they are returned to service
Flushing during equipment commissioning	New machines have original fabrication debris and dirt that has ingressed during transport and storage



Donaldson
FILTRATION SOLUTIONS

Hydraulic Cart
for Off-Line Filtration

Oil filter cart specifications

Hydraulic Cart	X770793
Supply	220 V @ 50/60 Hz
Electric motor	Built-in thermal lockout
Maximum fluid viscosity	300 cSt
Flow rate	50 lpm
Maximum Pressure	5 bar (internal bypass)
Indicators	Dual electrical indicators with flashing on the dashboard + manometer for pump pressure
Suction hose	4 m
Discharge hose	4 m
Dirt filtration	P766847 (ß7µm(c)>1000) *
Water adsorption	P766849 (95% Water removal efficiency) *
Optional	Suction anti-drain valve

* Different filter configurations are possible.

TCO
Filler Caps with Breather

Products

	Without Pressure Relief Valve				With Pressure Relief Valve			
	CELLULOSE MEDIA				CELLULOSE MEDIA			
	/4		/1		/4		/1	
	40µm Air		10µm Air		40µm Air		10µm Air	
Family	RMF		RMF		RMF		RMF	
TCO300	300	P171847	270	P171848				
TCO500	500	P173251	470	P171855	500	P171850	470	P171857
TCO501	500	P171851	470	P171856	500	P171852	470	P171858
TCO502	500	P171853	470	P171859	500	P171854	470	P171860
TCO502			470	P761184				

RMF = Recommended Maximum Flow in liters/minute

Technical Data

Series TCO 300:
- Non removable 500 micron mesh basket.

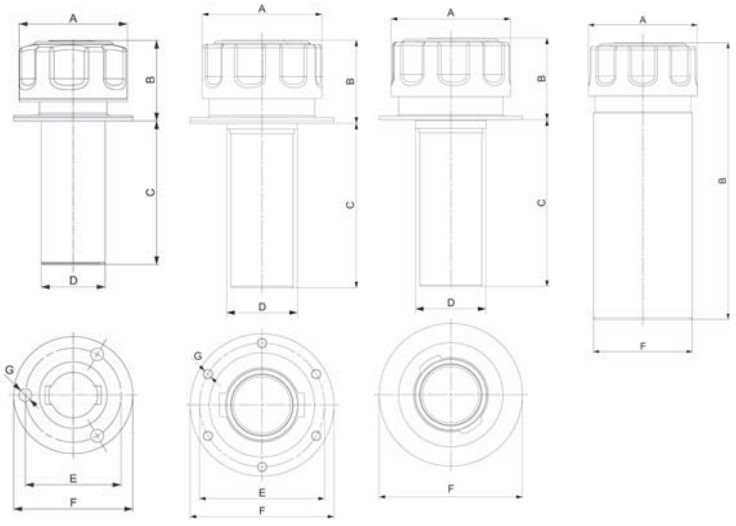
Series TCO 500:
- Removable 500 micron mesh basket.
- 40-10 micron air filter.
- Easy tightening.
- Drilled flanges and fixing screws.

Series TCO 501:
- Features as TCO 500 but with weldable flange.

Series TCO 502:
- Features as TCO 500 but with longer weldable external tube.

Series TCO 503:
- Non removable 125 micron mesh basket.

Series TCO 500, 501, 502 and TCO 503:
- Available with pressure relief valve setting at 40 kPa (0,4 bar).



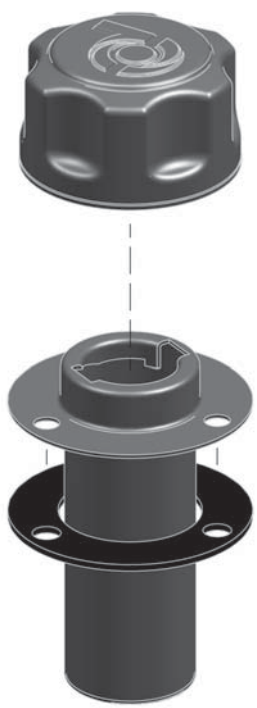
TCO300 TCO500 TCO501 TCO502

For all tank mounting hole: D+2 mm; all screws: M5x12 (UNI 5931)

ACCESSORIES

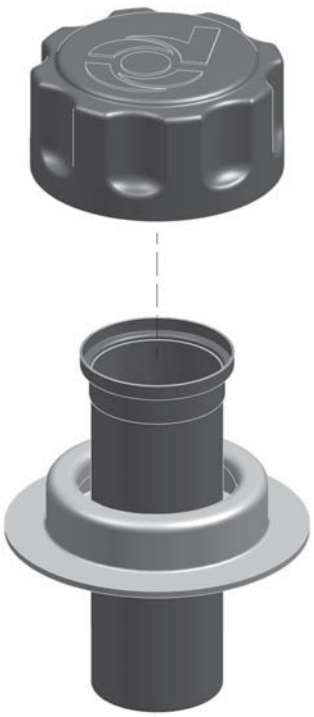
TCO
Filler Caps with Breather

DIMENSIONS						
A	B	C	D	E	F	G
mm	mm	mm	mm	mm	mm	mm
46	35	63	28	41	51	5,5 (3)
70	46	100	40	73	84	5,5 (6)
70	46	100	40		84	
70	180				64	
70	89	188	59	73	84	5,5 (6)



TCO300

TCO500



TCO501

TCO502

TCA

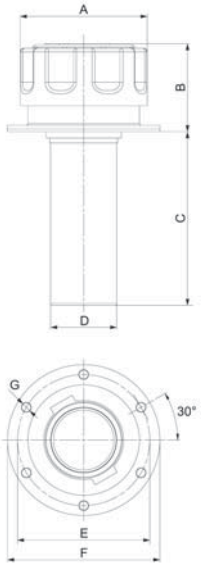
Anti-Vandalism Filler Cap with Breather

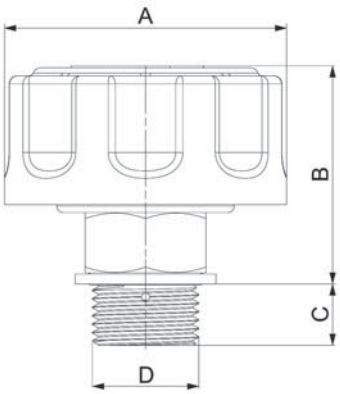
Products

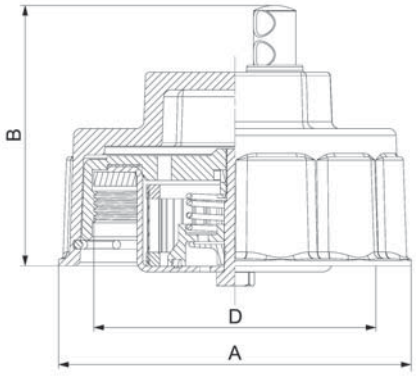
	Partnumber	Reference Drawing	Relief Valve	Lock Connection	Extra Features
RMF			bar		
270	P763513	A	none	no	chain
270	P763528	B	none	no	G1/4 screw masculin
500	P762065	A	0,4	yes	-
500	P173266	A	0,4	yes	oil antisplash
500	P173259	A	none	yes	removable mesh filter 500µm
500	P761036	A	none	yes	removable mesh filter 500µm
500	P173253	A	0,4	yes	removable mesh filter 500µm
470	P172493	B	0,4	yes	G3/4 screw masculin
500	P173475	C	0,7	yes	M80x2 feminin
-	P763672	C	none	yes	M80x2 feminin

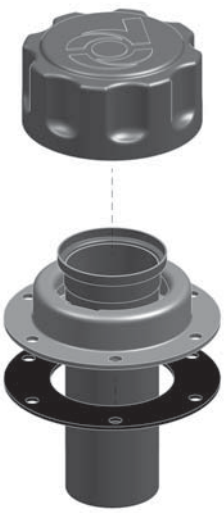
DIMENSIONS							
A	B	C	D	E	F	G	Holes
mm	mm	mm	mm	mm	mm	mm	Amount
46	35	63	28	41	51	5,5	3
46	41	14	-	-	-	-	-
70	46	-	-	73	84	5,5	
70	46	22	38	73	84	5,5	6
70	46	100	38	73	84	5,5	6
70	46	100	38	73	84	5,5	6
70	46	138	38	73	84	5,5	6
70	49	20	-	-	-	-	-
100	74	-	-	-	-	-	-
100	74	-	-	-	-	-	-

RMF = Recommended Maximum AIR-Flow in liters/minute

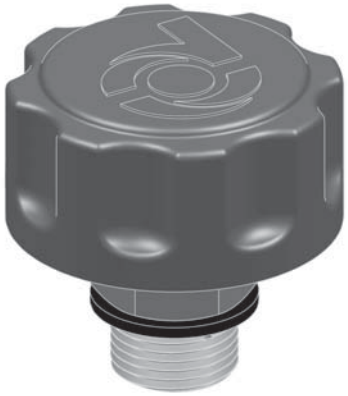




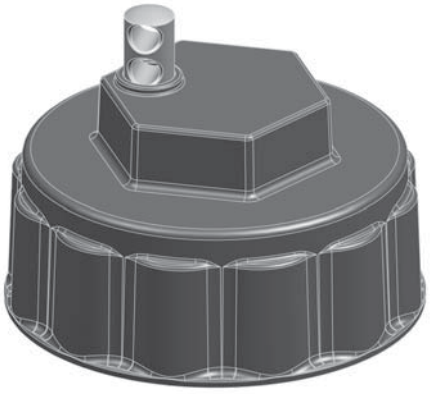




Reference Drawing A



Reference Drawing B



Reference Drawing C

ACCESSORIES

Products

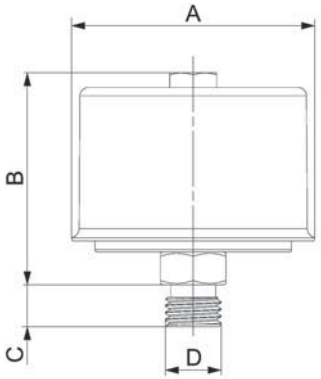
		/6		/4		/1			CARTRIDGE CODE
		WIRE MESH				CELLULOSE MEDIA			
		60µm Air		40µm Air			10µm Air		
Family	RMF	Assembly	Element	Assembly	Element	RMF	Assembly	Element	
FS1	200			P172381	P172433	200	P761046	P172435	CS1
FS3	200			P172382	P172433	200	P761047	P172435	CS1
FS4	200			P172383	P172433	200	P761048	P172435	CS1
FS5	200			P172384	P172433	200	P761049	P172435	CS1
FS6	200			P172385	P172433	200	P761050	P172435	CS1
FS7	500			P172386	P171783	500	P761051	P175447	CS2
FS8	1000			P172387	P171784	1000	P761052	P761045	CS3
FS9	1500	P172389	P171786	P172388	P171785	1500	P761053	P761054	CS4

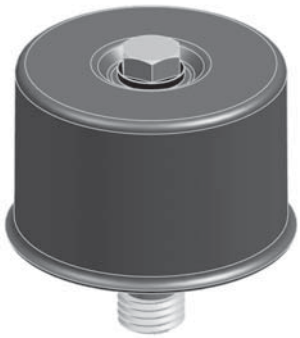
DIMENSIONS				
A	B	C	D	Reference Drawing
mm	mm	mm		
52	45	9	M12x1.5	A
52	45	9	M18x1.5	A
52	48	10	M22x1.5	A
52	45	9	G 1/4	A
52	46	9	G 3/8	A
72	62	10	G 1/2	A
108	77	15	G1	A
132	100	48		B

RMF = Recommended Maximum AIR-Flow in liters/minute

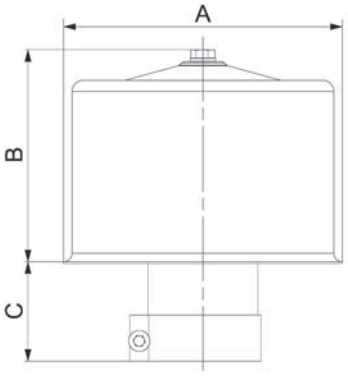
Technical Data

- To filter air entering the reservoir.
- Ports treaded per ISO 228/1 and UNI 4535-UNI 5545.
- Filter Elements in wire mesh 60-40 micron and cellulose media 10 micron.





