

Hydraulic Filtration Product Guide

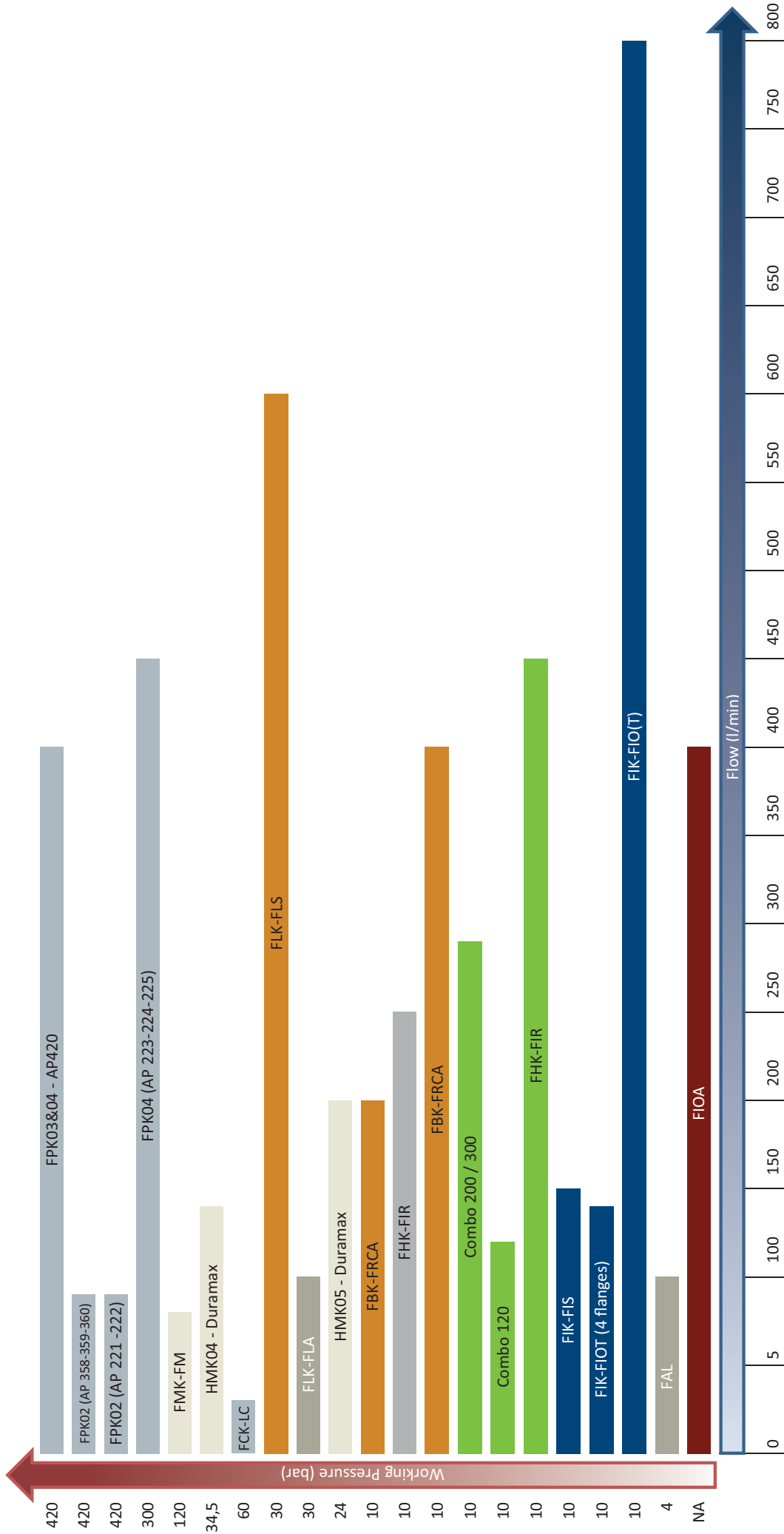
Return Line Filters • Suction Line Filters • In-Line Filters • Service Instructions • Accessories

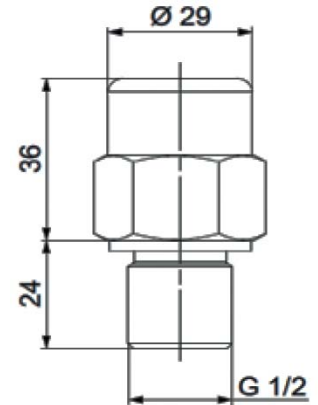
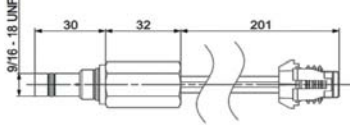
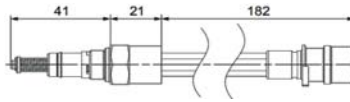
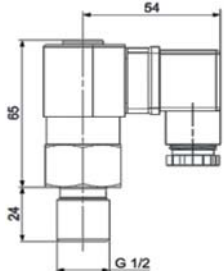
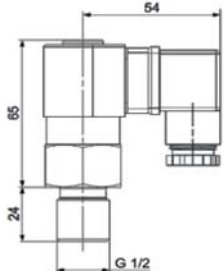
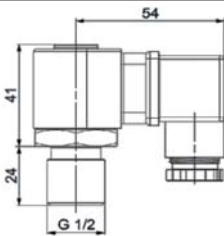
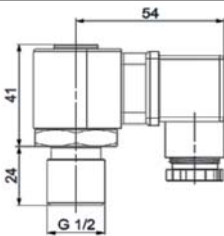
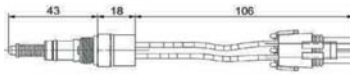
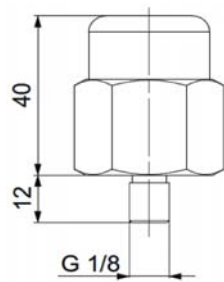
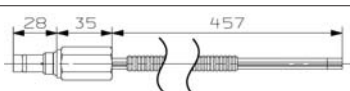
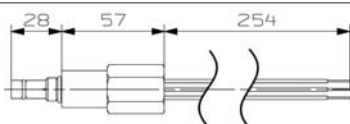


Donaldson Delivers Performance Under Any Pressure!

Clean, dry oil is essential for your equipment. Donaldson Company, a leader in filtration for over 90 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:



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		

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OVERVIEW

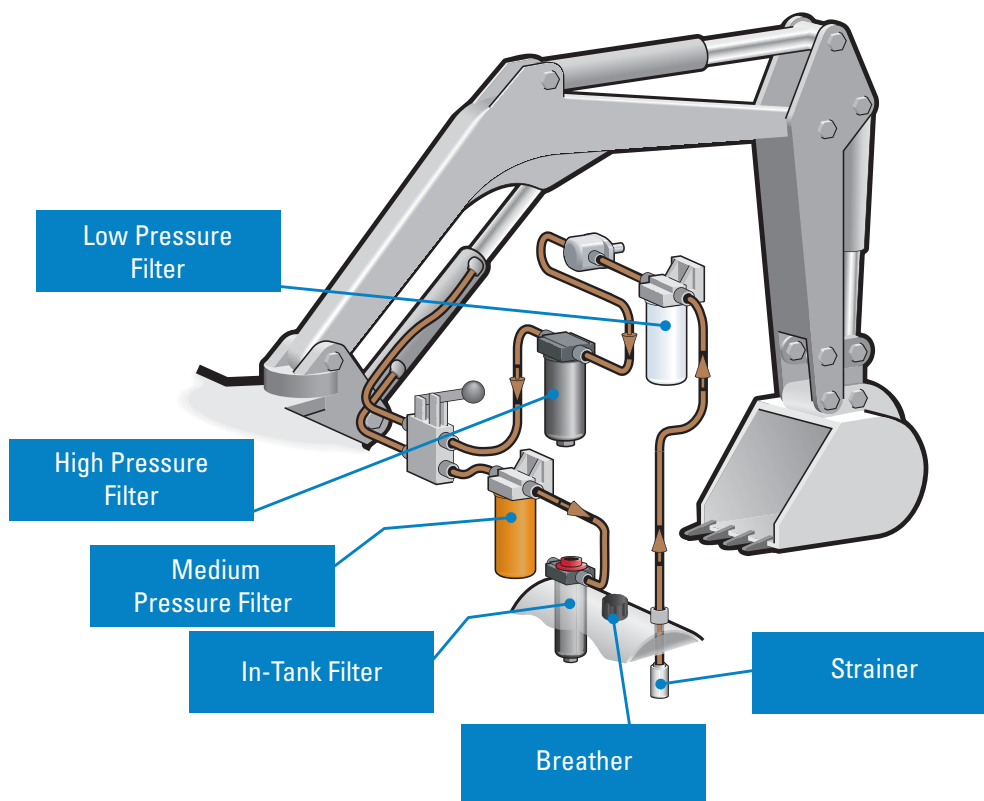
Hydraulic filtration solutions Engineered for today's industrial & mobile equipment



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

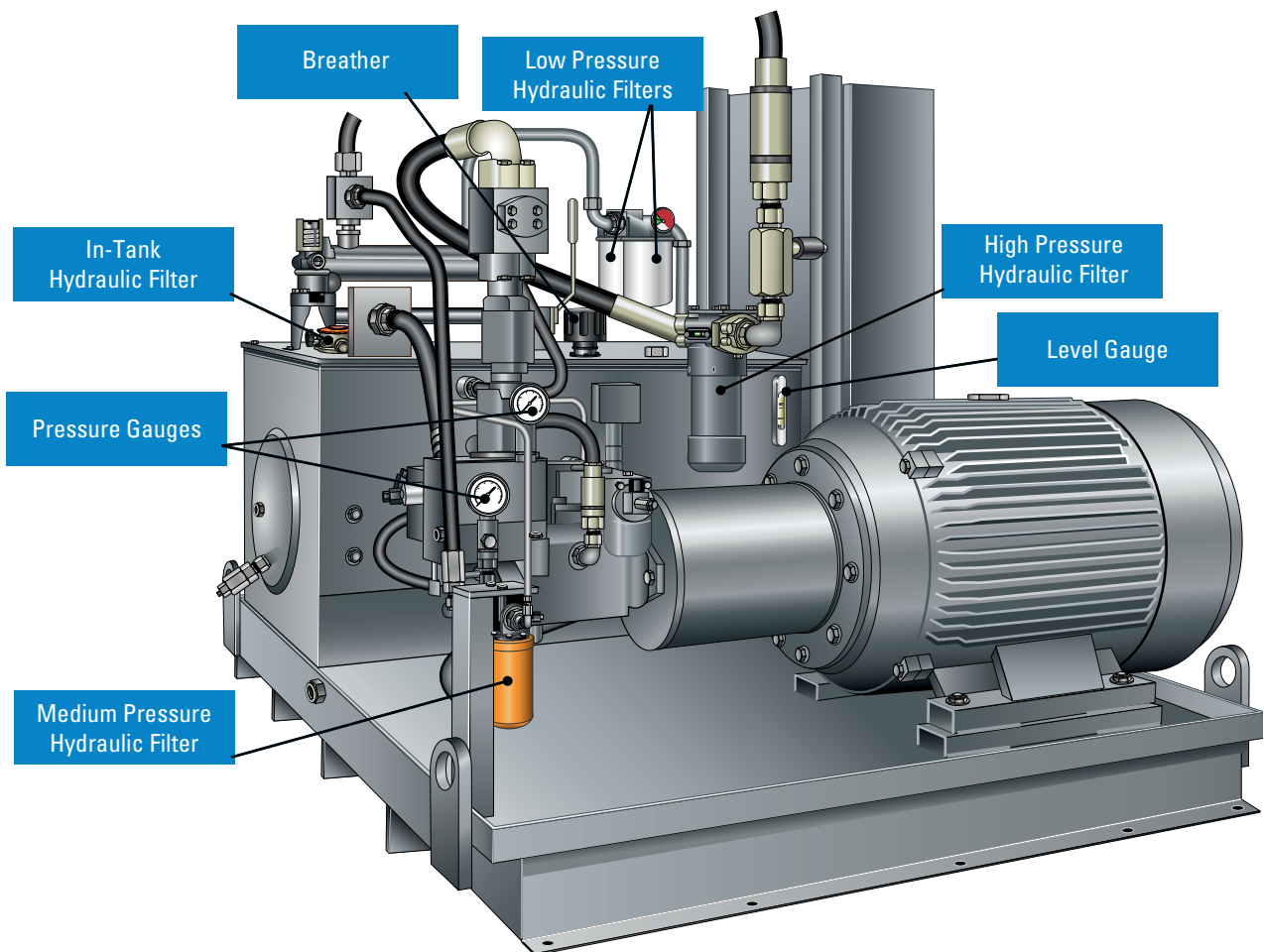
Increase dirt-holding capacity and lower ΔP with Donaldson high-performance DT filters.

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 ingress and remove entrained water.

Vacuum dehydrators & coalescers

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

OVERVIEW

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

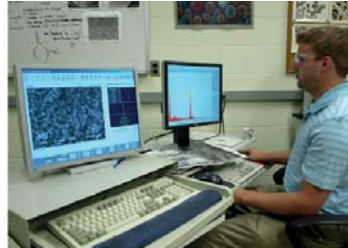
Filtration performance testing

- 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.

OVERVIEW

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)

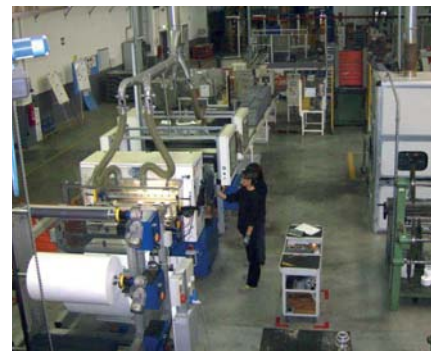
Donaldson Italy Srl manufacturing means quality production

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.



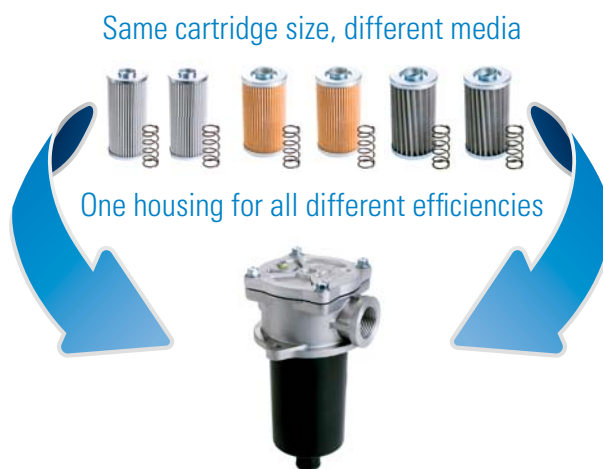
Industry shaping technology Mix&Match – your flexible hydraulic solutions

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).

Family	/β		/β		/β		Standard Housing without Cartridge	CARTRIDGE DIMENSIONS				POSSIBLE INDICATOR			
	RMF	90μm	RMF	60μm	RMF	β _{0.1μm} ≥1000		A	B	C	D		X	Y	Z
FIO20	20	P171500	20	P171505	15	P171504	P766446	G3/8	67	78	132	67	52	25.5	P171953 P171958 P171966 P173104
FIO30	30	P171500	30	P171505	20	P171504	P766447	G1/2	67	78	132	67	52	25.5	
FIO50	50	P171518	50	P171523	35	P171522	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.

OVERVIEW

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.



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 bypass valve use recommended to prevent pump starvation.



Reservoir Air Breather

Prevents ingress of airborne contaminants from entering the reservoir tank.



Suction Strainer

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



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.



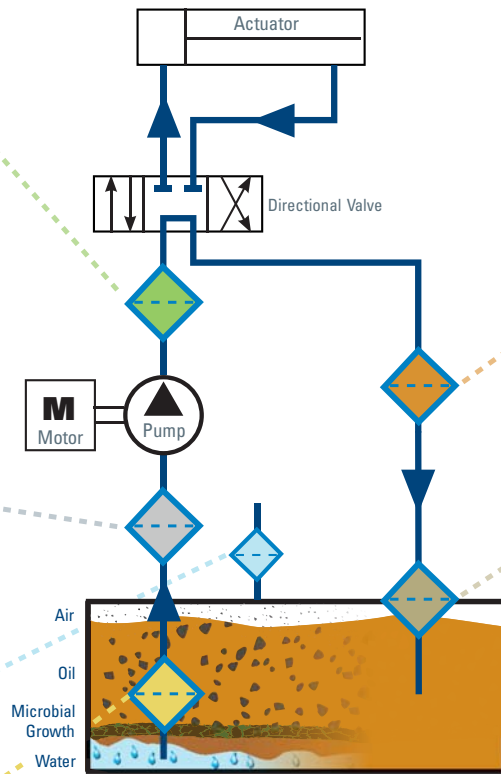
Return Line Filter

Captures debris from component wear or ingestion before it travels into the reservoir.



In-tank Return Line Filter

Space-saving in-tank return and suction line filters.



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.



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.

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Symbols Used

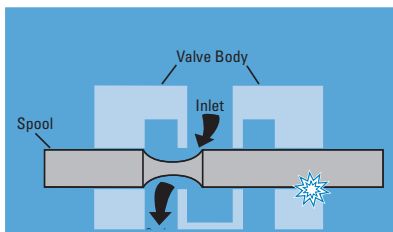
β	Beta Ratio
cSt	Centistokes
DP	Pressure Drop or Differential Pressure
ISO	International Standards Organization
μm	Micron or micrometer
ppm	Parts per million
SSU	Saybolt Seconds Universal

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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.



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.

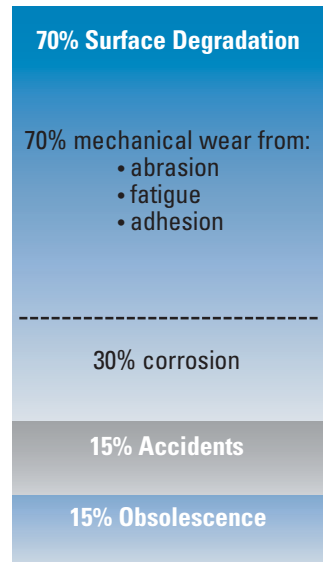
Types of Contaminant

- 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.



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

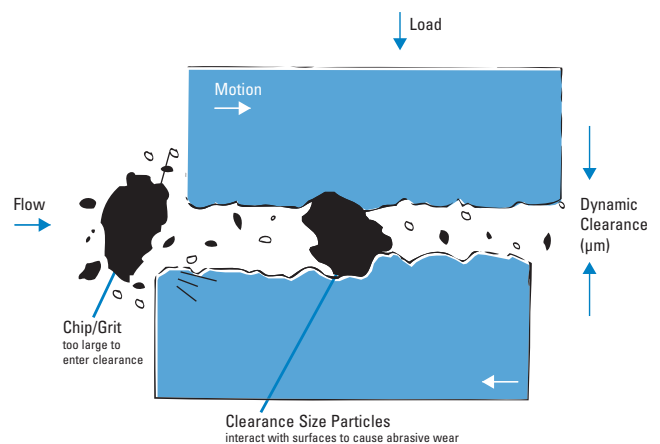
Ingressed or external contamination comes from the environment surrounding the system. Dirt can enter the hydraulic fluid supply through leaking seals, reservoir breather caps, and worn cylinder rod seals. Ingressed moisture, particularly, can cause long-term problems. As a hot system cools at night, 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 ingress 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 ingress. 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 ingress 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 given 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.

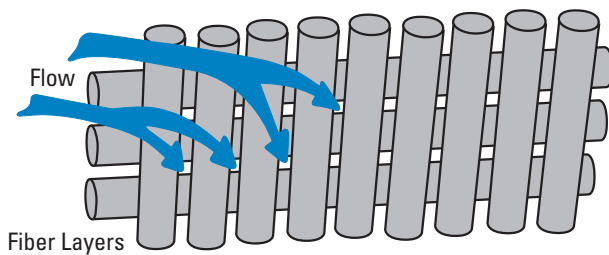
Biodegradable

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.

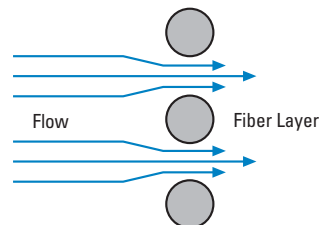
How Filter Media Functions in a Filtration System

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.

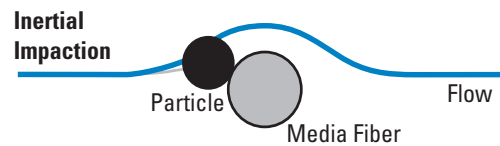
Looking at a cross-section view of the fibers, we can see how the flowstream is accelerated as it flows into the spaces between the fibers.



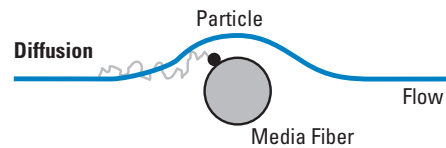
How Filter Media Collects Particles

There are four basic ways media captures particles

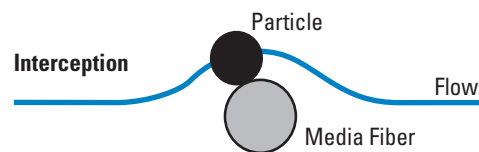
The first, called **inertia**, works on large, heavy particles suspended in the flow stream. These particles are heavier than the fluid surrounding them. As the fluid changes direction to enter the fiber space, the particle continues in a straight line and collides with the media fibers where it is trapped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

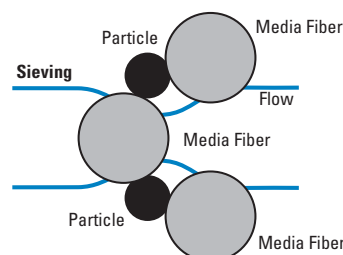


The third method of particle entrapment is called **interception**. Direct interception works on particles in the mid-range size that are not quite large enough to have inertia and not small enough to diffuse within the flow stream. These mid-sized particles follow the flow stream as it bends through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

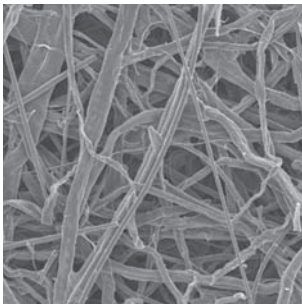
Media is a term used to describe any material used to filter particles out of a fluid flow stream. There are four basic types used to remove contamination in hydraulic applications:

Cellulose Media (Traditional)

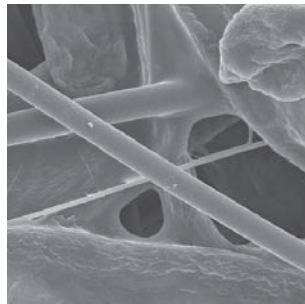
Cellulose fibers are actually wood fibers, microscopic in size and held together by resin. Fibers are irregular in both shape and size. Cellulose often has lower beta ratings, which means there are smaller pores in the media. Smaller media pores cause more flow resistance, resulting in higher pressure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

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

SEM 100X



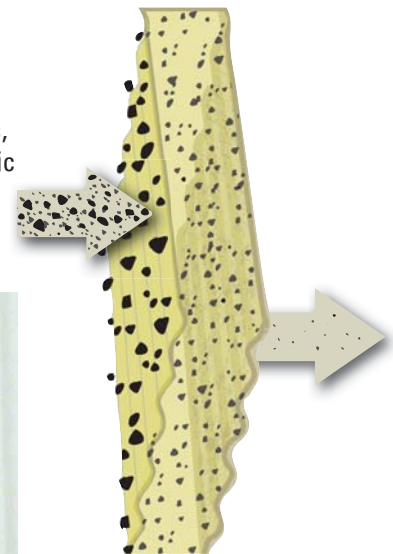
SEM 600X



MEDIA IMAGE



HOW IT WORKS



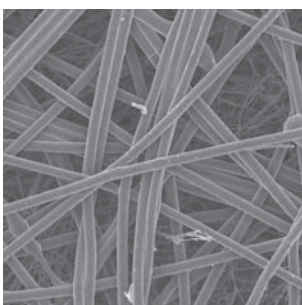
Synteq™ Media (Full Synthetic)

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.

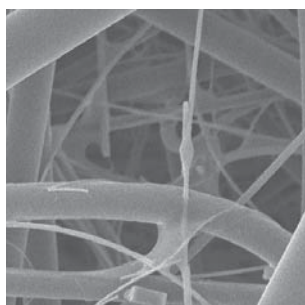
The low resistance of synthetic media to fluid flow makes it ideal for use with synthetic fluids, water glycols, water/oil emulsions, HWCF and petroleum-based fluids.



SEM 100X



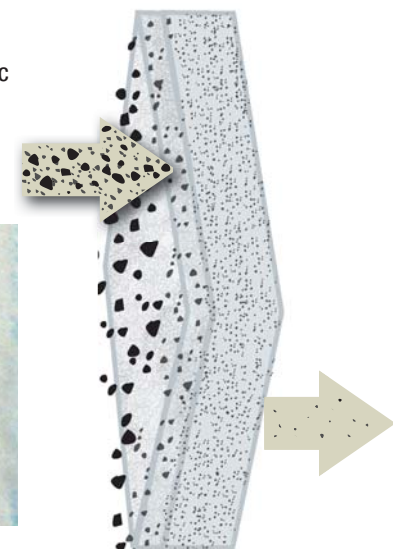
SEM 600X



MEDIA IMAGE



HOW IT WORKS



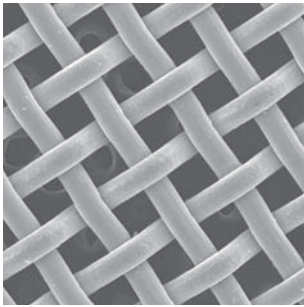
Wire-Mesh Media

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

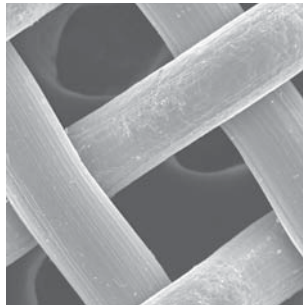
- 100 mesh yields 150 µm filtration
- 200 mesh yields 74 µm filtration
- 325 mesh yields 44 µm filtration

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.

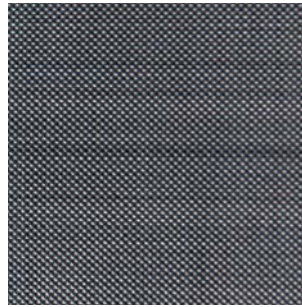
SEM 60X



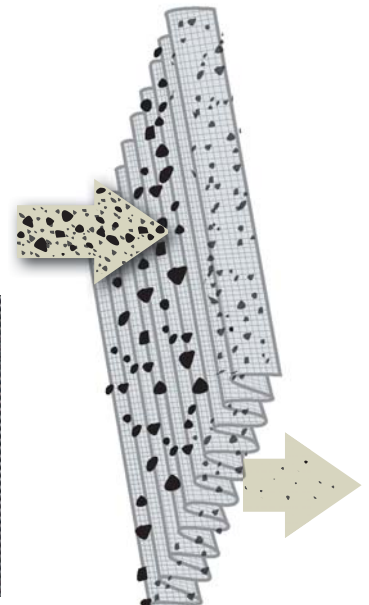
SEM 100X



MEDIA IMAGE



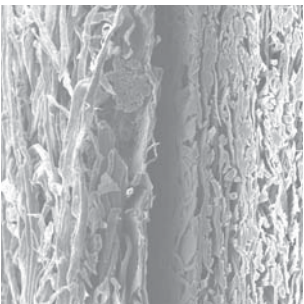
HOW IT WORKS



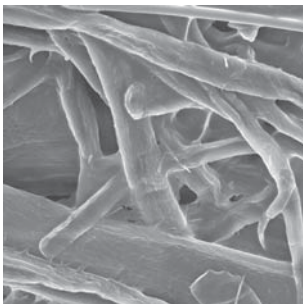
Water Absorbing Media

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.

SEM 100X



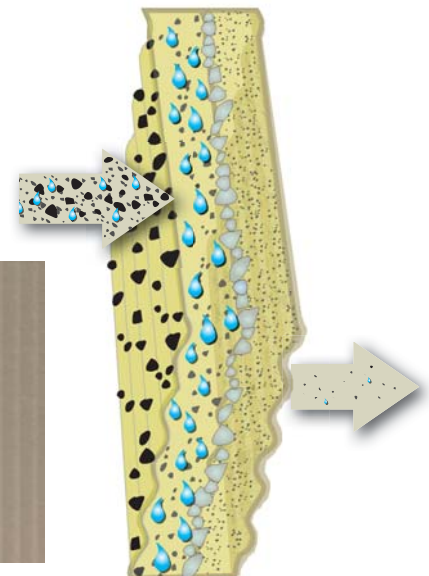
SEM 600X



MEDIA IMAGE



HOW IT WORKS



Donaldson Filter Media Efficiency Ratings per ISO 16889 Test Standards

ISO 16889 is the international standard for Multi-Pass Testing to determine the efficiency (beta rating or beta ratio) and the dirt-holding capacity of the filter. It replaced the ISO 4572 test standard.

Donaldson filter media has been re-tested per the new standard and the current beta ratios are shown at right. New beta ratios are shown at 200 and 1000, with a (c) to indicate test adherence to the ISO 16889 standard and traceability to NIST test dust.

Fluid to be Filtered	Recommended Media
Petroleum-based.....	Synteq or Cellulose
Phosphate Ester	DT Synteq
Diester.....	Synteq
Water Glycol	DT Synteq
Water-Oil Emulsion	Synteq
Biodegradable Fluid.....	Synteq
HWCF (high water content fluids)	Synteq
Coarse Filtration	Wire Mesh

Donaldson Filter Media Efficiency Ratings Per ISO 16889 Test Standards		
Media No	Former rating Beta x μm = 2/75 Per ISO 4572	Efficiency rating Beta x $\mu\text{m}(c)$ = 200/1000 Per ISO 16889
Donaldson Synteq XP Synthetic Media		
XP05		5/7
XP10		9/11
Donaldson Synteq Synthetic Media		
# 3	4/15	11/14
# 3 1/2	4/15	11/13
# 4	5/16	15/20
# 7	7/22	25/33
# 9	7/22	18/23
# 20	20/40	42/>50
/00	<2/3	5/6
/01	<2/5	7/8
/02	2/8	9/11
/03	7/22	18/23
Donaldson Cellulose Media		
# 3	4/16	18/24
# 10	10/25	19/23
/1	10/30	32/36
/3	25/45	46/>50

Hydraulic Filtration Pressure Drop

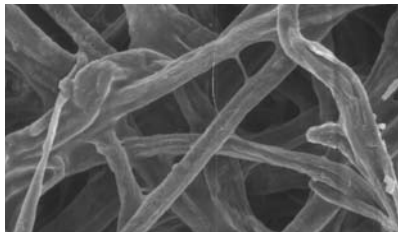
The difference between the inlet pressure and the outlet pressure is called pressure drop or differential pressure. It's symbolized by ΔP . ΔP is an irrecoverable loss of total pressure caused by the filter, and is mostly due to frictional drag on the fibers in the media.

Differential drop 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

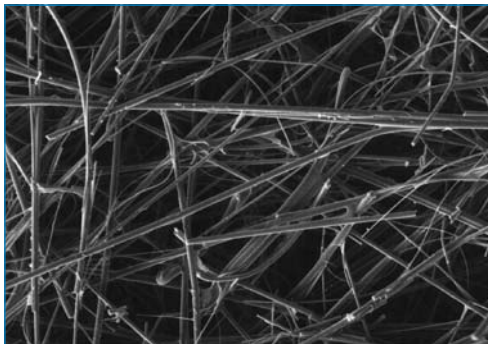
1. Filter Media

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.

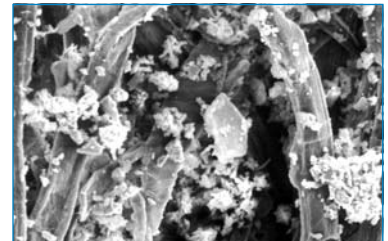
Synteq fibers offer the least amount of resistance to fluid passing through the media. Consistency of fiber shape allows the maximum amount of contaminant-catching surface area and specific pore size control. The result is media with predictable filtration efficiencies at removing specified contaminants (i.g., 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.

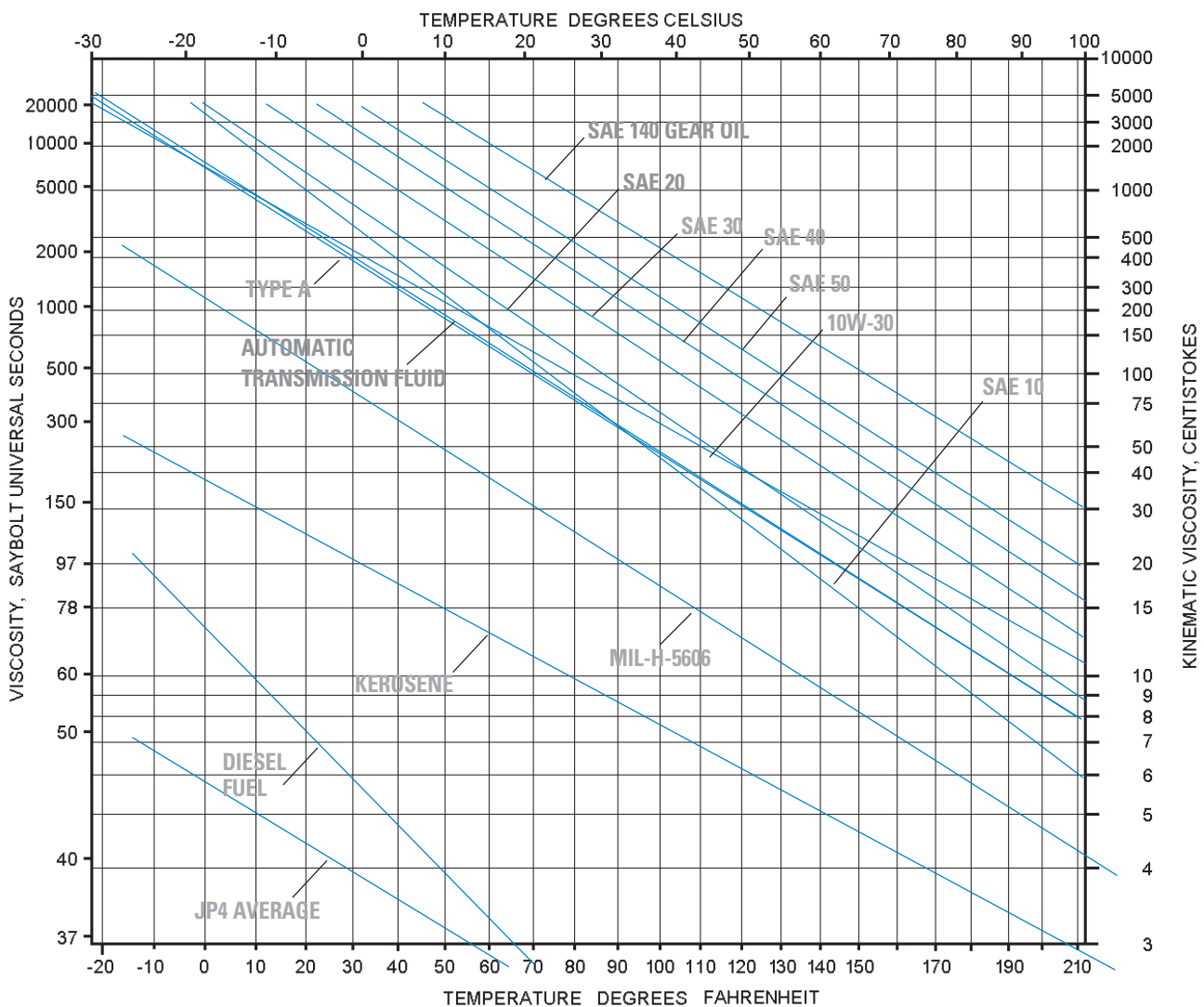
4. Fluid Viscosity

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



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 visible). 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.

Combining the ISO Rating and Filter Performance Ratings

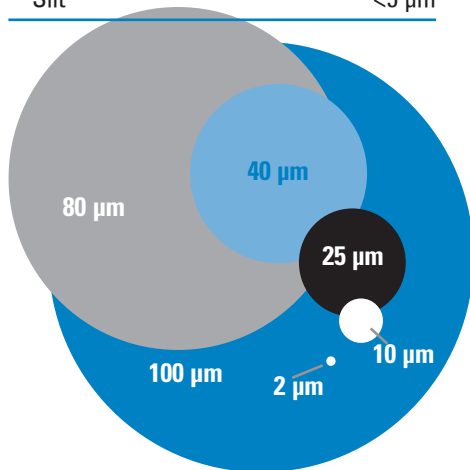
While filter manufacturers publish beta ratings for filter media to describe efficiency performance levels, a direct connection between the beta rating scale and the ISO rating scale cannot be made.

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
Variable 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

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

and greater, and 14 µm and greater in one milliliter of the system hydraulic oil sample.

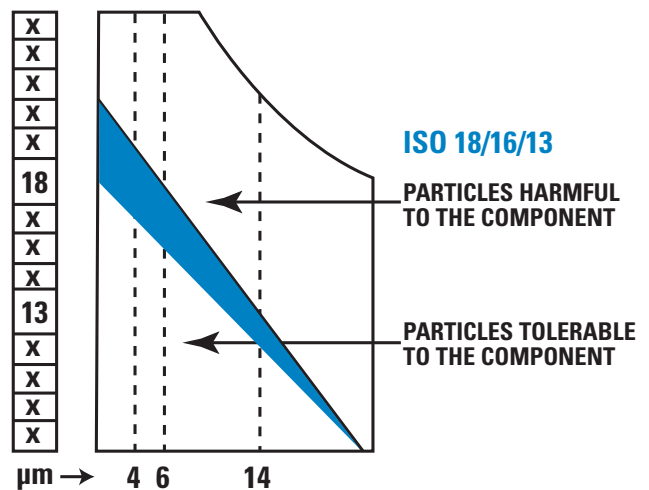
How to Use the ISO Rating

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 the 16 box of the ISO code.
- 3) Place a dot on the vertical 14 µm line horizontally even with the 13 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.



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 β) is a formula used to calculate the filtration efficiency of a particular fluid filter using base data obtained from multi-pass testing.

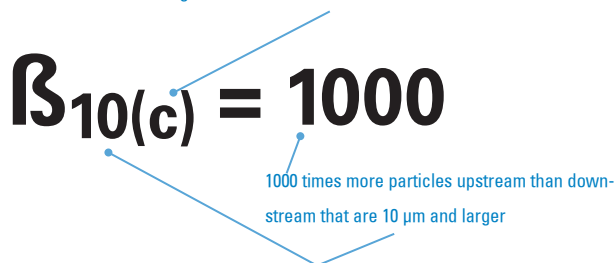
In a multi-pass test, fluid is continuously injected with a uniform amount of contaminant (i.e., ISO medium test dust), then pumped through the filter unit being tested. Filter efficiency is determined by monitoring oil contamination levels upstream and downstream of the test filter at specific times. 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

Indicates that testing was done with APC's calibrated with NIST fluid



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.

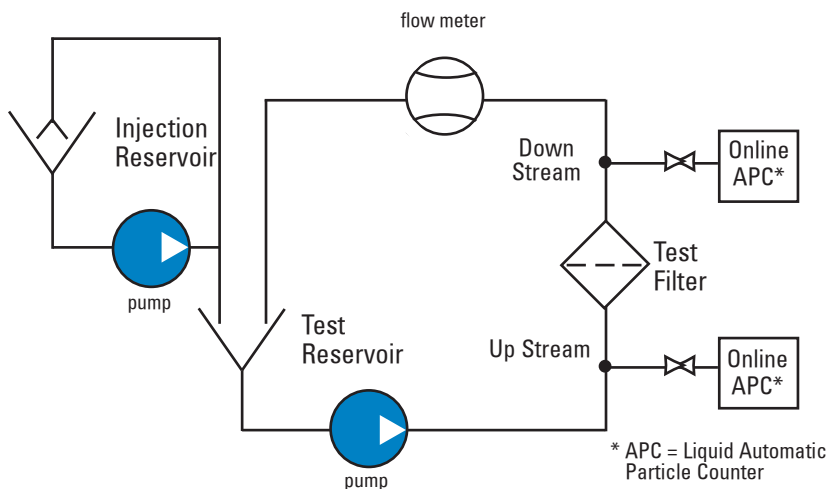
Overall, you can have strong confidence in filter ratings resulting from tests per ISO 16889, as they are highly accurate. As always, keep in mind that beta ratings are laboratory measurements under steady flow conditions with artificial contaminants – the real proof of the performance is how clean the 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

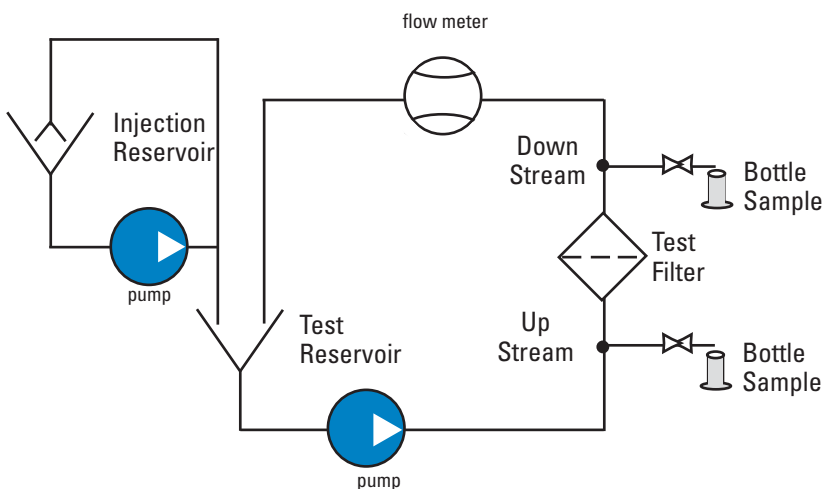
ACFTD calibrated size (µm) per ISO 4402 corresponds to a NIST-calibrated size [µm(c)] per ISO 11171

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: $\beta_4(c) = 200$ signifies that there are 200 times as many particles that are 4 µm and larger upstream as downstream. This is 99.5% efficiency.

Example: $\beta_5(c) = 1000$ 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.

Donaldson Filter Media Efficiency Ratings Per ISO 16889 Test Standards		
Media No	Former rating Beta x µm = 2/75 Per ISO 4572	Efficiency rating Beta x µm(c) = 200/1000 Per ISO 16889
Donaldson Synteq XP Synthetic Media		
XP05		5/7
XP10		9/11
Donaldson Synteq Synthetic Media		
# 3	4/15	11/14
# 3 ½	4/15	11/13
# 4	5/16	15/20
# 7	7/22	25/33
# 9	7/22	18/23
# 20	20/40	42/>50
/00	<2/3	5/6
/01	<2/5	7/8
/02	2/8	9/11
/03	7/22	18/23
Donaldson Cellulose Media		
# 3	4/16	18/24
# 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 ingress 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	
22/20/18	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

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.