Reference Drawing A



Reference Drawing B

ACCESSORIES

FFCA

Tank Breathers Spin-On with Flange and Fixing Screws

Products

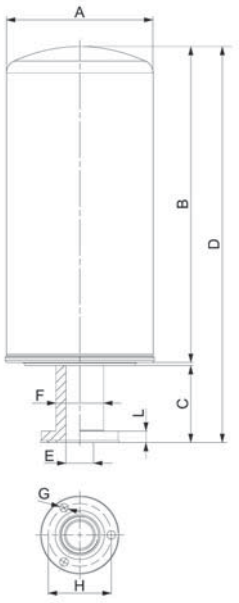
		Wire Mesh		Cellulose Media	Synthetic Media	Flange used to create complete assy	CARTRIDGE CODE
		/6	/3	/1	/02		
		60µm Air	30µm Air	10µm Air	10µm Air		
Family	RMF	Element	Element	Element	Element		
FFCA60	1200	P171607	P171606	P550268	P171602	P177227	CA60
FFCA80	1600	P171612	P171611	P171610	P171608		CA80
FFCA160	2400	P171617	P171616	P550148	P171613	P760682	CA160
FFCA200	3000	P171622	P171621	P171620	P171618		CA200

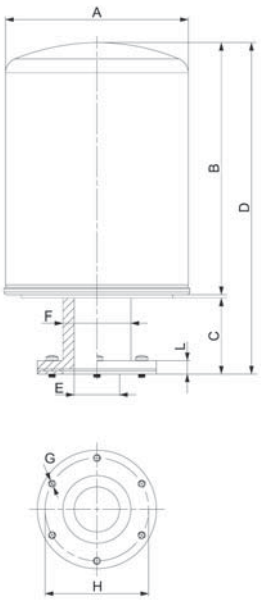
FILTER DIMENSIONS								
A	B	C	D	E	F	G	H	L
mm	mm	mm	mm	mm	mm	mm	mm	mm
96	149	50	199	18	50	5,5	41	3
96	207	50	257	18	50	5,5	41	3
126	181	50	231	32	84	5,5	73	6
126	226	50	276	32	84	5,5	73	6

RMF = Recommended Maximum AIR-Flow in liters/minute

Technical Data

- To vent the reservoir compensating oil volume changes, filtering air in suction.
- Wire Mesh Media with filtration efficiency 60 and 30 micron.
- Cellulose media with filtration efficiency 10 micron.
- Synthetic Media with filtration efficiency 10 micron.





ACCESSORIES

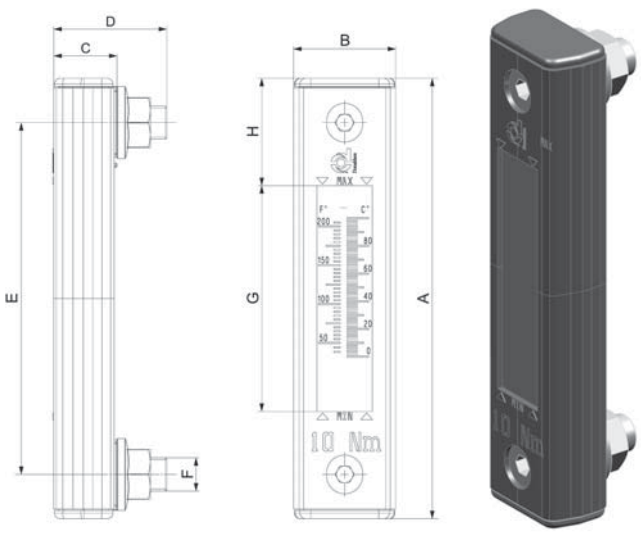
LVO/LVOT
Vertical Oil Level Gauge for Tank

Products

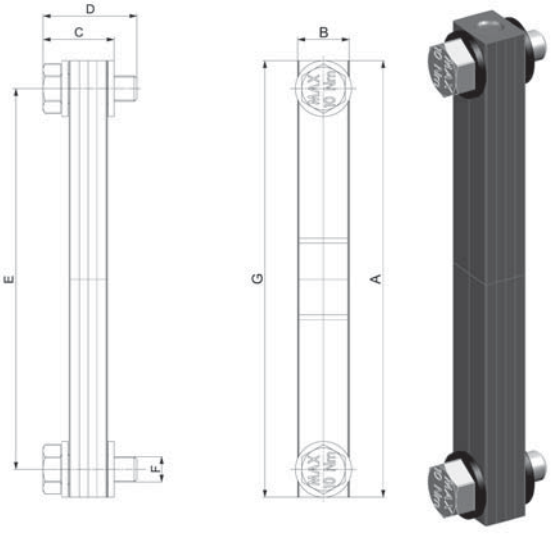
	Without thermometer	With thermometer	LEVEL GAUGE DIMENSIONS								
			A	B	C	D	E	F	G	H	Reference Drawing
			mm	mm	mm	mm	mm		mm	mm	
Family	LVO	LVOT									
LVO(T)76	P171913	P171915	108	37	23	41	76	M10	31	39	A
LVO(T) 77	P171914	P171916	108	37	23	41	76	M12	31	39	A
LVO(T) 127	P171917	P171919	159	37	23	41	127	M10	82	39	A
LVO(T) 128	P171918	P171920	159	37	23	41	127	M12	82	39	A
LVO(T) 150	P177439	P177438	172	22	28	37	150	M10	172	NA	B
LVO(T) 254	P171921	P171922	285	37	23	41	254	M12	2x82	39	A

Technical Data

- Installed on tanks holding mineral oils or petroleum based fluids, they allow a clear and direct oil level or oil level and temperature indication.
- Lens of transparent material protected by metal section, seals “O” Ring of “BUNA” rubber.
- Maximum working pressure: 100 kPa (1bar) for pressurised tanks.
- Recommended bolt tightening torque 10 Nm, with inside nut for tightening directly on the tank.
- LVO serie without thermometer.
- LVOT with thermometer 30°-90°C.
- Threaded per UNI 4534-UNI 5545



Reference Drawing A



Reference Drawing B

ACCESSORIES

Donaldson Engine E-Catalogues

Check out Donaldson's Engine E-catalogue by clicking or browsing to one of the below links:

www.donaldson-catalogue.com/air

www.donaldson-catalogue.com/hydraulic

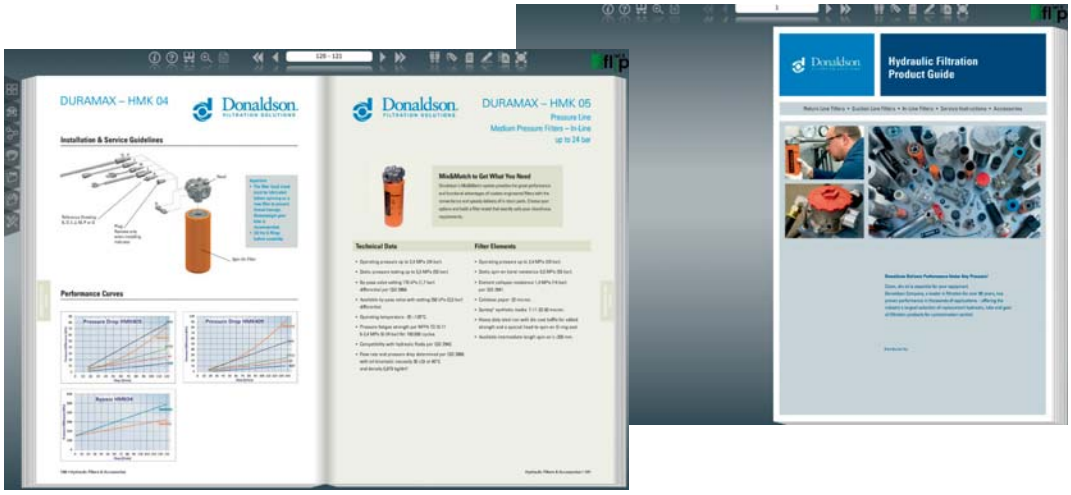
www.donaldson-catalogue.com/liquid

www.donaldson-catalogue.com/agriculture

www.donaldson-catalogue.com/truckBus

www.donaldson-catalogue.com/forklift

www.donaldson-catalogue.com/exhaust



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REMARK: If the E-Catalogue doesn't open, it means that Adobe Flash Player is not installed on your computer.

Donaldson
FILTRATION SOLUTIONS

Service Instructions

SERVICE INSTRUCTIONS

SERVICE INSTRUCTIONS

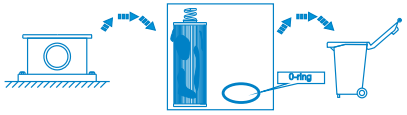
Donaldson
FILTRATION SOLUTIONS

Filter FIK-FDK FHK

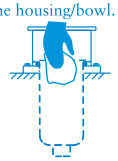
Filter FIK

3. Remove the cover.

4. Remove the filter element as gently as possible avoiding contaminant drops in the clean side of the housing. Discard the cartridge, the seal and the spring.

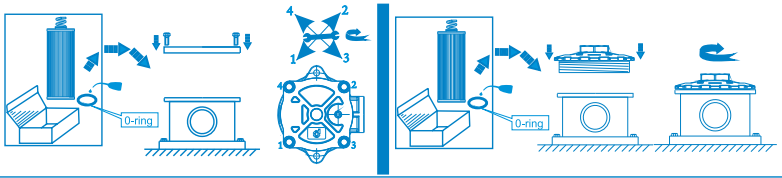


5. Clean out any sediment from the inside of the housing/bowl.

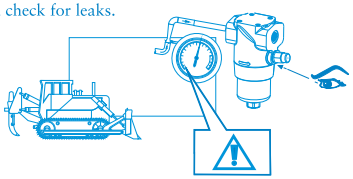


6. Clean out any sediment from the cover side and lubricate the seal.

7. Lubricate element o-ring with clean system oil and install the element. Reassemble the cover until the threads end.



8. Bleed the hydraulic system and check for leaks.



NEVER attempt to clean a used cellulose or synthetic filter element. The filter media will be damaged

ONLY use genuine replacement parts.

NEVER substitute an incorrect part even if it is of the same size.

NEVER fit a damaged replacement filter element (e.g. Dented canister, warped end caps, ripped media).

Once the spin-on or cartridge has been replaced, if there are the conditions (filter installed vertically with head pointing upwards), we recommend to fill the filter with clean oil before pressurizing the system.

NEVER run the system without a filter element - there would be no system protection.

ALWAYS dispose of used filter elements and old oil in accordance with local regulations.

ALWAYS wear protective equipment such as safety glasses and gloves during filter replacement.

This equipment has been assessed in accordance with the guidelines laid down in the European Pressure Directive 97/23/C .
We hereby declare the equipment meets the requirements of article 3, section 3, thus meeting the directive requirements.
Under the provisions of this directive the filter assembly is suitable for use with group 2 fluids only.

Manufactured by:
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OstigliaRD@emea.donaldson.com

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Belgium
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Fax. +32 16 400077
Engine-europe@emea.donaldson.com

For further information contact your local Donaldson dealer
www.Donaldson.com

E507943 rev.3

Hydraulic Filters Service Instructions

Only to be used by professionals

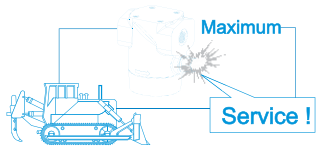
Donaldson

SERVICE INSTRUCTIONS

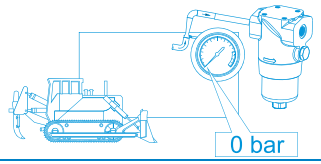
Donaldson
FILTRATION SOLUTIONS

Filter Replacement Instructions

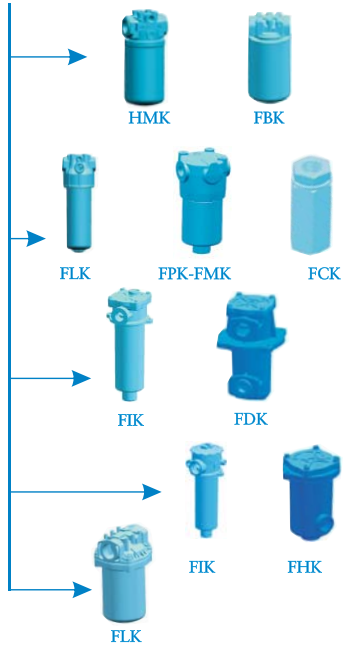
1. The filter requires servicing when the indicator shows the element to be clogged or in accordance with the service interval instructions of the OEM.



2. Turn off and check that there is no pressure.



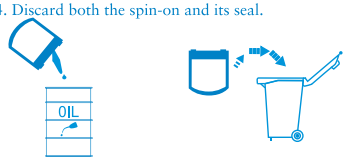
3. Remove filter :



Filter HMK-FBK

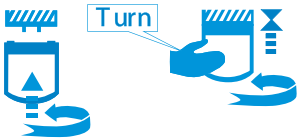
3. Remove the spin-on filter.