Petroleum-Based (Hydrocarbon) Fluids	Recommended Filter Media		
	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



Piston Pump Damage

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

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



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

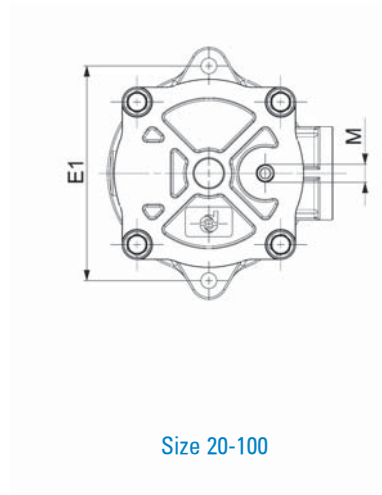
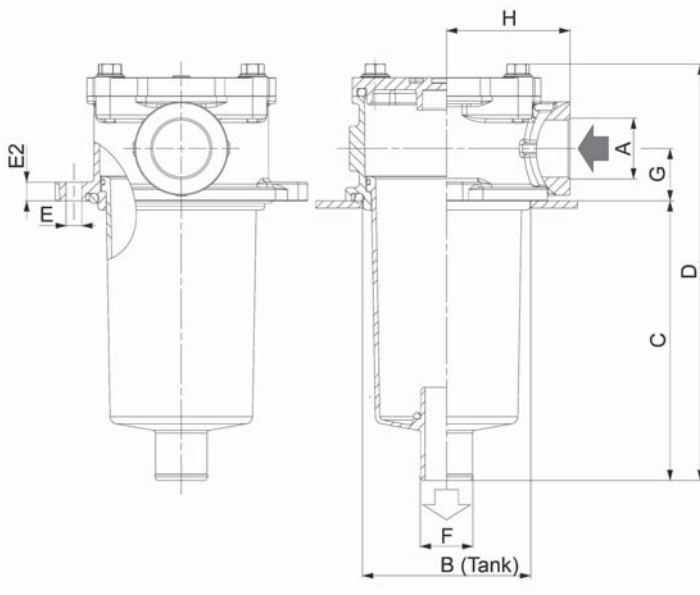
- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq[®] synthetic media: 11-23 micron.
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.

Components



Family	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		β _{50µm(c)} ≥1000		β _{36µm(c)} ≥1000		β _{23µm(c)} ≥1000		β _{11µm(c)} ≥1000		
	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	100	P171530	100	P171535	65	P171534	65	P171533	60	P171532	60	P171531	CR100
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

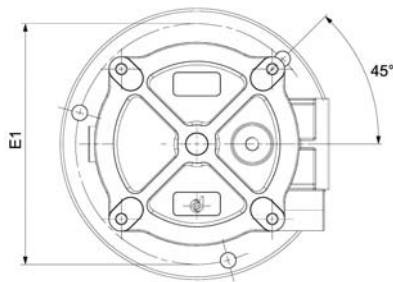
RMF = Recommended Maximum Flow in liters/minute with use of standard housing
 Maintain the filter outlet (ref. diameter F) well below the oil level to avoid foam formation.



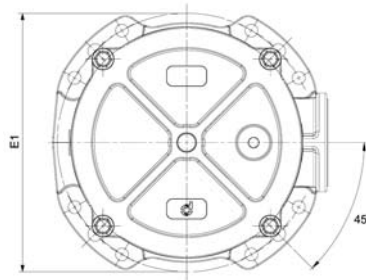


Standard Housing without Cartridge	HOUSING DIMENSIONS														CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR	
	A	B	C	D	E	E1	E2	F	G	H	V	W	T	M	N	X	Y		Z
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm
P766446	G3/8	67	78	132	6,4	90	9	25	22	49				G1/8	yes	67	52	25.5	
P766447	G1/2	67	78	132	6,4	90	9	25	22	49				G1/8	yes	67	52	25.5	
P766448	G1/2	90	100	172	8,4	115	10	28	28	66				G1/8	yes	75	70	29	
P766449	G3/4	90	100	172	8,4	115	10	28	28	66				G1/8	yes	82	70	29	
P766450	G3/4	90	150	222	8,4	115	10	28	28	66				G1/8	yes	128	70	29	
P766451	G1	90	150	222	10,5	115	10	28	28	66				G1/8	yes	128	70	29	
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 SAE 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 SAE 2	174	433	538	10,5	220	11	63,5	48,5	120	77,8	42,9	M12	G1/8	yes	400	140	65	

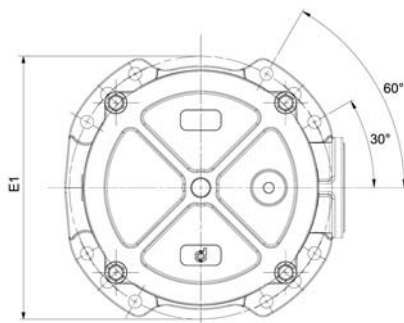
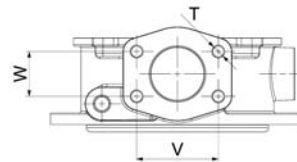
P171953
P171958
P171966
P173104



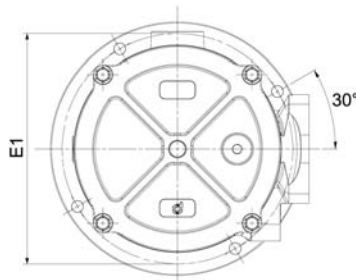
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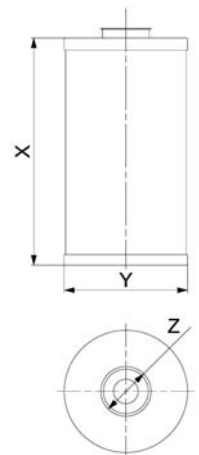
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Size 600-800



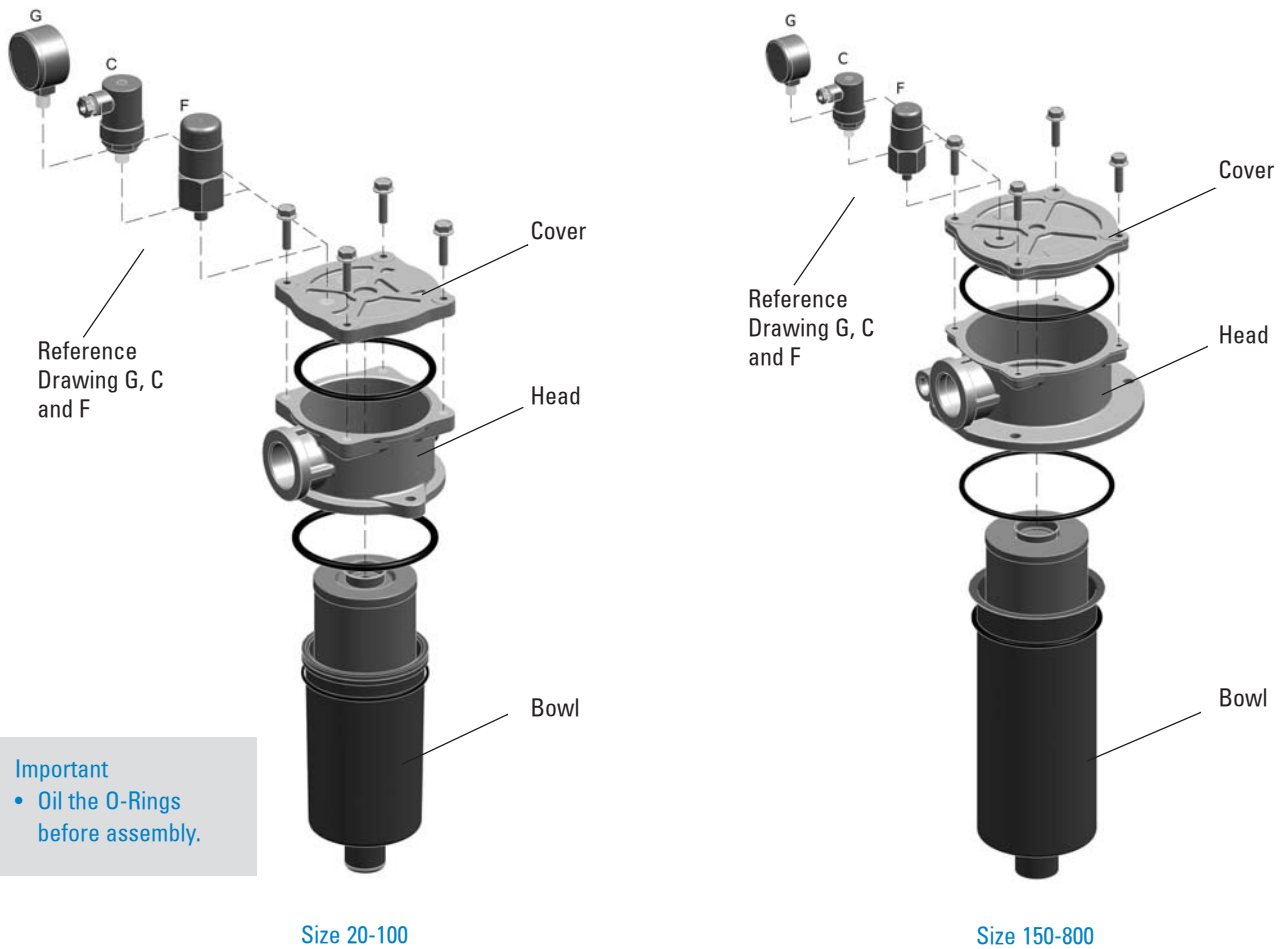
Size 600-800 SAEJ 518



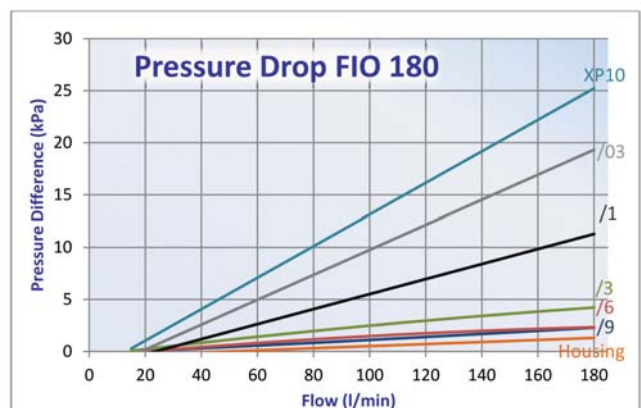
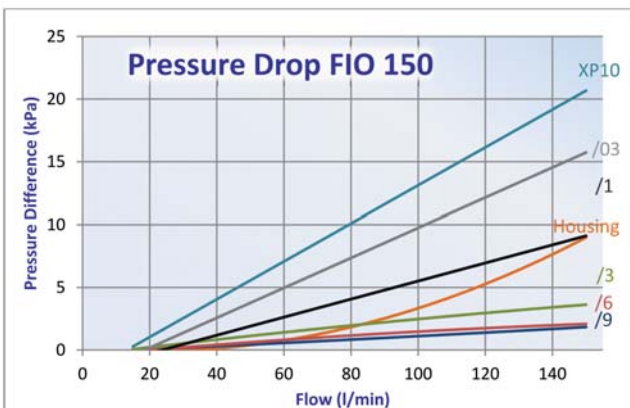
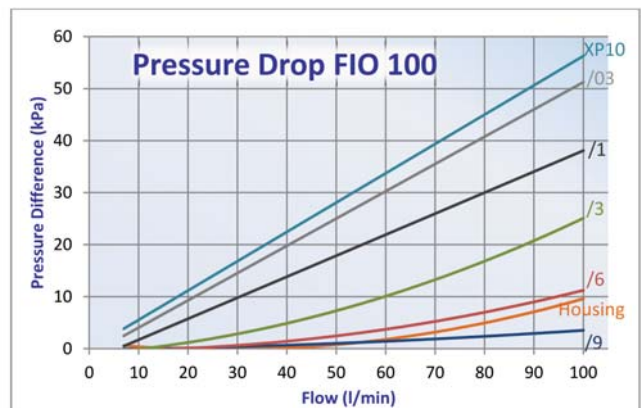
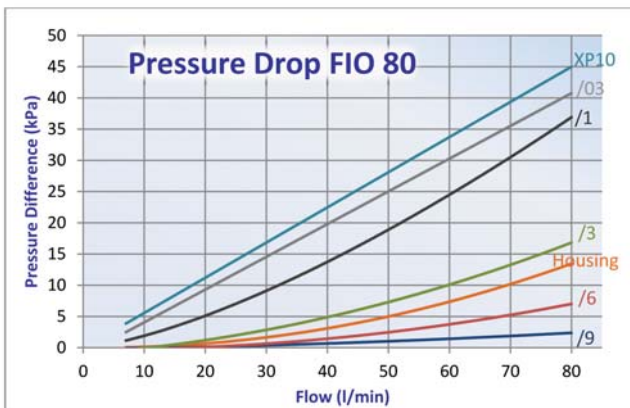
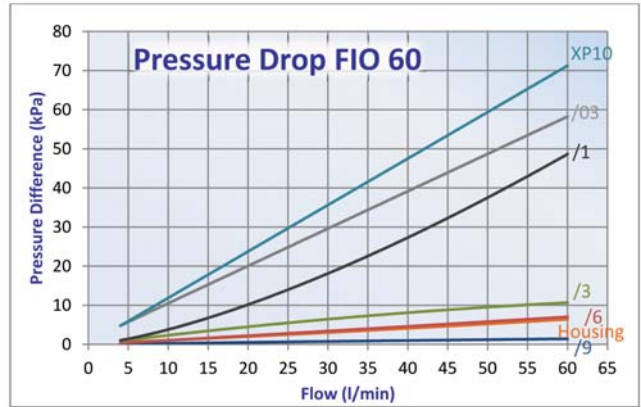
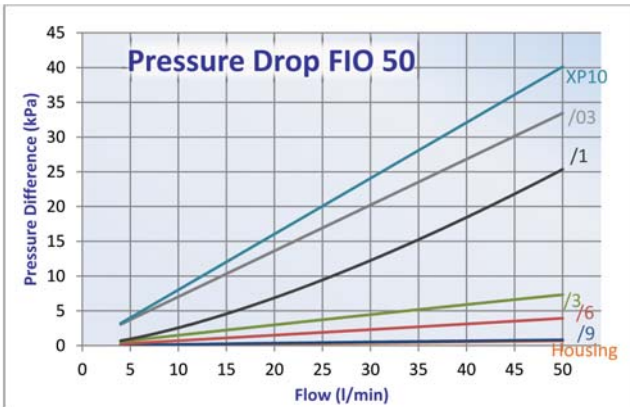
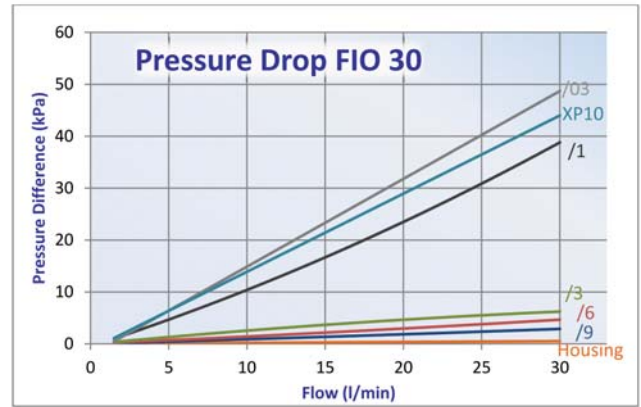
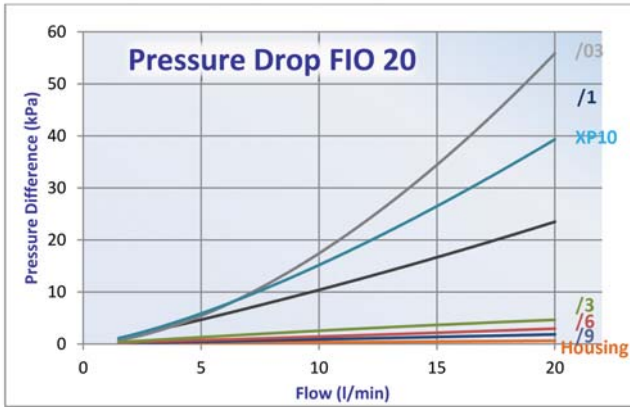
Indicator Choices

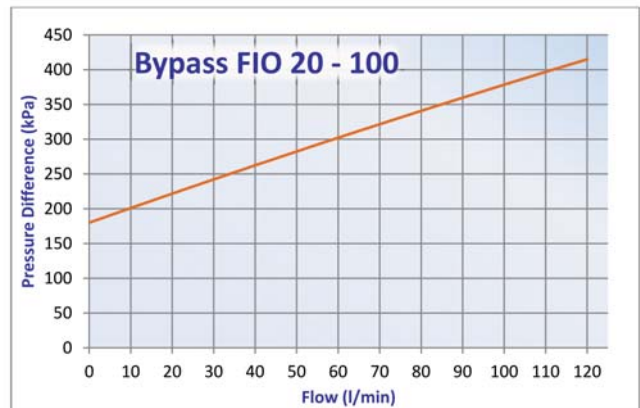
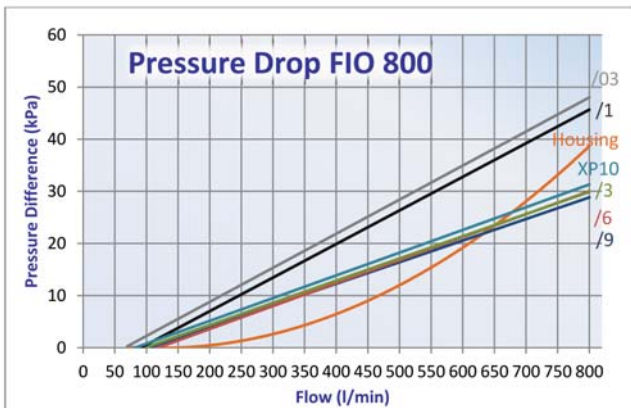
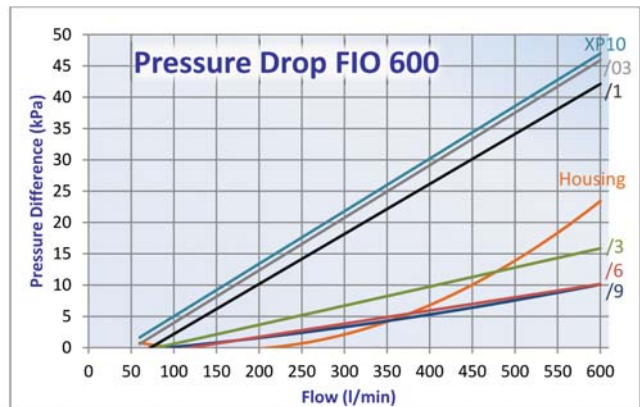
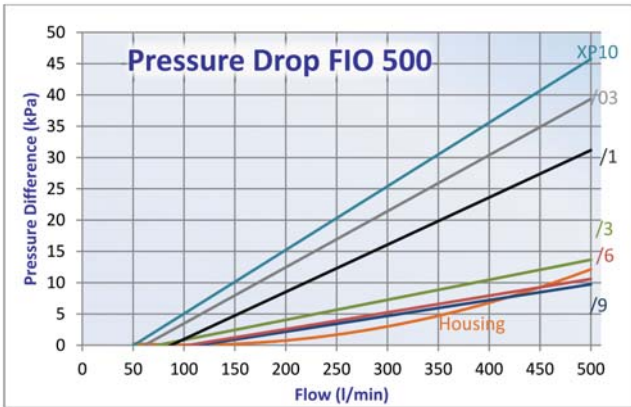
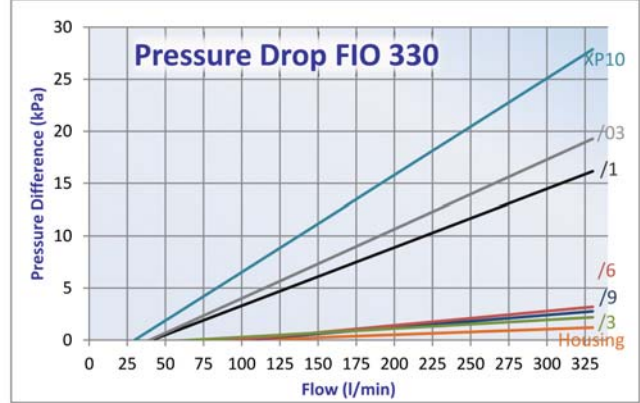
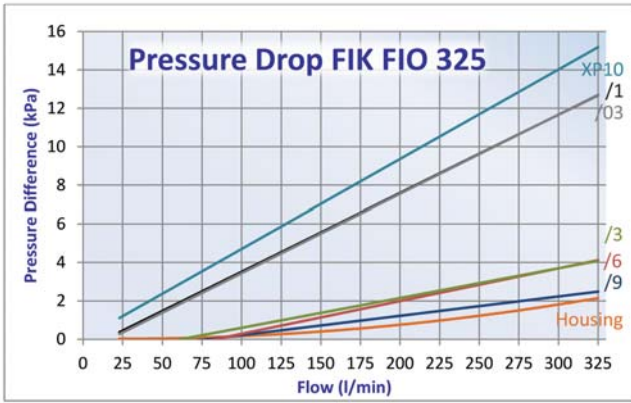
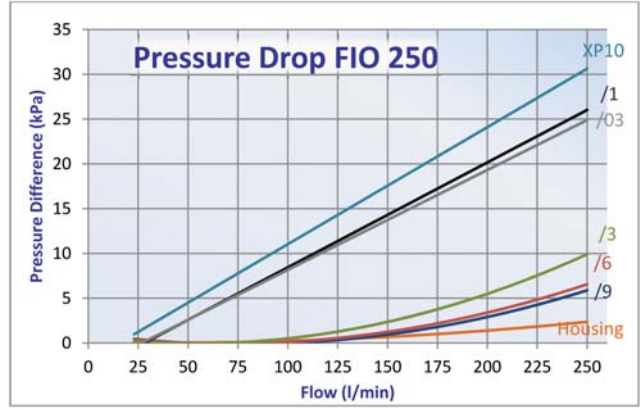
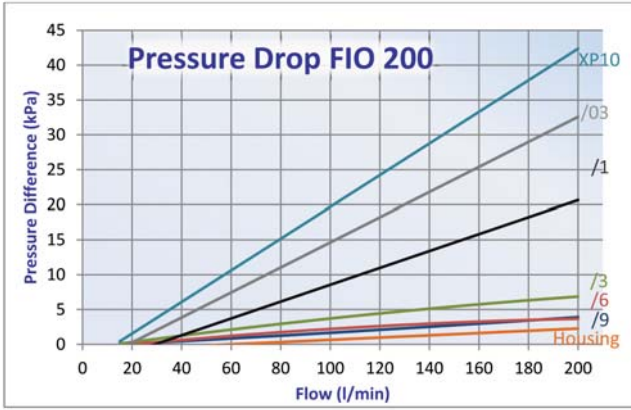
Indicator	Kind	Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171966	Electrical	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P171958	Visual	F	1,2				
P171953	Visual	G	range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

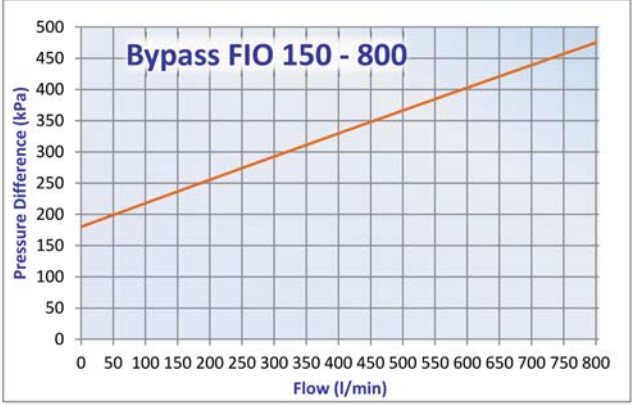
Installation & Service Guidelines



Performance Curves

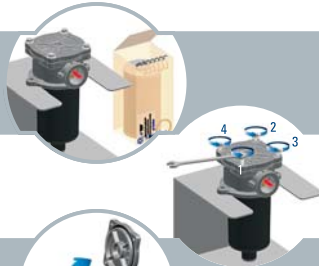






FIK-FIO(T)
FHK-FIR
SRK-Combo
200 + 300

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



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

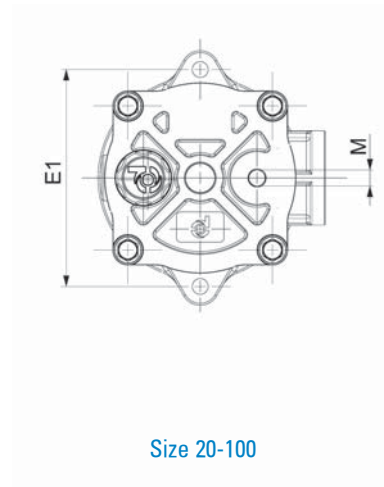
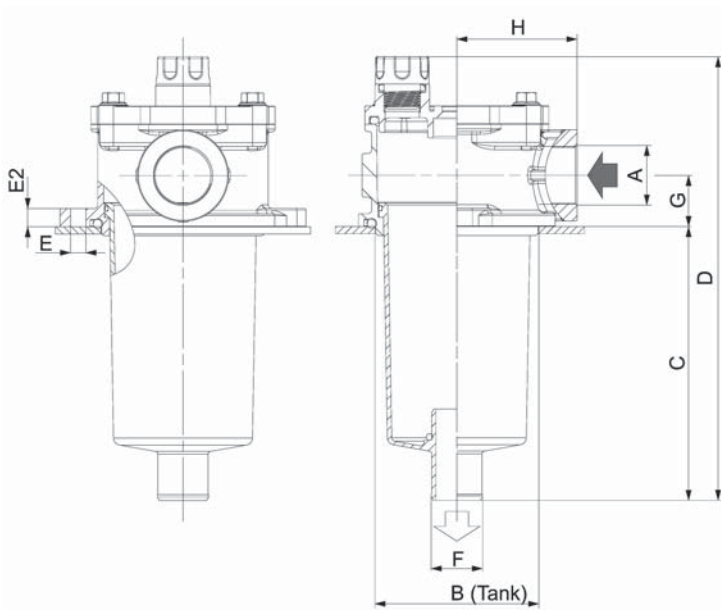
- Wire mesh: 60-90 micron.
- Cellulose media: 36-50 micron, reinforced with wire mesh.
- Synteq[®] synthetic media: 11-23 micron.
- By-pass valve setting 150 kPa (1,5 bar) per ISO 3968.
- Collapse resistance 1000 kPa (10 bar) per ISO 2941.
- Replacement element includes spring and O-ring seal.



Components

Family	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$\beta_{50\mu m(c)} \geq 1000$		$\beta_{36\mu m(c)} \geq 1000$		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		
	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
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

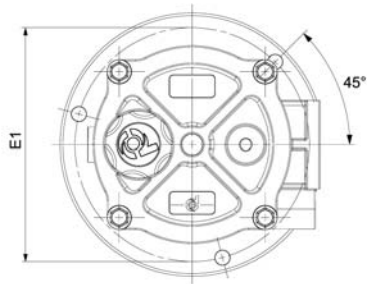
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
 Maintain the filter outlet (ref. diameter F) well below the oil level to avoid foam formation.



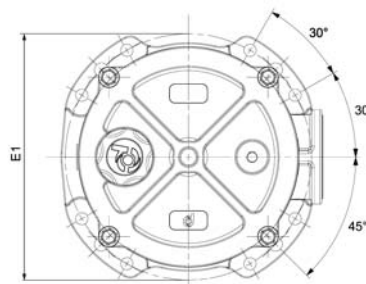


Standard Housing without Cartridge	HOUSING DIMENSIONS															CARTRIDGE ELEMENT			POSSIBLE INDICATOR
	A	B	C	D	E	E1	E2	F	G	H	M	N	V	W	T	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	mm	predrilled holes	plugged	mm	mm		mm	mm	mm	
P766463	G3/8	69	78	132	6,4	90	9	25	22	49	G1/8	yes				67	52	25,5	
P766464	G1/2	69	78	132	6,4	90	9	25	22	49	G1/8	yes				67	52	25,5	
P766465	G1/2	92	100	172	8,4	115	10	28	28	66	G1/8	yes				75	70	29	
P766466	G3/4	92	100	172	8,4	115	10	28	28	66	G1/8	yes				82	70	29	
P766467	G3/4	92	150	222	8,4	115	10	28	28	66	G1/8	yes				128	70	29	
P766468	G1	92	150	222	8,4	115	10	28	28	66	G1/8	yes				128	70	29	
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 SAE 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 SAE 2	176	433	538	10,5	220	11	63,5	48,5	120	G1/8	yes	77,8	42,9	M12	400	140	65	

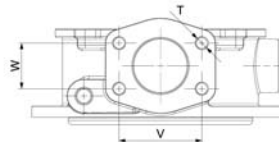
P171953
P171958
P171966
P173104



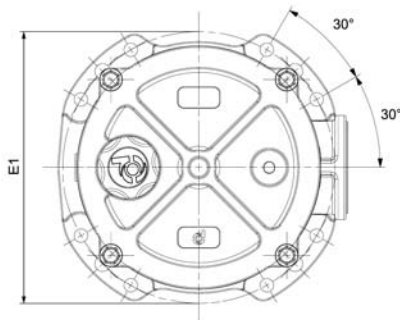
Size 150-200



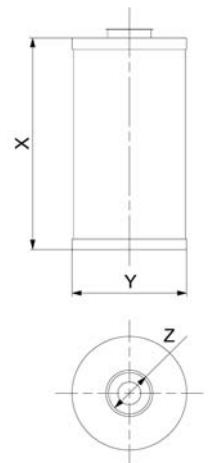
Size 250-500



Size 600-800 SAEJ 518



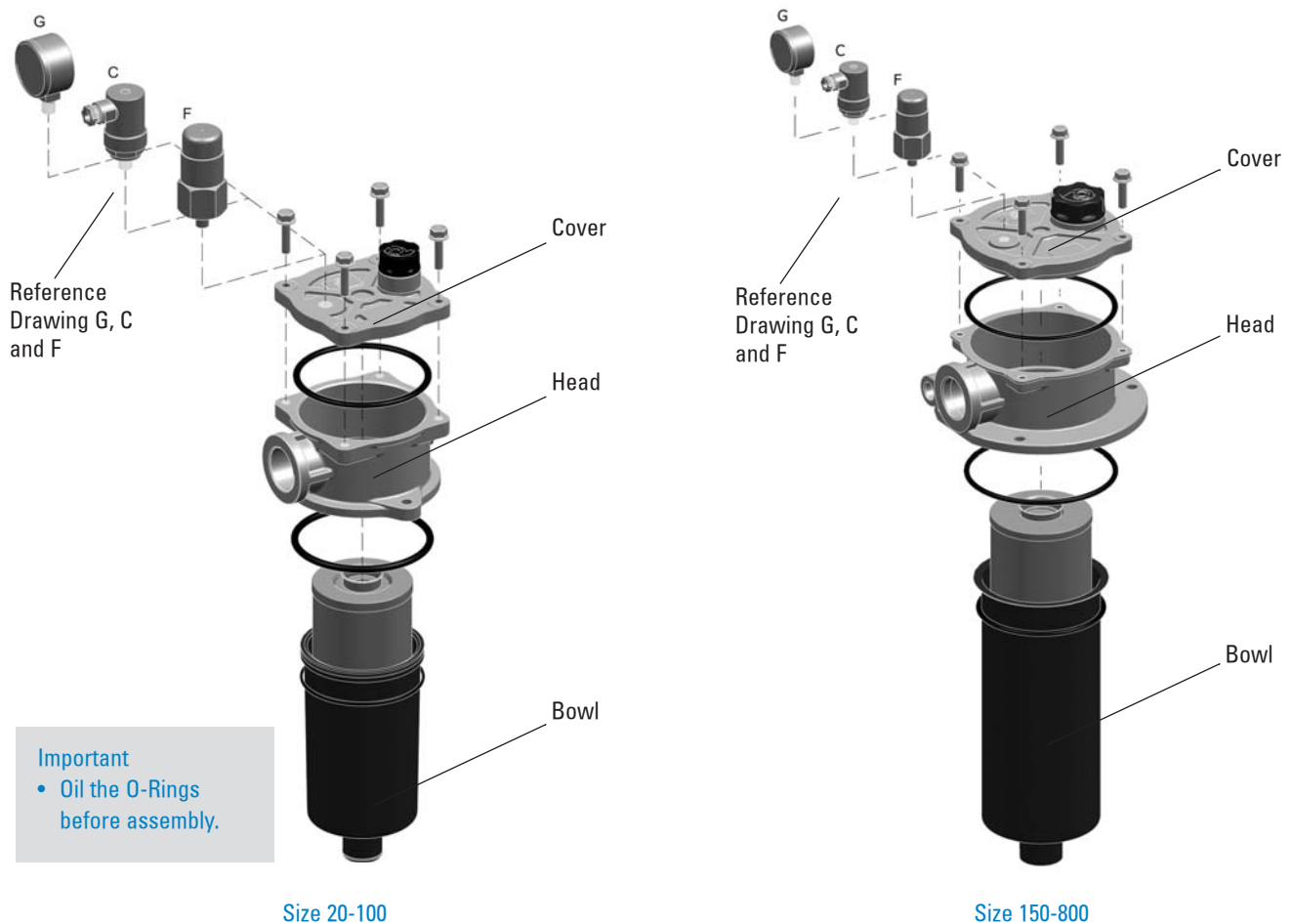
Size 600-800



Indicator Choices

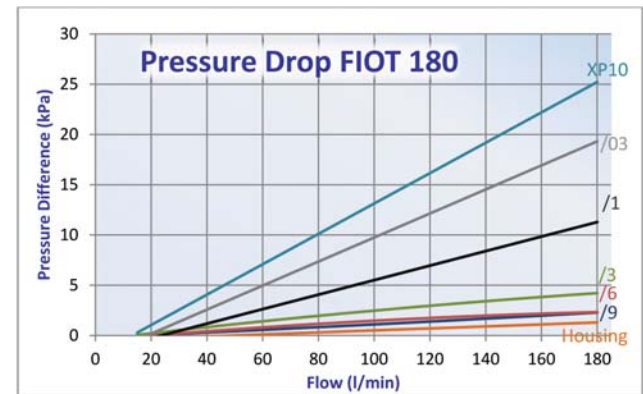
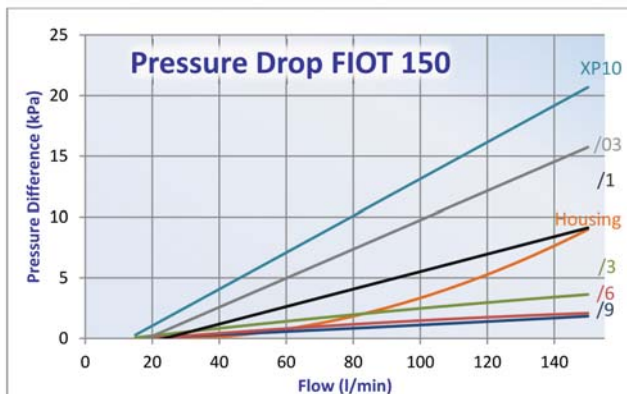
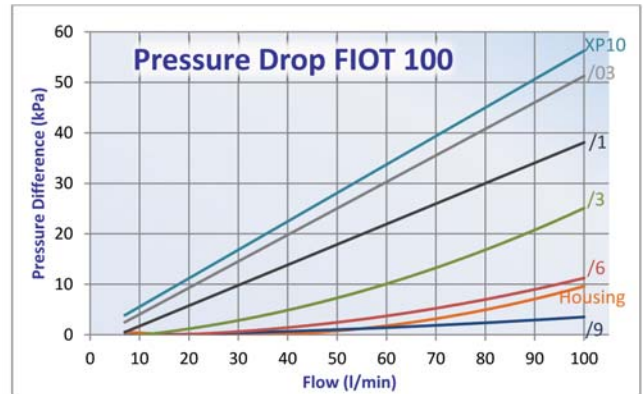
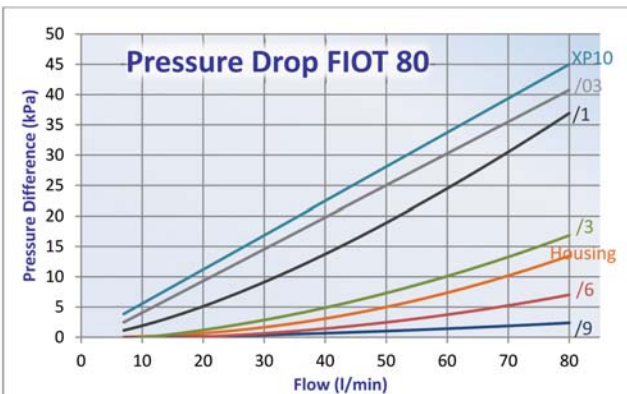
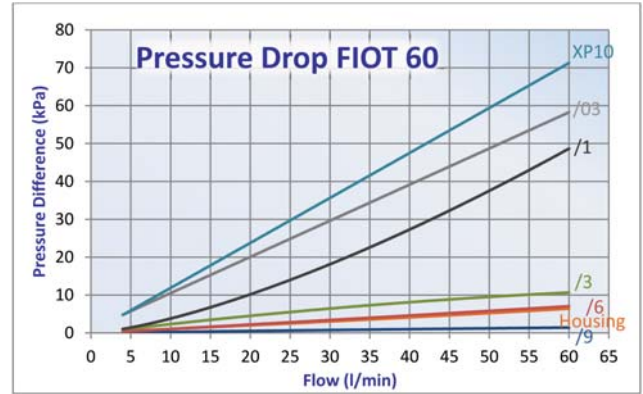
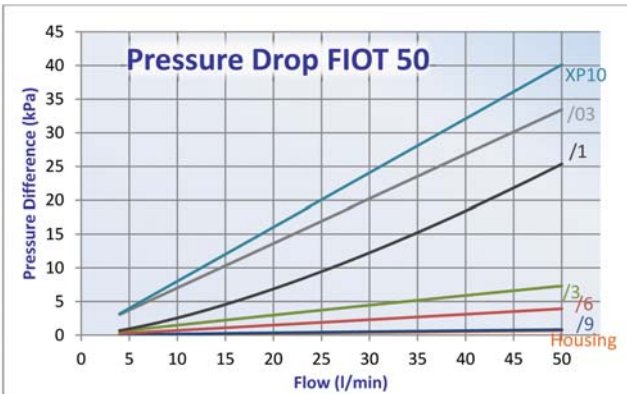
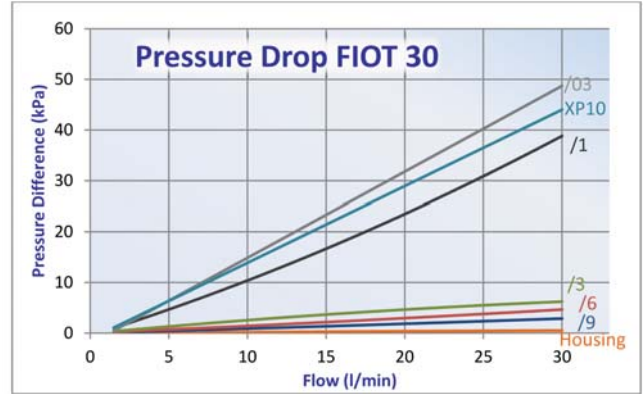
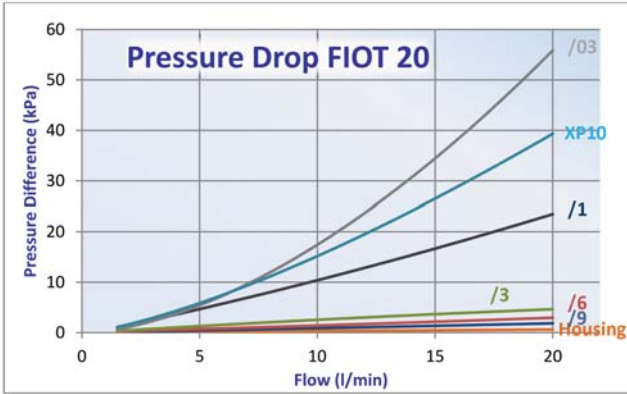
Indicator	Kind	Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171966	Electrical	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	C	1,2	Normally Closed	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P171958	Visual	F	1,2				
P171953	Visual	G	range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

Installation & Service Guidelines

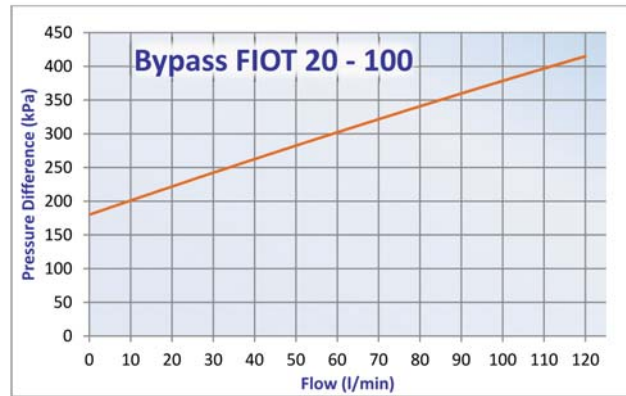
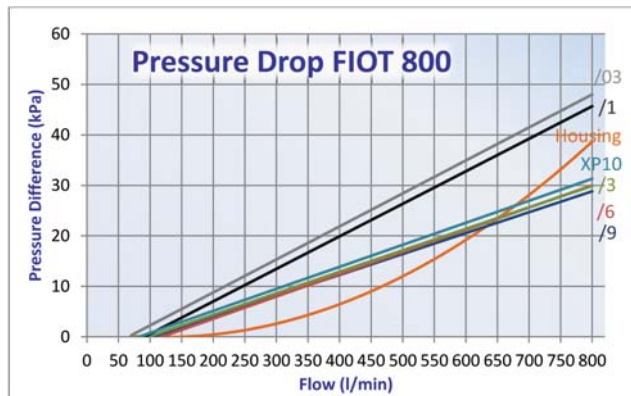
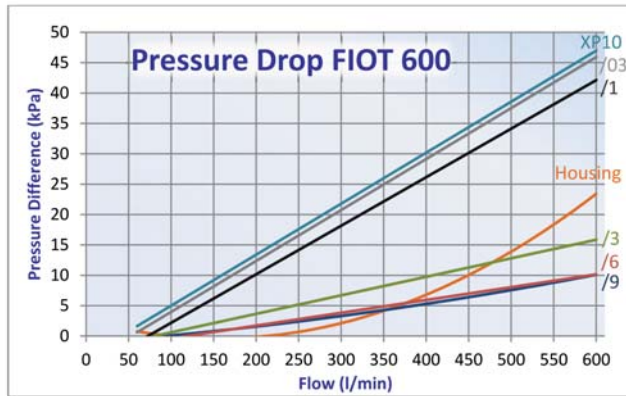
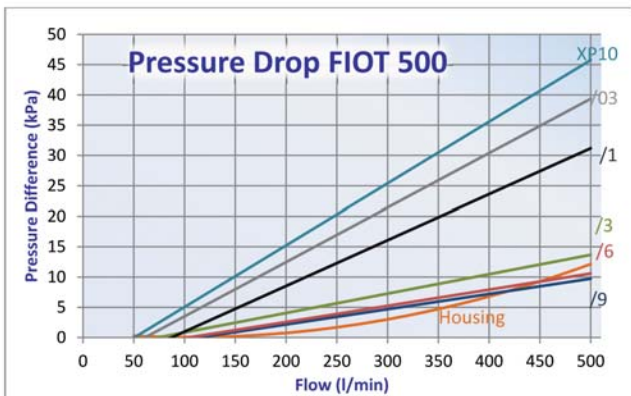
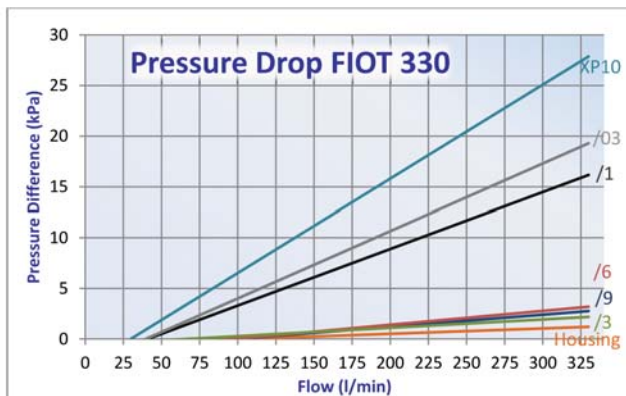
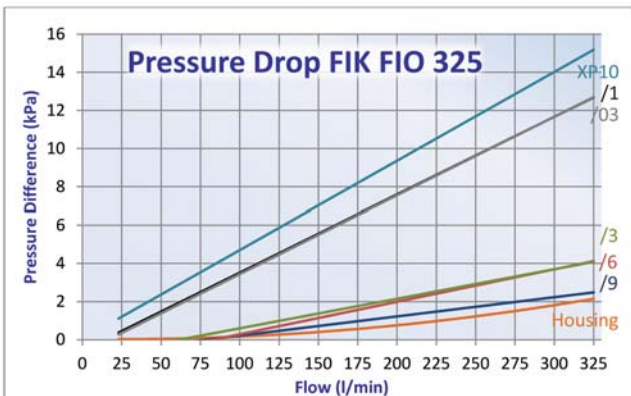
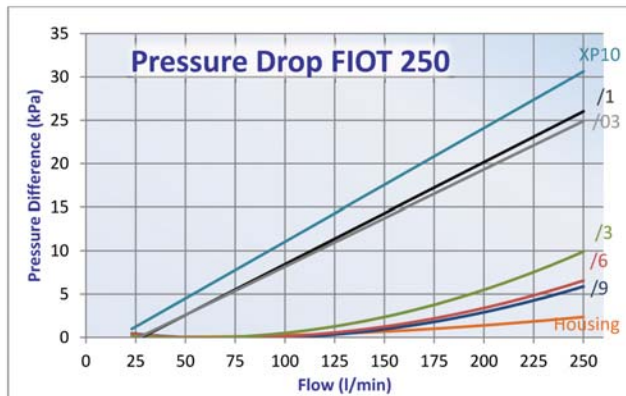
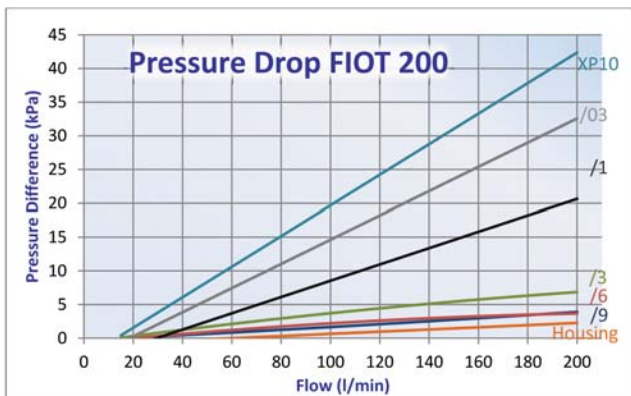


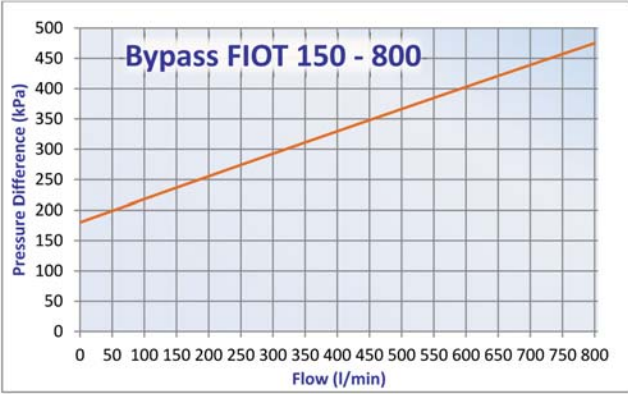


Performance Curves



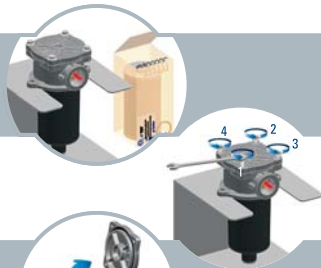
FIK-FIOT





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

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.

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.

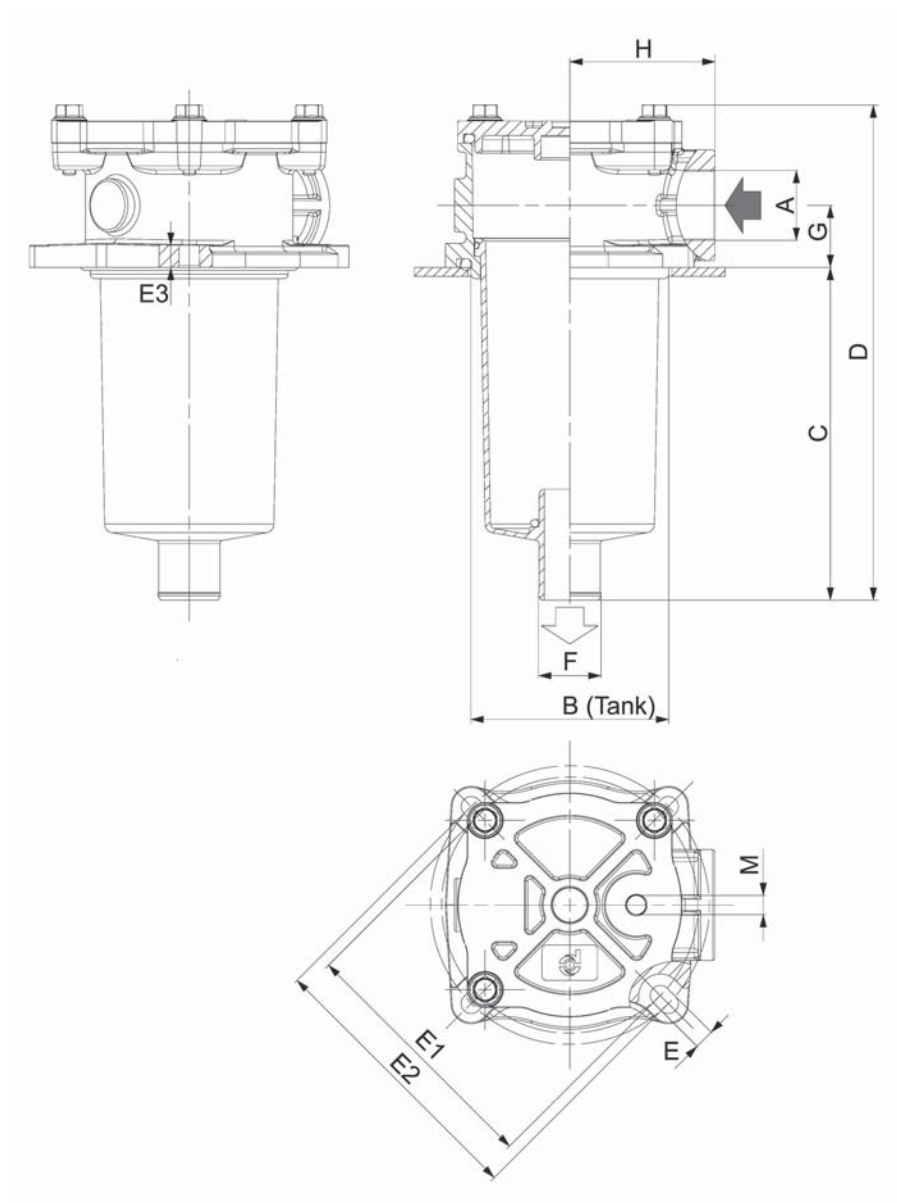
FIK-FIO/FIOT 4 HOLES FLANGES



Components

		WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
		/9		/6		/3		/1		/03		XP10		
		90µm		60µm		$\beta_{90\mu m(c)} \geq 1000$		$\beta_{36\mu m(c)} \geq 1000$		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		
Family		RMF		RMF		RMF		RMF		RMF		RMF		
FIO4 110	no filler cap	110	P171530	110	P171535	65	P171534	65	P171533	60	P171532	60	P171531	CR100
FIO4T 110	with filler cap													
FIO4 140	no filler cap	140	P171831	140	P171834	100	P171837	100	P171840	90	P171843	90	P171846	CR150
FIO4T 140	with filler cap													

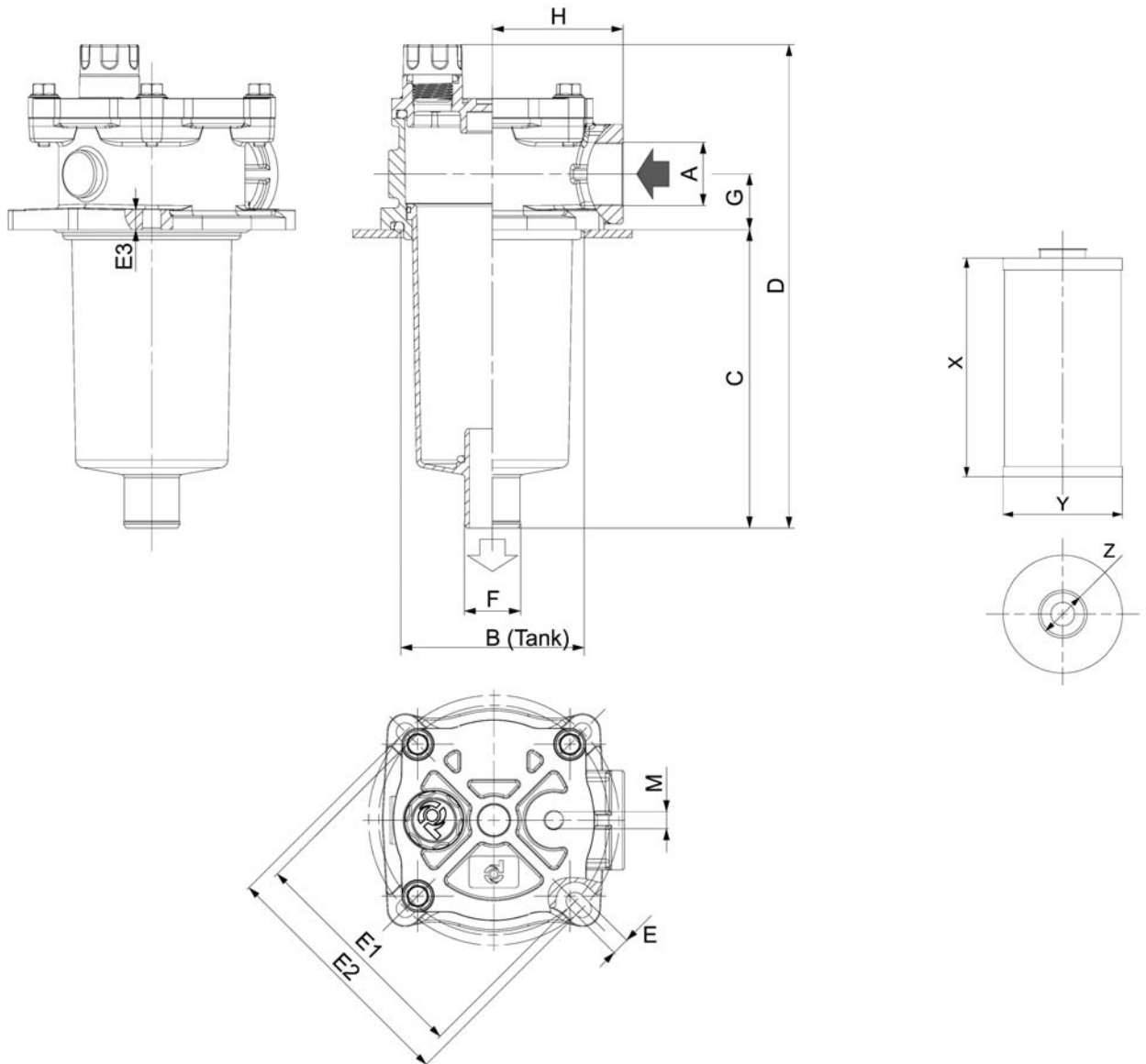
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.
 Maintain the filter outlet (ref. diameter F) well below the oil level to avoid foam formation.



FIO 4
110-140



Standard Housing without Cartridge	HOUSING DIMENSIONS														CARTRIDGE DIMENSIONS		
	A	B	C	D	E	E1	E2	E3	F	G	H	M	N	X	Y	Z	
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	predrilled holes	plugged	mm	mm	mm
P766677	G1	92	145	216	8,4	115	126	10	28	28	66	G1/8	YES	128	70	29	
P766676	G1	92	145	238	8,4	115	126	10	28	28	66	G1/8	YES				
P766675	G1	92	235	306	8,4	115	126	10	40	28	66	G1/8	YES	210	70	42	
P766674	G1	92	235	328	8,4	115	126	10	40	28	66	G1/8	YES				



FIOT 4
110-140

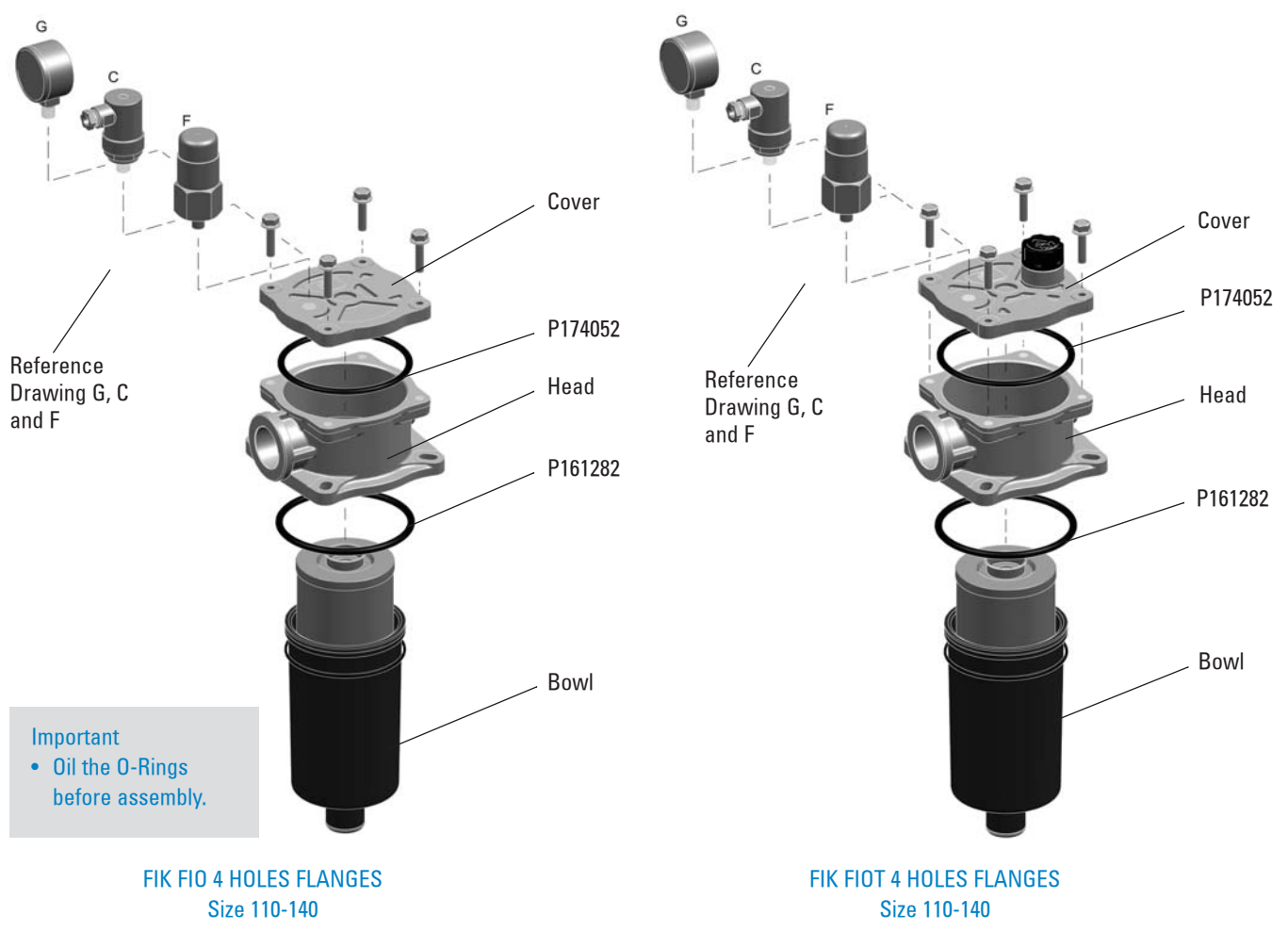
FIK-FIO/FIOT 4 HOLES FLANGES



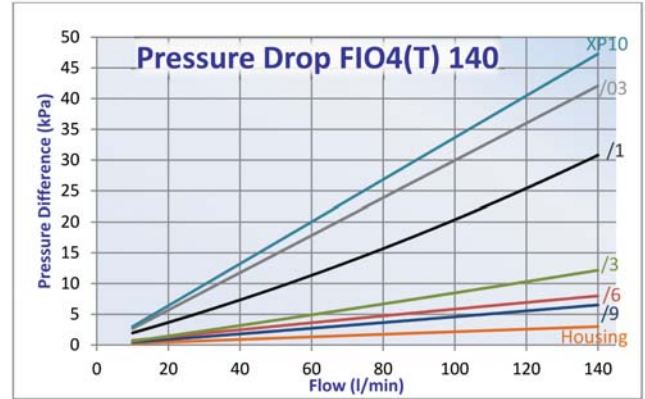
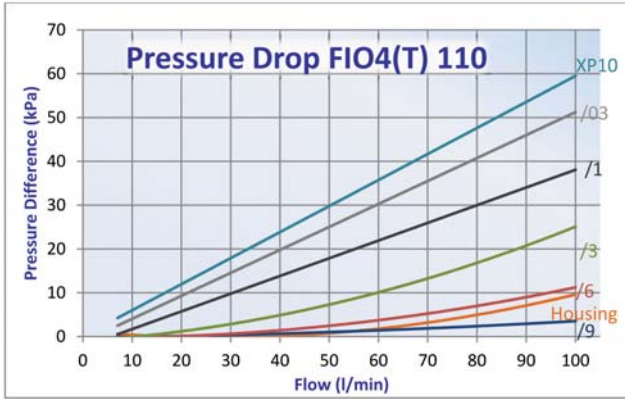
Indicator Choices

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.
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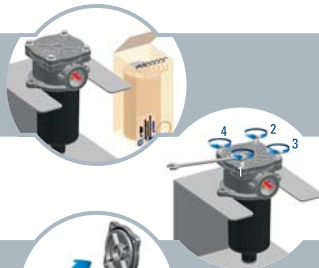


Performance Curves



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FHK-FIR
SRK-Combo
200 + 300

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in correct order



Remove carton ring
before use



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lid and housing is installed and intact



Check if O-Ring on cartridge is installed and intact



For FIK:
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For Low Pressure cartridges:
Mount spring on cartridge



Mount element in
housing



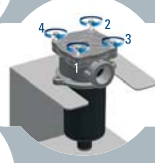
For Combo 120:
Align arrows as shown



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
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Only for cartridge type filters



Sparepart sticker in each sparepart box



Fix sparepart sticker in area indicated –
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- 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		β _{90µm(c)} ≥1000		β _{36µm(c)} ≥1000		β _{23µm(c)} ≥1000		β _{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
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



Family	NO MEDIA	CELLULOSE MEDIA				REMARK
	closes of breather hole	Without pressurization		With pressurization relief setpoint at 0.4 bar		
			10µm	10µm		
FIS20, 40	on request	RMF 150	P173330	RMF 150	not available	Standard Breather
FIS60, 100, 150, 200	P766528 (black)	150	P766530 (blue)	150	P766538 (red)	Breather with TRAP-Technology

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

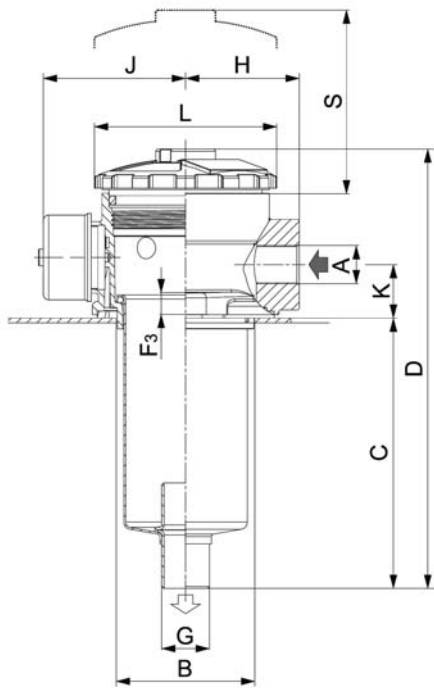
Dipstick Choices



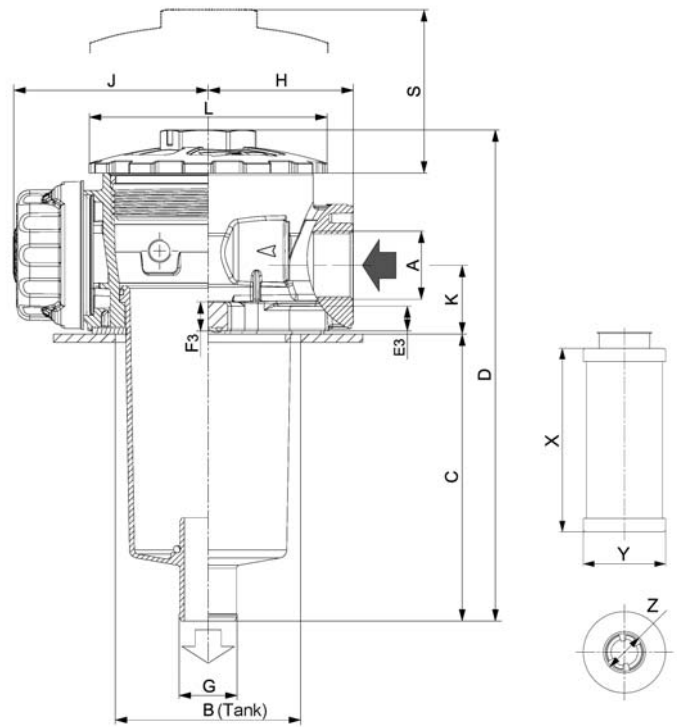
For Family	DIPSTICK	IN TANK LENGTH	USE HOLE DIAMETER
FIS20	P766623	138	M10
FIS40	P766624	293	M10
FIS60, 100	P766552	150	E or F
FIS150, 200	P766621	305	E or F



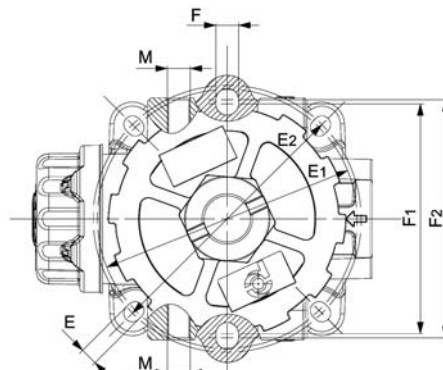
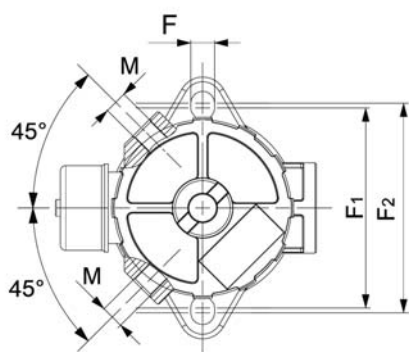
Standard Housing without Cartridge and without breather	HOUSING DIMENSIONS																		CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS		
	A	B	C	D	E	E1	E2	E3	F	F1	F2	F3	G	H	J	K	L	M	N	S	X		Y	Z
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	mm
P766618	G3/8	59	115	183	10				84	90	9		20	48	65	21	74	2x G1/8	YES	100	43	98	22	P171953 P171958 P171966 P173104
P766619	G1/2	59	180	248	10				84	90	9		20	48	65	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



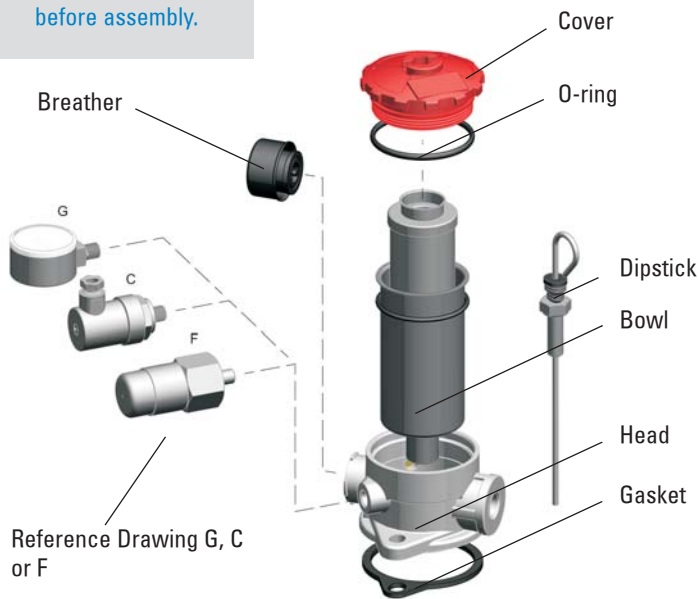
Indicator Choices

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.

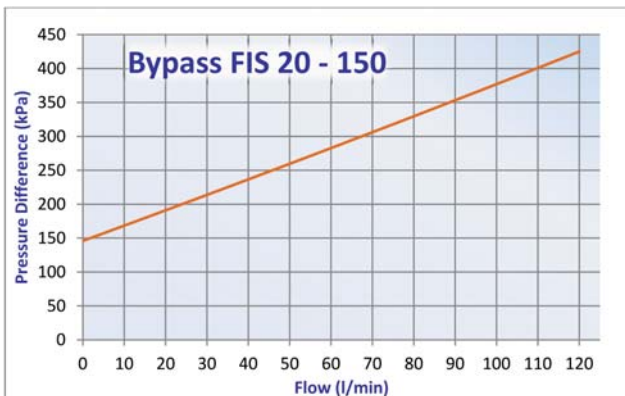
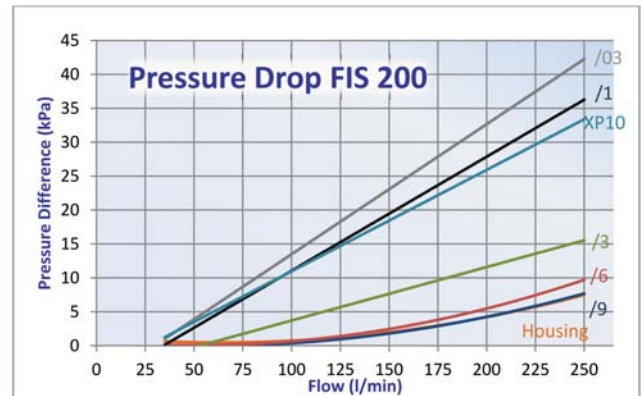
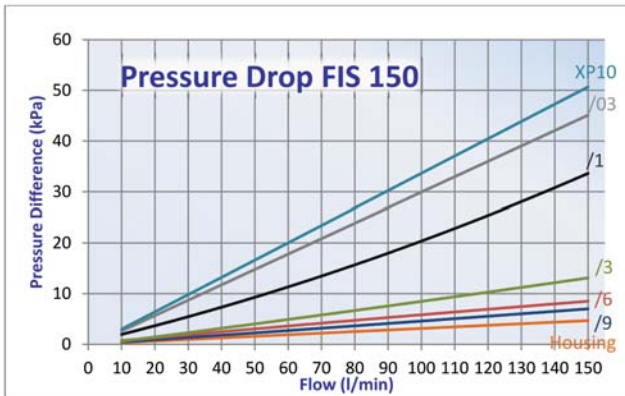
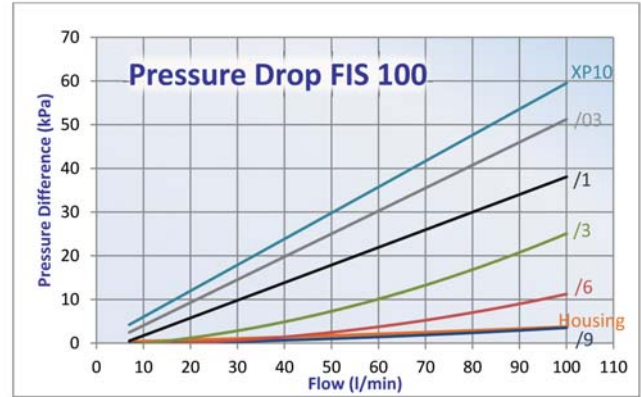
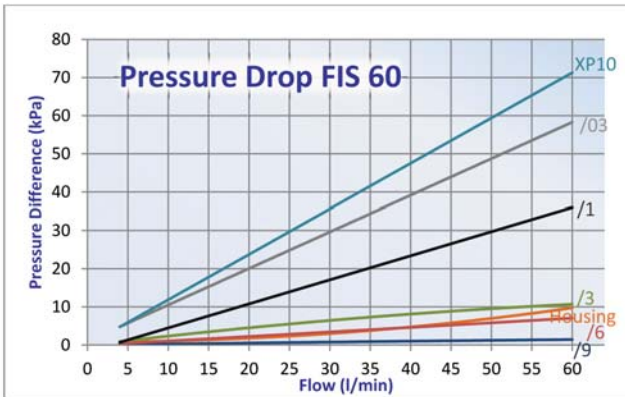
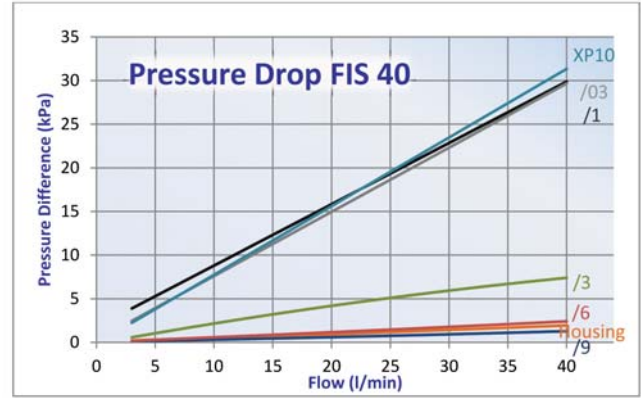
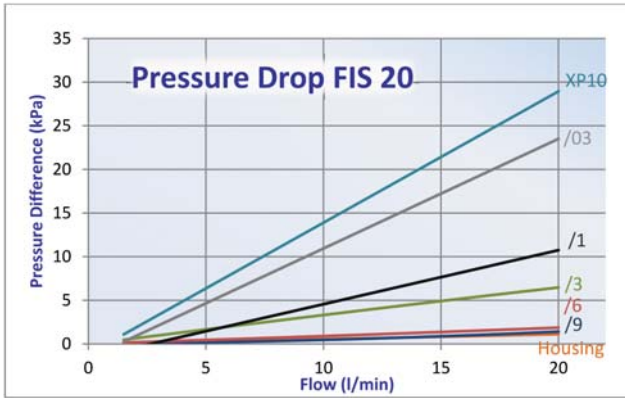


FIS 20-40



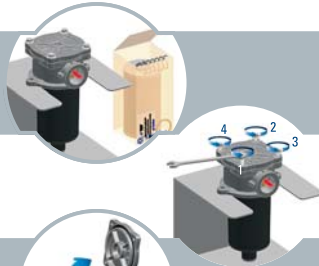
FIS 60-200

Performance Curves



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



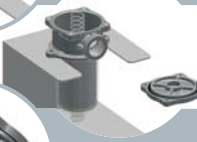
For Low Pressure cartridges:
Mount spring on cartridge



Mount element in
housing



For Combo 120:
Align arrows as shown



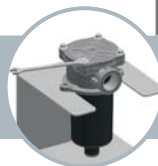
Assemble lid on housing



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



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.

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



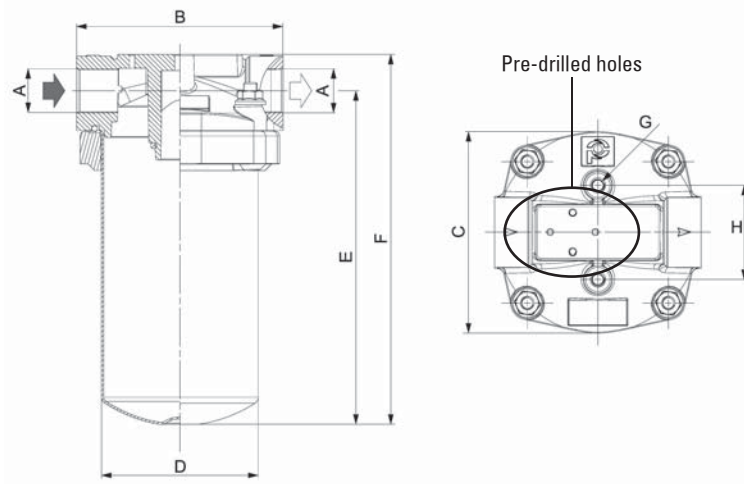
Family	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$\beta_{50\mu m(c)} \geq 1000$		$\beta_{36\mu m(c)} \geq 1000$		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		
	RMF		RMF	RMF		RMF		RMF		RMF			
FLS50	40	P171518	40	P171523	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
FLS 250 SAE Flange	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
FLS 330 SAE Flange	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
FLS 500 SAE Flange	500	P171566	500	P171571	400	P171570	400	P171569	350	P171568	350	P171567	CR500
FLS 800 SAE Flange	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.

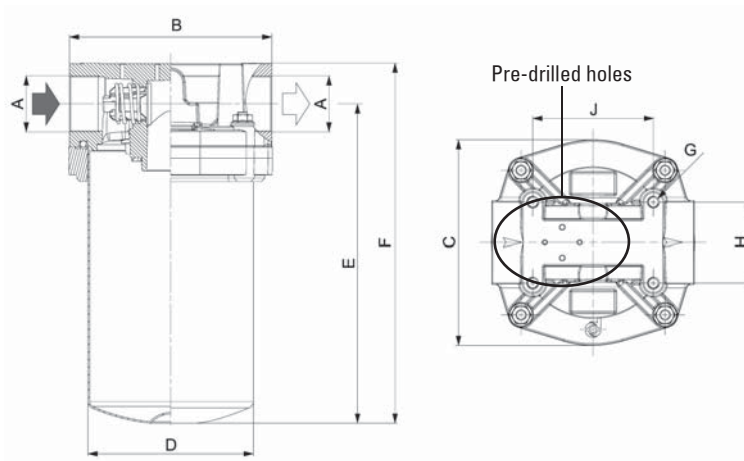
BPV = Bypass Valve Setting.