4. Discard both the spin-on and its seal.

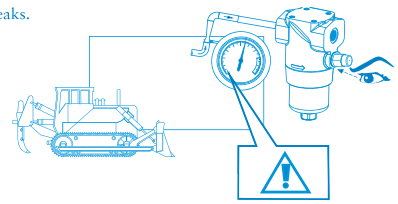


5. Clean the surfaces of the filter head. Lubricate thread and spin-on seal with clean system oil.

6. Screw the spin-on filter till upper surface and turn spin-on as shown on filter.

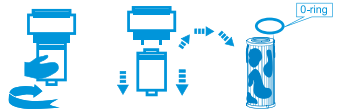


7. Bleed the hydraulic system and check for leaks.

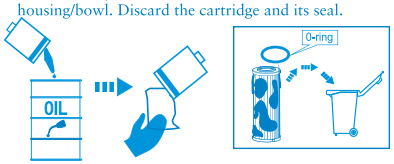


Filter FPK-FMK FLK-FCK

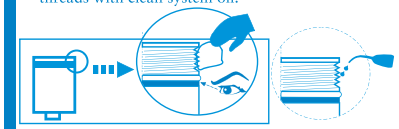
3. Unscrew the housing and remove the cartridge.



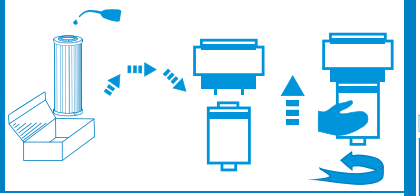
4. Clean out any sediment from the inside of the housing/bowl. Discard the cartridge and its seal.



5. Check the seal integrity, lubricate the seal and the threads with clean system oil.

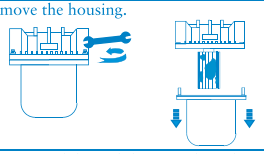


6. Lubricate element o-ring with clean system oil and install element . Reassembly the housing until threads end.

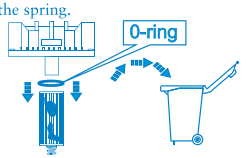


Filter FLK

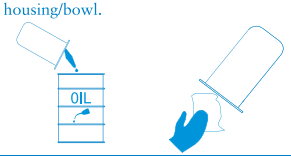
3. Remove the housing.



4. Remove and discard the cartridge , the seal and the spring.

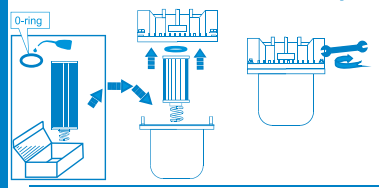


5. Clean out any sediment from the inside of the housing/bowl.

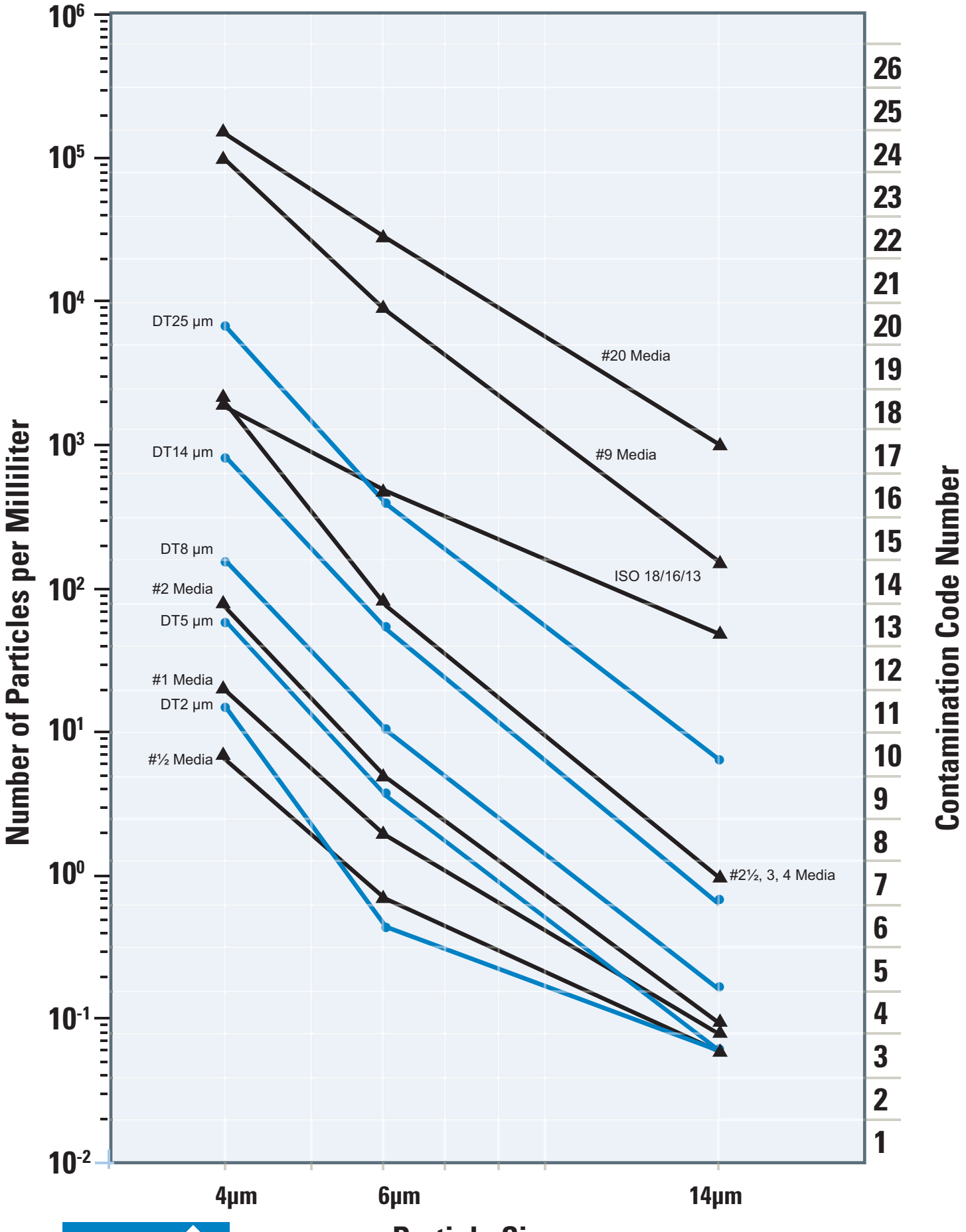


6. Clean out any sediment from the head side and lubricate the seal.

7. Lubricate element o-ring with clean system oil and install element . Reassemble the housing .



Application Guide for Donaldson Filter Media



Logarithmic Scale

This represents the number of particles at a given size in the oil sample

Donaldson
FILTRATION SOLUTIONS

Conversion Tables

Hydraulic Assembly to Mix&Match

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO

Donaldson FILTRATION SOLUTIONS

			WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA			
			/09		/6		/3		/1		/03		/02	
			90µm		60µm		ß8 $_{µm(c)}$≥1000		ß6 $_{µm(c)}$≥1000		ß23 $_{µm(c)}$≥1000		ß11 $_{µm(c)}$≥1000	
Family	Version	Version	RMF		RMF		RMF		RMF		RMF		RMF	
FIK20	Assembly	without predrilled holes	20	K030207	20	K030212	15	K030211	15	K030210	10		10	K030208
	Mix&Match			P171500 P766446		P171505 P766446		P171504 P766446		P171503 P766446		P171502 P766446		P171501 P766446
	Assembly	predrilled holes plugged	20	K030329	20	K030332	15	K030331	15	K030379	10		10	K030378
	Mix&Match			P171500 P766446		P171505 P766446		P171504 P766446		P171503 P766446		P171502 P766446		P171501 P766446
FIK30	Assembly	without predrilled holes	30	K030213	30	K030218	20	K030217	20	K030216	15		15	K030214
	Mix&Match			P171500 P766447		P171505 P766447		P171504 P766447		P171503 P766447		P171502 P766447		P171501 P766447
	Assembly	predrilled holes plugged	30	K030333	30	K030337	20	K030336	20	K030335	15		15	K030334
	Mix&Match			P171500 P766447		P171505 P766447		P171504 P766447		P171503 P766447		P171502 P766447		P171501 P766447
FIK50	Assembly	without predrilled holes	50	K040506	50	K040511	35	K040510	35	K040509	30		30	K040507
	Mix&Match			P171518 P766448		P171523 P766448		P171522 P766448		P171521 P766448		P171520 P766448		P171519 P766448
	Assembly	predrilled holes plugged	50	K040868	50	K040867	35	K040866	35	K040865	30		30	K040971
	Mix&Match			P171518 P766448		P171523 P766448		P171522 P766448		P171521 P766448		P171520 P766448		P171519 P766448
FIK60	Assembly	without predrilled holes	60	K040512	60	K040517	40	K040516	40	K040515	35		35	K040513
	Mix&Match			P171524 P766449		P171529 P766449		P171528 P766449		P171527 P766449		P171526 P766449		P171525 P766449
	Assembly	predrilled holes plugged	60	K040873	60	K040872	40	K040871	40	K040870	35		35	K040869
	Mix&Match			P171524 P766449		P171529 P766449		P171528 P766449		P171527 P766449		P171526 P766449		P171525 P766449
FIK80	Assembly	without predrilled holes	80	K040518	80	K040523	55	K040522	55	K040521	50		50	K040519
	Mix&Match			P171530 P766450		P171535 P766450		P171534 P766450		P171533 P766450		P171532 P766450		P171531 P766450
	Assembly	predrilled holes plugged	80	K040878	80	K040877	55	K040876	55	K040875	50		50	K040985
	Mix&Match			P171530 P766450		P171535 P766450		P171534 P766450		P171533 P766450		P171532 P766450		P171531 P766450
FIK100	Assembly	without predrilled holes	100	K040500	100	K040505	65	K040504	65	K040503	60		60	K040501
	Mix&Match			P171530 P766451		P171535 P766451		P171534 P766451		P171533 P766451		P171532 P766451		P171531 P766451
	Assembly	predrilled holes plugged	100	K040884	100	K040883	65	K040882	65	K040880	60		60	K040879
	Mix&Match			P171530 P766451		P171535 P766451		P171534 P766451		P171533 P766451		P171532 P766451		P171531 P766451

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8 µm(c)≥1000			ß6 µm(c)≥1000			ß23 µm(c)≥1000			ß11 µm(c)≥1000		
FIK150	Assembly	without predrilled holes	150	K051109		150	K051114		100	K051113		100	K051112		90			90	K051110	
	Mix&Match			P171536	P766452		P171541	P766452		P171540	P766452		P171539	P766452		P171538	P766452		P171537	P766452
	Assembly	predrilled holes plugged	150	K051238		150	K051237		100	K051236		100	K051235		90			90	K051233	
	Mix&Match			P171536	P766452		P171541	P766452		P171540	P766452		P171539	P766452		P171538	P766452		P171537	P766452
FIK180	Assembly	without predrilled holes	180	K051115		180	K051120		120	K051119		120	K051118		110			110	K051116	
	Mix&Match			P171536	P766453		P171541	P766453		P171540	P766453		P171539	P766453		P171538	P766453		P171537	P766453
	Assembly	predrilled holes plugged	180	K051242		180	K051241		120	K051229		120	K051232		110			110	K051239	
	Mix&Match			P171536	P766453		P171541	P766453		P171540	P766453		P171539	P766453		P171538	P766453		P171537	P766453
FIK200	Assembly	without predrilled holes	200	K070003		200	K070008		140	K070007		140	K070006		130			130	K070004	
	Mix&Match			P171542	P766454		P171547	P766454		P171546	P766454		P171545	P766454		P171544	P766454		P171543	P766454
	Assembly	predrilled holes plugged	200	K070280		200	K070285		140	K070284		140	K070283		130			130	K070281	
	Mix&Match			P171542	P766454		P171547	P766454		P171546	P766454		P171545	P766454		P171544	P766454		P171543	P766454
FIK250	Assembly	without predrilled holes	250	K070009		250	K070014		160	K070013		160	K070012		140			140	K070010	
	Mix&Match			P171548	P766455		P171553	P766455		P171552	P766455		P171551	P766455		P171550	P766455		P171549	P766455
	Assembly	predrilled holes plugged	250	K070286		250	K070290		160	K070289		160	K070288		140			140	K070355	
	Mix&Match			P171548	P766455		P171553	P766455		P171552	P766455		P171551	P766455		P171550	P766455		P171549	P766455
FIK325	Assembly	without predrilled holes	330	K070015		330	K070020		200	K070019		200	K070018		180			180	K070016	
	Mix&Match			P171554	P766456		P171559	P766456		P171558	P766456		P171557	P766456		P171556	P766456		P171555	P766456
	Assembly	predrilled holes plugged	330	K070291		330	K070295		200	K070294		200	K070293		180			180	K070356	
	Mix&Match			P171554	P766456		P171559	P766456		P171558	P766456		P171557	P766456		P171556	P766456		P171555	P766456
FIK330	Assembly	without predrilled holes	330	K070021		330	K070026		200	K070025		200	K070024		180			180	K070022	
	Mix&Match			P171560	P766457		P171565	P766457		P171564	P766457		P171563	P766457		P171562	P766457		P171561	P766457
	Assembly	predrilled holes plugged	330	K070296		330	K070301		200	K070300		200	K070299		180			180	K070297	
	Mix&Match			P171560	P766457		P171565	P766457		P171564	P766457		P171563	P766457		P171562	P766457		P171561	P766457