* 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

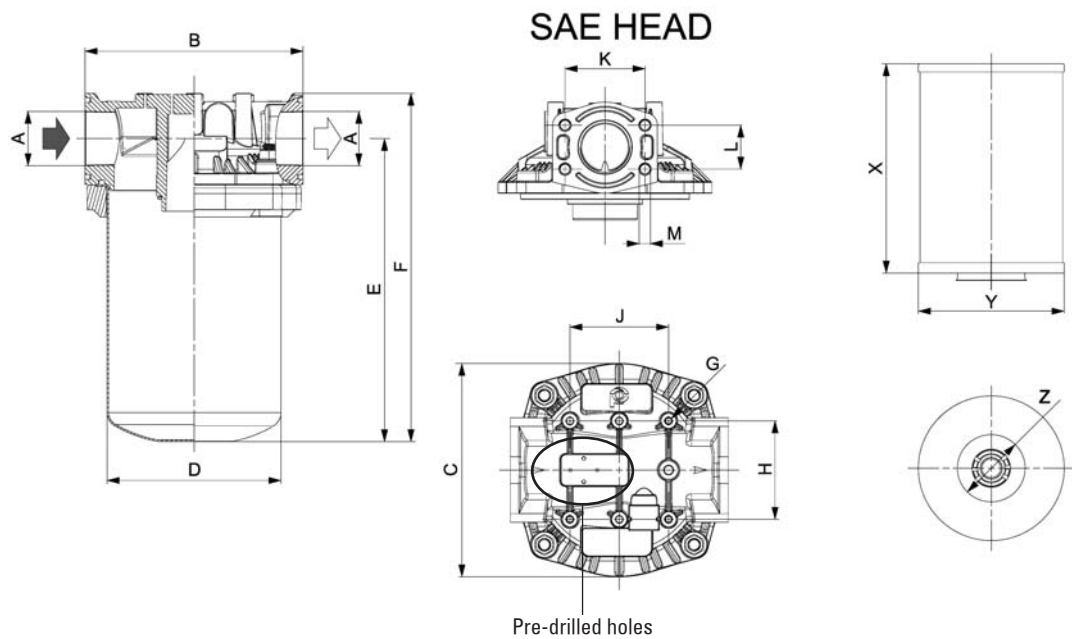




Standard housing with pre-drilled holes without cartridge	Standard housing without pre-drilled holes without cartridge	HOUSING DIMENSIONS														CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS Only applicable if housing is with pre-drilled holes.
		A	B	C	D	E	F	G	H	J	K	L	M	N	BPV	X	Y	Z	
			mm	mm	mm	mm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

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

FLS 250-800

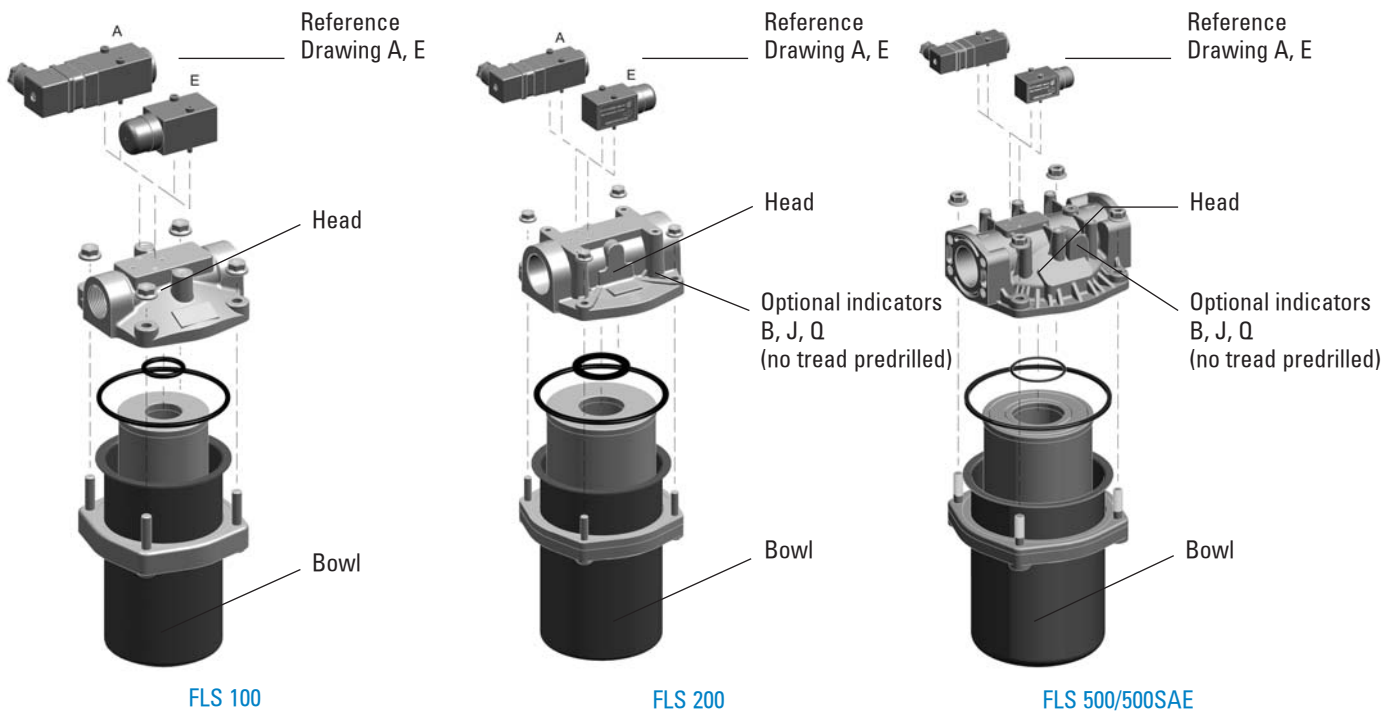


Indicator Choices

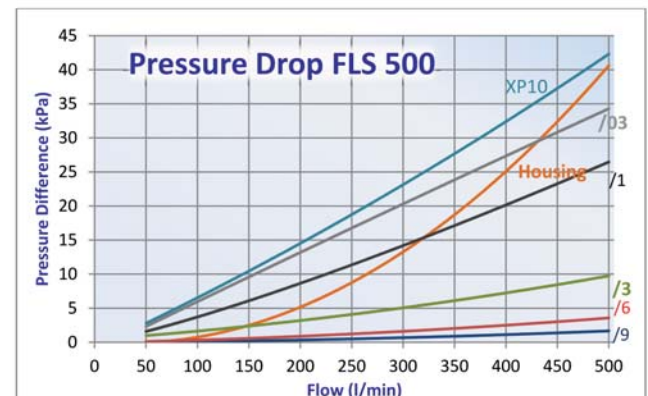
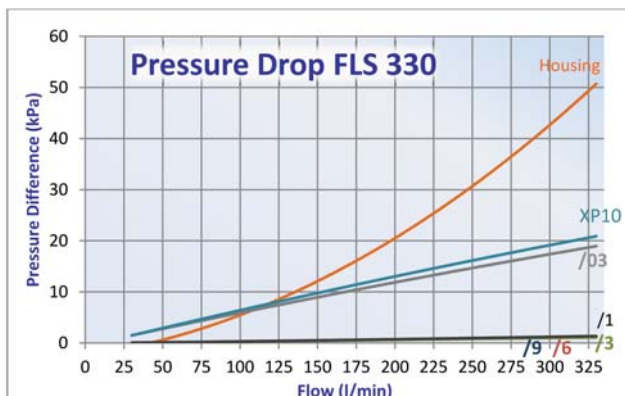
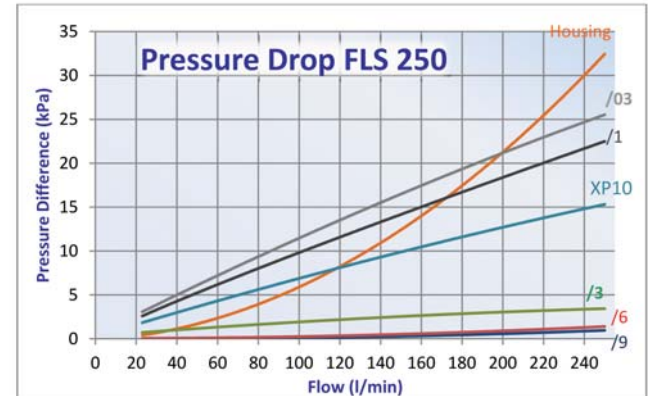
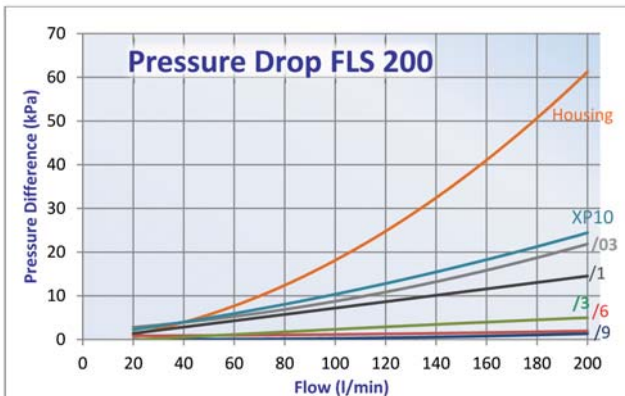
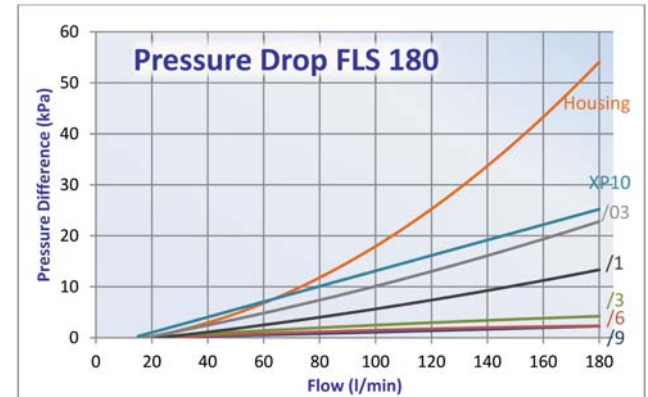
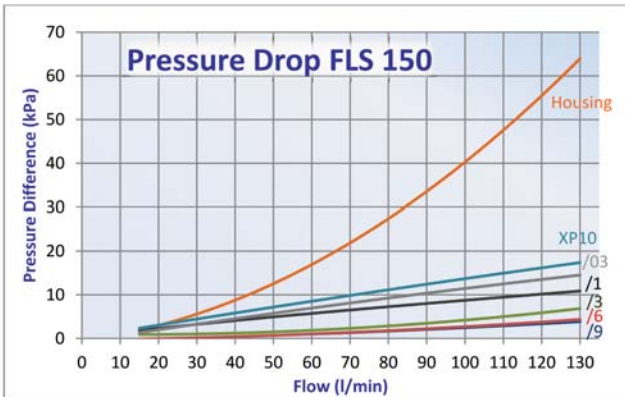
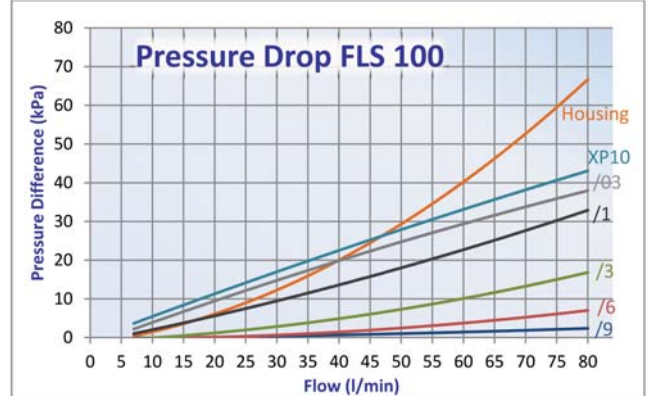
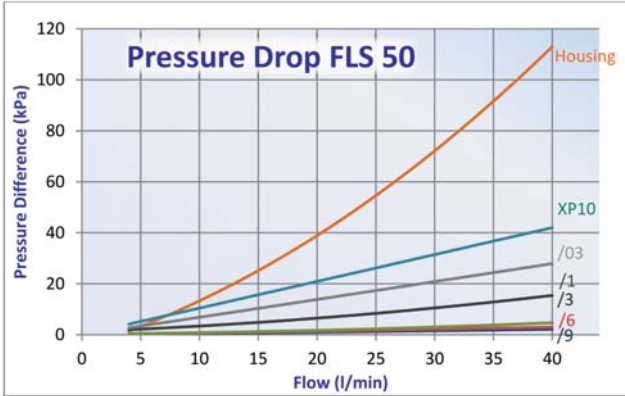
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171961	Electrical	Differential	A	1,4	Normally Open	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171963	Electrical	Differential	A	1,4	Normally Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171950	Visual	Differential	E	1,4				
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
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	24 V DC; 110 V AC; 2A

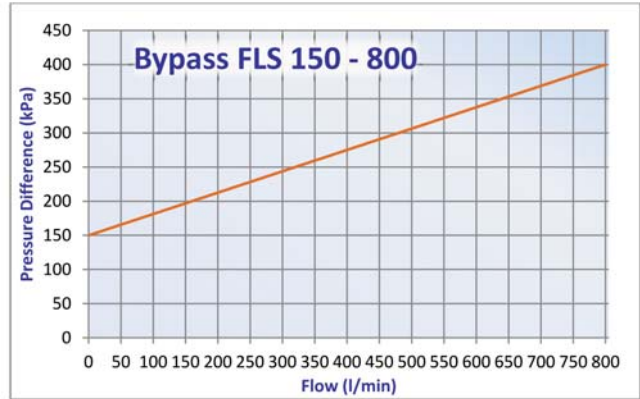
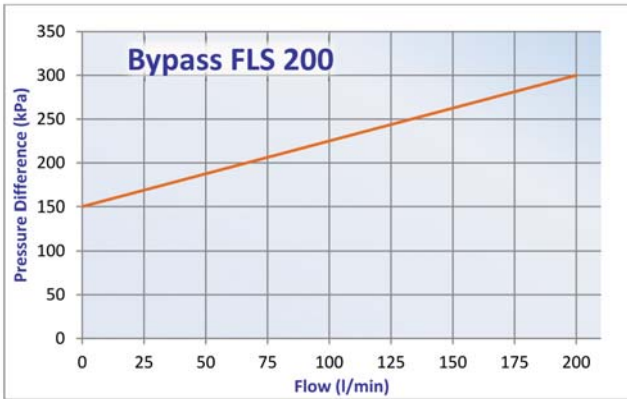
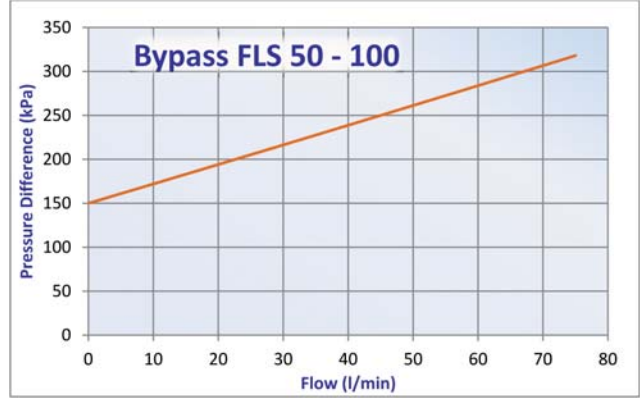
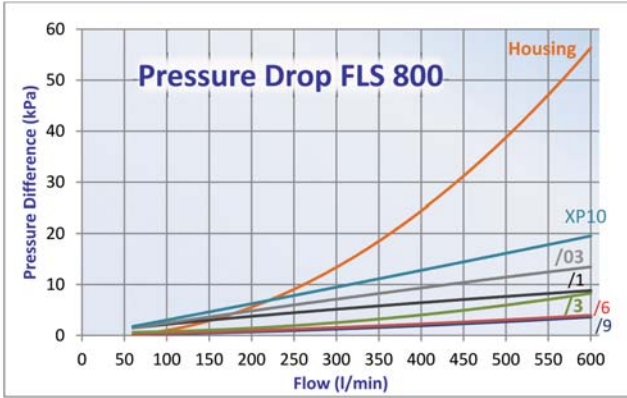
Installation & Service Guidelines

Important
• Oil the O-Rings before assembly.



Performance Curves







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/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, reinforced with wire mesh.
- Synteq® synthetic media: 11-23 micron.



Components

Family	WIRE MESH MEDIA		CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/6		/3		/1		/03		XP10		
	60µm		β _{50µm(c)} ≥1000		β _{36µm(c)} ≥1000		β _{23µm(c)} ≥1000		β _{11µm(c)} ≥1000		
	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
FRCA 160/200	P173441*	G3/4	1,7 bar	no	-	none	G3/4	M8
	P765584	G3/4	no opening	used	left	P162696 (installed)	G3/4	M8
	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	1,5 bar	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
FRCA 220/250	P765639	G1 1/4	no opening	drilled, not plugged	left	P162696	G1 1/4	M8
	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
FRCA 380/400	P764421	G1 1/4	no opening	plugged	right	P171954, P171958, P171966 or P173104	1 1/2-16 UN	M8
	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

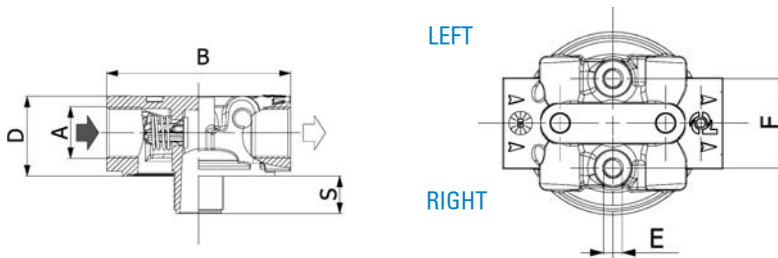
FBK Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.
Unless otherwise mentioned, the usage of indicators is mandatory, because the drilled holes for indicators are not plugged.

* Standard Head

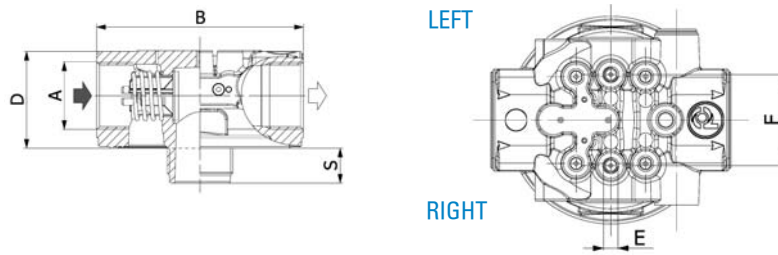


Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P173441	G3/4	95	13	41,5	M8	38		20	1,7	146	96	G3/4
NA										209	96	G3/4
										183	108	M40x2
										230	108	M40x2
P176846	G1 1/4	132	28,5	61,5	M8	50		24	1,5	181	128	G1 1/4
P766293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

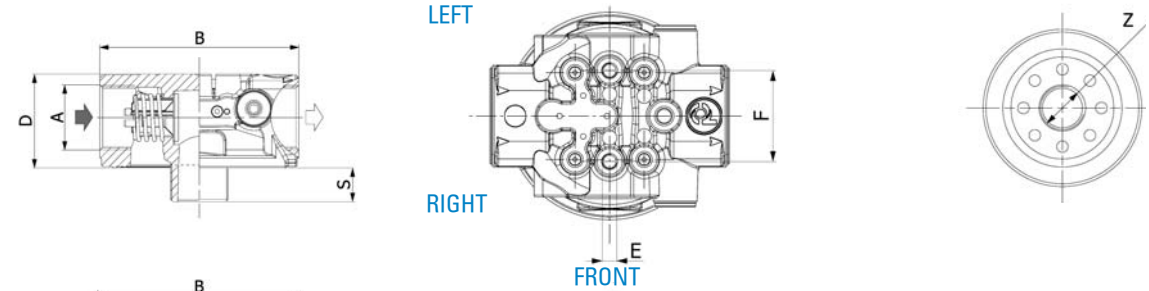
FRCA 60/80



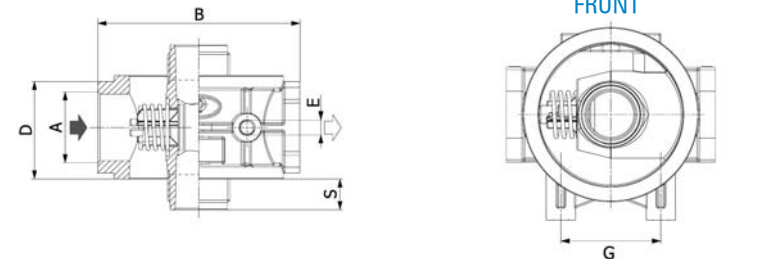
FRCA 160/200



FRCA 220/250



FRCA 380/400



Indicator Choices

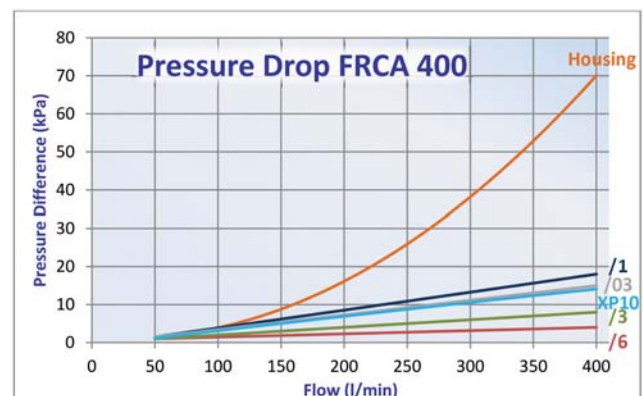
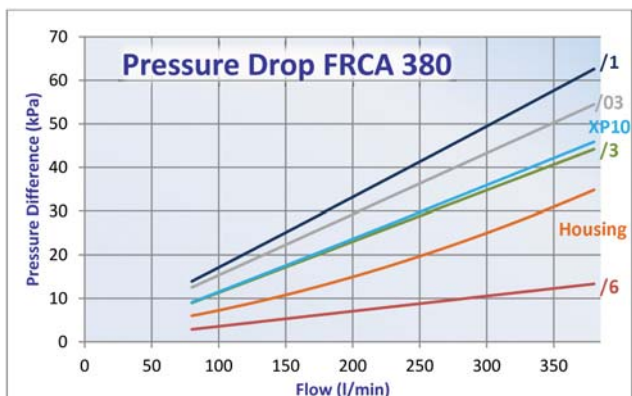
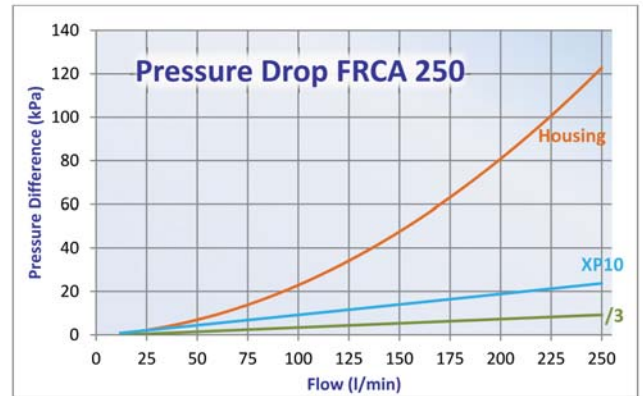
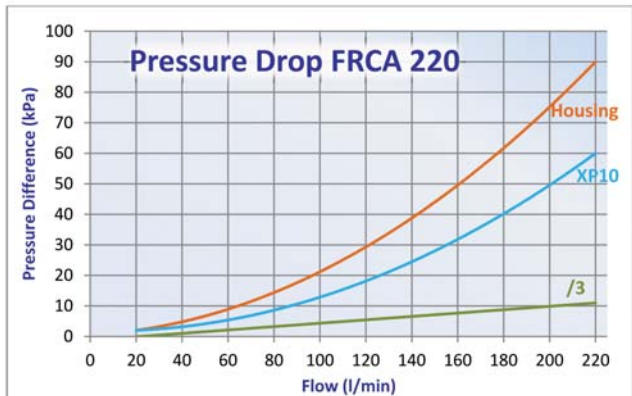
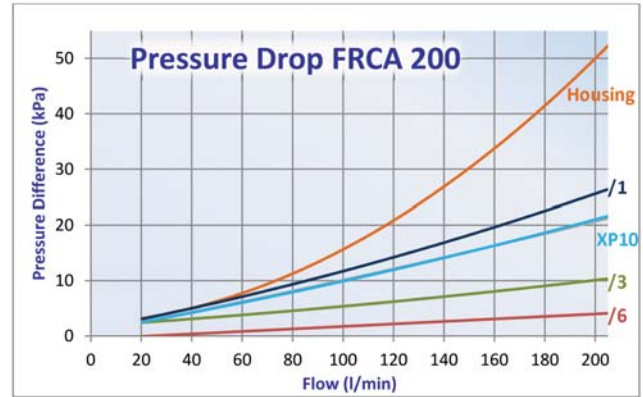
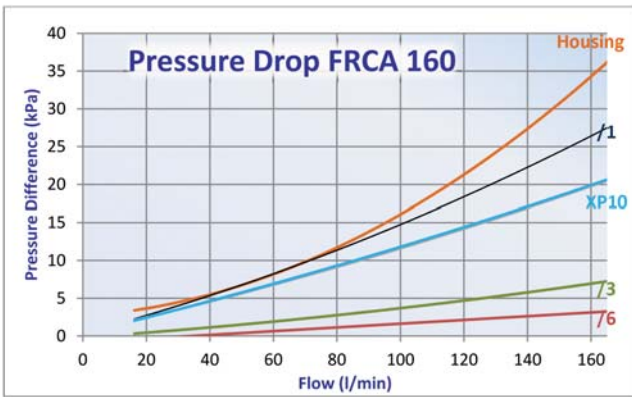
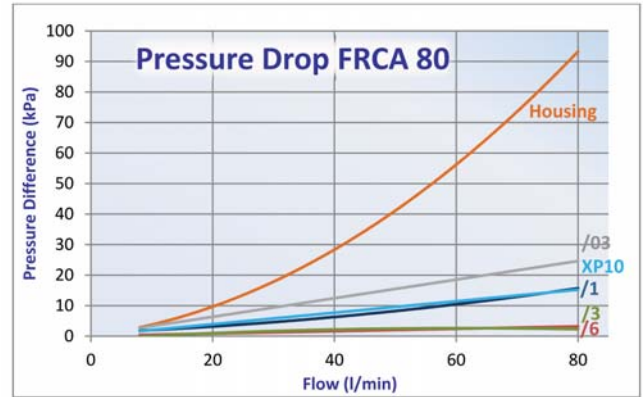
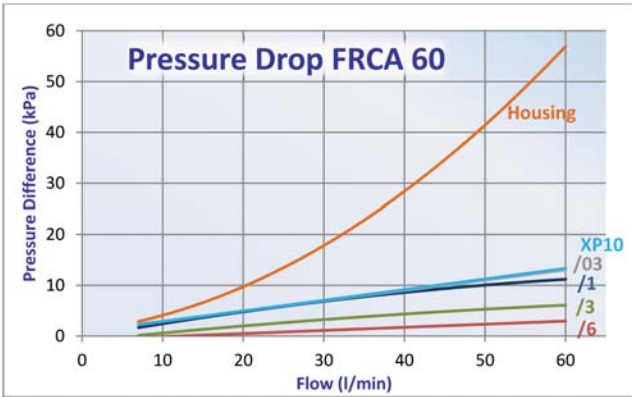
Indicator	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171961	Electrical	Differential	A	1,4	Normally Open/Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2 A ind.
P171963	Electrical	Differential	A	1,4	Normally Open/Closed	IP65	PG11	30 Vcc/Ac; 0,5 A res. and 0,2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

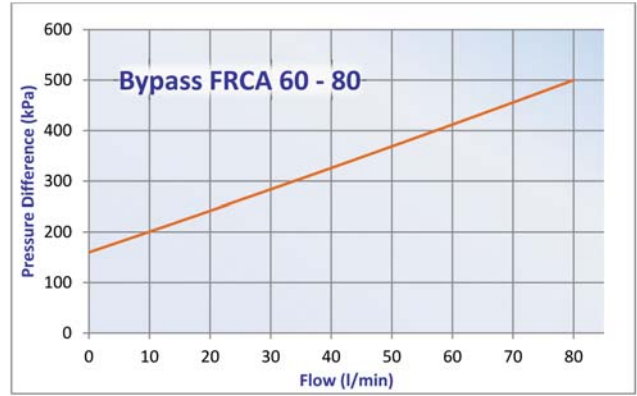
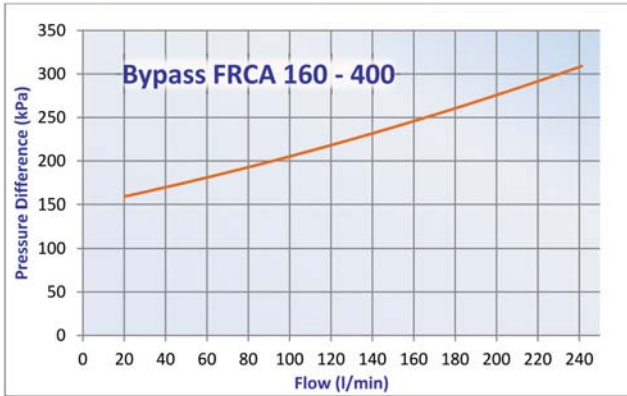
Installation & Service Guidelines

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







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



RETURN & SUCTION FILTERS IN-TANK

Family	WIRE MESH						CELLULOSE MEDIA						SYNTHETIC MEDIA						CARTRIDGE CODE
	/9			/6			/3			/1			/03			XP10			
	90µm			60µm			β _{90µm(c)} ≥ 1000			β _{36µm(c)} ≥ 1000			β _{23µm(c)} ≥ 1000			β _{11µm(c)} ≥ 1000			
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

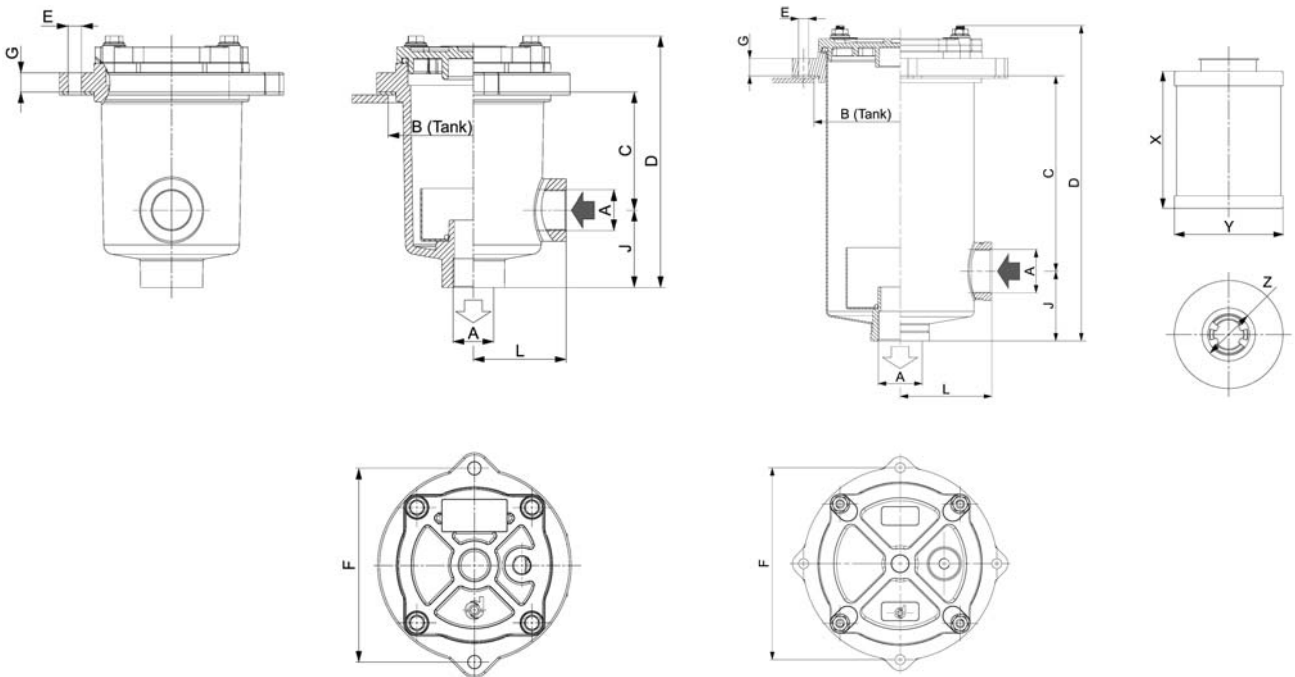
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171953	Visual	Vacuum	G	-1/5				
P171958	Visual	Differential	F	1,2				
P171966	Electrical	Differential	C	1,2	Normally Open	IP65	PG7	48 V; 0,5 A res. and 0,2 A ind.
P173104	Electrical	Differential	C	1,2	Normally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

Use indicators only on return line applications!



Standard Housing without Cartridge	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	

RETURN & SUCTION
FILTERS IN-TANK

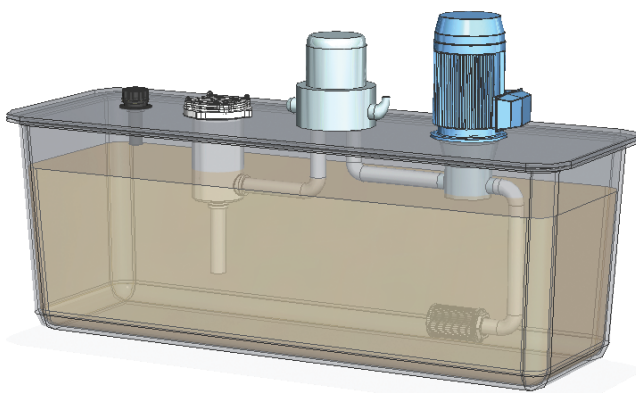
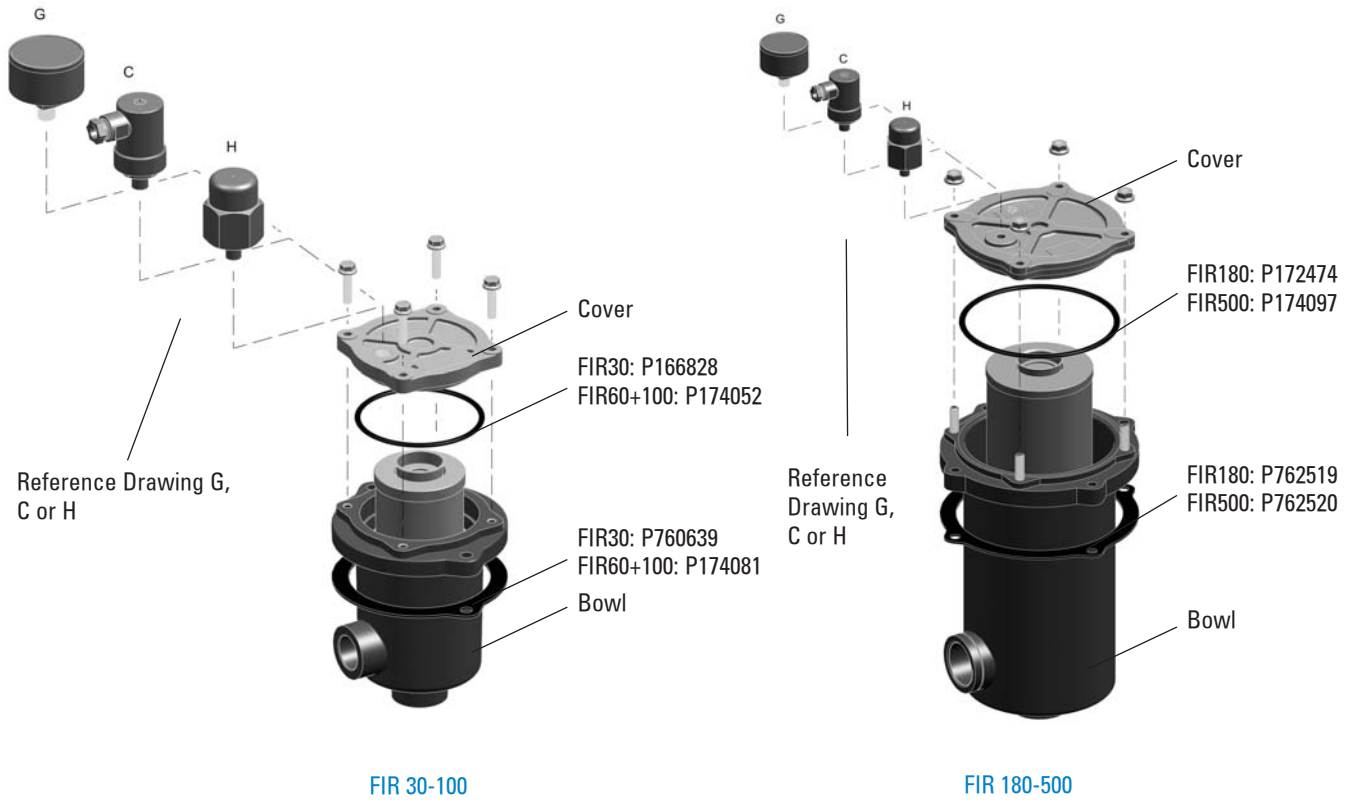


Size 30-100

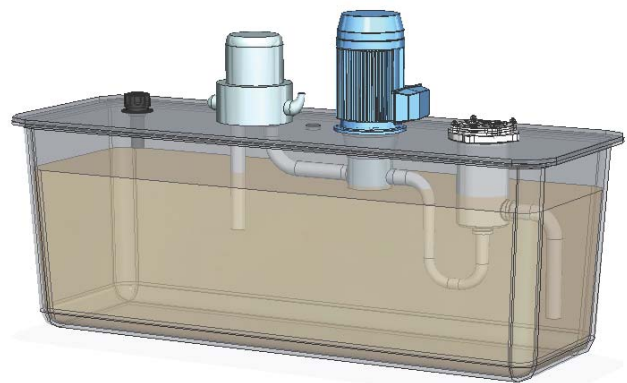
Size 180-500

Installation & Service Guidelines

RETURN & SUCTION FILTERS IN-TANK

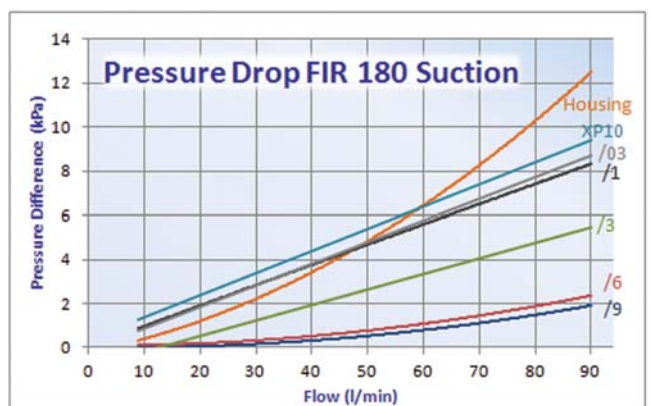
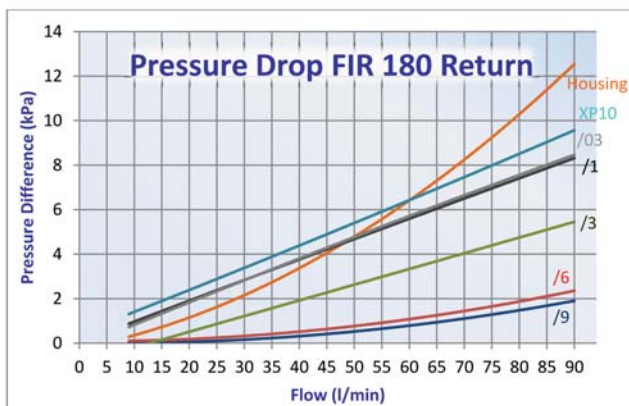
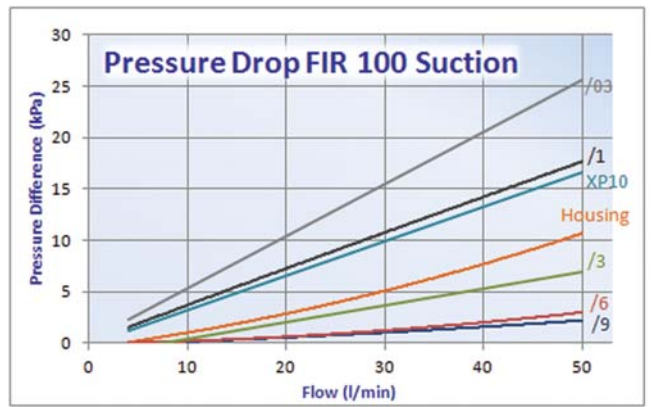
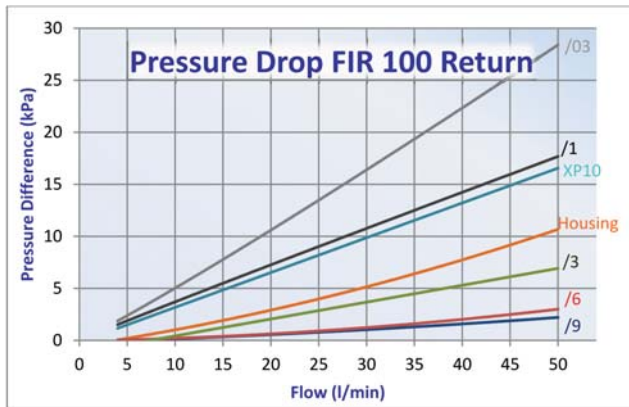
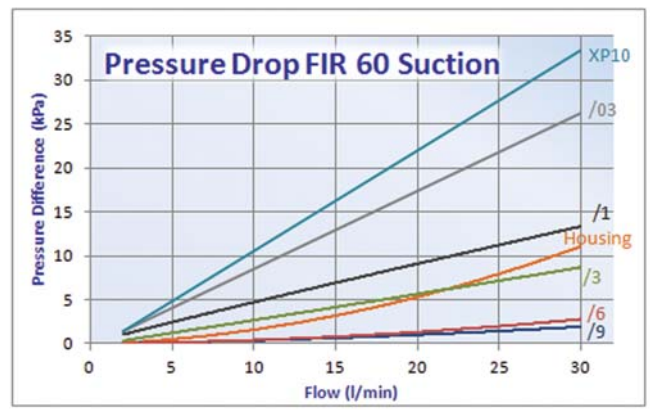
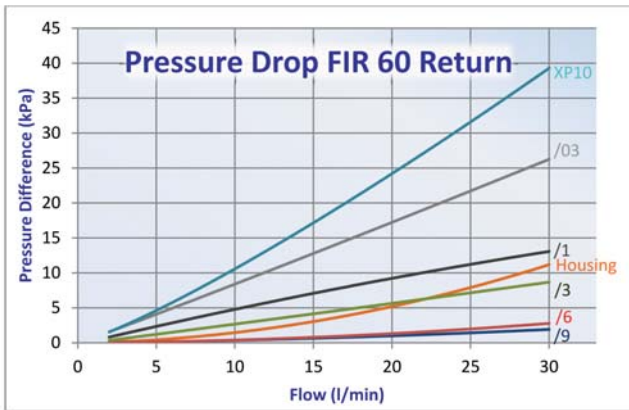
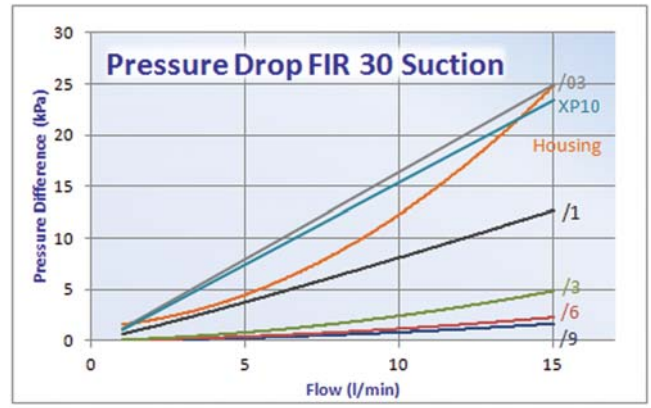
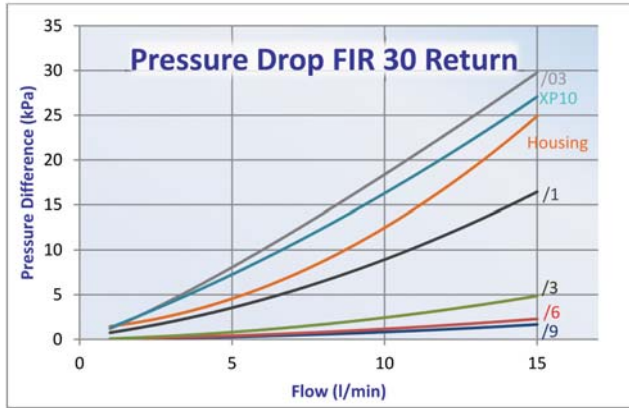


Example of how the filter is mounted in a return flow.

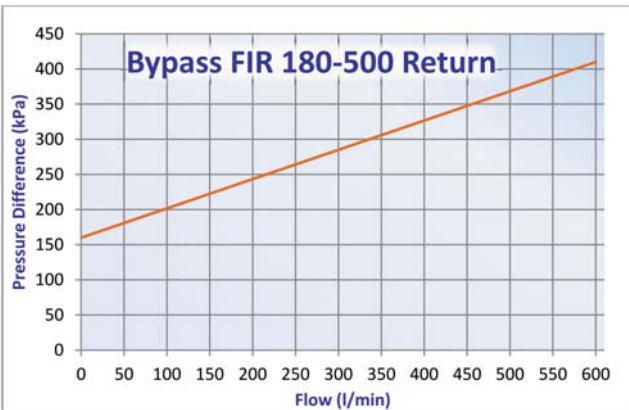
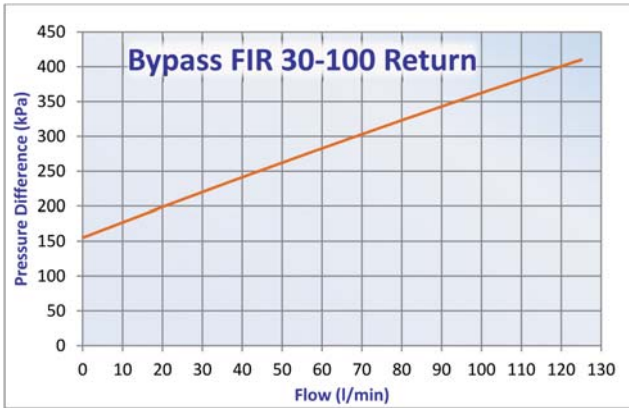
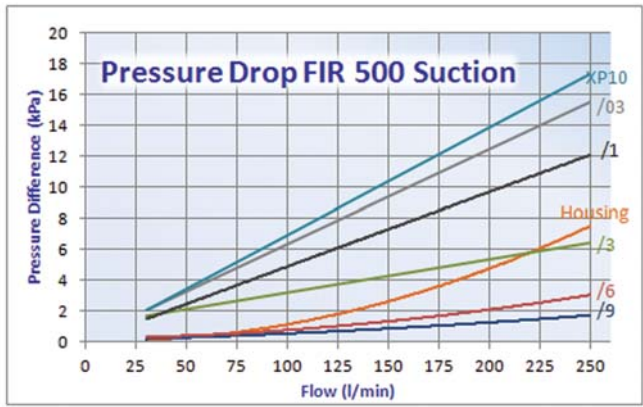
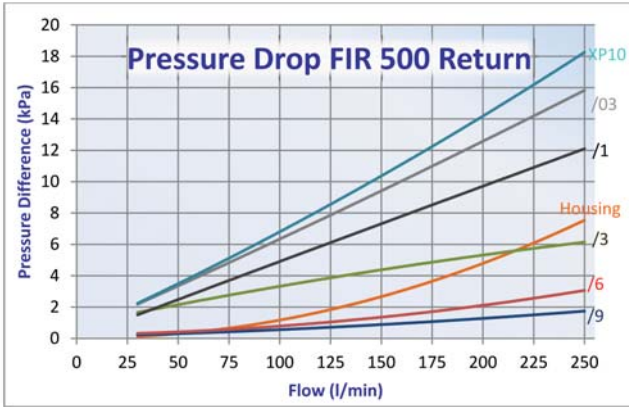


Example of how the filter is mounted in a suction flow.

Performance Curves



RETURN & SUCTION
FILTERS IN-TANK





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:
 $\beta_{11\mu(c)} = 200$, $\beta_{13\mu(c)} = 1000$.
- 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 μ m).
- By-pass filtered and pressurized.

Components

RETURN & SUCTION
FILTERS IN-TANK

Family	Style 1	Style 2	Style 3	Main Element		Suction Element					
				Synthetic Media		Wire Mesh					
				$\beta_{13(\mu m)} \geq 1000$		125 μm					
				RMF		RMF					
COMBO 120	with Emergency suction	Ports on same axis**		200	P763652	60	P763643				
		Ports on same side									
	without Emergency suction*	Ports on same axis**						-	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										
	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											
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										
	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											

* 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	mm	bar	bar	predilled holes	plugged or indicator	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	91	233	36	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	88	361	42	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				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	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)

RETURN & SUCTION
FILTERS IN-TANK

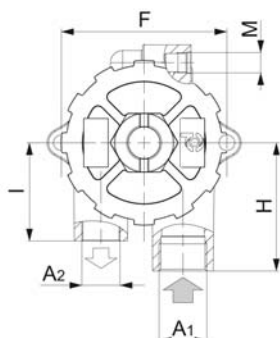
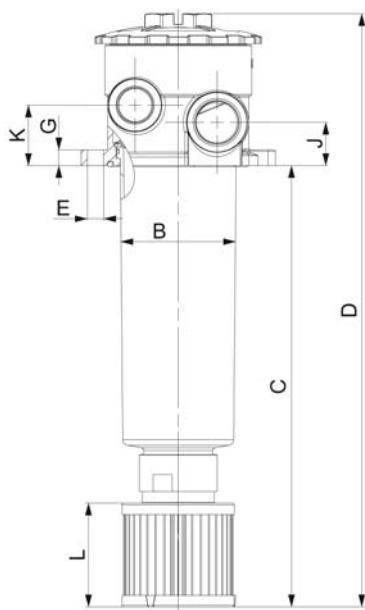
Indicator Choices

RETURN & SUCTION
FILTERS IN-TANK

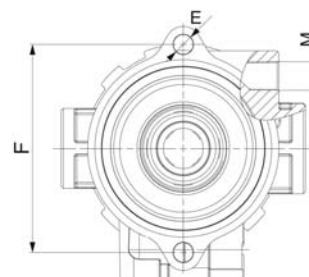
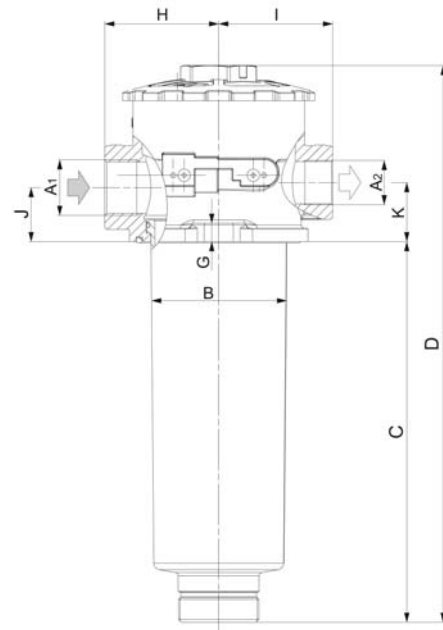
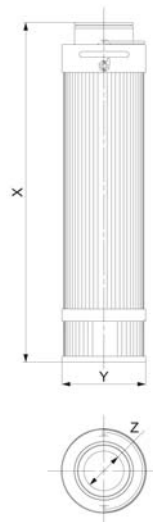
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171954	Visual	Vacuum	G	-1/3				
P764612	Visual	Differential	F	2,5				max 30 DCV; 0,5 A res. and 0,2 A ind.
P764431	Electrical	Differential	C	2,5	Normally Open	IP65	PG7	max 30 DCV; 0,5 A res. and 0,2 A ind.
P764613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

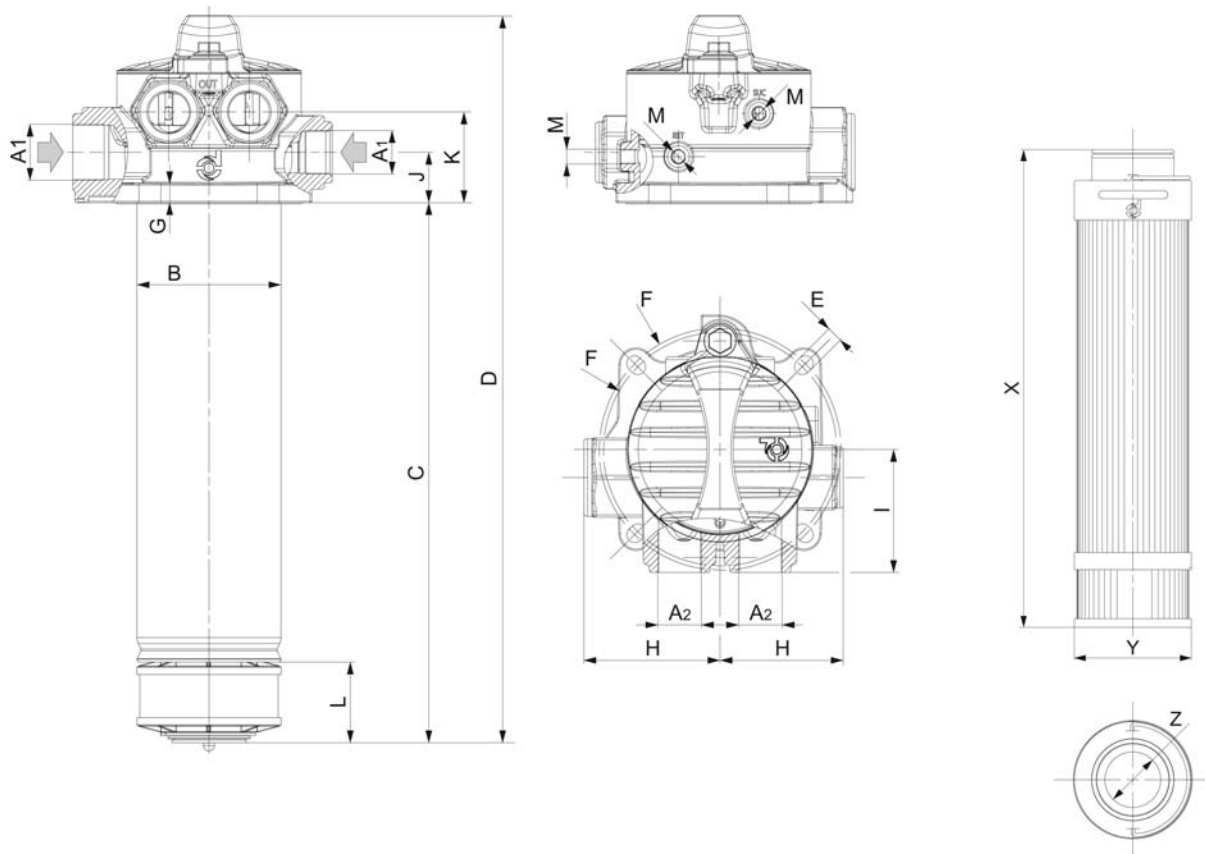
Ports on same Side



Ports on same Axis



Combo 200/300



RETURN & SUCTION
FILTERS IN-TANK

Additions

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

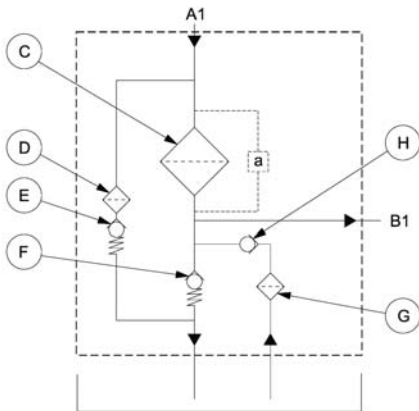
Additional extension tube for SRK 120 - only on request
Extends length of SRK with 178 mm
P763642

Hydraulic Filter Schematics

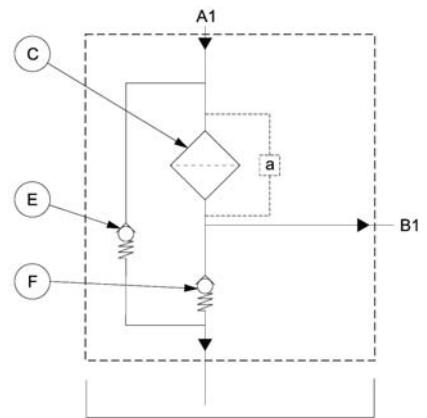
RETURN & SUCTION
FILTERS IN-TANK

Combo 120

With Emergency Suction

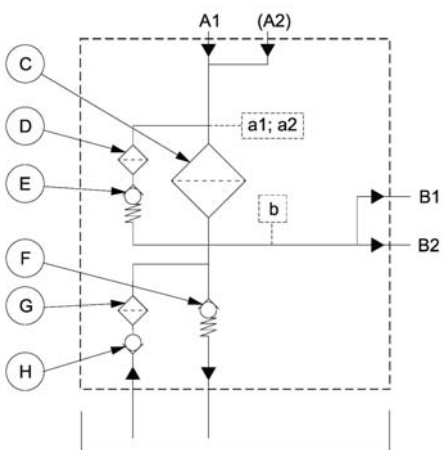


Without Emergency Suction

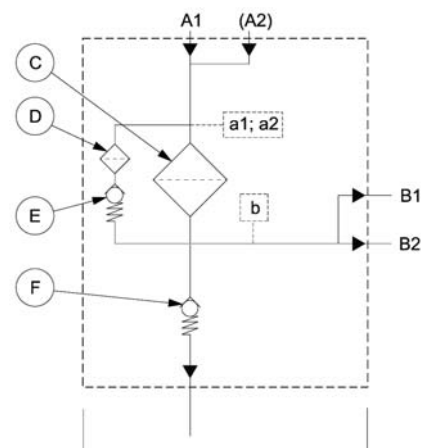


Combo 200/300

With Emergency Suction



Without Emergency Suction



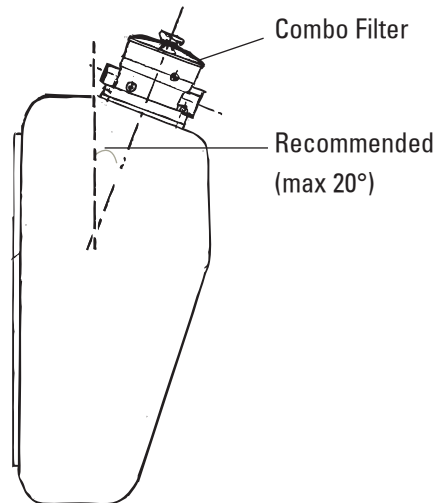
- A1 - A2: from hydraulic users
- B1 - B2: to boost pump
- a, a1, a2, b: pressure indicator ports
- C: main cartridge
- D: by-pass strainer
- E: by-pass valve
- F: back pressure valve
- G: suction strainer
- H: suction valve

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.

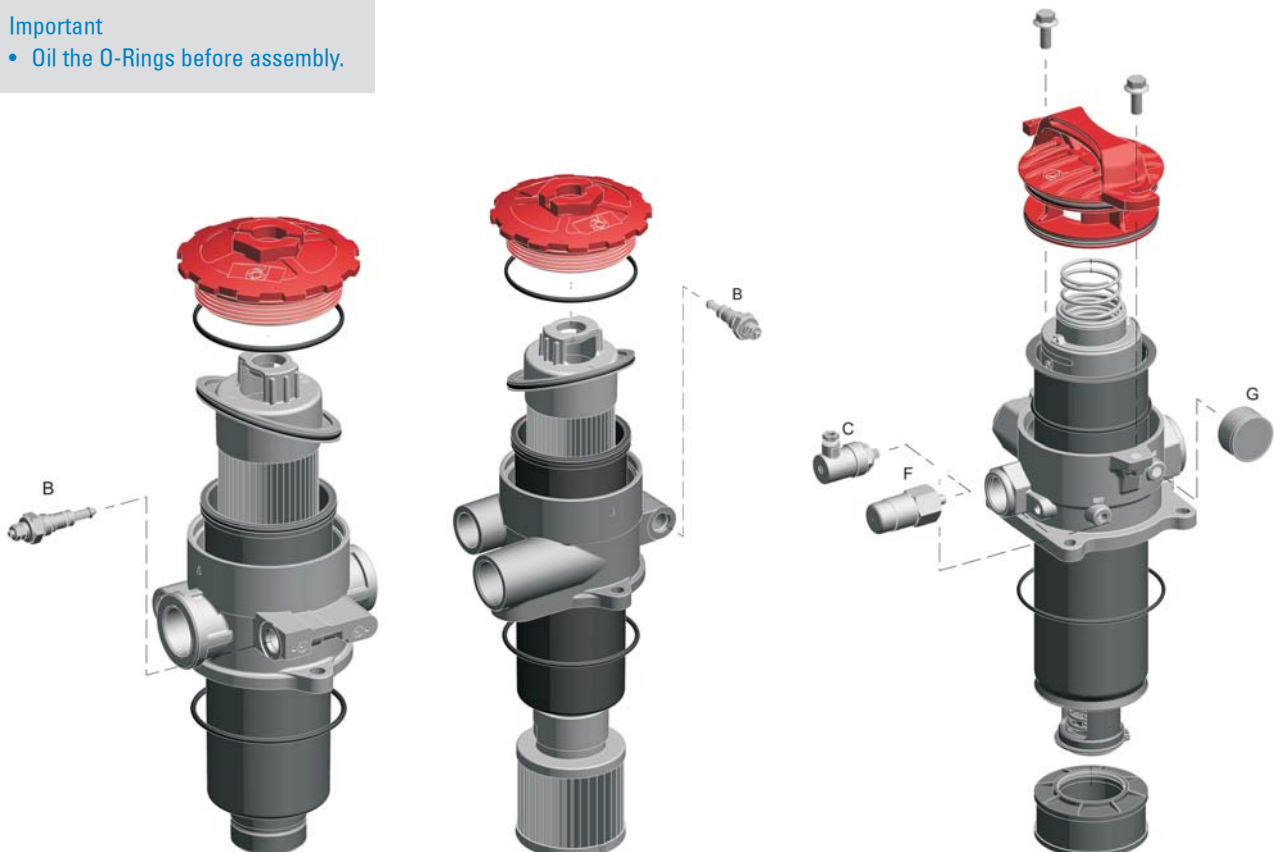
The suction port always gets clean oil. When the element becomes clogged, oil that reaches the suction port is gradually reduced, so the use of an electrical clogging indicator (P165194) is recommended. Return flow must always be higher than suction flow.

- Maximum slope on the installation: 20°.



Important

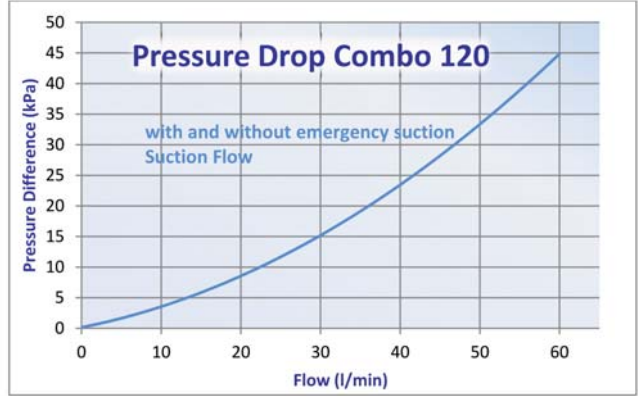
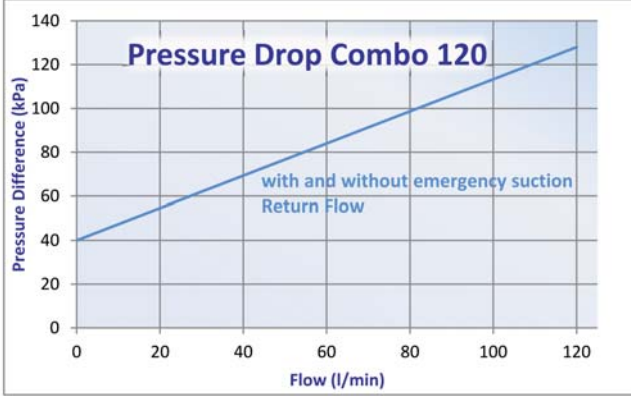
- Oil the O-Rings before assembly.



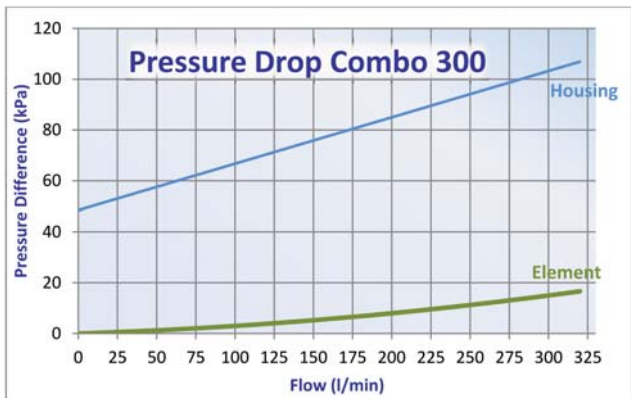
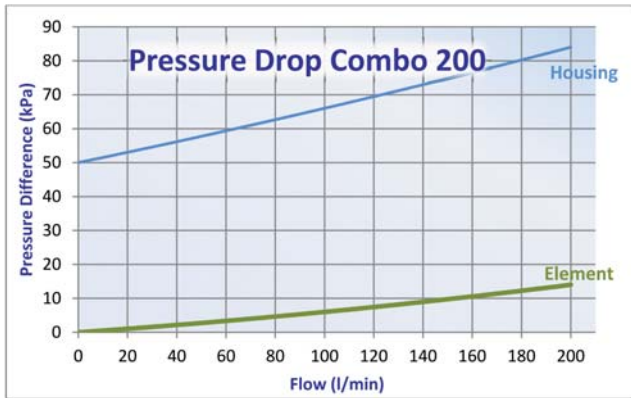
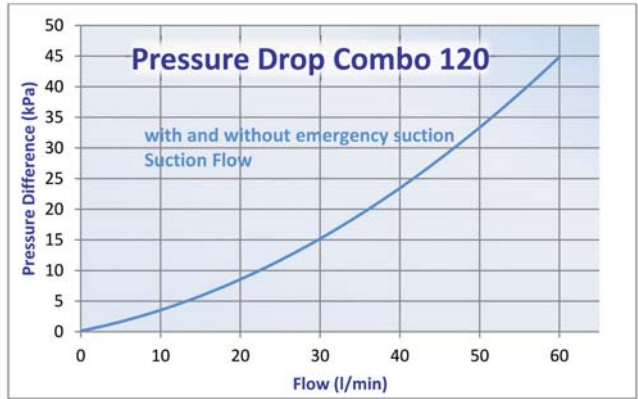
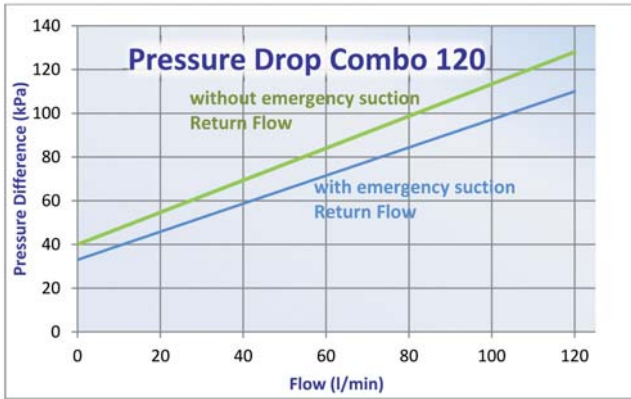
Performance Curves

RETURN & SUCTION
FILTERS IN-TANK

Ports on same Axis



Ports on same Side





Technical Data

- 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 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.

Strainers

SUCTION FILTERS
IN-TANK

Family	WIRE MESH				CELLULOSE MEDIA		CARTRIDGE CODE
	RMF	/9		/6		/3	
		90µm	60µm	β _{50µm(c)} =1000			
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	

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

Family	WIRE MESH		CARTRIDGE CODE
	RMF	/250	
		250µm	
FIOA20	10		FIOA20
FIOA35	17		FIOA35
FIOA50	25	P175334	FIOA50
FIOA85	43	P175335	FIOA85
FIOA90	45	P175336	FIOA90
FIOA130	65	P175337	FIOA130
FIOA160	80		FIOA160
FIOA175	85	P175340	FIOA175
FIOA180	90	P175338	FIOA180
FIOA220	110		FIOA220
FIOA230	116		FIOA230
FIOA360	186		FIOA360
FIOA500	250	P175339	FIOA500
FIOA600	300	P175342	FIOA600
FIOA800	400	P175343	FIOA800

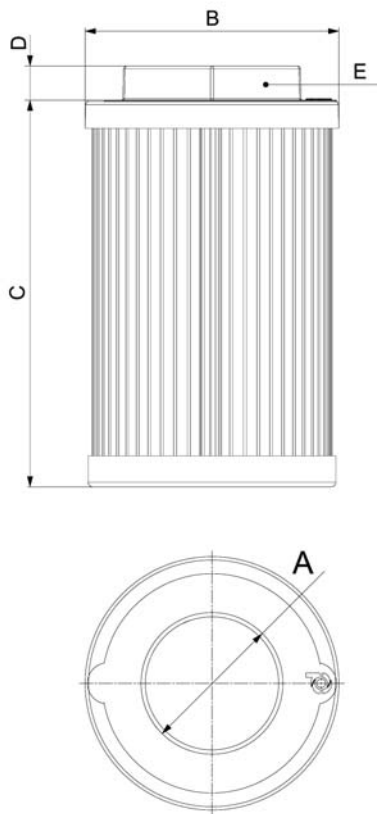
Strainer Dimensions Thread per NPT				
A	B	C	D	E
	mm	mm	mm	mm
3/8 NPT				
1/2 NPT				
3/4 NPT	75	85	12	36
1 NPT	95	83	12	46
1 NPT	75	131	10	45
1 1/4 NPT	95	172	12	60
1 1/2 NPT				
1 1/2 NPT	140	98	15	60
1 1/2 NPT	95	203	12	60
2 NPT				
2 NPT				
2 NPT				
2 NPT	140	301	15	80
2 1/2 NPT	140	301	15	92
3 NPT	140	301	15	105

RMF = Recommended Maximum Flow in liters/minute

WIRE MESH		
Family	RMF	
FIOA90S	45	P765208
FIOA90S	65	P766638

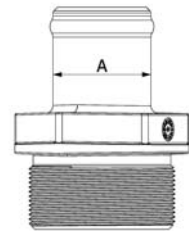
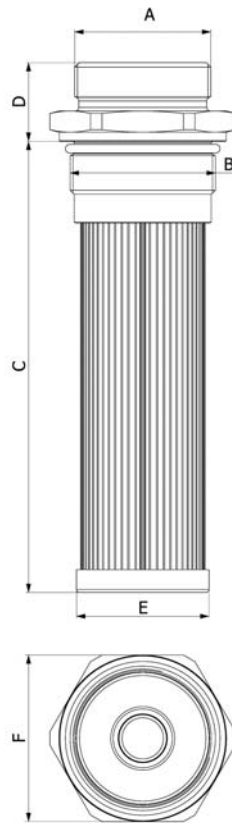
Strainer Dimensions								
Efficiency	A	B	C	D	E	F	BPV	Reference Drawing
μm		mm	mm	mm	mm	mm	bar	
90	diam 32	M48x1.5	155	48	45	50	NA	B
125	M45x2	M48x2	150	26	44	55	1	A

BPV= Bypass Valve Setting



Reference Drawing A

Reference Drawing B

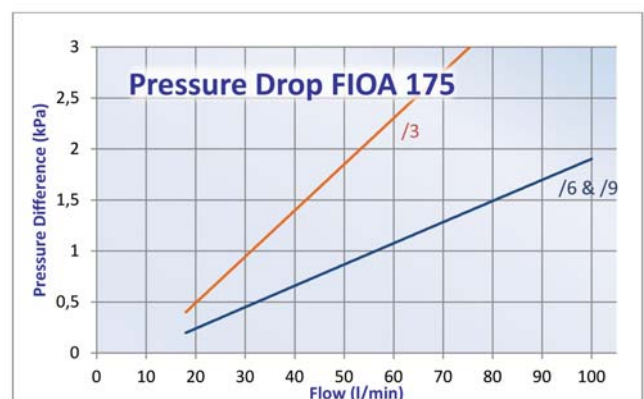
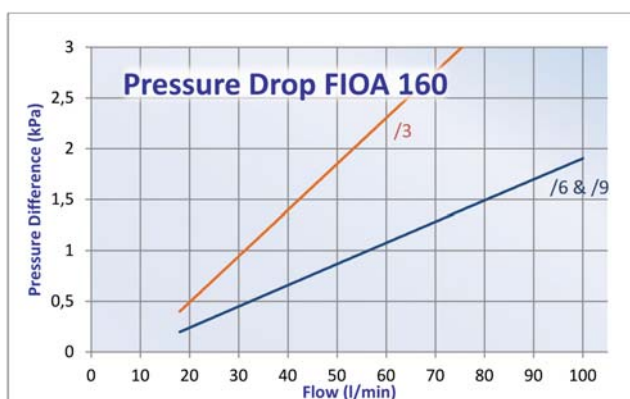
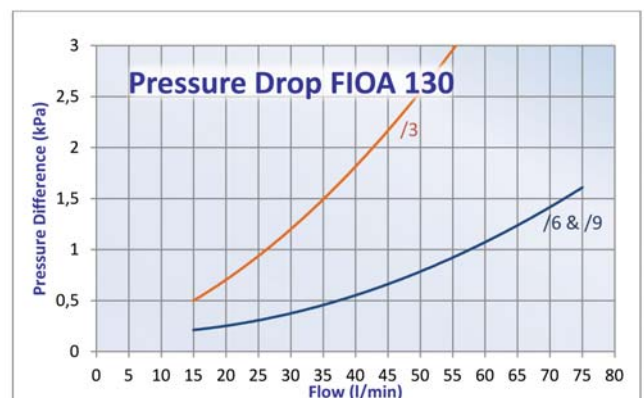
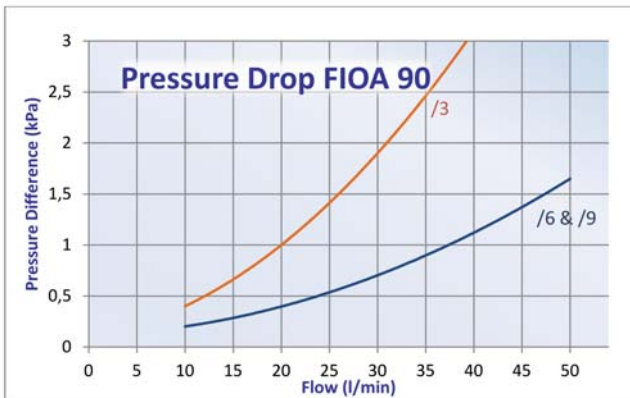
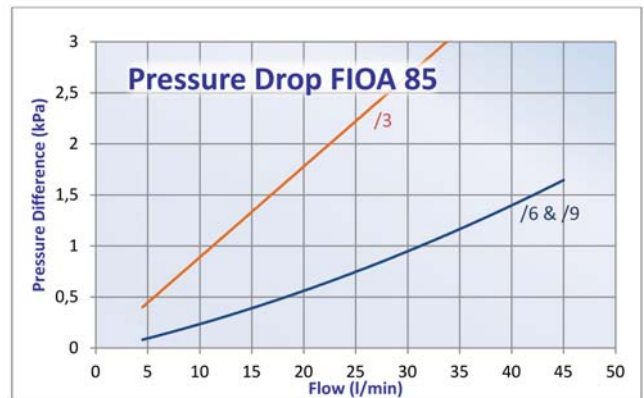
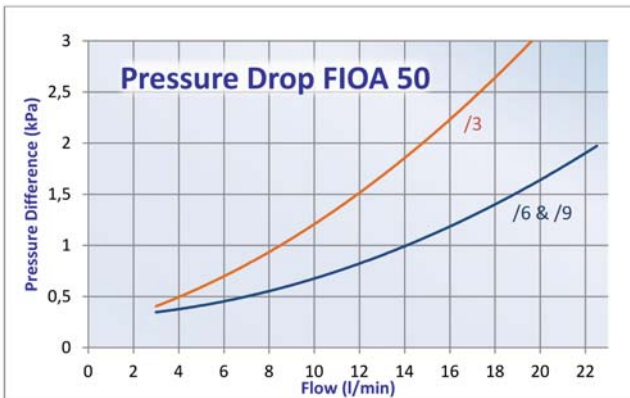
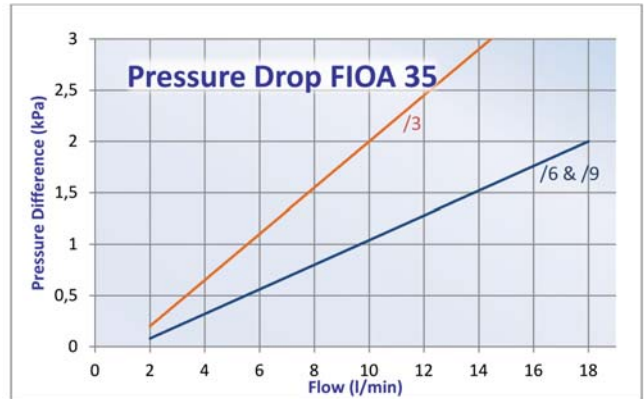
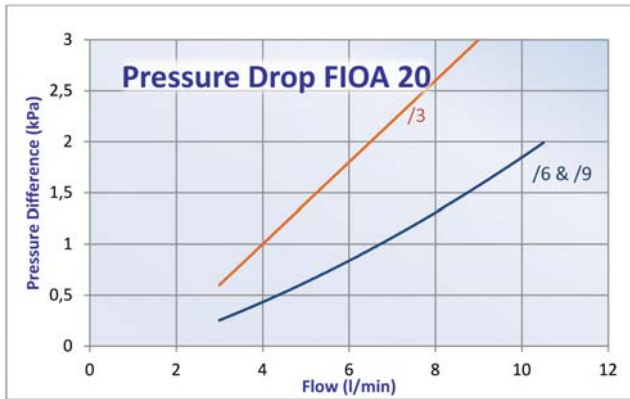


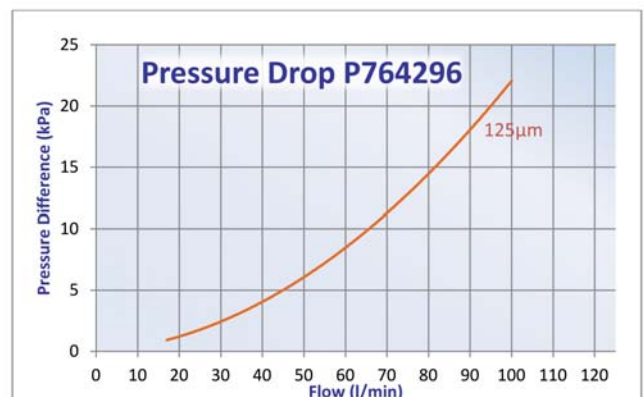
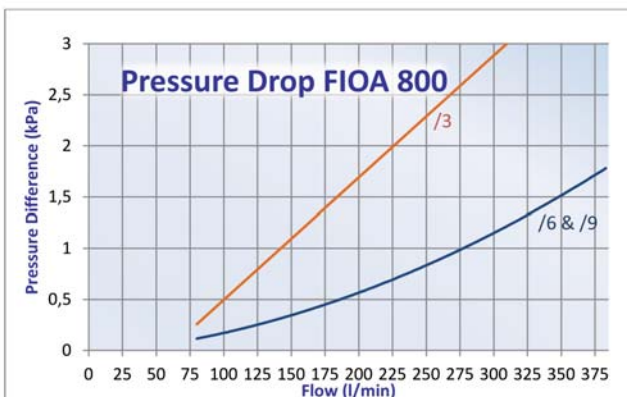
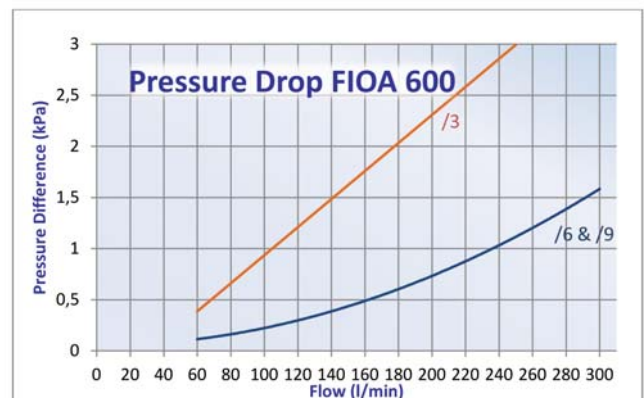
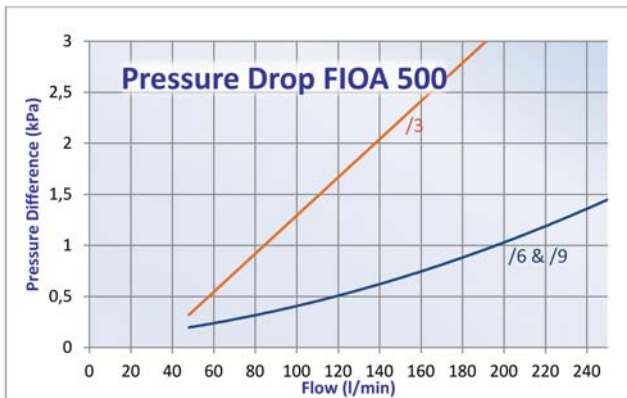
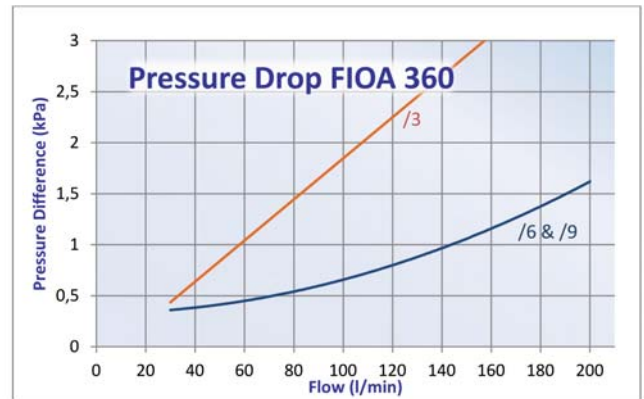
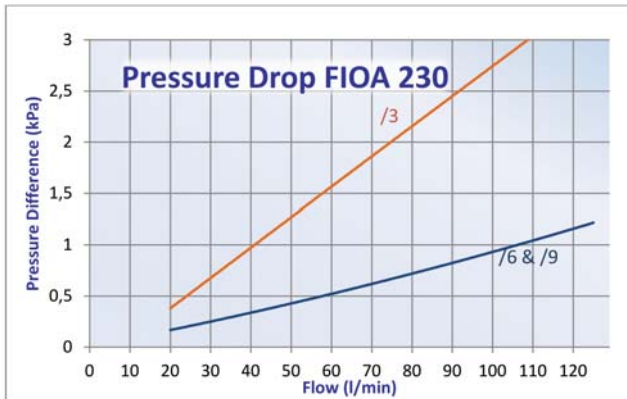
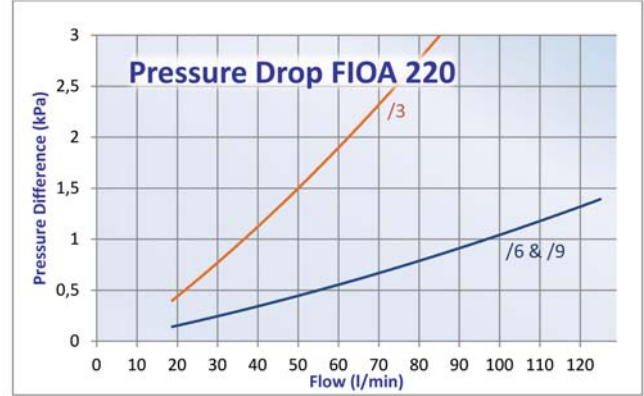
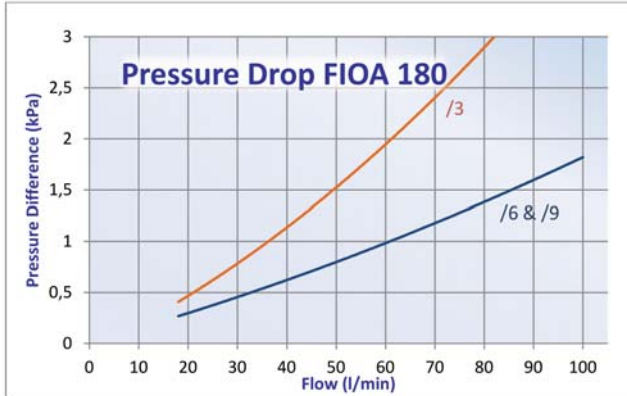
Important

- 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.

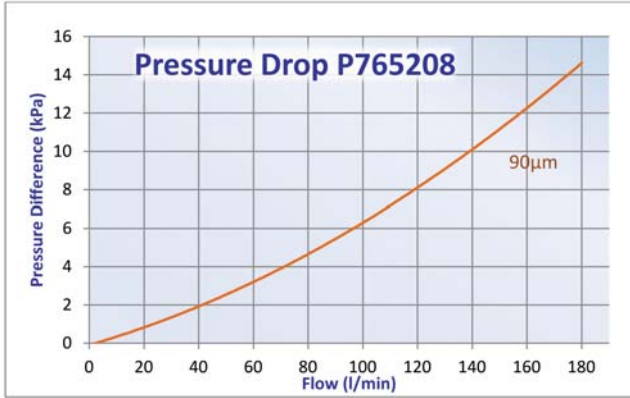
Performance Curves

SUCTION FILTERS
IN-TANK





SUCTION FILTERS
IN-TANK



SUCTION FILTERS
IN-TANK

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/dm³.

Filter Elements

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



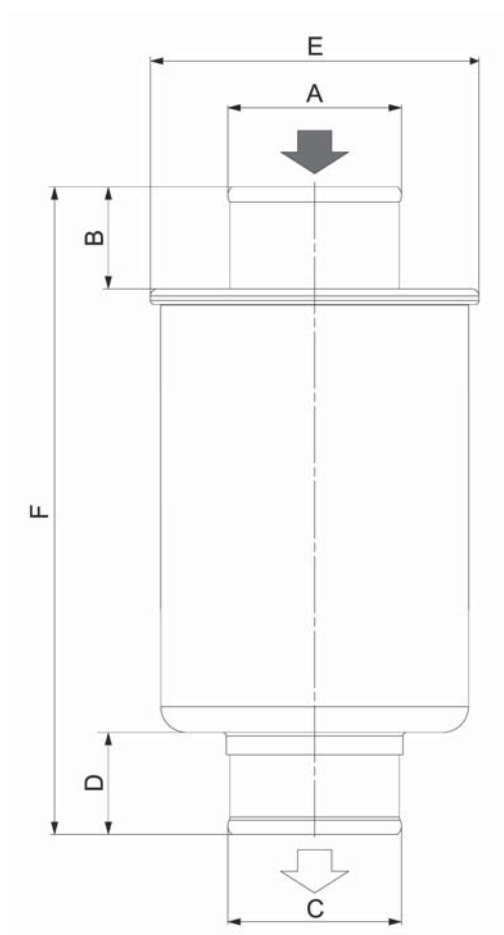
Components

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

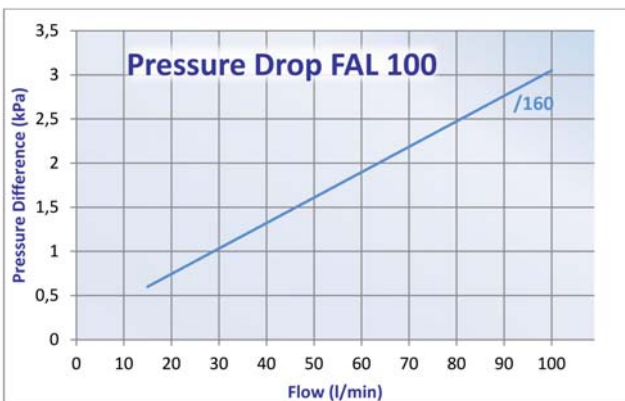
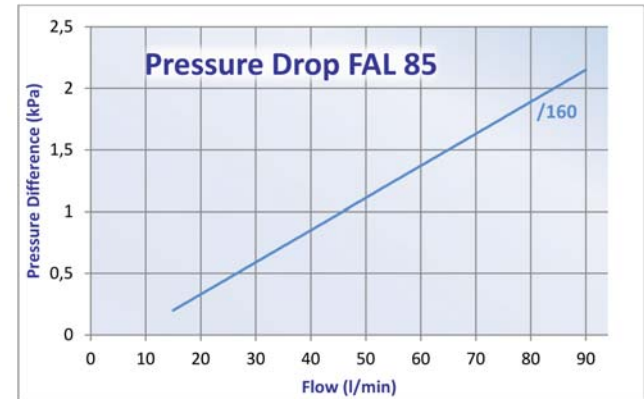
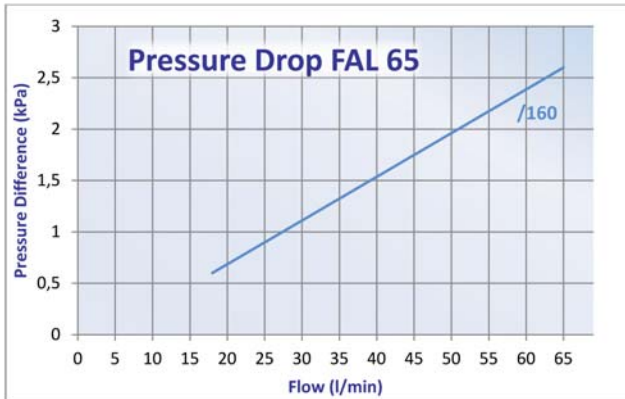
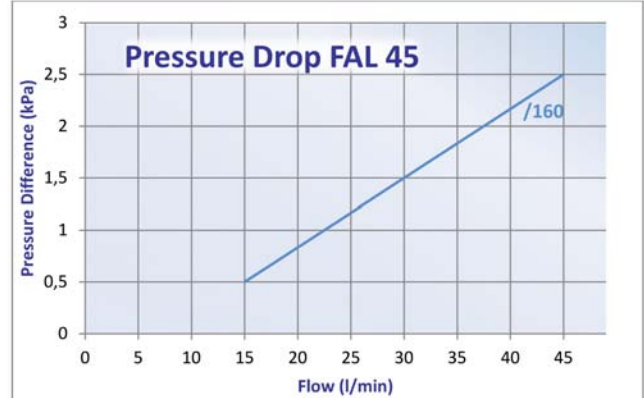
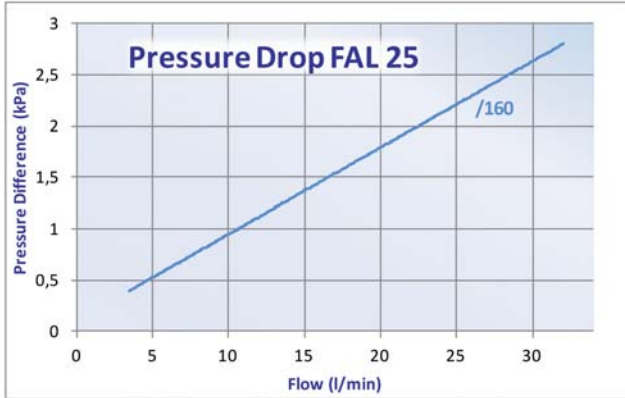
FILTER DIMENSIONS					
A	B	C	D	E	F
mm	mm	mm	mm	mm	mm
19	26	19	20	74	149
30	23	30	18	74	145
38	23	38	18	74	145
38	23	38	20	74	208
50	22	50	22	85	181

RMF = Recommended Maximum Flow in liters/minute

SUCTION FILTERS
IN-LINE



Performance Curves





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.