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8$_{µm(c)}$≥1000			ß6$_{µm(c)}$≥1000			ß23$_{µm(c)}$≥1000			ß11$_{µm(c)}$≥1000		
FIK500	Assembly	without predrilled holes	500	K070027		500	K070032		400	K070031		400	K070030		350			350	K070028	
	Mix&Match			P171566	P766458		P171571	P766458		P171570	P766458		P171569	P766458		P171568	P766458		P171567	P766458
	Assembly	predrilled holes plugged	500	K070302		500	K070307		400	K070306		400	K070305		350			350	K070303	
	Mix&Match			P171566	P766458		P171571	P766458		P171570	P766458		P171569	P766458		P171568	P766458		P171567	P766458
FIK600	Assembly	without predrilled holes	600	K070033		600	K070038		500	K070037		500	K070036		400			400	K070034	
	Mix&Match			P171572	P766459		P171577	P766459		P171576	P766459		P171575	P766459		P171574	P766459		P171573	P766459
	Assembly	predrilled holes plugged	600	K070308		600	K070311		500	K070310		500	K070309		400			400	K070277	
	Mix&Match			P171572	P766459		P171577	P766459		P171576	P766459		P171575	P766459		P171574	P766459		P171573	P766459
FIK600 SAE Flange	Assembly	without predrilled holes	600	K070045		600	K070050		500	K070049		500	K070048		400			400	K070046	
	Mix&Match			P171572	P766460		P171577	P766460		P171576	P766460		P171575	P766460		P171574	P766460		P171573	P766460
	Assembly	predrilled holes plugged	600	K070358		600	K070357		500	K070318		500	K070317		400			400	K070364	
	Mix&Match			P171572	P766460		P171577	P766460		P171576	P766460		P171575	P766460		P171574	P766460		P171573	P766460
FIK800	Assembly	without predrilled holes	800	K070039		800	K070044		600	K070043		600	K070042		500			500	K070040	
	Mix&Match			P171578	P766461		P171583	P766461		P171582	P766461		P171581	P766461		P171580	P766461		P171579	P766461
	Assembly	predrilled holes plugged	800	K070359		800	K070316		600	K070315		600	K070314		500			500	K070312	
	Mix&Match			P171578	P766461		P171583	P766461		P171582	P766461		P171581	P766461		P171580	P766461		P171579	P766461
FIK800 SAE Flange	Assembly	without predrilled holes	800	K070051		800	K070056		600	K070055		600	K070054		500			500	K070052	
	Mix&Match			P171578	P766462		P171583	P766462		P171582	P766462		P171581	P766462		P171580	P766462		P171579	P766462
	Assembly	predrilled holes plugged	800	K070363		800	K070362		600	K070321		600	K070320		500			500	K070360	
	Mix&Match			P171578	P766462		P171583	P766462		P171582	P766462		P171581	P766462		P171580	P766462		P171579	P766462
				Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Return Line Filters

Return Filters In-Tank FIK FIOT

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			$ß8_{µm(c)} \geq 1000$			$ß6_{µm(c)} \geq 1000$			$ß23_{µm(c)} \geq 1000$			$ß11_{µm(c)} \geq 1000$		
Family	Version	Version	RMF			RMF			RMF			RMF			RMF			RMF		
FIK20	Assembly	without predrilled holes	20	K030225		20	K030230		15	K030229		15	K030228		10	K030227		10	K030226	
	Mix&Match			P171500	P766463		P171505	P766463		P171504	P766463		P171503	P766463		P171502	P766463		P171501	P766463
	Assembly	predrilled holes plugged	20	K030341		20	K030394		15	K030342		15	K030389		10	K030388		10	K030387	
	Mix&Match			P171500	P766463		P171505	P766463		P171504	P766463		P171503	P766463		P171502	P766463		P171501	P766463
FIK30	Assembly	without predrilled holes	30	K030231		30	K030236		20	K030235		20	K030234		15	K030233		15	K030232	
	Mix&Match			P171500	P766464		P171505	P766464		P171504	P766464		P171503	P766464		P171502	P766464		P171501	P766464
	Assembly	predrilled holes plugged	30	K030343		30	K030346		20	K030345		20	K030344		15	K030396		15	K030385	
	Mix&Match			P171500	P766464		P171505	P766464		P171504	P766464		P171503	P766464		P171502	P766464		P171501	P766464
FIK50	Assembly	without predrilled holes	50	K040536		50	K040541		35	K040540		35	K040539		30	K040538		30	K040537	
	Mix&Match			P171518	P766465		P171523	P766465		P171522	P766465		P171521	P766465		P171520	P766465		P171519	P766465
	Assembly	predrilled holes plugged	50	K040892		50	K040895		35	K040894		35	K040893		30	K040994		30	K040993	
	Mix&Match			P171518	P766465		P171523	P766465		P171522	P766465		P171521	P766465		P171520	P766465		P171519	P766465
FIK60	Assembly	without predrilled holes	60	K040542		60	K040547		40	K040546		40	K040545		35	K040544		35	K040543	
	Mix&Match			P171524	P764666		P171529	P764666		P171528	P764666		P171527	P764666		P171526	P764666		P171525	P764666
	Assembly	predrilled holes plugged	60	K040896		60	K040900		40	K040899		40	K040898		35	K040897		35	K041008	
	Mix&Match			P171524	P764666		P171529	P764666		P171528	P764666		P171527	P764666		P171526	P764666		P171525	P764666
FIK80	Assembly	without predrilled holes	80	K040548		80	K040553		55	K040552		55	K040551		50	K040550		50	K040549	
	Mix&Match			P171530	P766467		P171535	P766467		P171534	P766467		P171533	P766467		P171532	P766467		P171531	P766467
	Assembly	predrilled holes plugged	80	K040901		80	K040904		55	K040903		55	K040902		50	K041017		50	K041016	
	Mix&Match			P171530	P766467		P171535	P766467		P171534	P766467		P171533	P766467		P171532	P766467		P171531	P766467
FIK100	Assembly	without predrilled holes	100	K040530		100	K040535		65	K040534		65	K040533		60	K040532		60	K040531	
	Mix&Match			P171530	P766468		P171535	P766468		P171534	P766468		P171533	P766468		P171532	P766468		P171531	P766468
	Assembly	predrilled holes plugged	100	K040889		100	K040891		65	K040890		65	K040864		60	K041023		60	K040889	
	Mix&Match			P171530	P766468		P171535	P766468		P171534	P766468		P171533	P766468		P171532	P766468		P171531	P766468

Return Line Filters

Return Filters In-Tank FIK FIOT

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8 $_{µm(c)}$≥1000			ß6 $_{µm(c)}$≥1000			ß23 $_{µm(c)}$≥1000			ß11 $_{µm(c)}$≥1000		
FIK150	Assembly	without predrilled holes	150	K051121		150	K051127		100	K051126		100	K051125		90	K051124		90	K051123	
	Mix&Match			P171536	P766469		P171541	P766469		P171540	P766469		P171539	P766469		P171538	P766469		P171537	P766469
	Assembly	predrilled holes plugged	150	K051243		150	K051247		100	K051246		100	K051245		90	K051244		90	K041029	
	Mix&Match			P171536	P766469		P171541	P766469		P171540	P766469		P171539	P766469		P171538	P766469		P171537	P766469
FIK180	Assembly	without predrilled holes	180	K051128		180	K051133		120	K051132		120	K051131		110	K051130		110	K051129	
	Mix&Match			P171536	P766470		P171541	P766470		P171540	P766470		P171539	P766470		P171538	P766470		P171537	P766470
	Assembly	predrilled holes plugged	180	K051248		180	K051250		120	K051227		120	K051231		110	K051263		110	K051249	
	Mix&Match			P171536	P766470		P171541	P766470		P171540	P766470		P171539	P766470		P171538	P766470		P171537	P766470
FIK200	Assembly	without predrilled holes	200	K070057		200	K070062		140	K070061		140	K070060		130	K070059		130	K070058	
	Mix&Match			P171542	P766471		P171547	P766471		P171546	P766471		P171545	P766471		P171544	P766471		P171543	P766471
	Assembly	predrilled holes plugged	200	K070458		200	K070461		140	K070460		140	K070322		130	K070319		130	K070459	
	Mix&Match			P171542	P766471		P171547	P766471		P171546	P766471		P171545	P766471		P171544	P766471		P171543	P766471
FIK250	Assembly	without predrilled holes	250	K070063		250	K070068		160	K070067		160	K070066		140			140	K070064	
	Mix&Match			P171548	P766472		P171553	P766472		P171552	P766472		P171551	P766472		P171550	P766472		P171549	P766472
	Assembly	predrilled holes plugged	250	K070462		250	K070325		160	K070324		160	K070323		140			140	K070463	
	Mix&Match			P171548	P766472		P171553	P766472		P171552	P766472		P171551	P766472		P171550	P766472		P171549	P766472
FIK325	Assembly	without predrilled holes	330	K070069		330	K070074		200	K070073		200	K070072		180	K070071		180	K070070	
	Mix&Match			P171554	P764673		P171559	P764673		P171558	P764673		P171557	P764673		P171556	P764673		P171555	P764673
	Assembly	predrilled holes plugged	330	K070465		330	K070330		200	K070329		200	K070328		180	K070327		180	K070326	
	Mix&Match			P171554	P764673		P171559	P764673		P171558	P764673		P171557	P764673		P171556	P764673		P171555	P764673
FIK330	Assembly	without predrilled holes	330	K070075		330	K070080		200	K070079		200	K070078		180	K070077		180	K070076	
	Mix&Match			P171560	P766474		P171565	P766474		P171564	P766474		P171563	P766474		P171562	P766474		P171561	P766474
	Assembly	predrilled holes plugged	330	K070385		330	K070335		200	K070334		200	K070333		180	K070332		180	K070331	
	Mix&Match			P171560	P766474		P171565	P766474		P171564	P766474		P171563	P766474		P171562	P766474		P171561	P766474

Return Line Filters

Return Filters In-Tank FIK FIOT

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8 $_{\mu m(c)}$≥1000			ß6 $_{\mu m(c)}$≥1000			ß23 $_{\mu m(c)}$≥1000			ß11 $_{\mu m(c)}$≥1000		
FIK500	Assembly	without predrilled holes	500	K070081		500	K070086		400	K070085		400	K070084		350	K070083		350	K070082	
	Mix&Match			P171566	P766475		P171571	P766475		P171570	P766475		P171569	P766475		P171568	P766475		P171567	P766475
	Assembly	predrilled holes plugged	500	K070366		500	K070339		400	K070338		400	K070337		350	K070367		350	K070336	
	Mix&Match			P171566	P766475		P171571	P766475		P171570	P766475		P171569	P766475		P171568	P766475		P171567	P766475
FIK600	Assembly	without predrilled holes	600	K070087		600	K070092		500	K070091		500	K070090		400	K070089		400	K070088	
	Mix&Match			P171572	P766476		P171577	P766476		P171576	P766476		P171575	P766476		P171574	P766476		P171573	P766476
	Assembly	predrilled holes plugged	600	K070343		600	K070454		500	K070342		500	K070341		400	K070369		400	K070340	
	Mix&Match			P171572	P766476		P171577	P766476		P171576	P766476		P171575	P766476		P171574	P766476		P171573	P766476
FIK600 SAE Flange	Assembly	without predrilled holes	600	K070099		600	K070104		500	K070103		500	K070102		400	K070101		400	K070100	
	Mix&Match			P171572	P766477		P171577	P766477		P171576	P766477		P171575	P766477		P171574	P766477		P171573	P766477
	Assembly	predrilled holes plugged	600	K070466		600	K070345		500	K070344		500	K070469		400	K070468		400	K070467	
	Mix&Match			P171572	P766477		P171577	P766477		P171576	P766477		P171575	P766477		P171574	P766477		P171573	P766477
FIK800	Assembly	without predrilled holes	800	K070093		800	K070098		600	K070097		600	K070096		500	K070095		500	K070094	
	Mix&Match			P171578	P766478		P171583	P766478		P171582	P766478		P171581	P766478		P171580	P766478		P171579	P766478
	Assembly	predrilled holes plugged	800	K070455		800	K070457		600	K070348		600	K070347		500	K070456		500	K070346	
	Mix&Match			P171578	P766478		P171583	P766478		P171582	P766478		P171581	P766478		P171580	P766478		P171579	P766478
FIK800 SAE Flange	Assembly	without predrilled holes	800	K070105		800	K070110		600	K070109		600	K070108		500	K070107		500	K070106	
	Mix&Match			P171578	P766479		P171583	P766479		P171582	P766479		P171581	P766479		P171580	P766479		P171579	P766479
	Assembly	predrilled holes plugged	800	K070470		800			600	K070742		600	K070350		500	K070471		500	K070349	
	Mix&Match			P171578	P766479		P171583	P766479		P171582	P766479		P171581	P766479		P171580	P766479		P171579	P766479