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.



Components

Family	WIRE MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/9		/6		/3		/1		/03		XP10		
	90µm		60µm		$\beta_{50\mu m(c)} \geq 1000$		$\beta_{36\mu m(c)} \geq 1000$		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		
	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
FLA 250 SAE Flange	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
FLA 330 SAE Flange	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
FLA 500 SAE Flange	250	P171566	250	P171571	200	P171570	200	P171569	170	P171568	170	P171567	CR500
FLA 800 SAE Flange	300	P171578	300	P171583	250	P171582	250	P171581	200	P171580	200	P171579	CR800

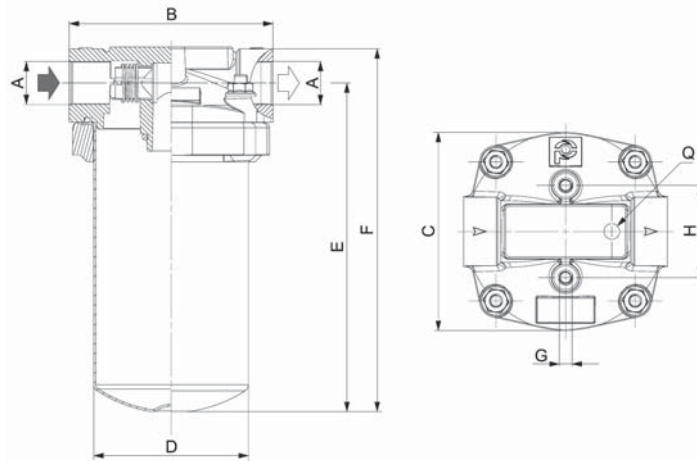
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.

All housings are predrilled and holes are plugged, you are not obliged to install an indicator.

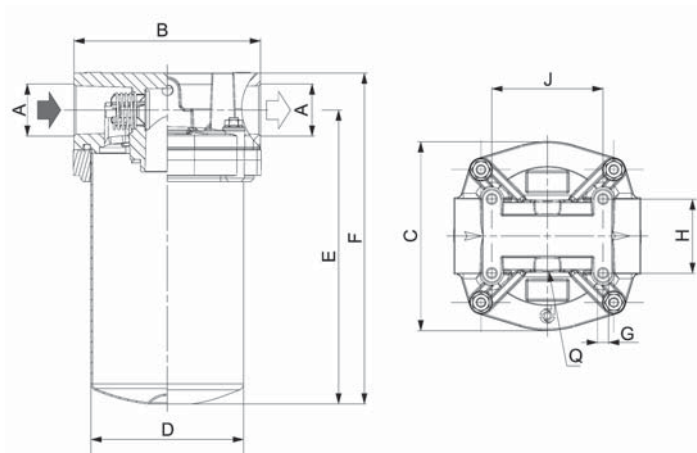
The Bypass valve is installed in the head of the filter. The Cartridges have also a Bypass valve, but at a higher setpoint.

SUCTION FILTERS
IN-LINE

FLA 50-180

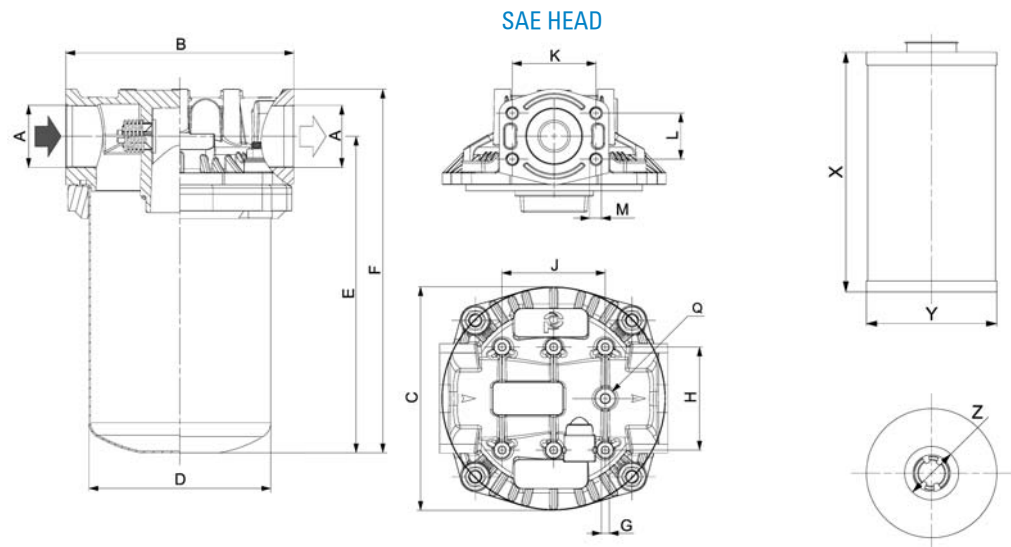


FLA 200



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	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 SAE 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 SAE 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 SAE 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 SAE 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 330-800



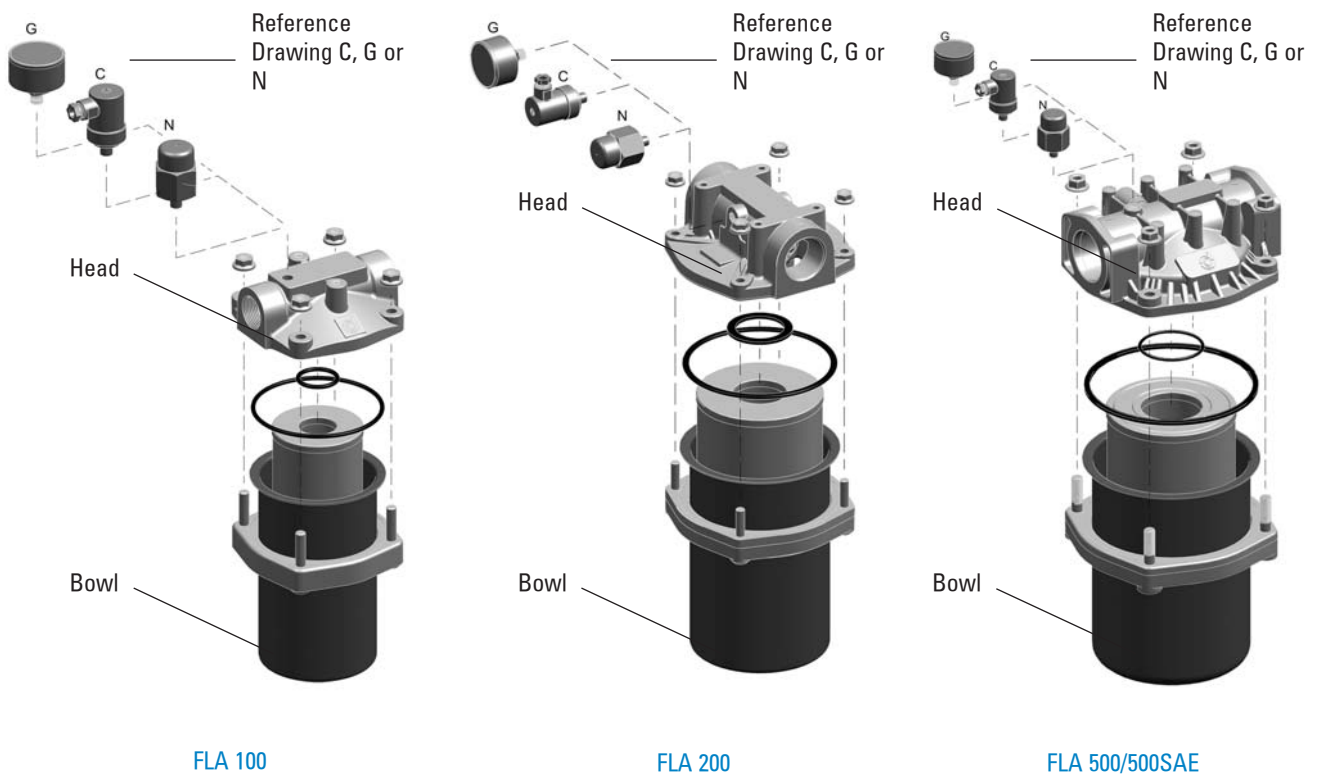
SUCTION FILTERS
IN-LINE

Indicator Choices

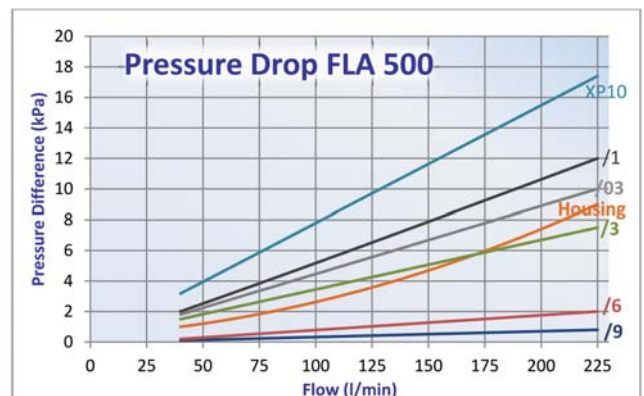
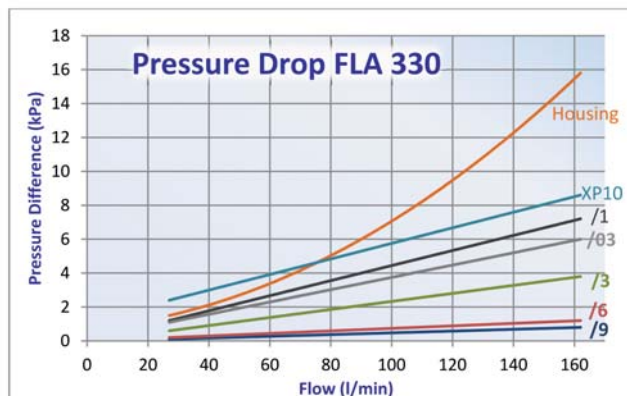
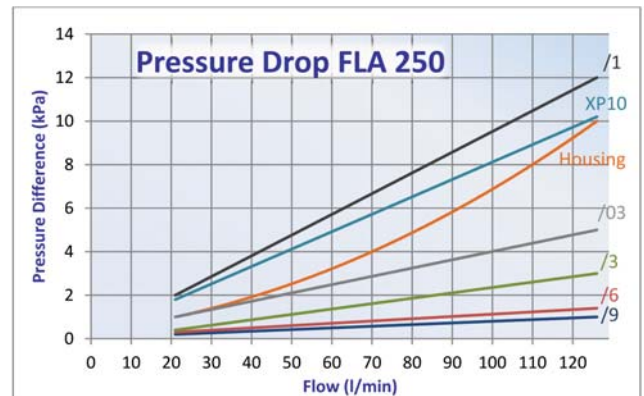
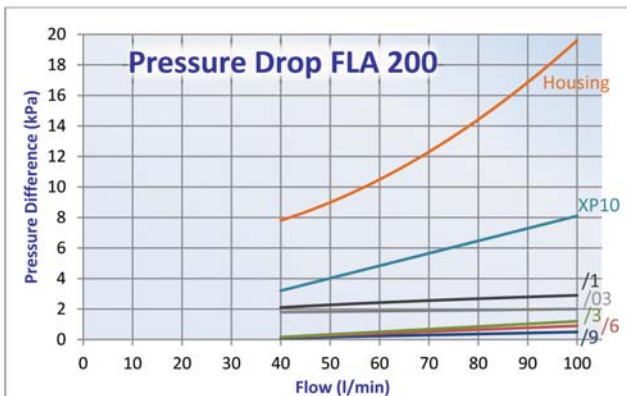
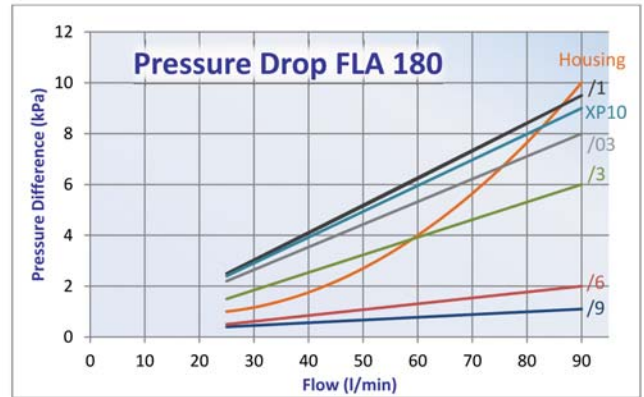
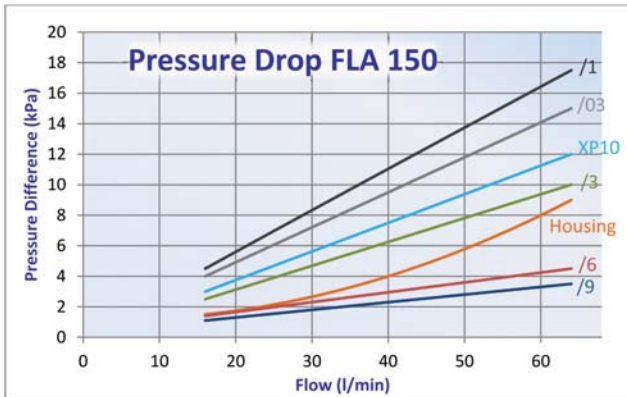
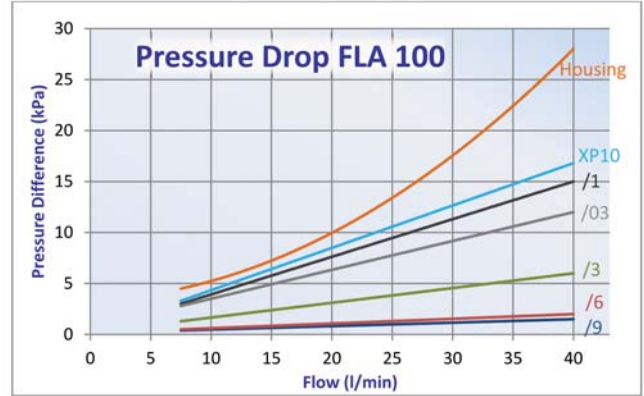
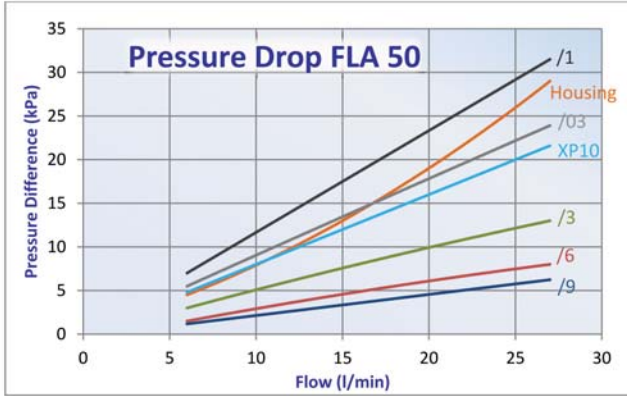
Part	Kind		Reference Drawing	Setting (bar)	Contact	Protection Class	Cable Clamp	Max. Values
P171954	Visual	Vacuum	G	-0,3				
P171959	Visual	Vacuum	N	-0,3				
P171967	Electrical	Vacuum	C	-0,3	Normally Open	IP65	PG7	48 VAC - 30 VDC; 0,5 A res. and 0,2 A ind.
P173105	Electrical	Vacuum	C	-0,3	Normally Closed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

SUCTION FILTERS
IN-LINE

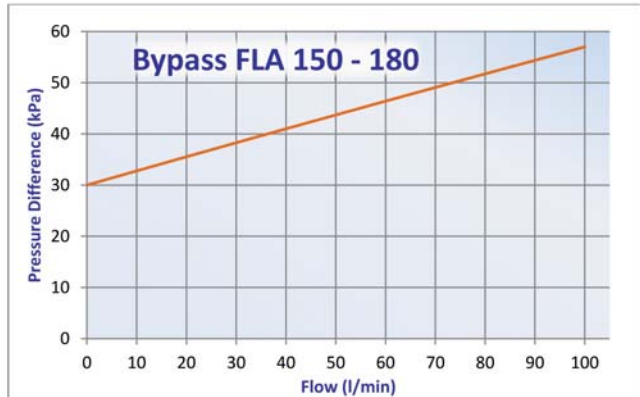
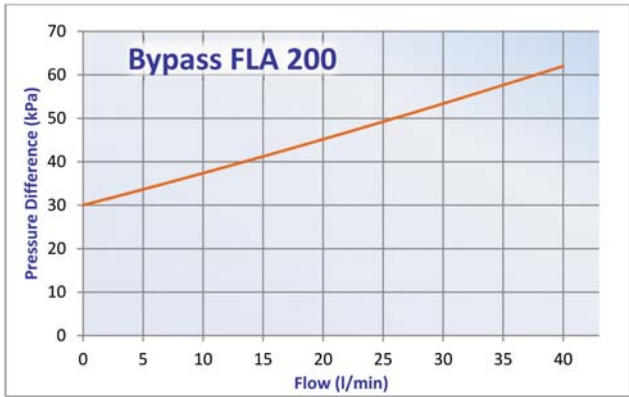
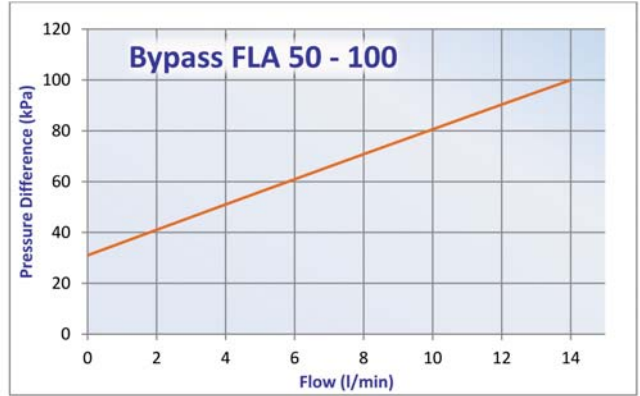
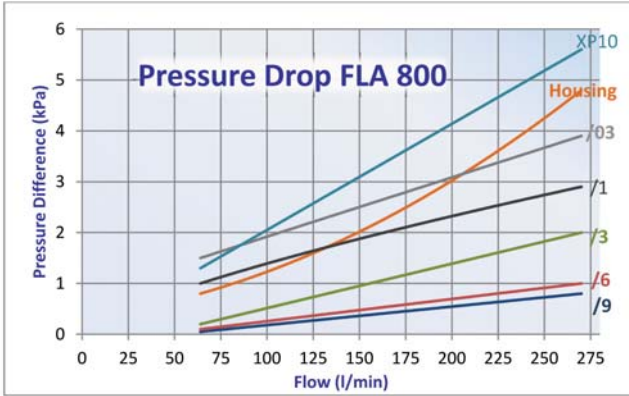
Installation & Service Guidelines



Performance Curves



SUCTION FILTERS
IN-LINE



SUCTION FILTERS
IN-LINE



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.



Components

	WIRE MESH MEDIA		CELLULOSE MEDIA				SYNTHETIC MEDIA				CARTRIDGE CODE
	/6		/3		/1		/03		XP10		
	60µm		$\beta_{50\mu m} \geq 1000$		$\beta_{36\mu m} \geq 1000$		$\beta_{23\mu m} \geq 1000$		$\beta_{11\mu m} \geq 1000$		
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

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 P173108	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 P173108	G3/4	M8
FACA 160/200	P761259	G1 1/4	0,3 bar	plugged	left + right	P171954, P171959, P171967 or P173108	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 P173108	G1 1/4	M8
	P173403	G1 1/4	no opening	plugged	left + right	P171954, P171959, P171967 or P173108	G1 1/4	M8
FACA 220/250	P764420	G1 1/4	0,3 bar	plugged	right	P171954, P171959, P171967 or P173108	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 P173108	1 1/2-16 UN	M8
FACA 380/400	P761260	G1 1/2	0,3 bar	plugged	front	P171954, P171959, P171967 or P173108	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.

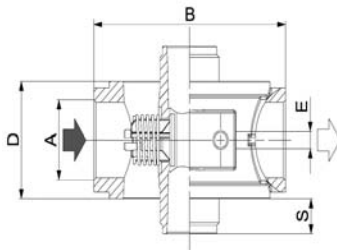
* Standard Head

SUCTION FILTERS IN-LINE

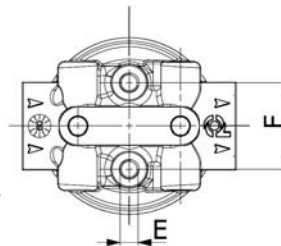


Standard Head	HEAD DIMENSIONS									SPIN-ON DIMENSIONS		
	A	B	C	D	E	F	G	S	BPV	X	Y	Z
		mm	mm	mm		mm	mm	mm	bar	mm	mm	
P173442	G3/4	95	13	41,5	M8	38		20	0,3	146	96	G3/4
										209	96	G3/4
NA										183	108	M40x2
										230	108	M40x2
P173203	G1 1/4	132	28,5	61,5	M8	50		24	0,3	181	128	G1 1/4
										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

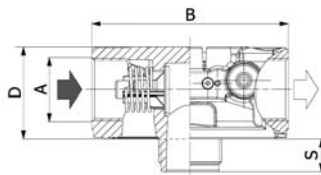


LEFT

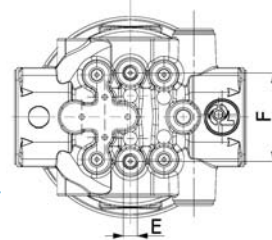


RIGHT

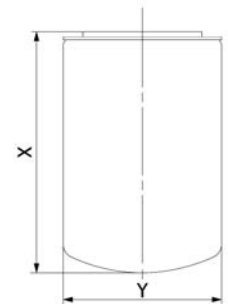
FACA 160/200



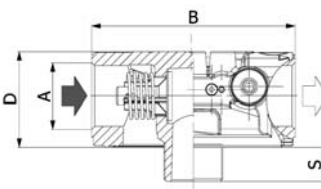
LEFT



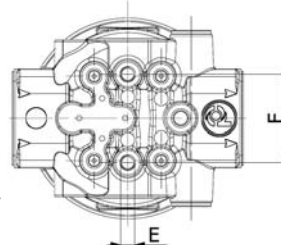
RIGHT



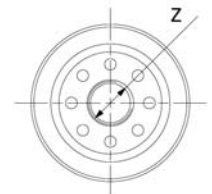
FACA 220/250



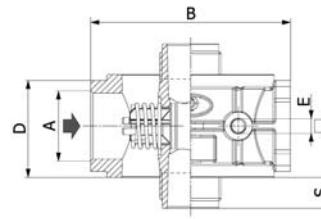
LEFT



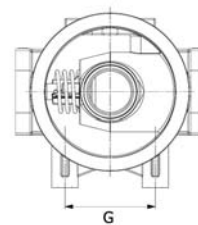
RIGHT



FACA 380/400



FRONT



SUCTION FILTERS
IN-LINE

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				

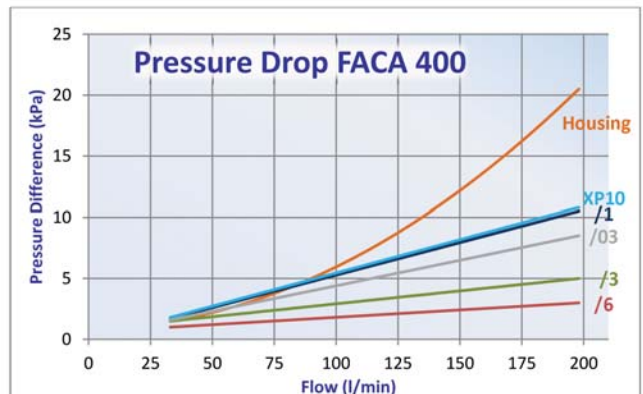
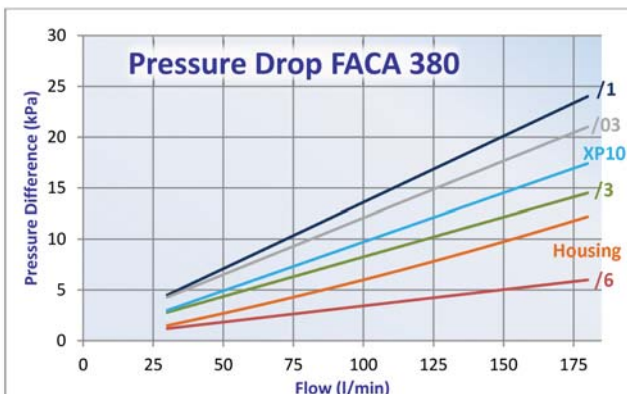
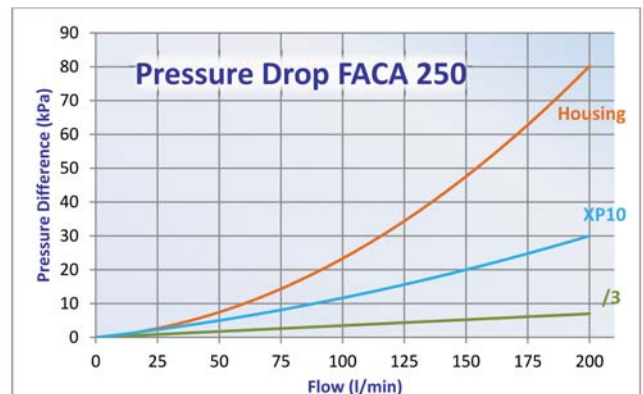
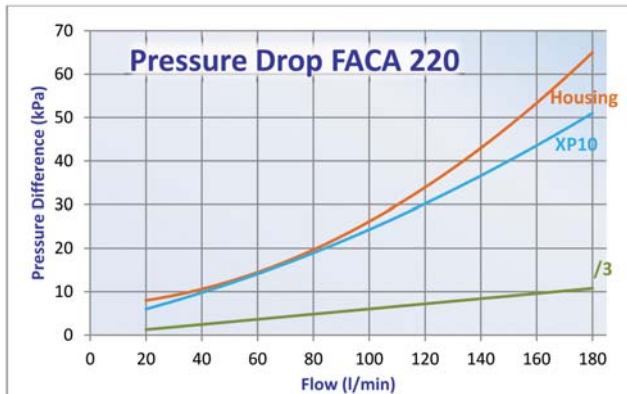
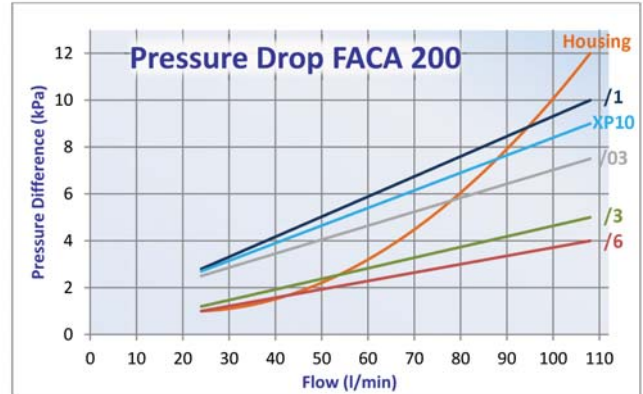
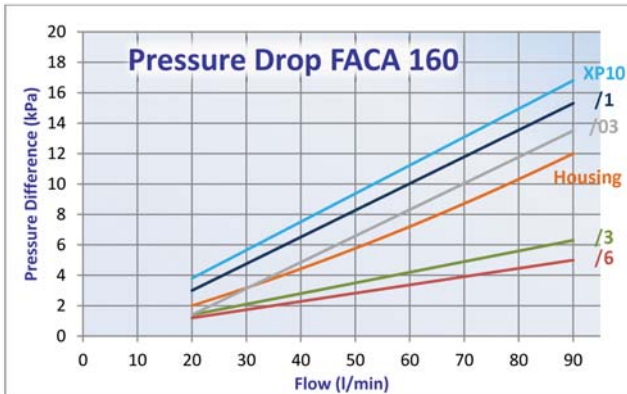
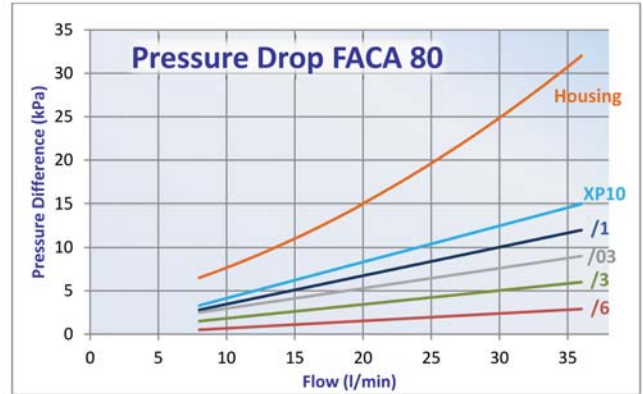
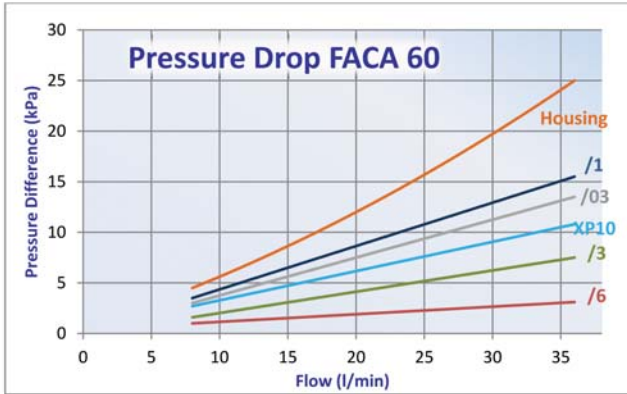
SUCTION FILTERS
IN-LINE

Installation & Service Guidelines

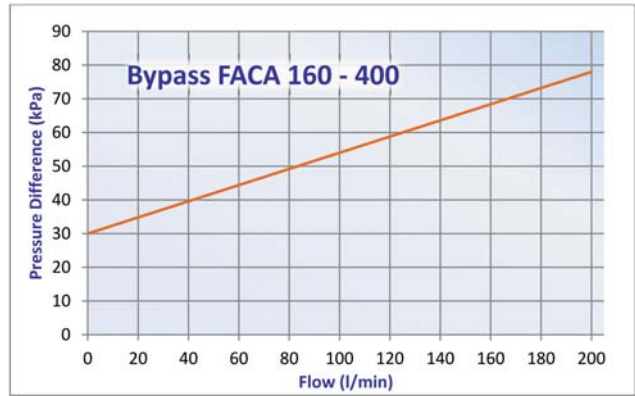
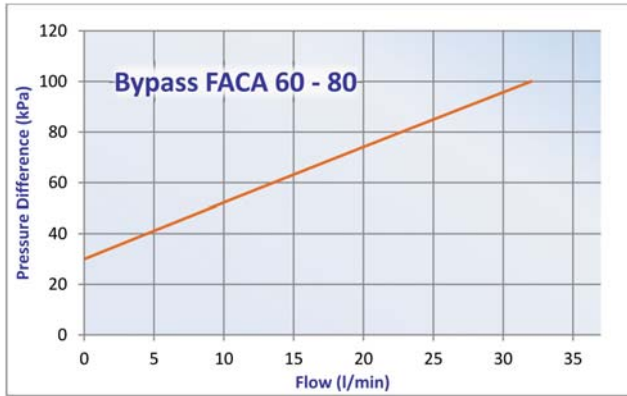
Important

- 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



SUCTION FILTERS
IN-LINE





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	Filter Elements
----------------	-----------------

- | | |
|--|---|
| <ul style="list-style-type: none"> • 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 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. | <ul style="list-style-type: none"> • 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. |
|--|---|

MEDIUM PRESSURE FILTERS

Components



	WIRE MESH MEDIA				CELLULOSE MEDIA		SYNTHETIC MEDIA						CARTRIDGE CODE
	/6		/3M		/1		/03		XP10		XP5		
	60µm		30µm		$\beta_{36\mu m(c)} \geq 1000$		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		$\beta_{8\mu m(c)} \geq 1000$		
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

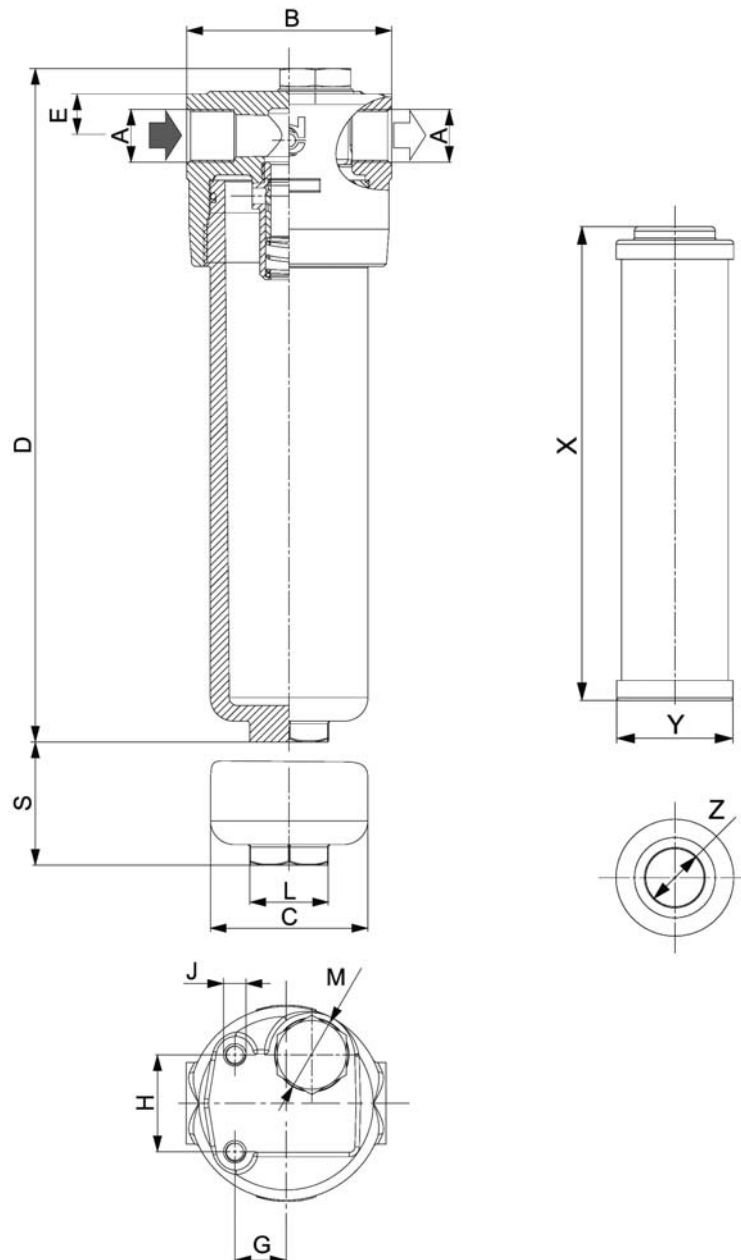
RMF = Recommended Maximum Flow in liters/minute with use of standard housing.

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.	

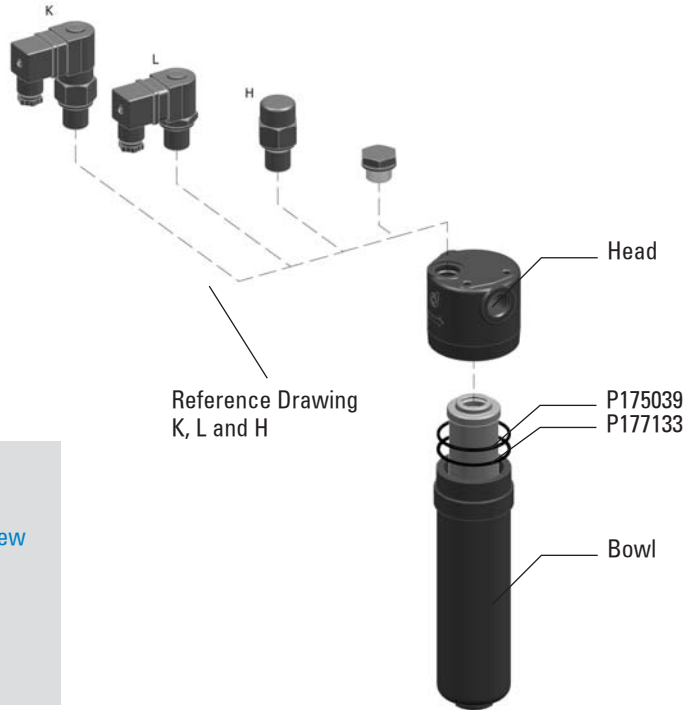


Standard Housing	HOUSING DIMENSIONS													CARTRIDGE DIMENSIONS			POSSIBLE INDICATORS
	A	B	C	D	E	G	H	J	L	S	BPV	M	N	X	Y	Z	
		mm	mm	mm	mm	mm	mm		mm	mm	bar	predrilled holes	plugged	mm	mm	mm	
P766661	G1/2	78	60	172	17	20	38	M8x1,25	Hex27	30	6	G1/2	YES	90	43	22,2	P171945, P171947, P171944, P761056
P766660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



MEDIUM PRESSURE
FILTERS

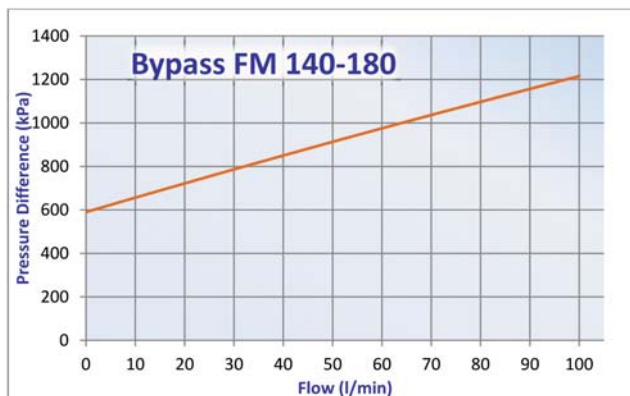
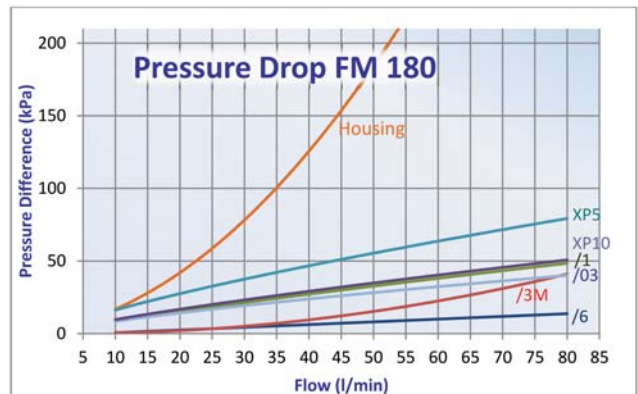
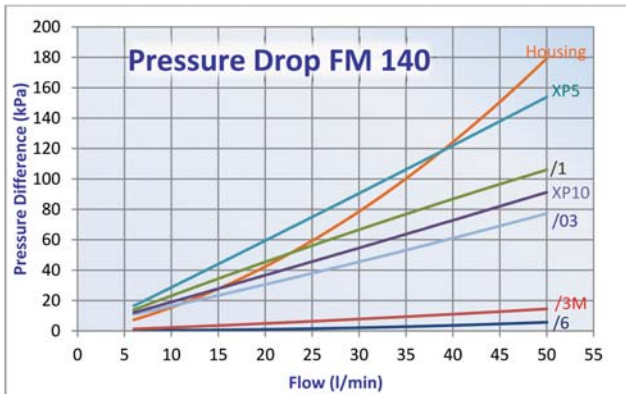
Installation & Service Guidelines



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





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.



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

MEDIUM PRESSURE FILTERS



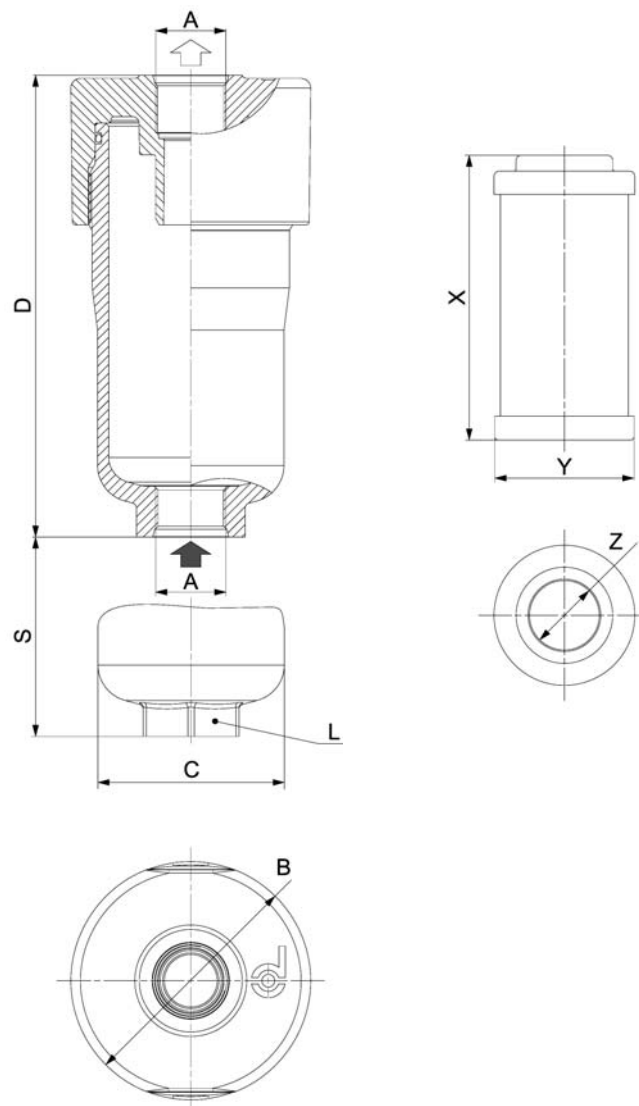
Important

- 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.

HOUSING DIMENSIONS					
A	B	C	D	L	S
	mm	mm	mm	mm	mm
M22x1,5	75	58	145	HEX30	100

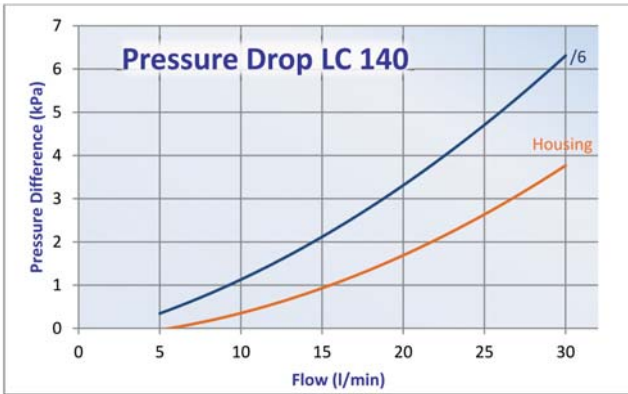
CARTRIDGE DIMENSIONS		
X	Y	Z
mm	mm	mm
44	91	23

POSSIBLE INDICATOR
none



MEDIUM PRESSURE
FILTERS

Performance Curves



MEDIUM PRESSURE
FILTERS



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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.



Components

Family	CELLULOSE MEDIA		SYNTHETIC MEDIA						CARTRIDGE CODE		
	#10		#20		#7		XP10			XP5	
	$\beta_{23\mu(m)} \geq 1000$		$\beta_{50\mu(m)} \geq 1000$		$\beta_{33\mu(m)} \geq 1000$		$\beta_{11\mu(m)} \geq 1000$			$\beta_{7\mu(m)} \geq 1000$	
	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



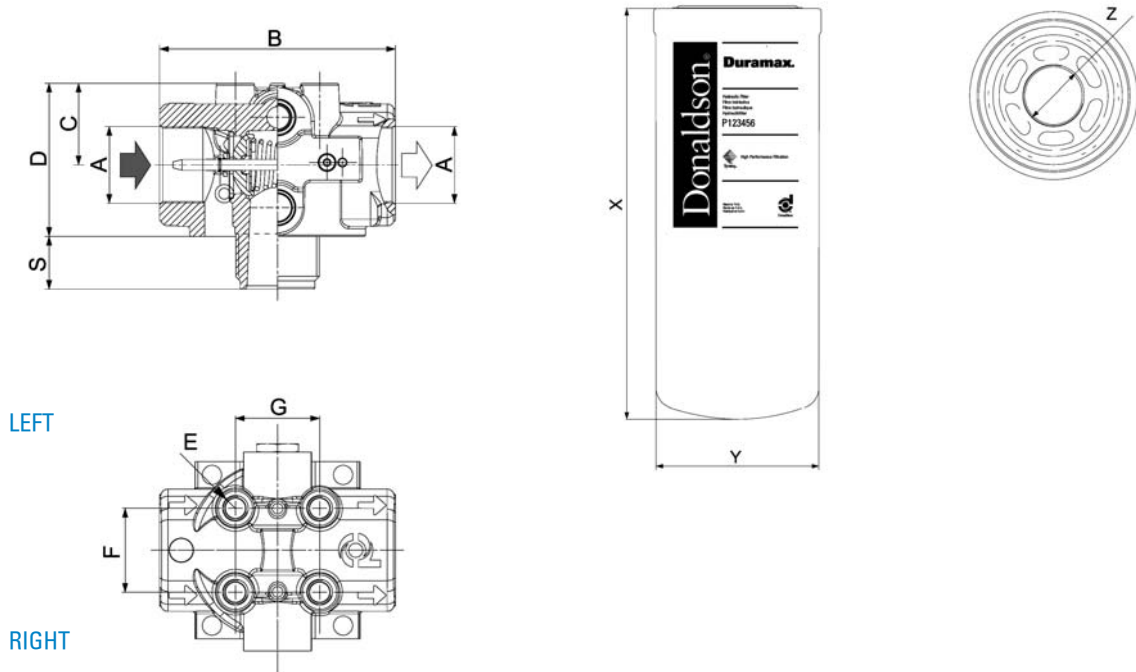
Head for Family	Head	Ports	Bypass Valve Setting	Indicator Info				Snout	Mounting holes
				Drilled holes for indicator	Indicator hole plugged	Side	Indicator to use		
HMK04	P167473	1 1/16-12 UN	1,7 bar	no	-	-	none	1 3/8-12 UNF	3/8-16 UNC
	P173918	1 1/16-12 UN	3,5 bar	plugged	yes	left	P165194, P167455, 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

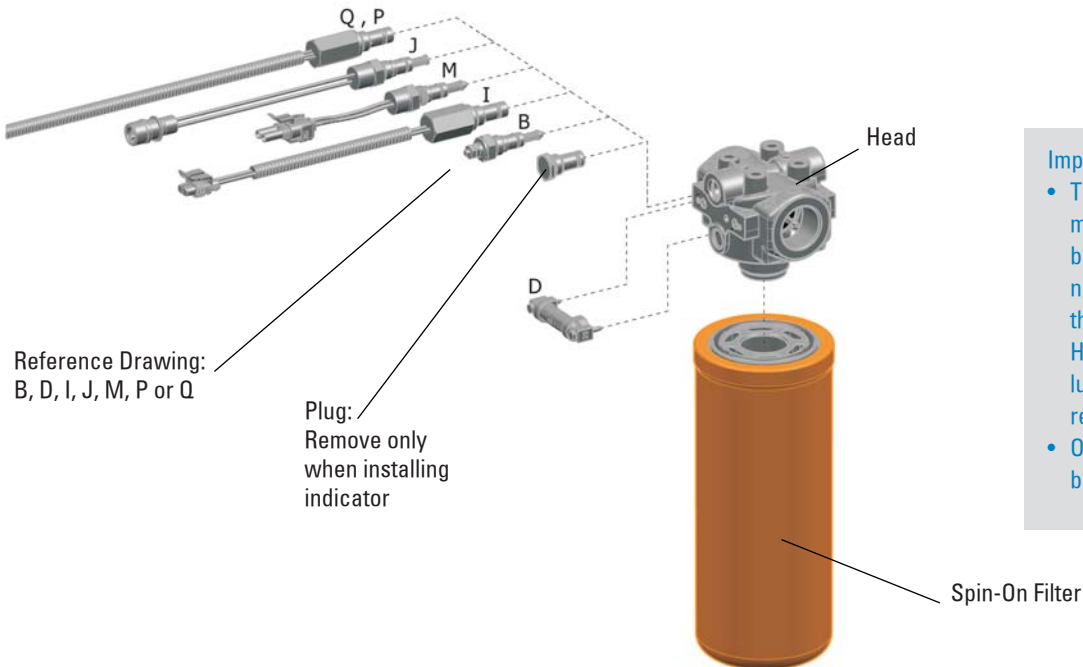


MEDIUM PRESSURE FILTERS

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

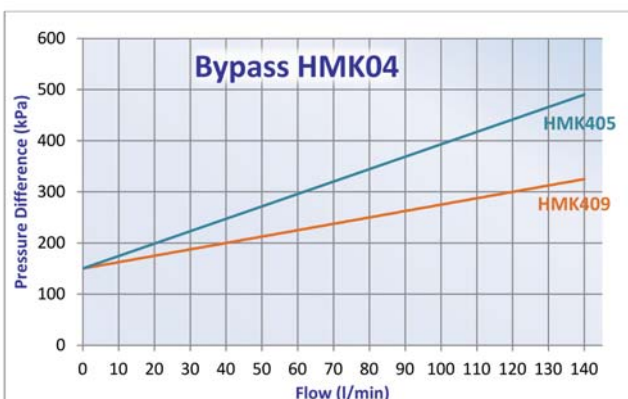
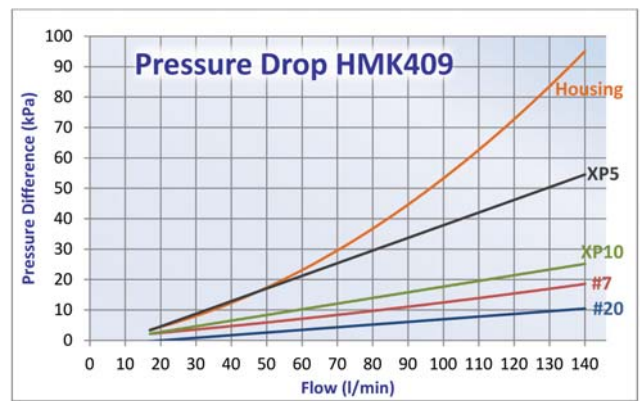
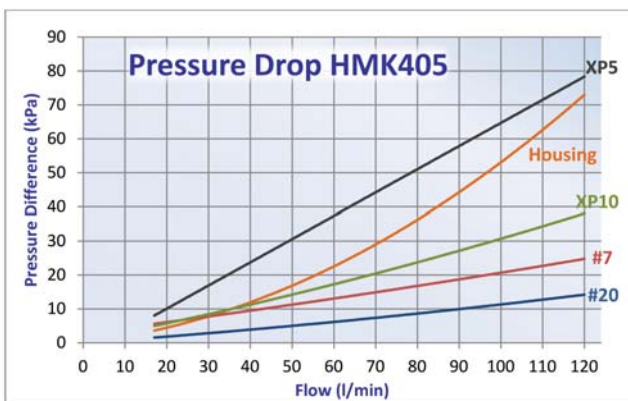
Installation & Service Guidelines



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





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.



Components

	CELLULOSE MEDIA		SYNTHETIC MEDIA								CARTRIDGE CODE
	#10		#20		#7		XP10		XP5		
	$\beta_{23\mu\text{m(c)}} \geq 1000$		$\beta_{50\mu\text{m(c)}} \geq 1000$		$\beta_{33\mu\text{m(c)}} \geq 1000$		$\beta_{11\mu\text{m(c)}} \geq 1000$		$\beta_{7\mu\text{m(c)}} \geq 1000$		
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	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

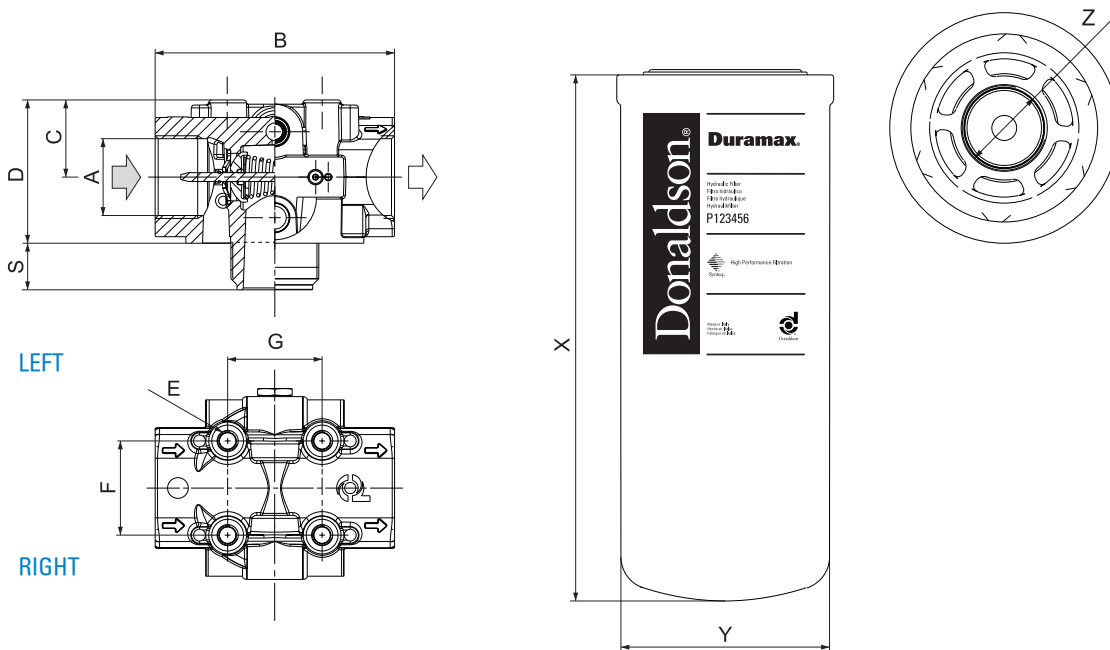
HMK 05 – Duramax Filters aren't delivered with drilled holes for indicators or bypass valve, heads are.

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

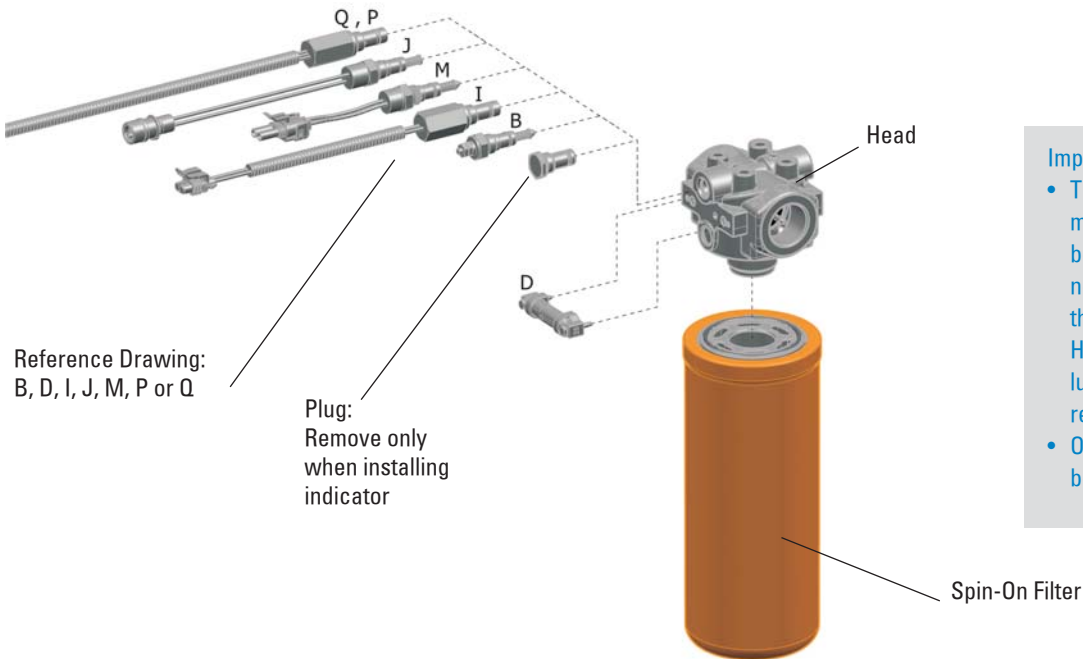


MEDIUM PRESSURE FILTERS

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

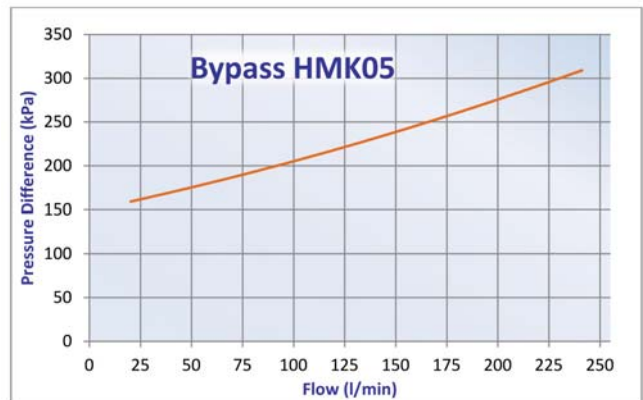
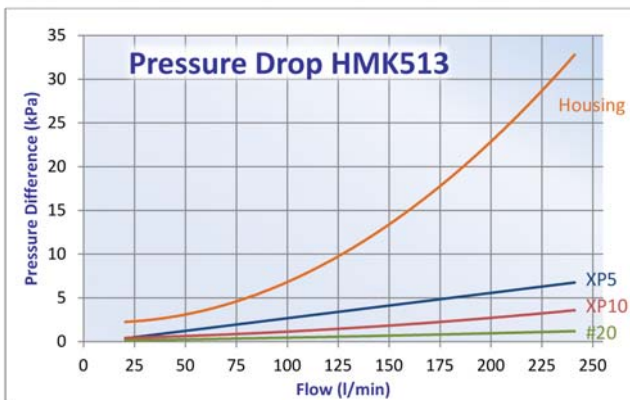
Installation & Service Guidelines



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





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.



Components

		SYNTHETIC MEDIA								CARTRIDGE CODE
		/03		XP10		XP5		/00		
		$\beta_{23\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		$\beta_{9\mu m(c)} \geq 1000$		$\beta_{9\mu m(c)} \geq 1000$		
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.

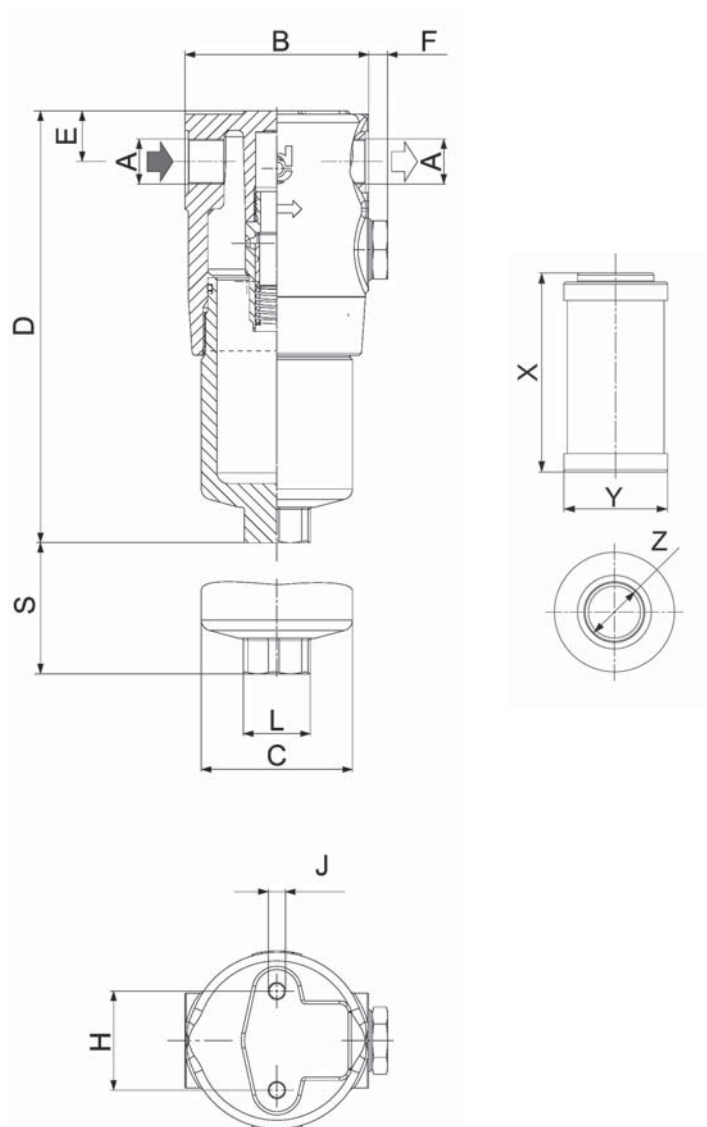
Indicator Choices

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.	

HIGH PRESSURE FILTERS

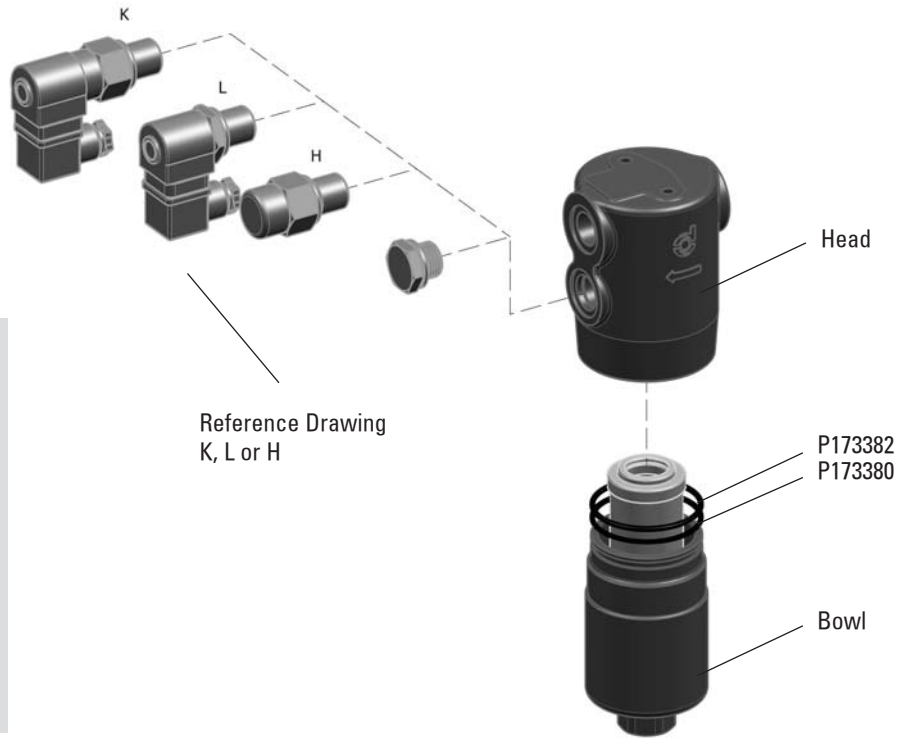


Standard Housing	HOUSING DIMENSIONS													CARTRIDGE DIMENSIONS			POSSIBLE INDICATOR
	A	B	C	D	E	F	H	J	L	M	N	S	BPV	X	Y	Z	
		mm	mm	mm	mm	mm	mm		mm	predrilled holes	plugged	mm	bar	mm	mm	mm	
P766377	G1/2	85	70	197	23	9	46	M8	Hex30	G1/2	yes	40	6	87	46	25,4	P171945 P171947 P171944 P761056
P766378	G1/2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



HIGH PRESSURE
FILTERS

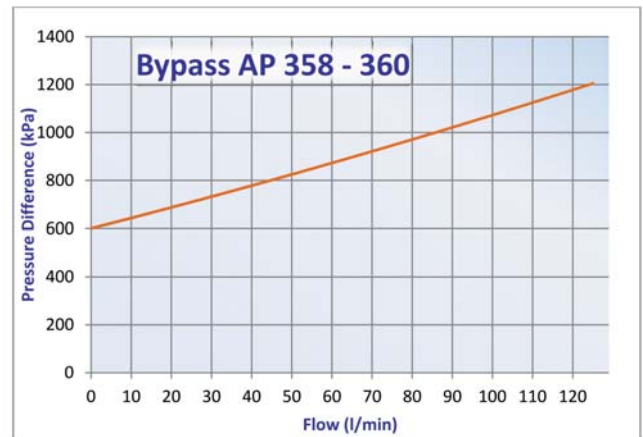
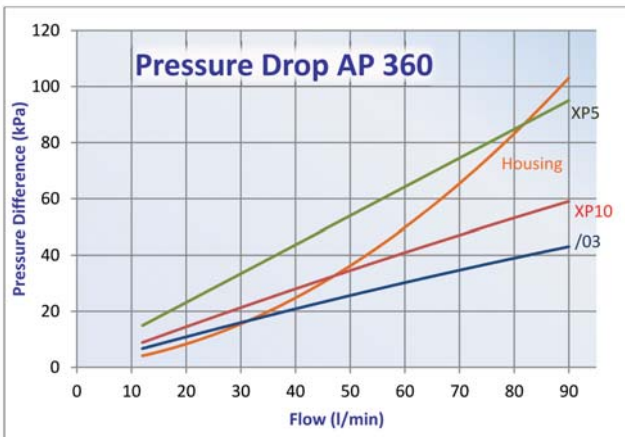
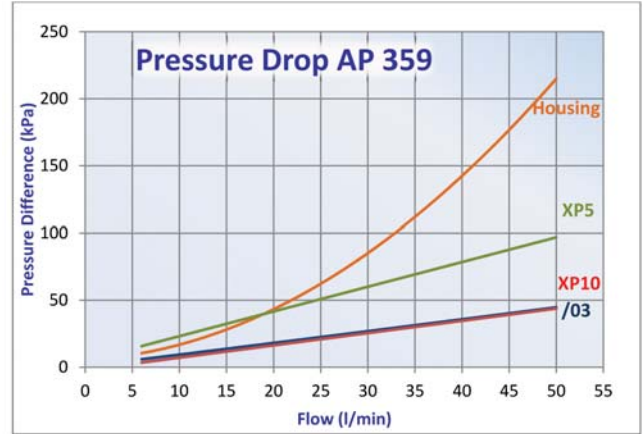
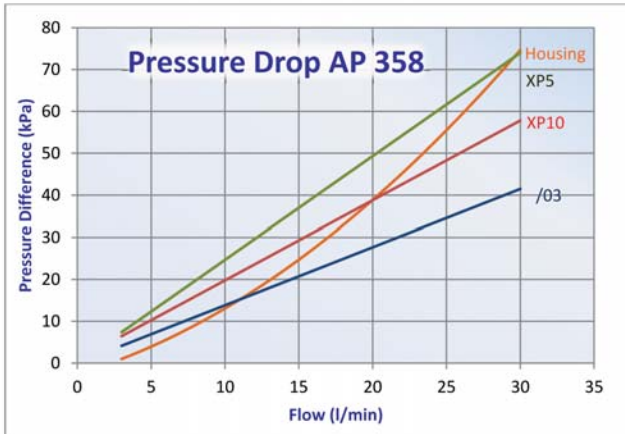
Installation & Service Guidelines



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





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) .
- Fatigue 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.

Components



		SYNTHETIC MEDIA						CARTRIDGE CODE
		/03		XP10		XP5		
		$\beta_{25\mu m(c)} \geq 1000$		$\beta_{11\mu m(c)} \geq 1000$		$\beta_{8\mu m(c)} \geq 1000$		
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		on request		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

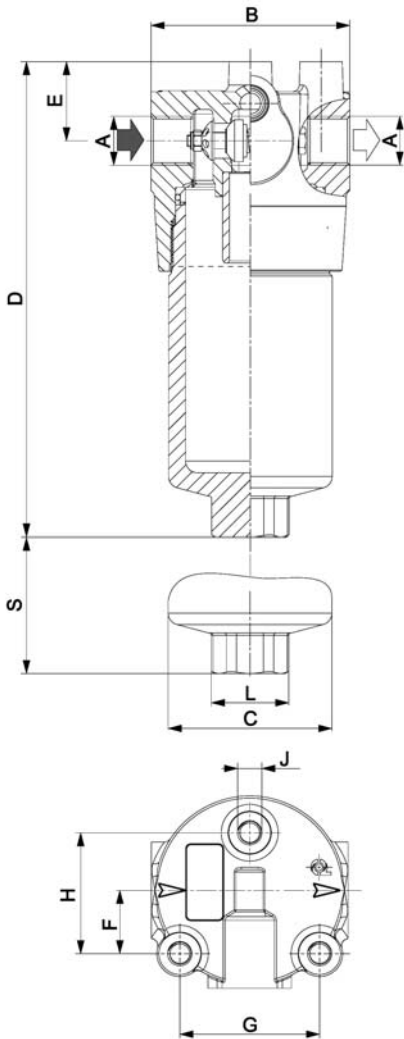


Family	Alternative Housing (see thread for indicator)	DIMENSIONS HOUSING													POSSIBLE INDICATOR	
		A	B	C	D	E	F	G	H	J	L	M	N	S		BPV
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	predilled holes	plugged	mm		bar
AP221	P766380	G1/2	85	70	200	34	27,5	60,5	52,5	M10	Hex30	9/16-18 UNF	yes	40	3,5	P763975 P763976 P171087
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	

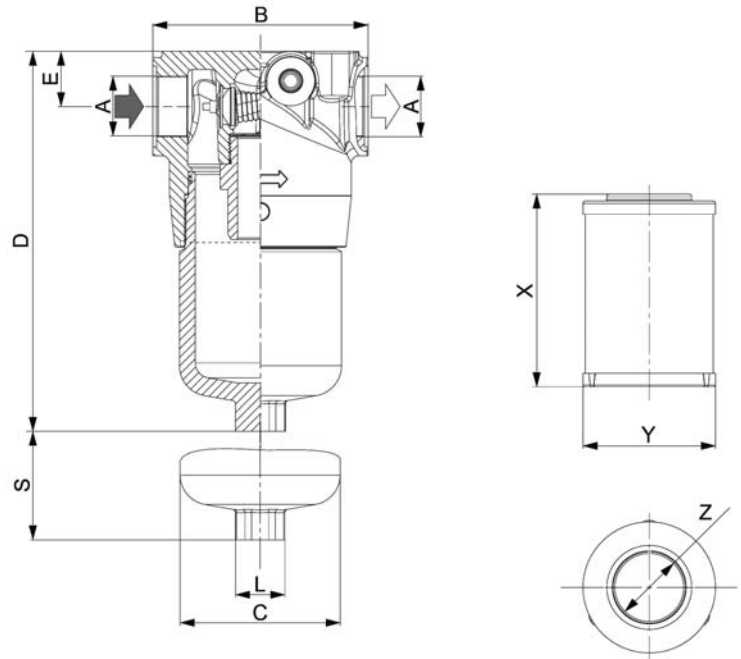
HIGH PRESSURE FILTERS



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	mm	predilled holes	plugged	mm	bar	mm	mm	mm	
P766385	G1/2	85	70	200	M10	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	M10	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	M12	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	M12	28,5	94	57	M12	Hex30	9/16-18 UNF	yes	47	6	208	78	43	
P766384	G1 1/2	140	105	467,5	M12	28,5	94	57	M12	Hex30	9/16-18 UNF	yes	47	6	330	78	43	



AP 221-222



AP 223-224-225

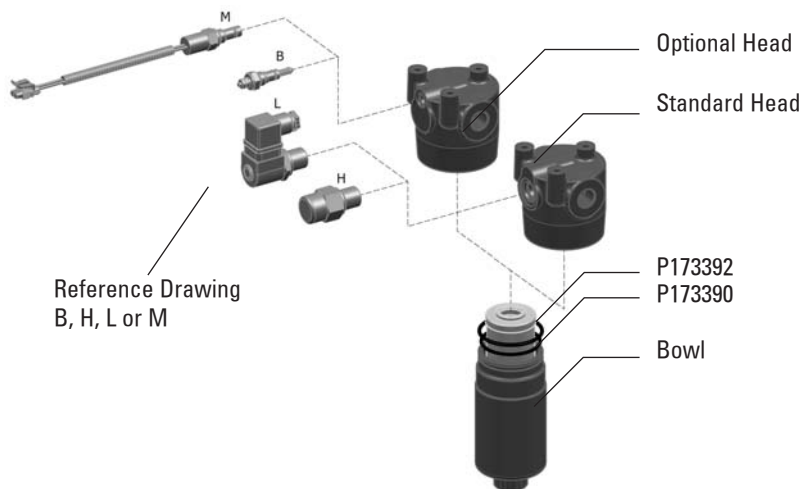
HIGH PRESSURE
FILTERS

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

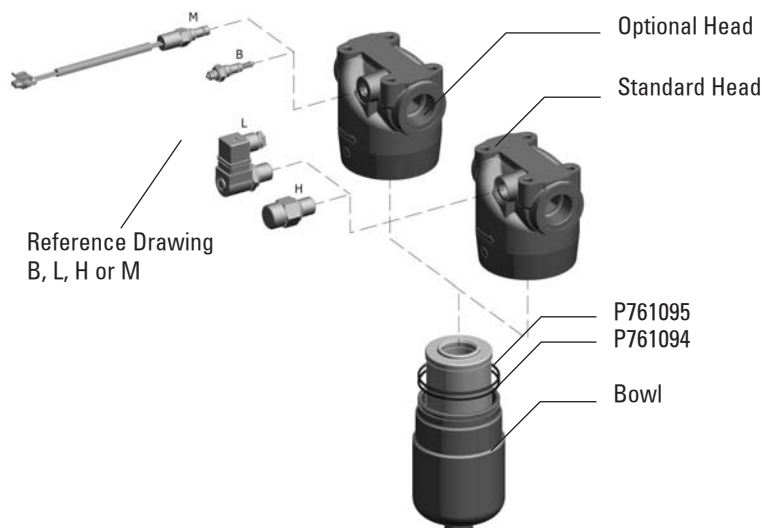
AP 221-222



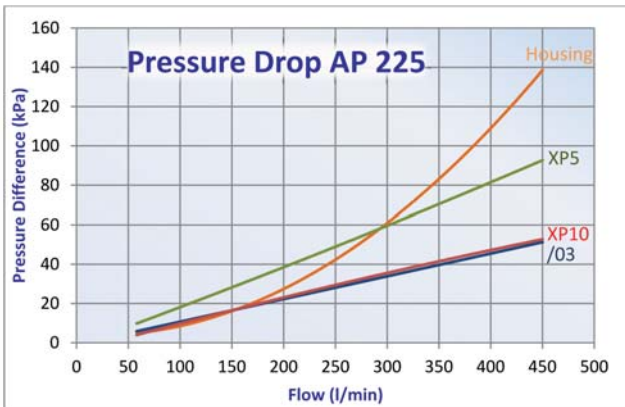
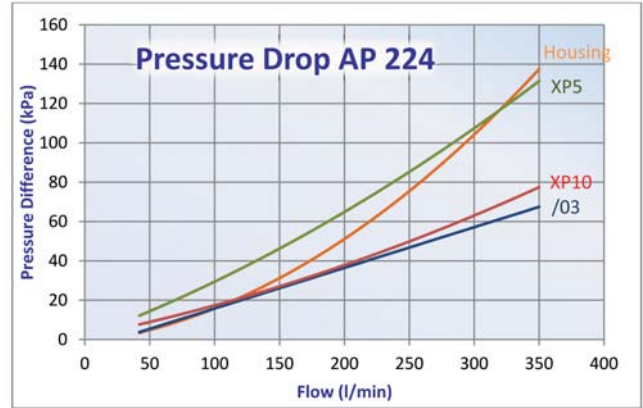
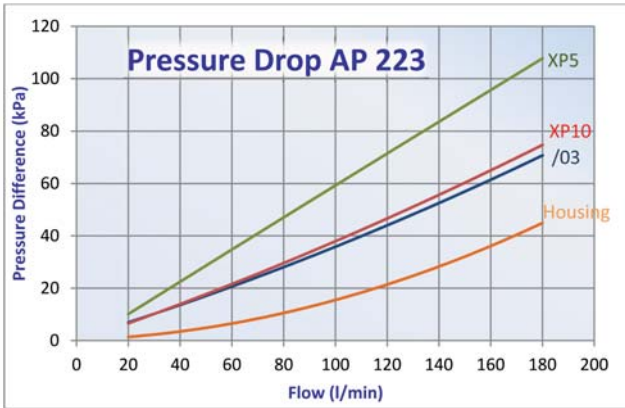
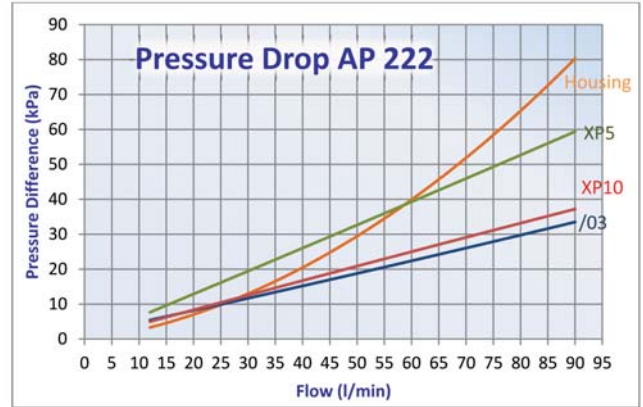
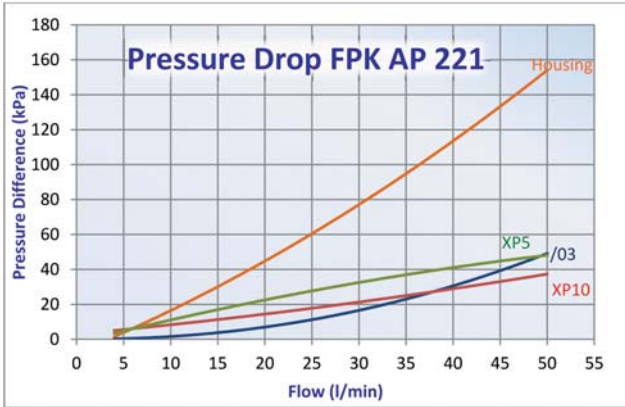
Important

- 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.

AP 223-224-225



Performance Curves





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.

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.



Components

		SYNTHETIC MEDIA						CARTRIDGE CODE
		/03		XP10		XP5		
		B _{23µlcl} ≥1000		B _{11µlcl} ≥1000		B _{8µlcl} ≥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

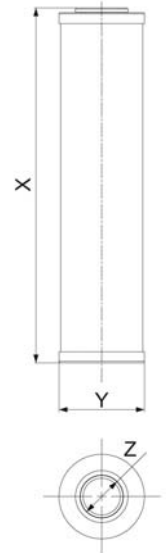
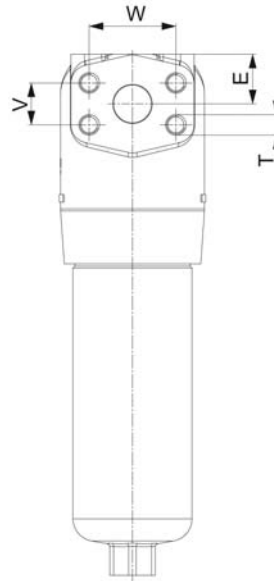
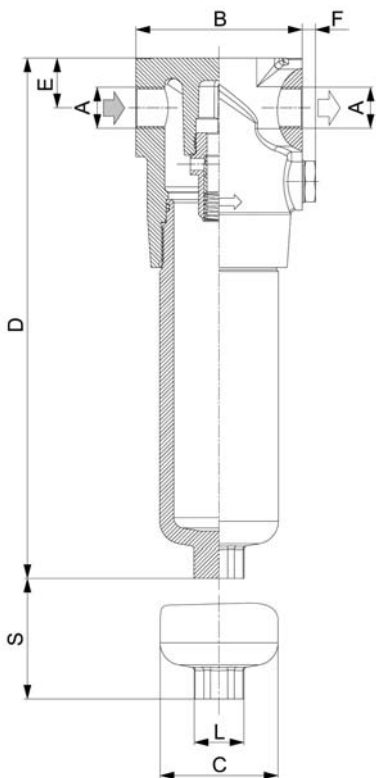
Alternative Housing Choices



Family	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
			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	
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	3/4 SAE 6000	110	78,5	246	33	9	50	57	M10	Hex 30	G1/2	yes	M10	23,8	50,8	165	6	no	
AP363	P766440	1 SAE 6000	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes	M12	27,76	57,15	270	6	no	
AP363	P766444	1 SAE 6000	110	78,5	345	33	9	50	57	M10	Hex 30	G1/2	yes	M12	27,76	57,15	270	6	yes	
AP364	P766441	1 1/4 SAE 6000	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes	M14	31,75	66,68	180	6	no	
AP364	P766445	1 1/4 SAE 6000	140	107	302	46	9	94	57	M12	Hex 30	G1/2	yes	M14	31,75	66,68	180	6	yes	
AP365	P766442	1 1/2 SAE 6000	140	107	395	46	9	94	57	M12	Hex 30	G1/2	yes	M16	36,5	79,38	280	6	no	
AP366	P766443	1 1/2 SAE 6000	140	107	542	46	9	94	57	M12	Hex 30	G1/2	yes	M16	36,5	79,38	420	6	no	

P171945
P171947
P171944
P761056

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	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	
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	

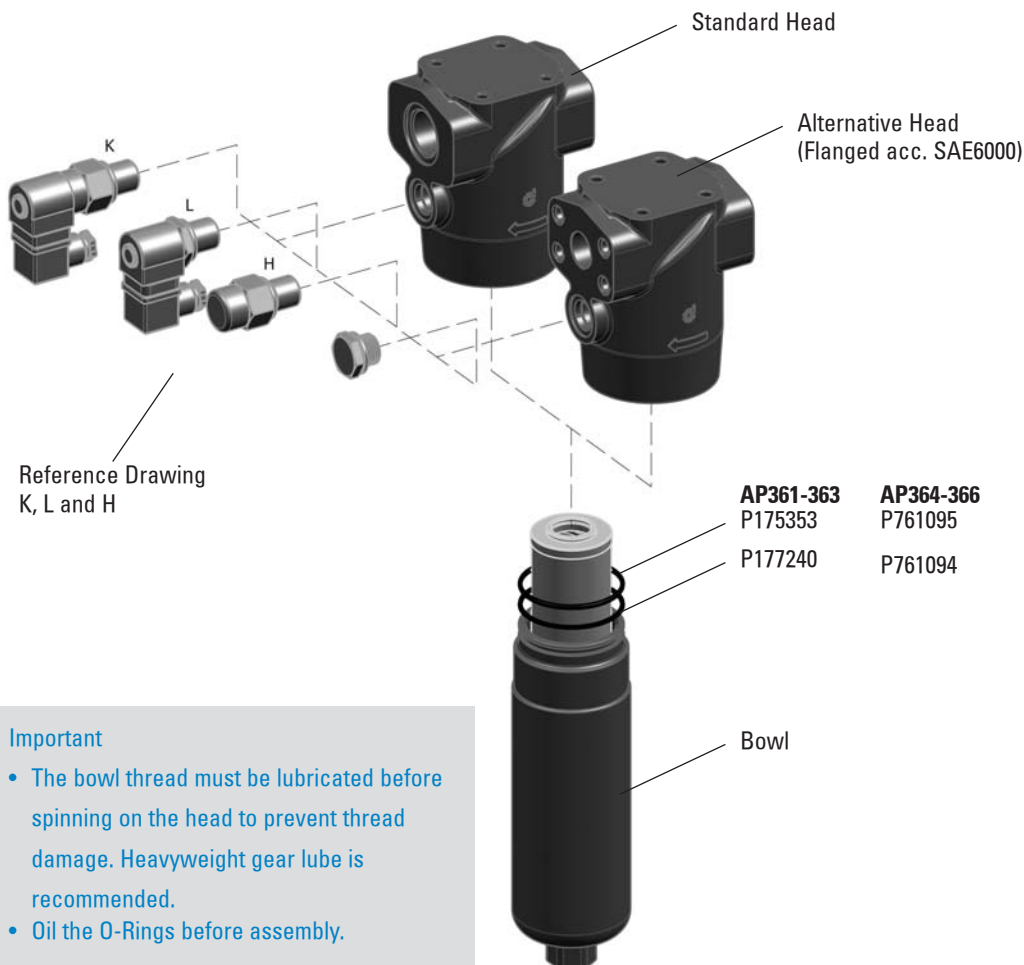


HIGH PRESSURE
FILTERS

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.	