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO/FIOT (4 holes flanges)

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8$_{µm(c)}$≥1000			ß6$_{µm(c)}$≥1000			ß23$_{µm(c)}$≥1000			ß11$_{µm(c)}$≥1000		
Family	Version	Version	RMF			RMF			RMF			RMF			RMF			RMF		
FIK 4 110	Assembly	without predrilled holes	110	K051560		110	K041561		65	K041562		65	K041563		60	K041564		60	K041565	
	Mix&Match			P171530	P766451		P171535	P766451		P171534	P766451		P171533	P766451		P171532	P766451		P171531	P766451
	Assembly	predrilled holes plugged		K041536			K041538			K041538			K041539			K041540			K041541	
	Mix&Match			P171530	P766451		P171535	P766451		P171534	P766451		P171533	P766451		P171532	P766451		P171531	P766451
FIK 4 140	Assembly	without predrilled holes	140	K041566		140	K041567		100	K041568		100	K041569		90	K041570		90	K041571	
	Mix&Match			P171831	P766675		P171834	P766675		P171837	P766675		P171840	P766675		P171843	P766675		P171846	P766675
	Assembly	predrilled holes plugged		K041542			K041543			K041544			K041545			K041546			K041547	
	Mix&Match			P171831	P766675		P171834	P766675		P171837	P766675		P171840	P766675		P171843	P766675		P171846	P766675
FIKT 4 110	Assembly	without predrilled holes	110	K041572		110	K041573		65	K041522		65	K041575		60	K041567		60	K041577	
	Mix&Match			P171530	P766468		P171535	P766468		P171534	P766468		P171533	P766468		P171532	P766468		P171531	P766468
	Assembly	predrilled holes plugged		K041548			K041549			K041550			K041551			K041552			K041553	
	Mix&Match			P171530	P766468		P171535	P766468		P171534	P766468		P171533	P766468		P171532	P766468		P171531	P766468
FIKT 4 140	Assembly	without predrilled holes	140	K041578		140	K041579		100	K041580		100	K041581		90	K041582		90	K041583	
	Mix&Match			P171831	P766674		P171834	P766674		P171837	P766674		P171840	P766674		P171843	P766674		P171846	P766674
	Assembly	predrilled holes plugged		K041554			K041555			K041556			K041557			K041558			K041559	
	Mix&Match			P171831	P766674		P171834	P766674		P171837	P766674		P171840	P766674		P171843	P766674		P171846	P766674
				Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Return Line Filters

Return Filters In-Tank FIK FIS

Donaldson FILTRATION SOLUTIONS

				WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA			
				/9		/6		/3		/1		/03		/02	
				90µm		60µm		ß8 $_{\mu m(c)}$≥1000		ß6 $_{\mu m(c)}$≥1000		ß23 $_{\mu m(c)}$≥1000		ß11 $_{\mu m(c)}$≥1000	
Family	Element	Version	Version	RMF		RMF		RMF		RMF		RMF		RMF	
FIS20	CR20	Assembly	without predrilled holes	20	K030304	20	K030306	15	K030308	15	K030310	10	K030312	10	K030314
		Mix&Match			P171829 P766618		P171832 P766618		P171835 P766618		P171838 P766618		P171841 P766618		P171844 P766618
		Assembly	predrilled holes plugged		K030524		K030529		K030528		K030527		K030526		K030525
		Mix&Match			P171829 P766618		P171832 P766618		P171835 P766618		P171838 P766618		P171841 P766618		P171844 P766618
FIS40	CR40	Assembly	without predrilled holes	40	K030305	40	K030307	30	K030309	30	K030311	25	K030313	25	K030315
		Mix&Match			P171830 P766619		P171833 P766619		P171836 P766619		P171839 P766619		P171842 P766619		P171845 P766619
		Assembly	predrilled holes plugged		K030530		K030535		K030534		K030533		K030532		K030531
		Mix&Match			P171830 P766619		P171833 P766619		P171836 P766619		P171839 P766619		P171842 P766619		P171845 P766619
FIS60	CR60	Assembly	without predrilled holes	60	K040758	60	K040761	40	K070764	40	K040767	35	K040770	35	K040773
		Mix&Match			P171524 P766597		P171529 P766597		P171528 P766597		P171527 P766597		P171526 P766597		P171525 P766597
		Assembly	predrilled holes plugged		K041337		K041342		K041341		K041340		K041339		K041338
		Mix&Match			P171524 P766597		P171529 P766597		P171528 P766597		P171527 P766597		P171526 P766597		P171525 P766597
FIS100	CR100	Assembly	without predrilled holes	100	K040759	100	K040762	65	K040765	65	K040768	60	K040771	60	K040774
		Mix&Match			P171530 P766598		P171535 P766598		P171534 P766598		P171533 P766598		P171532 P766598		P171531 P766598
		Assembly	predrilled holes plugged		K041319		K041329		K041328		K041322		K041321		K041320
		Mix&Match			P171530 P766598		P171535 P766598		P171534 P766598		P171533 P766598		P171532 P766598		P171531 P766598
FIS150	CR150	Assembly	without predrilled holes	150	K040760	150	K040763	120	K040766	120	K040769	110	K040772	110	K040775
		Mix&Match			P171831 P766599		P171834 P766599		P171837 P766599		P171840 P766599		P171843 P766599		P171846 P766599
		Assembly	predrilled holes plugged		K041330		K041336		K041335		K041334		K041332		K041331
		Mix&Match			P171831 P766599		P171834 P766599		P171837 P766599		P171840 P766599		P171843 P766599		P171846 P766599
				Sparepart	Housing		Sparepart Housing		Sparepart Housing		Sparepart Housing		Sparepart Housing		Sparepart Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact.

Stock item (check e-commerce for availability) .Please bare in mind the Restyling on FIS 60-100-150-200

Return Line Filters

Return Filters In-Line FIK FLS

Donaldson FILTRATION SOLUTIONS

			WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA			
			/09		/6		/3		/1		/03		/02	
			90µm		60µm		ß8 µm(c) ≥1000		ß6 µm(c) ≥1000		ß23 µm(c) ≥1000		ß11 µm(c) ≥1000	
Family	Version	Version	RMF		RMF		RMF		RMF		RMF		RMF	
FLS 50	Assembly	without predrilled holes	40	K030259	40	K030264	35	K030263	35	K030262	30	K030261	30	K030260
	Mix&Match			P171518 P766995		P171523 P766995		P171522 P766995		P171521 P766995		P171520 P766995		P171519 P766995
	Assembly	with predrilled holes		K030372		K030325		K030376		K030375		K030374		K030373
	Mix&Match			P171518 P766672		P171523 P766672		P171522 P766672		P171521 P766672		P171520 P766672		P171519 P766672
FLS100	Assembly	without predrilled holes	80	K030271	80	K030276	65	K030275	65	K030274	60	K030273	60	K030272
	Mix&Match			P171530 P766996		P171535 P766996		P171534 P766996		P171533 P766996		P171532 P766996		P171531 P766996
	Assembly	with predrilled holes		K030365		K030371		K030326		K030368		K030367		K030366
	Mix&Match			P171530 P766673		P171535 P766673		P171534 P766673		P171533 P766673		P171532 P766673		P171531 P766673
FLS150	Assembly	without predrilled holes	130	K040596	130	K040601	110	K040600	110	K040599	90	K040598	90	K040597
	Mix&Match			P171584 P766997		P171589 P766997		P171588 P766997		P171587 P766997		P171586 P766997		P171585 P766997
	Assembly	with predrilled holes		K040948		K040953		K040952		K040951		K040950		K040949
	Mix&Match			P171584 P766671		P171589 P766671		P171588 P766671		P171587 P766671		P171586 P766671		P171585 P766671
FLS180	Assembly	without predrilled holes	180	K040608	180	K040613	130	K040612	130	K040611	110	K040610	110	K040609
	Mix&Match			P171536 P766998		P171541 P766998		P171540 P766998		P171539 P766998		P171538 P766998		P171537 P766998
	Assembly	with predrilled holes		K040954		K040959		K040958		K040957		K040956		K040955
	Mix&Match			P171536 P766670		P171541 P766670		P171540 P766670		P171539 P766670		P171538 P766670		P171537 P766670
FLS200	Assembly	without predrilled holes	200	K040620	200	K040625	140	K040624	140	K040623	120	K040622	120	K040621
	Mix&Match			P171596 P766999		P171601 P766999		P171600 P766999		P171599 P766999		P171598 P766999		P171597 P766999
	Assembly	with predrilled holes		K040960		K040963		K040962		K040961		K041125		K041124
	Mix&Match			P171596 P766666		P171601 P766666		P171600 P766666		P171599 P766666		P171598 P766666		P171597 P766666
FLS250	Assembly	without predrilled holes	250	K070159	250	K070164	160	K070163	160	K070162	140	K070161	140	K070160
	Mix&Match			P171590 P767000		P171595 P767000		P171594 P767000		P171593 P767000		P171592 P767000		P171591 P767000
	Assembly	with predrilled holes		K070560		K070419		K070418		K070417		K070559		K070558
	Mix&Match			P171590 P766667		P171595 P766667		P171594 P766667		P171593 P766667		P171592 P766667		P171591 P766667
FLS330	Assembly	without predrilled holes	330	K070171	330	K070176	220	K070175	220	K070174	180	K070173	180	K070172
	Mix&Match			P171560 P767002		P171565 P767002		P171564 P767002		P171563 P767002		P171562 P767002		P171561 P767002
	Assembly	with predrilled holes		K070420		K070425		K070424		K070423		K070422		K070421
	Mix&Match			P171560 P766669		P171565 P766669		P171564 P766669		P171563 P766669		P171562 P766669		P171561 P766669

Return Line Filters

Return Filters In-Line FIK FLS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			/02		
			90µm			60µm			ß8$_{µm(c)}$≥1000			ß6$_{µm(c)}$≥1000			ß23$_{µm(c)}$≥1000			ß11$_{µm(c)}$≥1000		
FLS500	Assembly	without predrilled holes	500	K070183		500	K070188		400	K070187		400	K070186		350	K070185		350	K070184	
	Mix&Match			P171566	P767004		P171571	P767004		P171570	P767004		P171569	P767004		P171568	P767004		P171567	P767004
	Assembly	with predrilled holes		K070426			K070431			K070430			K070429			K070428			K070427	
	Mix&Match			P171566	P766665		P171571	P766665		P171570	P766665		P171569	P766665		P171568	P766665		P171567	P766665
FLS250 SAE Flange	Assembly	without predrilled holes	250	K070195		250	K070200		160	K070199		160	K070198		140	K070197		140	K070196	
	Mix&Match			P171590	P767001		P171595	P767001		P171594	P767001		P171593	P767001		P171592	P767001		P171591	P767001
	Assembly	with predrilled holes		K070432			K070433			K070564			K070563			K070562			K070561	
	Mix&Match			P171590	P766663		P171595	P766663		P171594	P766663		P171593	P766663		P171592	P766663		P171591	P766663
FLS330 SAE Flange	Assembly	without predrilled holes	330	K070207		330	K070212		220	K070211		220	K070210		180	K070209		180	K070208	
	Mix&Match			P171560	P767003		P171565	P767003		P171564	P767003		P171563	P767003		P171562	P767003		P171561	P767003
	Assembly	with predrilled holes		K070569			K070568			K070434			K070567			K070566			K070565	
	Mix&Match			P171560	P766662		P171565	P766662		P171564	P766662		P171563	P766662		P171562	P766662		P171561	P766662
FLS500 SAE Flange	Assembly	without predrilled holes	500	K070219		500	K070224		400	K070223		400	K070222		350	K070221		350	K070220	
	Mix&Match			P171566	P767005		P171571	P767005		P171570	P767005		P171569	P767005		P171568	P767005		P171567	P767005
	Assembly	with predrilled holes		K070571			K070439			K070438			K070437			K070436			K070435	
	Mix&Match			P171566	P766668		P171571	P766668		P171570	P766668		P171569	P766668		P171568	P766668		P171567	P766668
FLS800 SAE Flange	Assembly	without predrilled holes	600	K070231		600	K070236		500	K070235		500	K070234		400	K070233		400	K070232	
	Mix&Match			P171578	P767006		P171583	P767006		P171582	P767006		P171581	P767006		P171580	P767006		P171579	P767006
	Assembly	with predrilled holes		K070440			K070445			K070444			K070443			K070442			K070441	
	Mix&Match			P171578	P766664		P171583	P766664		P171582	P766664		P171581	P766664		P171580	P766664		P171579	P766664
				Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Return Line Filters

Low Pressure Filters In-Line FBK-FRCA

Donaldson FILTRATION SOLUTIONS

			WIRE MESH MEDIA			CELLULOSE MEDIA						SYNTHETIC MEDIA						BOX
			/6			/3			/1			/03			/02			
			60µm			$ß_{50µm(c)} \geq 1000$			$ß_{30µm(c)} \geq 1000$			$ß_{23µm(c)} \geq 1000$			$ß_{10µm(c)} \geq 1000$			
Family	Version		RMF			RMF			RMF			RMF			RMF			
FRCA60	Assembly	no Indicator holes	60	K040635		60	K040634		50	K040633		40	K040632		40	K040631		E509389
	Mix&Match			P171607	P173441		P171606	P173441		P550268	P173441		P171604	P173441		P171602	P173441	
FRCA80	Assembly	no Indicator holes	80	K040645		70	K040644		60	K040643		50	K040642		50	K040641		E771397
	Mix&Match			P171612	P173441		P171611	P173441		P171610	P173441		P171609	P173441		P171608	P173441	
FRCA108						100												
FRCA118						100												
FRCA160	Assembly	no Indicator holes	160	K051155		150	K051154		140	K051153		120	K051152		120	K051151		E771403
	Mix&Match			P171617	P176846		P171616	P176846		P550148	P176846		P171614	P176846		P171613	P176846	
FRCA200	Assembly	no Indicator holes	200	K051165		190	K051164		160	K051163		140	K051162		140	K051161		E771404
	Mix&Match			P171622	P176846		P171621	P176846		P171620	P176846		P171619	P176846		P171618	P176846	
FRCA380	Assembly	no Indicator holes	380	K250035		340	K250034		300	K250033		280	K250032		280	K250031		E771406
	Mix&Match			P171617	P766293		P171616	P766293		P550148	P766293		P171614	P766293		P171613	P766293	
FRCA400	Assembly	no Indicator holes	400	K250040		360	K250039		320	K250038		300	K250037		300	K250036		E507967
	Mix&Match			P171622	P766293		P171621	P766293		P171620	P766293		P171619	P766293		P171618	P766293	
FRCA220						200									150			
FRCA250						230									170			
				Sparepart	Head		Sparepart	Head		Sparepart	Head		Sparepart	Head		Sparepart	Head	

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; not order-able via e-Commerce - ordering only possible via your salescontact; MOQ is 25 pcs

Stock item (check e-commerce for availability)

Return & Suction Filters

Low Pressure Filters In-Tank FHK-FIR

		WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
		/9			/6			/3			/1			/03			XP10		
		90µm			60µm			$ß8_{µm(c)} \geq 1000$			$ß6_{µm(c)} \geq 1000$			$ß23_{µm(c)} \geq 1000$			$ß11_{µm(c)} \geq 1000$		
Family	Version	RMF			RMF			RMF			RMF			RMF			RMF		
FHK 30	Assembly	30	K035009		30	K030352		20	K030245		20	K030244		15	K030428		15	K035010	
	Mix&Match		P171500	P766679		P171505	P766679		P171504	P766679		P171503	P766679		P171502	P766679		P171501	P766679
FHK 60	Assembly	60	K040560		60	K040917		40	K040564		40	K040563		35	K040562		35	K040561	
	Mix&Match		P171524	P766481		P171529	P766481		P171528	P766481		P171527	P766481		P171526	P766481		P171525	P766481
FHK 100	Assembly	100	K040566		100	K040571		65	K040570		65	K040569		60	K040568		60	K040567	
	Mix&Match		P171530	P766482		P171535	P766482		P171534	P766482		P171533	P766482		P171532	P766482		P171531	P766482
FHK 180	Assembly	180	K051134		180	K051139		120	K051138		120	K051137		110	K051136		110	K051135	
	Mix&Match		P171536	P766678		P171541	P766678		P171540	P766678		P171539	P766678		P171538	P766678		P171537	P766678
FHK 500	Assembly	500	K070117		500	K070380		400	K070121		400	K070120		350	K070119		350	K070118	
	Mix&Match		P171566	P766483		P171571	P766483		P171570	P766483		P171569	P766483		P171568	P766483		P171567	P766483
			Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Suction Line Filters

Suction Filters In-Line FLK FLA

Donaldson FILTRATION SOLUTIONS

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			XP10		
			90µm			60µm			ß8 µm(c) ≥1000			ß6 µm(c) ≥1000			ß23 µm(c) ≥1000			ß11 µm(c) ≥1000		
Family	Version	Version	RMF			RMF			RMF			RMF			RMF			RMF		
FLA 50	Assembly	without predrilled holes	20	K030253		20	K030258		15	K030257		15	K030256		10	K030255		10	K030254	
	Mix&Match			P171518	P766484		P171523	P766484		P171522	P766484		P171521	P766484		P171520	P766484		P171519	P766484
	Assembly	with predrilled holes		K030361			K030364			K030363			K030362			K030426			K030355	
	Mix&Match			P171518	P766484		P171523	P766484		P171522	P766484		P171521	P766484		P171520	P766484		P171519	P766484
FLA100	Assembly	without predrilled holes	40	K030265		40	K030270		30	K030269		30	K030268		25	K030267		25	K030266	
	Mix&Match			P171530	P766485		P171535	P766485		P171534	P766485		P171533	P766485		P171532	P766485		P171531	P766485
	Assembly	with predrilled holes		K030356			K030360			K030359			K030358			K030427			K030357	
	Mix&Match			P171530	P766485		P171535	P766485		P171534	P766485		P171533	P766485		P171532	P766485		P171531	P766485
FLA150	Assembly	without predrilled holes	65	K040590		65	K040595		55	K040594		55	K040593		45	K040592		45	K040591	
	Mix&Match			P171584	P766486		P171589	P766486		P171588	P766486		P171587	P766486		P171586	P766486		P171585	P766486
	Assembly	with predrilled holes		K040932			K040936			K040935			K040934			K04113			K040933	
	Mix&Match			P171584	P766486		P171589	P766486		P171588	P766486		P171587	P766486		P171586	P766486		P171585	P766486
FLA180	Assembly	without predrilled holes	90	K040602		90	K040607		60	K040606		60	K040605		55	K040604		55	K040603	
	Mix&Match			P171536	P766487		P171541	P766487		P171540	P766487		P171539	P766487		P171538	P766487		P171537	P766487
	Assembly	with predrilled holes		K040937			K040941			K040940			K040939			K041114			K040938	
	Mix&Match			P171536	P766487		P171541	P766487		P171540	P766487		P171539	P766487		P171538	P766487		P171537	P766487
FLA200	Assembly	without predrilled holes	100	K040614		100	K040619		70	K040618		70	K040617		80	K040616		80	K040615	
	Mix&Match			P171596	P766488		P171601	P766488		P171600	P766488		P171599	P766488		P171598	P766488		P171597	P766488
	Assembly	with predrilled holes		K040942			K040945			K040944			K040943			K041116			K041115	
	Mix&Match			P171596	P766488		P171601	P766488		P171600	P766488		P171599	P766488		P171598	P766488		P171597	P766488
FLA250	Assembly	without predrilled holes	125	K070153		125	K070158		80	K070157		80	K070156		70	K070155		70	K070154	
	Mix&Match			P171590	P766489		P171595	P766489		P171594	P766489		P171593	P766489		P171592	P766489		P171591	P766489
	Assembly	with predrilled holes		K070396			K070399			K070398			K070397			K041116			K070496	
	Mix&Match			P171590	P766489		P171595	P766489		P171594	P766489		P171593	P766489		P171592	P766489		P171591	P766489
FLA330	Assembly	without predrilled holes	170	K070165		170	K070170		110	K070169		110	K070168		90	K070167		90	K070166	
	Mix&Match			P171560	P766491		P171565	P766491		P171564	P766491		P171563	P766491		P171562	P766491		P171561	P766491
	Assembly	with predrilled holes		K070400			K070404			K070403			K070402			K070497			K070401	
	Mix&Match			P171560	P766491		P171565	P766491		P171564	P766491		P171563	P766491		P171562	P766491		P171561	P766491

Suction Line Filters

Suction Filters In-Line FLK FLA

			WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA					
			/09			/6			/3			/1			/03			XP10		
			90µm			60µm			ß8 $_{µm(c)}$≥1000			ß6 $_{µm(c)}$≥1000			ß23 $_{µm(c)}$≥1000			ß11 $_{µm(c)}$≥1000		
FLA500	Assembly	without predrilled holes	250	K070177		250	K070182		200	K070181		200	K070180		170	K070179		170	K070178	
	Mix&Match			P171566	P766493		P171571	P766493		P171570	P766493		P171569	P766493		P171568	P766493		P171567	P766493
	Assembly	with predrilled holes		K070405			K070410			K070409			K070408			K070407			K070406	
	Mix&Match			P171566	P766493		P171571	P766493		P171570	P766493		P171569	P766493		P171568	P766493		P171567	P766493
FLA250 SAE Flange	Assembly	without predrilled holes	125	K070189		125	K070194		80	K070193		80	K070192		70	K070191		70	K070190	
	Mix&Match			P171590	P766490		P171595	P766490		P171594	P766490		P171593	P766490		P171592	P766490		P171591	P766490
	Assembly	with predrilled holes		K070503			K070502			K070501			K070500			K070499			K070498	
	Mix&Match			P171590	P766490		P171595	P766490		P171594	P766490		P171593	P766490		P171592	P766490		P171591	P766490
FLA330 SAE Flange	Assembly	without predrilled holes	170	K070201		170	K070206		110	K070205		110	K070204		90	K070203		90	K070202	
	Mix&Match			P171560	P766492		P171565	P766492		P171564	P766492		P171563	P766492		P171562	P766492		P171561	P766492
	Assembly	with predrilled holes		K070510			K070509			K070508			K070507			K070506			K070505	
	Mix&Match			P171560	P766492		P171565	P766492		P171564	P766492		P171563	P766492		P171562	P766492		P171561	P766492
FLA500 SAE Flange	Assembly	without predrilled holes	250	K070213		250	K070218		200	K070217		200	K070216		170	K070215		170	K070214	
	Mix&Match			P171566	P766494		P171571	P766494		P171570	P766494		P171569	P766494		P171568	P766494		P171567	P766494
	Assembly	with predrilled holes		K070515			K070411			K070514			K070513			K070512			K070511	
	Mix&Match			P171566	P766494		P171571	P766494		P171570	P766494		P171569	P766494		P171568	P766494		P171567	P766494
FLA800 SAE Flange	Assembly	without predrilled holes	300	K070225		300	K070230		250	K070229		250	K070228		200	K070227		200	K070226	
	Mix&Match			P171578	P766495		P171583	P766495		P171582	P766495		P171581	P766495		P171580	P766495		P171579	P766495
	Assembly	with predrilled holes		K070412			K070416			K070415			K070414			K070517			K070516	
	Mix&Match			P171578	P766495		P171583	P766495		P171582	P766495		P171581	P766495		P171580	P766495		P171579	P766495
				Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Suction Line Filters

Low Pressure Filters In-Line FBK-FACA

Donaldson FILTRATION SOLUTIONS

			WIRE MESH MEDIA			CELLULOSE MEDIA						SYNTHETIC MEDIA						Box
			/6			/3			/1			/03			/02			
			60µm			$ß_{50µm(c)}≥1000$			$ß_{35µm(c)}≥1000$			$ß_{23µm(c)}≥1000$			$ß_{11µm(c)}≥1000$			
Family	Version		RMF			RMF			RMF			RMF			RMF			
CA60	Assembly	no indicator holes	30			25	K040629		20	K040628		15	K040627		15	K040626		E509389
	Mix&Match						P171606	P173442		P550268	P173442		P171604	P173442		P171602	P173442	
	Assembly	G1/8 predrilled and plugged					K041141			K041140			K041139			K041138		E509389
	Mix&Match						P171606	P761262		P550268	P761262		P171604	P761262		P171602	P761262	
CA80	Assembly	no indicator holes	35			30	K040639		25	K040638		20	K040637		20	K040636		E771397
	Mix&Match						P171611	P173442		P171610	P173442		P171609	P173442		P171608	P173442	
	Assembly	G1/8 predrilled and plugged					K040970			K041147			K041146			K041145		E771397
	Mix&Match						P171611	P761262		P171610	P761262		P171609	P761262		P171608	P761262	
CA108						50												
CA118						60												
CA160	Assembly	no indicator holes	80			80	K041149		70	K051148		60	K051147		60	K051146		E771403
	Mix&Match						P171616	P173203		P550148	P173203		P171614	P173203		P171613	P173203	
	Assembly	G1/8 predrilled and plugged					K051334			K051230			K051333			K051332		E771403
	Mix&Match						P171616	P761259		P550148	P761259		P171614	P761259		P171613	P761259	
CA200	Assembly	no indicator holes	100			100	K051159		90	K051158		80	K051157		80	K051156		E771404
	Mix&Match						P171621	P173203		P171620	P173203		P171619	P173203		P171618	P173203	
	Assembly	G1/8 predrilled and plugged					K051340			K051339			K051338			K051261		E771404
	Mix&Match						P171621	P761259		P171620	P761259		P171619	P761259		P171618	P761259	
CA380	Assembly	no indicator holes	190			190	K250004		170	K250003		150	K250002		150	K250001		E771406
	Mix&Match						P171616	P766294		P550148	P766294		P171614	P766294		P171613	P766294	
	Assembly	G1/8 predrilled and plugged					K250109			K250062			K250108			K250107		E771406
	Mix&Match						P171616	P761260		P550148	P761260		P171614	P761260		P171613	P761260	
CA400	Assembly	no indicator holes	200			200	K250009		180	K250008		180	K250007		180	K250006		E507967
	Mix&Match						P171621	P766294		P171620	P766294		P171619	P766294		P171618	P766294	
	Assembly	G1/8 predrilled and plugged					K250116			K250115			K250114			K250113		E507967
	Mix&Match						P171621	P761260		P171620	P761260		P171619	P761260		P171618	P761260	
CA220						100									80			
CA250						120									90			
				Sparepart	Head		Sparepart	Head		Sparepart	Head		Sparepart	Head		Sparepart	Head	

RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

In-Line Filters

Medium Pressure Filters FMK FM

		WIRE MESH MEDIA						CELLULOSE MEDIA			SYNTHETIC MEDIA								
		/6			/3M			/1			/03			/02			/01		
		60µm			30µm			ß36$_{µm(c)}$≥1000			ß23$_{µm(c)}$≥1000			ß11$_{µm(c)}$≥1000			ß8$_{µm(c)}$≥1000		
Family	Version	RMF			RMF			RMF			RMF			RMF			RMF		
FMK140	Assembly	50	K020083		50	K020082		40	K020081		40	K020080		40	K020079		40	K020078	
	Mix&Match		P171706	P766661		P171705	P766661		P171704	P766661		P171703	P766661		P171702	P766661		P171701	P766661
FMK180	Assembly	80	K020089		80	K020088		60	K020087		60	K020086		60	K020085		60	K020084	
	Mix&Match		P171712	P766660		P171711	P766660		P171710	P766660		P171709	P766660		P171708	P766660		P171707	P766660
			Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

Medium Pressure Filters In-Line HMK04

			CELLULOSE MEDIA			SYNTHETIC MEDIA											Box
			#10			#20			#7			XP10			XP05		
			$ß_{23µm(c)} \geq 1000$			$ß_{50µm(c)} \geq 1000$			$ß_{25µm(c)} \geq 1000$			$ß_{9µm(c)} \geq 1000$			$ß_{7µm(c)} \geq 1000$		
Family		Version	RMF			RMF			RMF			RMF			RMF		
K405	Assembly	no indicator installed	100	K045741		120	K045739		110	K045743		110	K045745		100	K045747		E509389
	Mix&Match			P163419	P762554		P165335	P762554		P164381	P762554		P164375	P762554		P165354	P762554	
	Assembly	indicator P162400 installed	100	K045794		120	K045795		110	K045793		110	K045792		100	K045791		E509389
	Mix&Match			P163419	P173386+P162400		P165335	P173386+P162400		P164381	P173386+P162400		P164375	P173386+P162400		P165354	P173386+P162400	
	Assembly	indicator P162696 installed	100	K045804		120	K045805		110	K045803		110	K045802		100	K045801		E509389
	Mix&Match			P163419	P766295		P165335	P766295		P164381	P766295		P164375	P766295		P165354	P766295	
K409	Assembly	no indicator installed	110	K045742		140	K045740		130	K045744		130	K045746		120	K045748		E507971
	Mix&Match			P163324	P173438		P165338	P173438		P164384	P173438		P164378	P173438		P165332	P173438	
K409	Assembly	indicator P162400 installed	110	K045799		140	K045800		130	K045798		130	K045797		120	K045796		E507971
	Mix&Match			P163324	P173438+P162400		P165338	P173438+P162400		P164384	P173438+P162400		P164378	P173438+P162400		P165332	P173438+P162400	
K409	Assembly	indicator P162696 installed	110	K045809		140	K045810		130	K045808		130	K045807		120	K045806		E507971
	Mix&Match			P163324	P766296		P165338	P766296		P164384	P766296		P164378	P766296		P165332	P766296	
				Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator	

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

Medium Pressure Filters In-Line HMK05

			CELLULOSE MEDIA			SYNTHETIC MEDIA										Box
			#10			#20			#7			XP10			XP05		
			$ß_{23µm(c)} \geq 1000$			$ß_{50µm(c)} \geq 1000$			$ß_{23µm(c)} \geq 1000$			$ß_{9µm(c)} \geq 1000$			$ß_{7µm(c)} \geq 1000$		
Family		Version	RMF			RMF			RMF			RMF			RMF		
HMK513	Assembly	no indicator installed	100	K053124		120	K053123		110	K053125		110	K053126		100	K053127		E771405
	Mix&Match			P165705	P766297		P165672	P766297		P165569	P766297		P165659	P766297		P165675	P766297	
	Assembly	indicator P162400 installed		K053143			K053144			K053142			K053141			K053140		E771405
	Mix&Match			P165705	P766299+P162400		P165672	P766299+P162400		P165569	P766299+P162400		P165659	P766299+P162400		P165675	P766299+P162400	
	Assembly	indicator P162696 installed		K053147			K053148			K053146			K053132			K053145		E771405
	Mix&Match			P165705	P766298		P165672	P766298		P165569	P766298		P165659	P766298		P165675	P766298	
				Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator		Sparepart	Head+Indicator	

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

High Pressure Filters In-Line FPK02

		SYNTHETIC MEDIA											
		/03			/02			/01			/00		
		ß23 $_{\mu m(c)}$≥1000			ß11 $_{\mu m(c)}$≥1000			ß8 $_{\mu m(c)}$≥1000			ß6 $_{\mu m(c)}$≥1000		
Family	Version	RMF			RMF			RMF			RMF		
AP358	Assembly	30	K020104		30	K020103		20	K020169		20	K020214	
	Mix&Match		P171715	P766377		P171714	P766377		P171713	P766377		P761392	P766377
AP359	Assembly	50	K020110		50	K020109		40	K020108		40	not available	
	Mix&Match		P165136	P766378		P165006	P766378		P165041	P766378		P169429	P766378
AP360	Assembly	90	K020116		90	K020115		70	K020114		70	not available	
	Mix&Match		P165138	P766379		P165015	P766379		P165043	P766379		P167838	P766379
			Sparepart	Housing		Sparepart	Housing		Sparepart	Housing		Sparepart	Housing

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

High Pressure Filters In-Line FPK02-04

		SYNTHETIC MEDIA								
		/03			/02			/01		
		ß23 $_{\mu m(c)}$≥1000			ß11 $_{\mu m(c)}$≥1000			ß8 $_{\mu m(c)}$≥1000		
Family	Version	RMF			RMF			RMF		
FPK221	Assembly	50	K020173		40	K020172		30	K020171	
	Mix&Match		P169797	P766385		P169447	P766385		P169446	P766385
FPK221	Assembly	50	X770617		40	X779053				
	Mix&Match		P169797	P766385 + P761058		P169447	P766385 + P761058			
FPK222	Assembly	90	K020177		80	K020176		70	K020175	
	Mix&Match		P169450	P766386		P169449	P766386		P169798	P766386
FPK222	Assembly				80	K020212		70	K020230	
	Mix&Match					P169449	P766381		P169798	P766381
FPK223	Assembly	180	K041585		150	K041588		120	K041591	
	Mix&Match		P164172	P766382		P164164	P766382		P164592	P766382
FPK224	Assembly	350	K041586		300	K041589		250	K041592	
	Mix&Match		P164174	P766383		P164166	P766383		P164594	P766383
FPK225	Assembly	450	K041587		400	K041590		350	K041593	
	Mix&Match		P164176	P766384		P164168	P766384		P164596	P766384
			Sparepart	Housing + Indicator		Sparepart	Housing + Indicator		Sparepart	Housing + Indicator

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non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

High Pressure Filters In-Line FPK03-04

		SYNTHETIC MEDIA					
		/03		/02		/01	
		ß23 $_{\mu m(c)}$≥1000		ß11 $_{\mu m(c)}$≥1000		ß8 $_{\mu m(c)}$≥1000	
Family	Version	RMF		RMF		RMF	
AP361	Assembly	50	K030286	50	K030285	40	K030284
	Mix&Match		P171733 P766427		P171732 P766427		P171731 P766427
AP362	Assembly	80	K030289	80	K030288	60	K030287
	Mix&Match		P171736 P766428		P171735 P766428		P171734 P766428
AP362 SAE Flange	Assembly	80	K030292	80	K030291	60	K030290
	Mix&Match		P171736 P766439		P171735 P766439		P171734 P766439
AP363	Assembly	120	K030295	120	K030294	80	K030293
	Mix&Match		P171739 P766429		P171738 P766429		P171737 P766429
AP363 SAE Flange	Assembly	120	K030298	120	K030297	80	K030296
	Mix&Match		P171739 P766440		P171738 P766440		P171737 P766440
AP364	Assembly	180	K040676	180	K040675	160	K040674
	Mix&Match		P171742 P766430		P171741 P766430		P171740 P766430
AP364 SAE Flange	Assembly	180	K040679	180	K040678	160	K040677
	Mix&Match		P171742 P766441		P171741 P766441		P171740 P766441
AP365	Assembly	300	K040682	300	K040681	270	K040680
	Mix&Match		P171745 P766431		P171744 P766431		P171743 P766431
AP365 SAE Flange	Assembly	300	K040685	300	K040684	270	K040683
	Mix&Match		P171745 P766442		P171744 P766442		P171743 P766442
AP366	Assembly	400	K040688	400	K040687	320	K040686
	Mix&Match		P171748 P766432		P171747 P766432		P171746 P766432
AP366 SAE Flange	Assembly	400	K040691	400	K040690	320	K040689
	Mix&Match		P171748 P766443		P171747 P766443		P171746 P766443
			Sparepart Housing		Sparepart Housing		Sparepart Housing

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non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

Pressure Line

High Pressure Filters In-Line FCK-LC

		/6			/03			/02			/01		
		WIREMESH			SYNTHETIC MEDIA								
		60µ			ß23 $_{\mu m(c)}$≥1000			ß11 $_{\mu m(c)}$≥1000			ß8 $_{\mu m(c)}$≥1000		
Family	Version	RMF			RMF			RMF			RMF		
FCK2	Assembly	2	K010009		2	K010007		2	K010006		2	K010005	
	Mix&Match		P171771	P767138		P171769	P767138		P171768	P767138		P171767	P767138
FCK5	Assembly	5	K020124		5	K020122		5	K020121		5	K020120	
	Mix&Match		P171776	P767139		P171774	P767139		P171773	P767139		P171772	P767139
FCK10	Assembly	10	K020129		10	K020127		10	K020126		10	K020125	
	Mix&Match		P171781	P767140		P171779	P767140		P171778	P767140		P171777	P767140
FCK20	Assembly	20	K030303		20	K030301		20	K030300		20	K030299	
	Mix&Match		P763493	P767141		P763485	P767141		P763489	P767141		P763487	P767141
			Sparepart	Housing + Indicator		Sparepart	Housing + Indicator		Sparepart	Housing + Indicator		Sparepart	Housing + Indicator

RMF = Recommended Maximum Flow in liters/minute with use of standard head.
non-stock item; MOQ is 25 pcs; ordering only possible via your salescontact

Stock item (check e-commerce for availability)

NOTES

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K041301	SRK-COMBO	77
K041511	SRK-COMBO	77
K041528	SRK-COMBO	77
K041535	SRK-COMBO	77
K041595	SRK-COMBO	77
K041596	SRK-COMBO	77
K041597	SRK-COMBO	77
K041598	SRK-COMBO	77
K041599	SRK-COMBO	77
K041600	SRK-COMBO	77
K041601	SRK-COMBO	77
K041602	SRK-COMBO	77
K041603	SRK-COMBO	77
K041604	SRK-COMBO	77
K041605	SRK-COMBO	77
K041606	SRK-COMBO	77
K041607	SRK-COMBO	77
K041608	SRK-COMBO	77
K041609	SRK-COMBO	77
K041610	SRK-COMBO	77
K041659	SRK-COMBO	77
K041660	SRK-COMBO	77
K041661	SRK-COMBO	77
K041662	SRK-COMBO	77
K041663	SRK-COMBO	77
K041664	SRK-COMBO	77
K041665	SRK-COMBO	77
K041666	SRK-COMBO	77
K041667	SRK-COMBO	77
K041668	SRK-COMBO	77
K041669	SRK-COMBO	77
K041670	SRK-COMBO	77
K041671	SRK-COMBO	77
K041672	SRK-COMBO	77
K041673	SRK-COMBO	77
K041674	SRK-COMBO	77
P162400	FBK-FRCA	64
P162400	FBK-FRCA	66
P162400	DURAMAX – HMK 04	120
P162400	DURAMAX – HMK 04	121
P162400	DURAMAX – HMK 05	124
P162400	DURAMAX – HMK 05	125
P162696	FBK-FRCA	64
P162696	FBK-FRCA	66
P162696	DURAMAX – HMK 04	120
P162696	DURAMAX – HMK 04	121
P162696	DURAMAX – HMK 05	124
P162696	DURAMAX – HMK 05	125
P163324	DURAMAX – HMK 04	120
P163419	DURAMAX – HMK 04	120
P163839	FBK-FRCA	64
P163839	FBK-FRCA	66
P163839	DURAMAX – HMK 04	120
P163839	DURAMAX – HMK 04	121
P163839	DURAMAX – HMK 05	124
P163839	DURAMAX – HMK 05	125
P164164	FPK 02 & 04 – AP220	134
P164166	FPK 02 & 04 – AP220	134
P164168	FPK 02 & 04 – AP220	134
P164172	FPK 02 & 04 – AP220	134
P164174	FPK 02 & 04 – AP220	134
P164176	FPK 02 & 04 – AP220	134
P164375	DURAMAX – HMK 04	120
P164378	DURAMAX – HMK 04	120
P164381	DURAMAX – HMK 04	120
P164384	DURAMAX – HMK 04	120
P164592	FPK 02 & 04 – AP220	134
P164594	FPK 02 & 04 – AP220	134
P164596	FPK 02 & 04 – AP220	134
P165006	FPK 02 – AP280	128
P165015	FPK 02 – AP280	128
P165041	FPK 02 – AP280	128
P165043	FPK 02 – AP280	128
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P165194	SRK-COMBO	77
P165194	SRK-COMBO	78
P165194	DURAMAX – HMK 04	120
P165194	DURAMAX – HMK 04	121
P165194	DURAMAX – HMK 05	124
P165194	DURAMAX – HMK 05	125
P165332	DURAMAX – HMK 04	120
P165335	DURAMAX – HMK 04	120
P165338	DURAMAX – HMK 04	120
P165354	DURAMAX – HMK 04	120
P165569	DURAMAX – HMK 05	124
P165659	DURAMAX – HMK 05	124
P165672	DURAMAX – HMK 05	124
P165675	DURAMAX – HMK 05	124
P165705	DURAMAX – HMK 05	124
P167181	FPK 02 – AP280	128
P167183	FPK 02 – AP280	128
P167186	FPK 02 & 04 – AP220	134
P167412	FPK 02 & 04 – AP220	134
P167413	FPK 02 & 04 – AP220	134
P167415	FPK 02 & 04 – AP220	134
P167455	SRK-COMBO	77
P167455	DURAMAX – HMK 04	120
P167455	DURAMAX – HMK 04	121
P167455	DURAMAX – HMK 05	124
P167455	DURAMAX – HMK 05	125
P167473	DURAMAX – HMK 04	120
P167580	SRK-COMBO	78
P167580	DURAMAX – HMK 04	121
P167580	DURAMAX – HMK 05	125
P167838	FPK 02 – AP280	128
P169429	FPK 02 – AP280	128
P169446	FPK 02 & 04 – AP220	134
P169447	FPK 02 & 04 – AP220	134
P169449	FPK 02 & 04 – AP220	134
P169450	FPK 02 & 04 – AP220	134
P169797	FPK 02 & 04 – AP220	134
P169798	FPK 02 & 04 – AP220	134
P170926	FLK	116
P170926	DURAMAX – HMK 04	120
P170926	DURAMAX – HMK 04	121
P170926	DURAMAX – HMK 05	124
P170926	DURAMAX – HMK 05	125
P171087	FLK	116
P171087	DURAMAX – HMK 04	120
P171087	DURAMAX – HMK 04	121
P171087	DURAMAX – HMK 05	124
P171087	DURAMAX – HMK 05	125
P171087	FPK 02 & 04 – AP220	134
P171087	FPK 02 & 04 – AP220	135
P171143	DURAMAX – HMK 04	120
P171143	DURAMAX – HMK 04	121
P171143	DURAMAX – HMK 05	124
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P171500	FIK-FIOT	44
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P171502	FIK-FIOT	44
P171502	FHK-FIR	70
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P171503	FHK-FIR	70
P171504	FIK-FIO	36
P171504	FIK-FIOT	44
P171504	FHK-FIR	70
P171505	FIK-FIO	36
P171505	FIK-FIOT	44
P171505	FHK-FIR	70
P171518	FIK-FIO	36
P171518	FIK-FIOT	44
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P171520	FIK-FIO	36
P171520	FIK-FIOT	44
P171520	FLK-FLS	58
P171520	FLK-FLA	94
P171521	FIK-FIO	36
P171521	FIK-FIOT	44
P171521	FLK-FLS	58
P171521	FLK-FLA	94
P171522	FIK-FIO	36
P171522	FIK-FIOT	44
P171522	FLK-FLS	58
P171522	FLK-FLA	94
P171523	FIK-FIO	36
P171523	FIK-FIOT	44
P171523	FLK-FLS	58
P171523	FLK-FLA	94
P171524	FIK-FIO	36
P171524	FIK-FIOT	44
P171524	FIK-FIS	52
P171524	FHK-FIR	70
P171525	FIK-FIO	36
P171525	FIK-FIOT	44
P171525	FIK-FIS	52
P171525	FHK-FIR	70
P171526	FIK-FIO	36
P171526	FIK-FIOT	44
P171526	FIK-FIS	52
P171526	FHK-FIR	70
P171527	FIK-FIO	36
P171527	FIK-FIOT	44
P171527	FIK-FIS	52
P171527	FHK-FIR	70
P171528	FIK-FIO	36
P171528	FIK-FIOT	44
P171528	FIK-FIS	52
P171528	FHK-FIR	70
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P171529	FIK-FIOT	44
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P171530	FLK-FLA	94
P171531	FIK-FIO	36
P171531	FIK-FIOT	44
P171531	FIK-FIS	52
P171531	FLK-FLS	58
P171531	FHK-FIR	70
P171531	FLK-FLA	94
P171532	FIK-FIO	36
P171532	FIK-FIOT	44
P171532	FIK-FIS	52
P171532	FLK-FLS	58
P171532	FHK-FIR	70
P171532	FLK-FLA	94
P171533	FIK-FIO	36
P171533	FIK-FIOT	44
P171533	FIK-FIS	52
P171533	FLK-FLS	58
P171533	FHK-FIR	70
P171533	FLK-FLA	94
P171534	FIK-FIO	36
P171534	FIK-FIOT	44
P171534	FIK-FIS	52
P171534	FLK-FLS	58
P171534	FHK-FIR	70
P171534	FLK-FLA	94
P171535	FIK-FIO	36
P171535	FIK-FIOT	44
P171535	FIK-FIS	52
P171535	FLK-FLS	58
P171535	FHK-FIR	70
P171535	FLK-FLA	94
P171536	FIK-FIO	36
P171536	FIK-FIOT	44
P171536	FLK-FLS	58
P171536	FHK-FIR	70
P171536	FLK-FLA	94
P171537	FIK-FIO	36
P171537	FIK-FIOT	44
P171537	FLK-FLS	58
P171537	FHK-FIR	70
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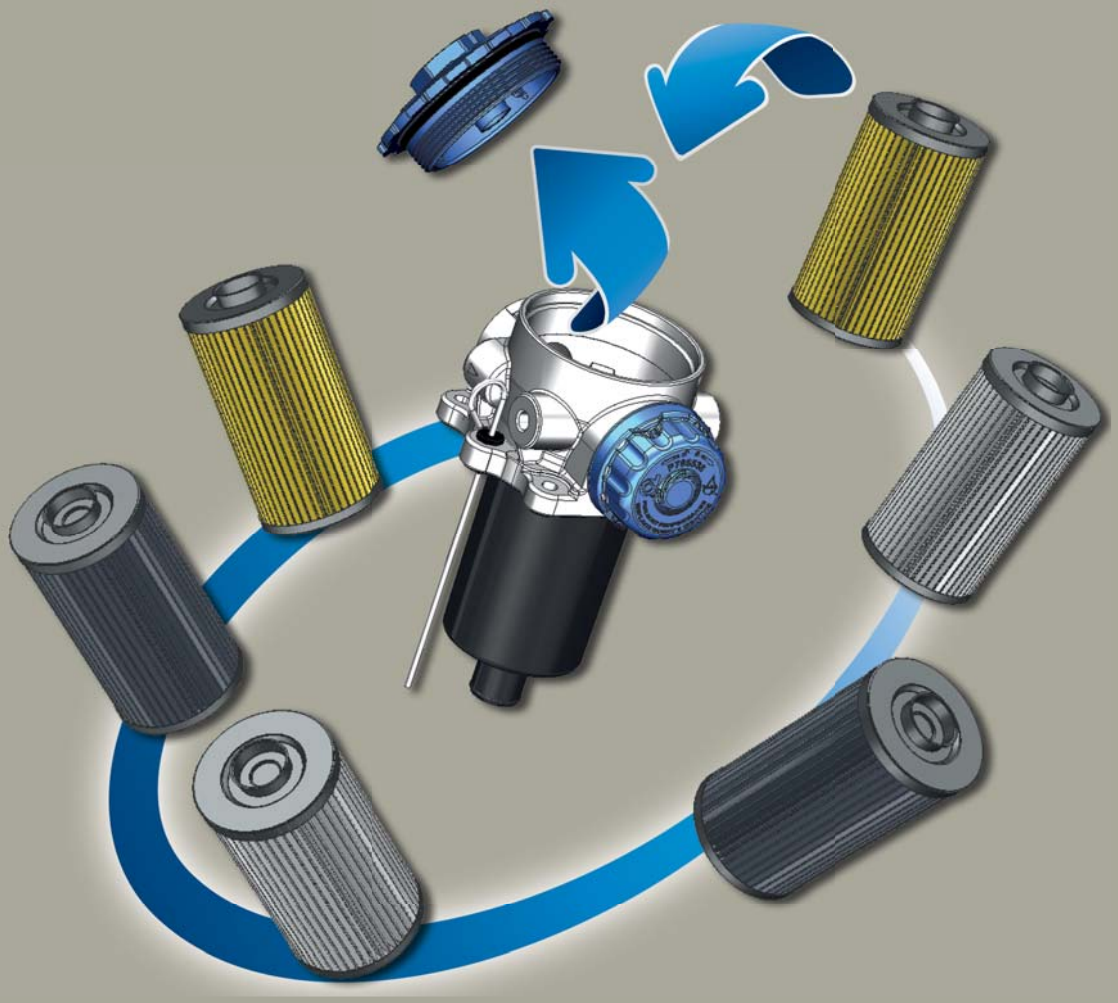

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