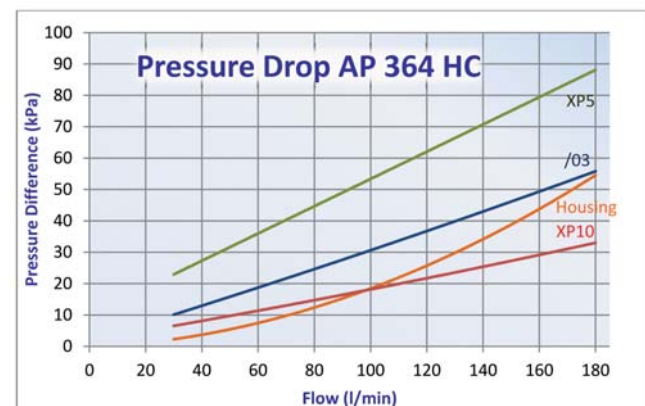
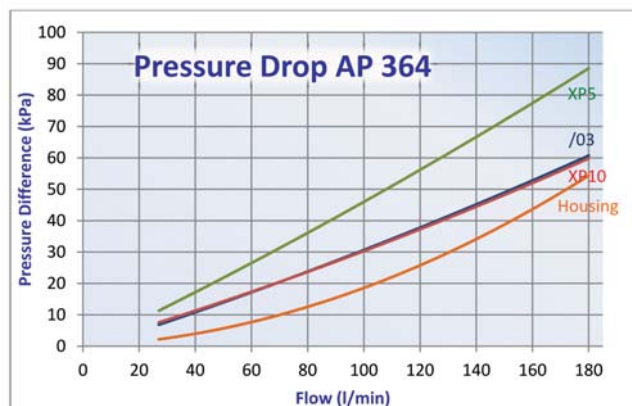
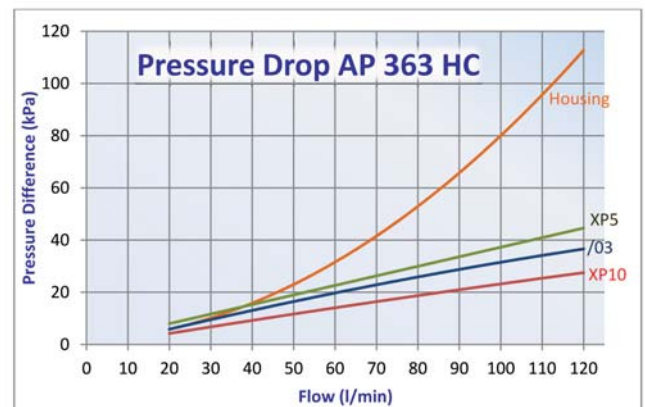
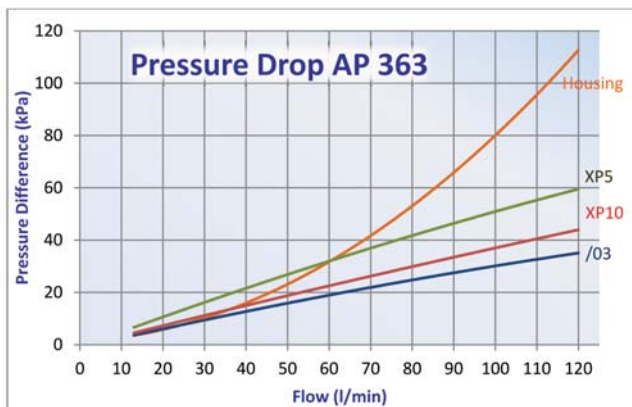
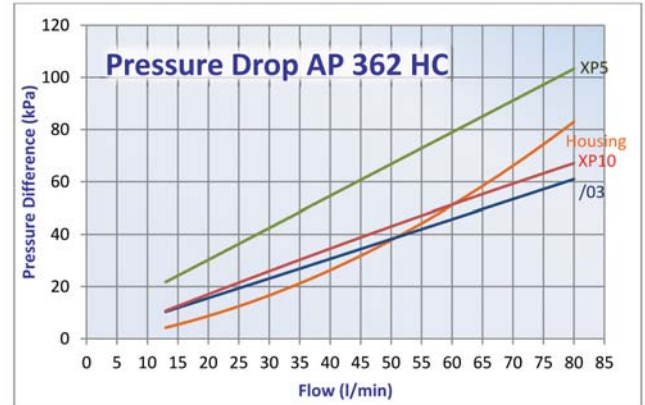
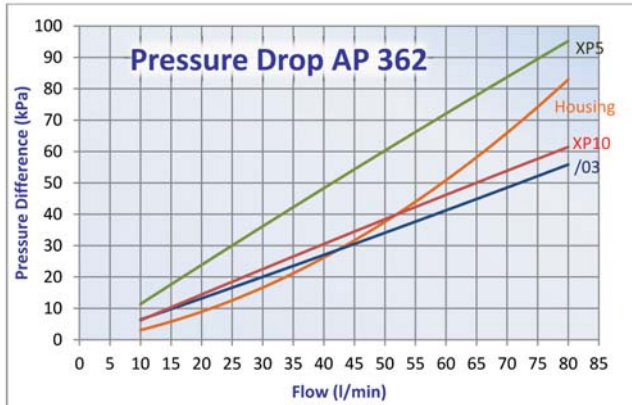
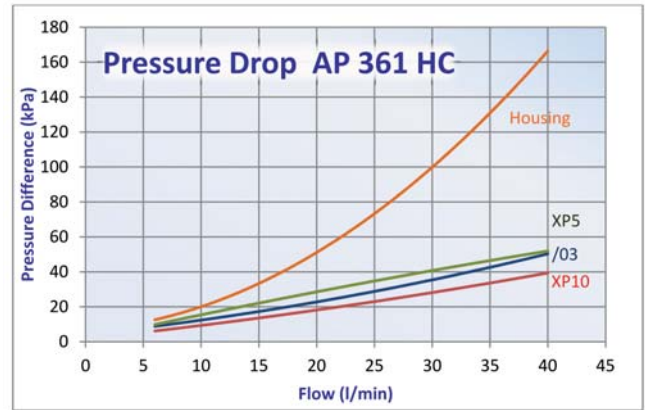
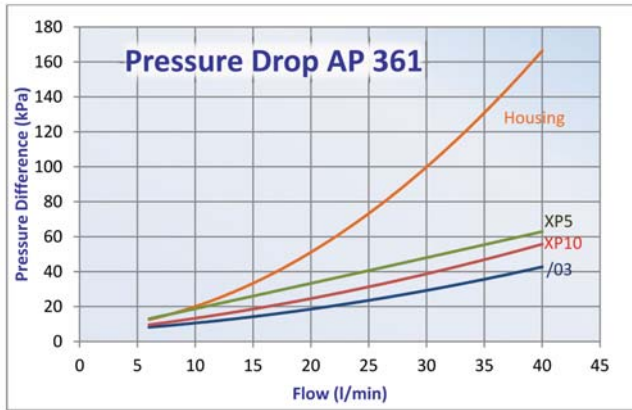
Installation & Service Guidelines



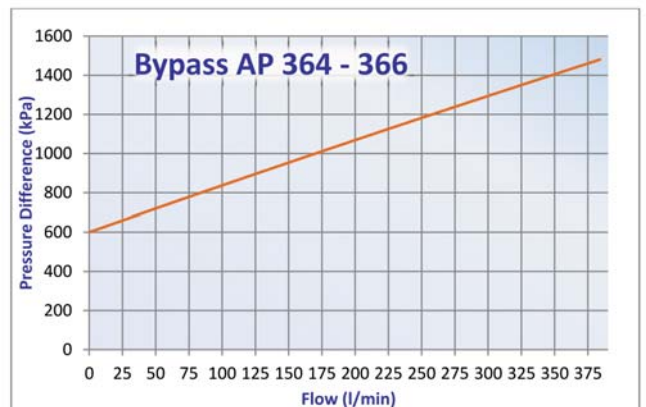
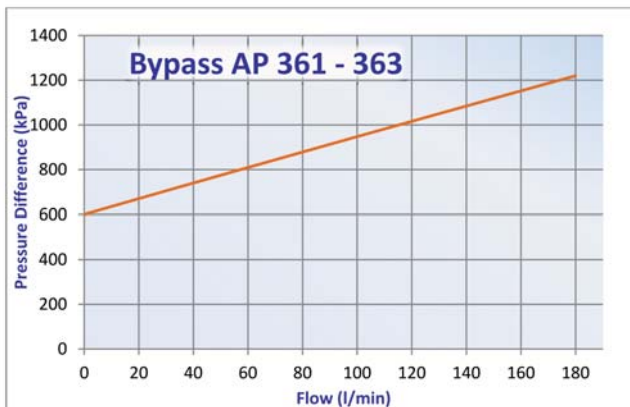
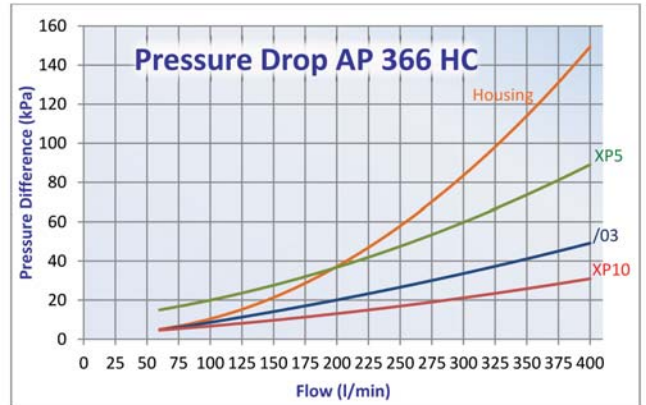
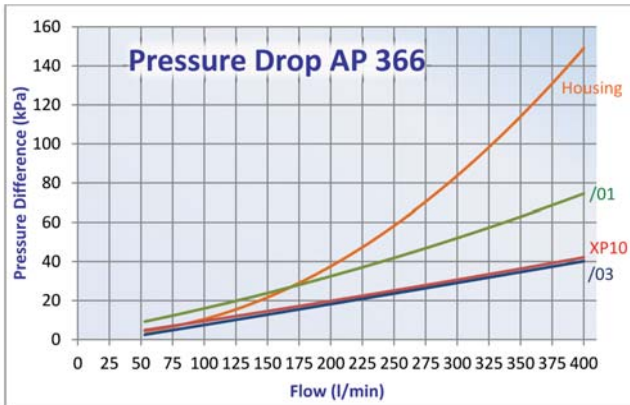
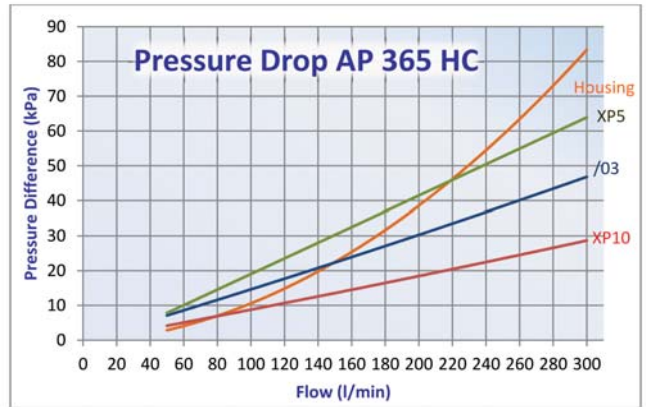
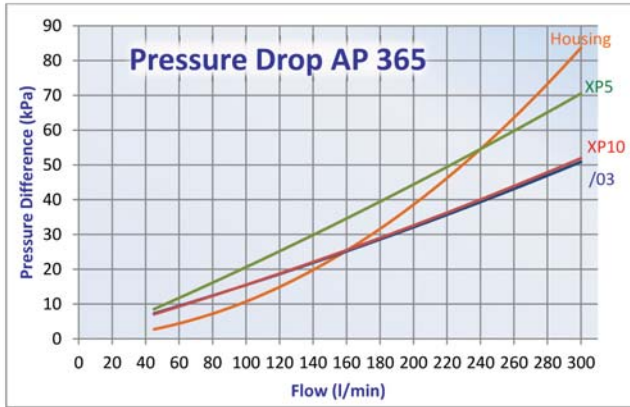
Important

- 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



HIGH PRESSURE
FILTERS



HIGH PRESSURE
FILTERS



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.



Components

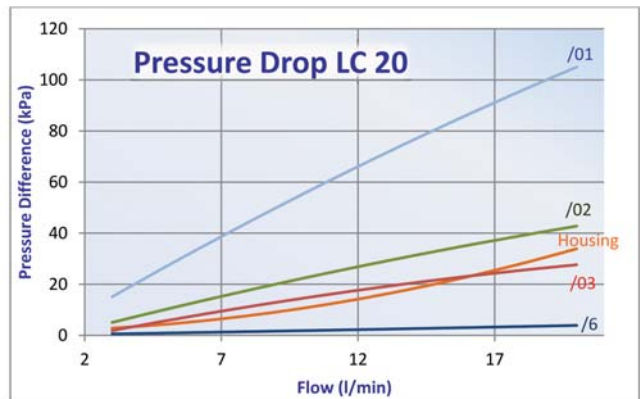
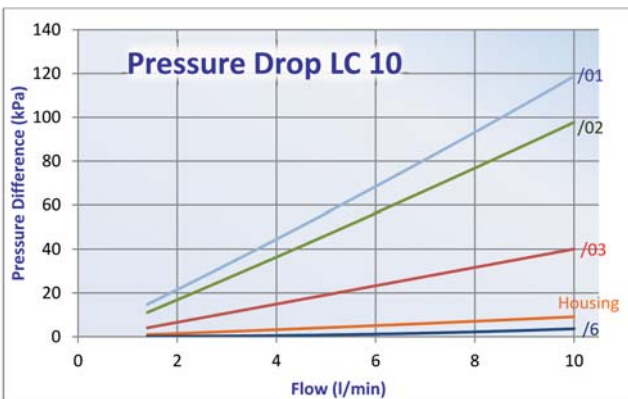
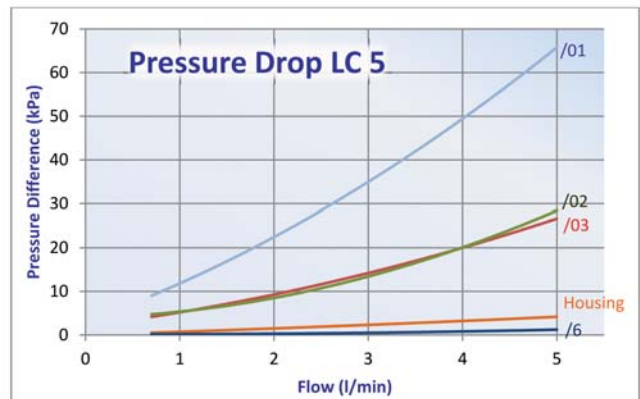
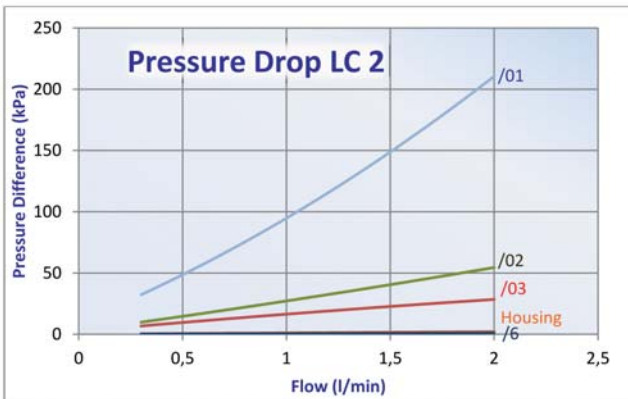
Family	WIRE MESH MEDIA			SYNTHETIC MEDIA									CARTRIDGE CODE
	/6			/03			/02			/01			
	RMF	Complete Filter	Sparepart	RMF	Complete Filter	Sparepart	RMF	Complete Filter	Sparepart	RMF	Complete Filter	Sparepart	
		60µm		$\beta_{23\mu(m)} \geq 1000$			$\beta_{11\mu(m)} \geq 1000$			$\beta_{8\mu(m)} \geq 1000$			
LC2	2	On request	P171771	2	On request	P171769	2	K010006	P171768	2	On request	P171767	CLC2
LC5	5	On request	P171776	5	On request	P171774	5	K020121	P171773	5	On request	P171772	CLC5
LC10	10	On request	P171781	10	On request	P171779	10	K020126	P171778	10	On request	P171777	CLC10
LC20	20	On request	P763493	20	On request	P763485	20	K030300	P763489	20	On request	P763487	CLC140

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

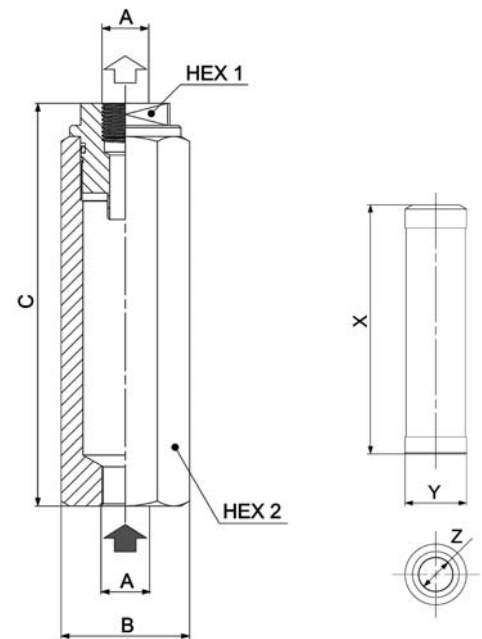
Stocked item (check e-commerce for availability)

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

Performance Curves



HOUSING DIMENSIONS					CARTRIDGE DIMENSIONS		
A	B	C	Hex 1	Hex 2	X	Y	Z
	mm	mm	mm	mm	mm	mm	mm
G3/8	42	103	Hex 27	Hex 36	47	21	9,5
G1/2	58	135	Hex 30	Hex 50	70	28,6	15,8
G1/2	58	182	Hex 30	Hex 50	117	28,6	15,8
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





- TCO 148
- TCA 150
- FS 151
- FFCA 152
- LVO/LVOT 153



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	P171851	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:

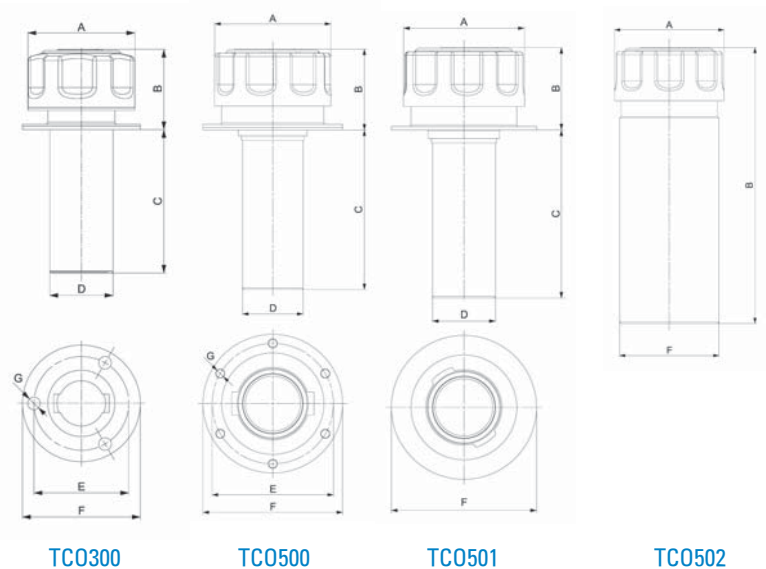
- Removable 500 micron mesh basket.
- 40-10 micron air filter.
- Easy tightening.
- Drilled flanges and fixing screws.

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:

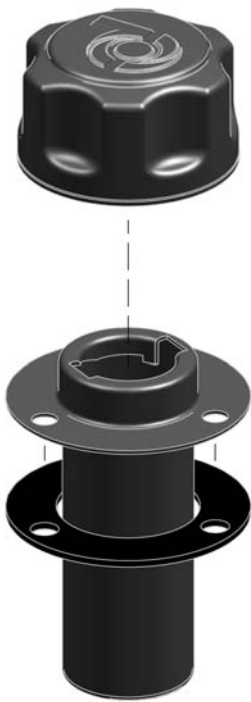
- Non removable 125 micron mesh basket.

Series TCO 500, 501, 502 and TCO 503:

- Available with pressure relief valve setting at 40 kPa (0,4 bar).

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

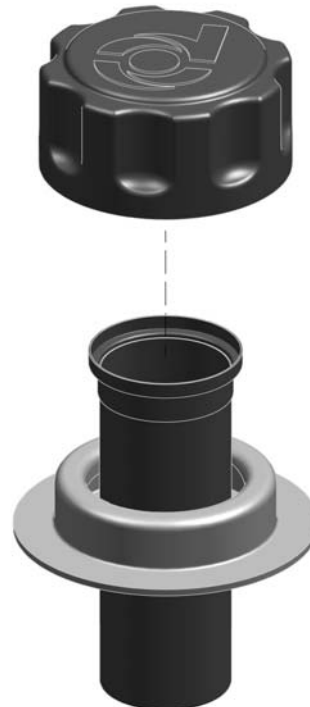
DIMENSIONS						
A	B	C	D	E	F	G
mm	mm	mm	mm	mm	mm	mm
46	35	63	28	41	51	5,5 (3)
70	46	100	38	73	84	5,5 (6)
70	46	100	38		84	
70	180				64	
70	89	188	59	73	84	5,5 (6)



TCO300



TCO500



TCO501



TCO502

ACCESSORIES

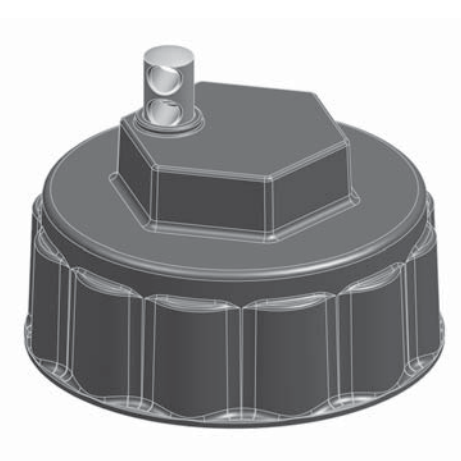
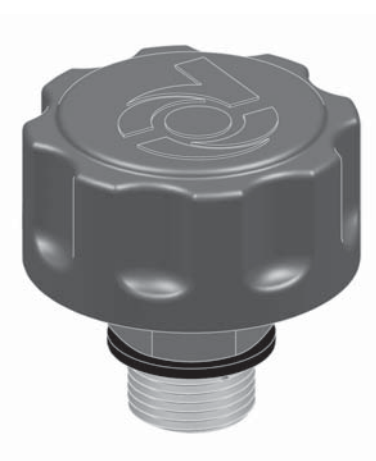
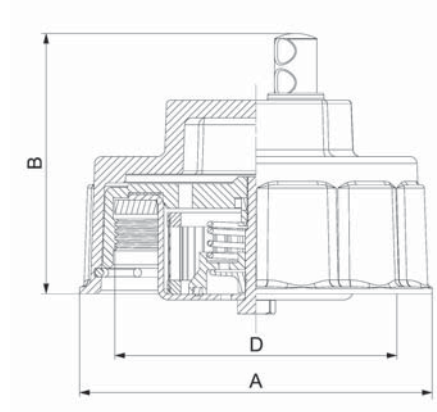
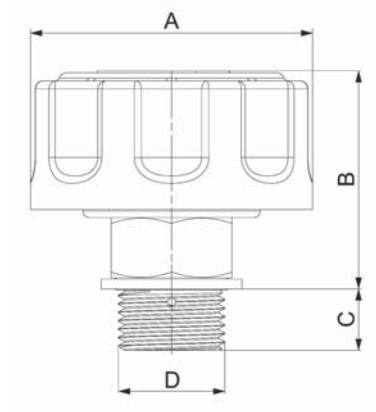
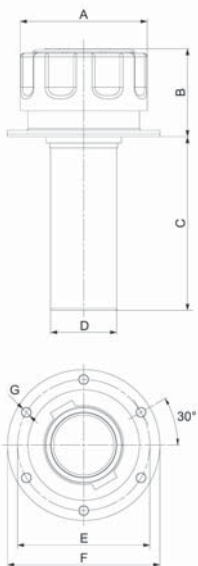


Products

	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							Holes
A	B	C	D	E	F	G	Amount
mm	mm	mm	mm	mm	mm	mm	
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



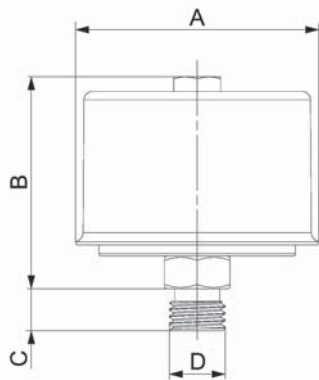
Products

Family	RMF	/6		/4		/1			CARTRIDGE CODE	DIMENSIONS				
		WIRE MESH				CELLULOSE MEDIA				A	B	C	D	Reference Drawing
		60µm Air	40µm Air	10µm Air										
Assembly	Element	Assembly	Element	RMF	Assembly	Element	mm	mm	mm					
FS1	200			P172381	P172433	200	P761046	P172435	CS1	52	45	9	M12x1.5	A
FS3	200			P172382	P172433	200	P761047	P172435	CS1	52	45	9	M18x1.5	A
FS4	200			P172383	P172433	200	P761048	P172435	CS1	52	48	10	M22x1.5	A
FS5	200			P172384	P172433	200	P761049	P172435	CS1	52	45	9	G 1/4	A
FS6	200			P172385	P172433	200	P761050	P172435	CS1	52	46	9	G 3/8	A
FS7	500			P172386	P171783	500	P761051	P175447	CS2	72	62	10	G 1/2	A
FS8	1000			P172387	P171784	1000	P761052	P761045	CS3	108	77	15	G1	A
FS9	1500	P172389	P171786	P172388	P171785	1500	P761053	P761054	CS4	132	100	48		B

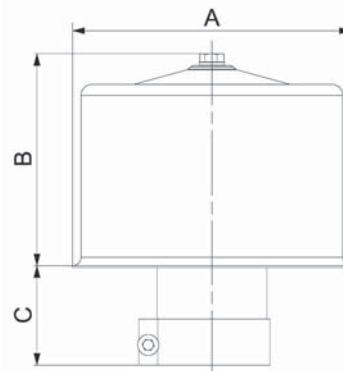
RMF = Recommended Maximum AIR-Flow in liters/minute

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

FFCA

Tank Breathers Spin-On with Flange and Fixing Screws



Products

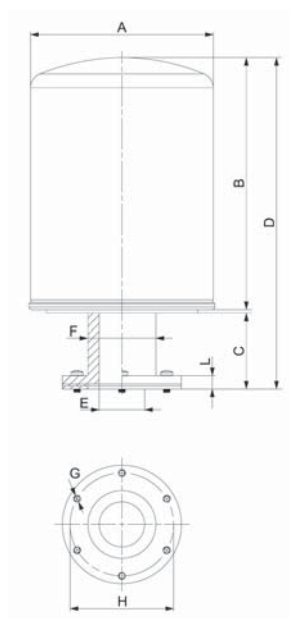
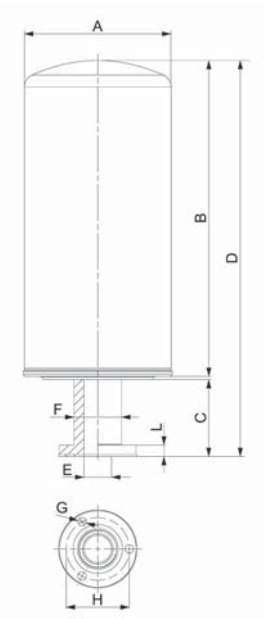
Family	RMF	Wire Mesh		Cellulose Media	Synthetic Media	Flange used to create complete assy	CARTRIDGE CODE	FILTER DIMENSIONS								
		/6	/3	/1	/02			A	B	C	D	E	F	G	H	L
		60µm Air	30µm Air	10µm Air	10µm Air			mm	mm	mm	mm	mm	mm	mm	mm	mm
FFCA60	1200	P171607	P171606	P550268	P171602	P177227	CA60	96	149	50	199	18	50	5,5	41	3
FFCA80	1600	P171612	P171611	P171610	P171608			CA80	96	207	50	257	18	50	5,5	41
FFCA160	2400	P171617	P171616	P550148	P171613	P760682	CA160	126	181	50	231	32	84	5,5	73	6
FFCA200	3000	P171622	P171621	P171620	P171618			CA200	126	226	50	276	32	84	5,5	73

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



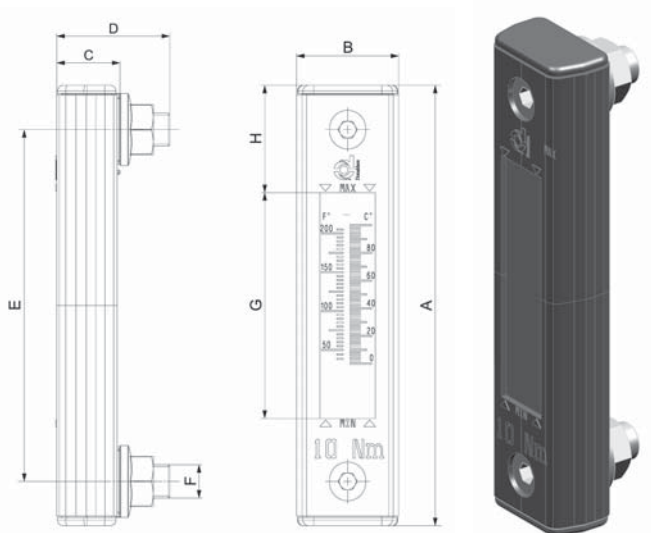


Products

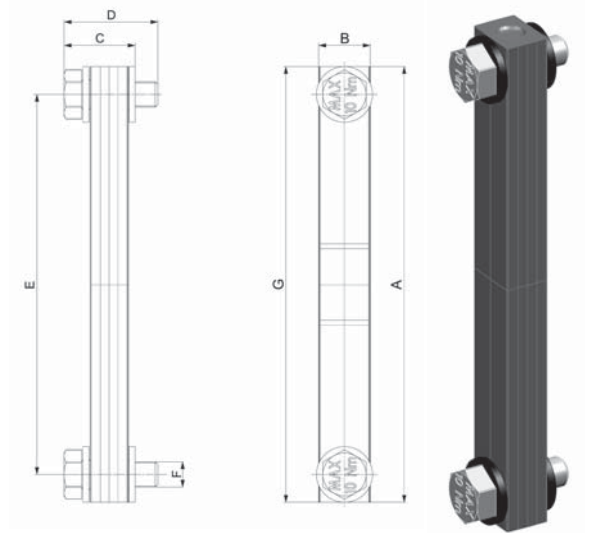
Family	Without thermometer	With thermometer	LEVEL GAUGE DIMENSIONS						Reference Drawing		
			A	B	C	D	E	F		G	H
			mm	mm	mm	mm	mm		mm	mm	
LVO(T)76	P171913	P171915	108	37	23	41	76	M10	31	39	A
LVO(T) 77	P171914	P171916	108	37	23	41	76	M12	31	39	A
LVO(T) 127	P171917	P171919	159	37	23	41	127	M10	82	39	A
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



FIK-FIO(T) FHK-FIR SRK-Combo 200 + 300	FLK-FLS FLK-FLA	FPK02&04-AP220 FPK02-AP280 FPK03&04-AP420 FMK-FM FCK-LC	FIK-FIS SRK-Combo 120	FBK-FRCA FBK-FACA HMK04 HMK05

SERVICE INSTRUCTIONS



Filter FIK-FDK FHK

Filter FIK

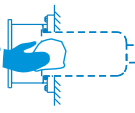
3. Remove the cover.



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.



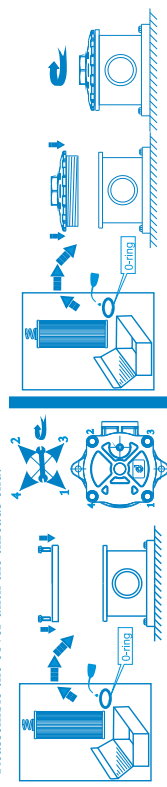
5. Clean out any sediment from the inside of the housing/bowl.



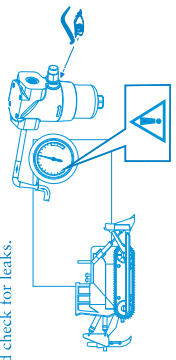
6. Clean out any sediment from the cover side and lubricate the seal.



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.



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

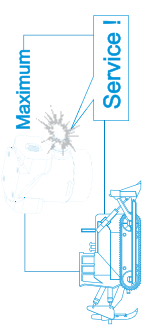

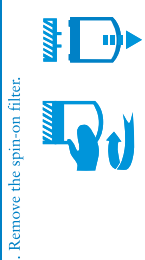

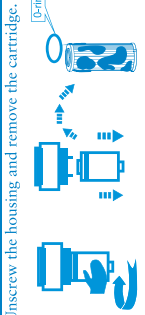

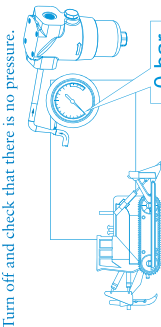

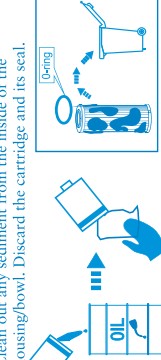
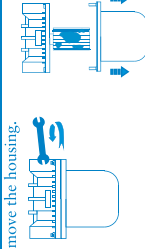
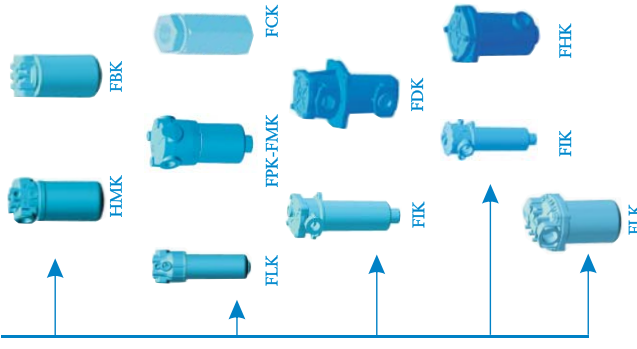

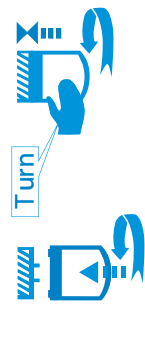
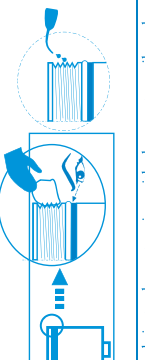
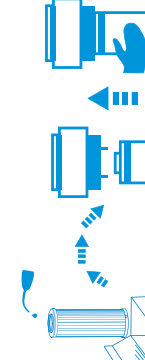
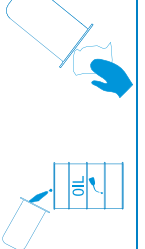
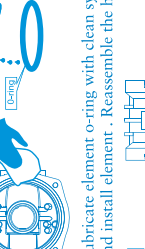
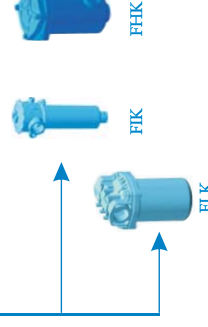
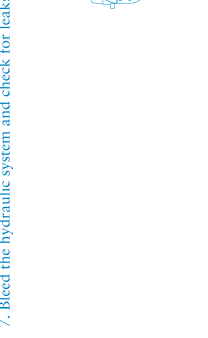
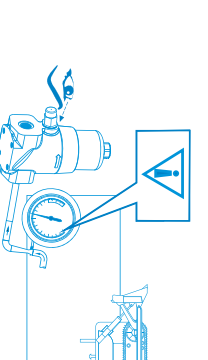
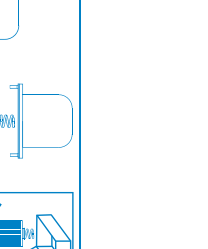
E507943 rev.3

Hydraulic Filters Service Instructions

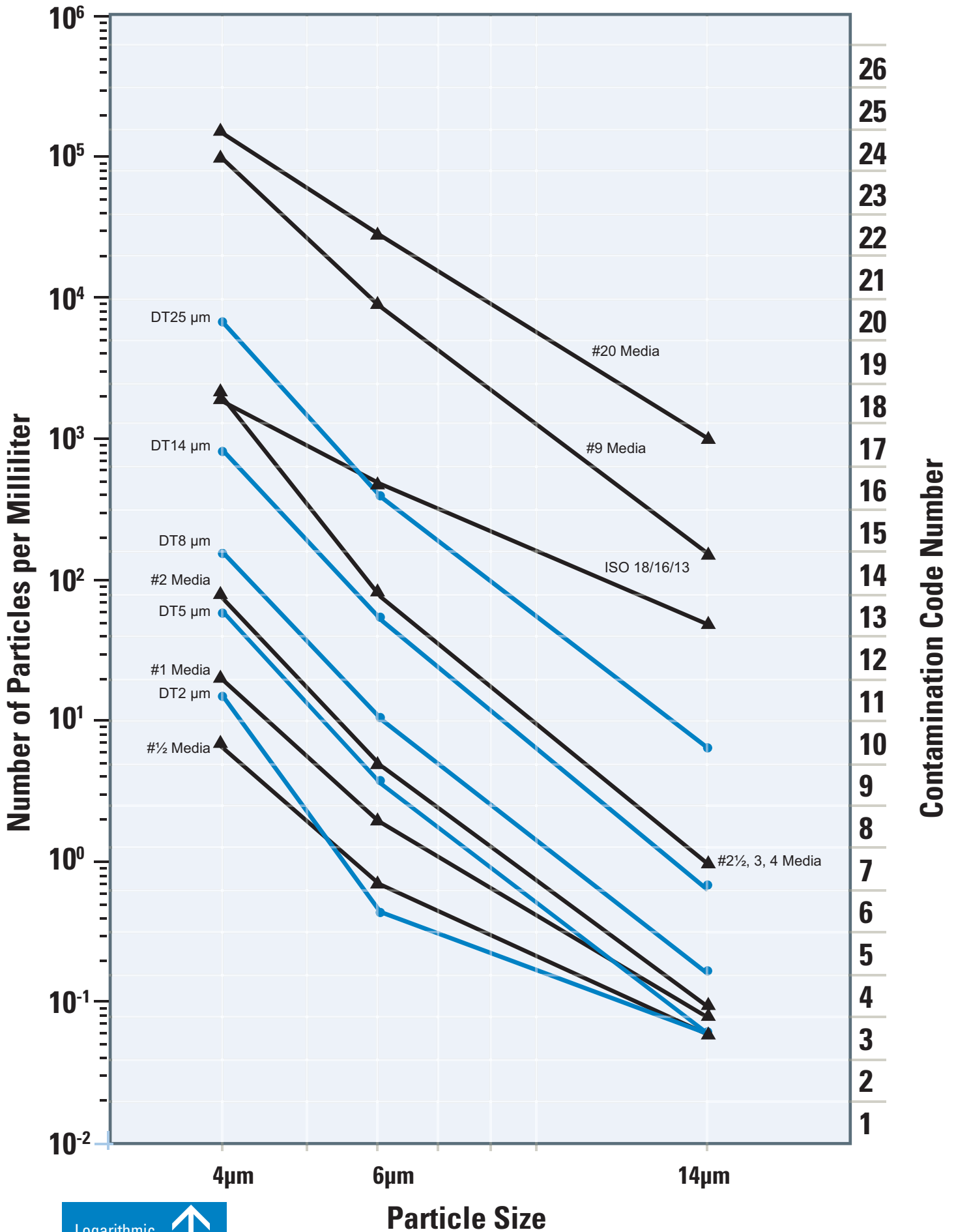
Only to be used by professionals



SERVICE INSTRUCTIONS

<p>Filter Replacement Instructions</p> <p>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.</p>  <p>Maximum Service!</p>	<p>Filter HMK-FBK</p>  <p>3. Remove the spin-on filter.</p> 	<p>Filter FPK-FMK FLK-FCK</p>  <p>3. Unscrew the housing and remove the cartridge.</p> 	<p>Filter FLK</p> 
<p>2. Turn off and check that there is no pressure.</p>  <p>0 bar</p>	<p>4. Discard both the spin-on and its seal.</p> 	<p>4. Clean out any sediment from the inside of the housing/bowl. Discard the cartridge and its seal.</p> 	<p>3. Remove the housing.</p> 
<p>3. Remove filter :</p> 	<p>5. Clean the surfaces of the filter head. Lubricate thread and spin-on seal with clean system oil.</p>  <p>6. Screw the spin-on filter till upper surface and turn spin-on as shown on filter.</p>  <p>Turn</p>	<p>5. Check the seal integrity, lubricate the seal and the threads with clean system oil.</p>  <p>6. Lubricate element o-ring with clean system oil and install element. Reassembly the housing until threads end.</p> 	<p>5. Clean out any sediment from the inside of the housing/bowl.</p>  <p>6. Clean out any sediment from the head side and lubricate the seal.</p> 
<p>7. Bleed the hydraulic system and check for leaks.</p> 	<p>7. Bleed the hydraulic system and check for leaks.</p> 	<p>7. Lubricate element o-ring with clean system oil and install element . Reassemble the housing .</p> 	<p>7. Lubricate element o-ring with clean system oil and install element . Reassemble the housing .</p> 

Application Guide for Donaldson Filter Media



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



- FIK-FIO 160
- FIK-FIOT 163
- FIK-FIO/FIOT..... 166
- FIK-FIS 167
- FLK-FLS..... 168
- FBK-FRCA..... 170
- FHK-FIR..... 171
- FLK-FLA..... 172
- FBK-FACA..... 174
- FMK-FM..... 175
- HMK04 176
- HMK05 177
- FPK02 178
- FPK02-04..... 179
- FPK03-04..... 180

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO



Family	Version Assembly	Version Mix&Match	Version Assembly	Version Mix&Match	Version without predrilled holes	Version predrilled holes plugged	WIRED MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA			
							/09		/6		/3		/1		/03		/02	
							90µm	60µm	RMF	RMF	β _{0.8} ≥1000	β _{0.8} ≥1000	β ₆ ≥1000	β ₆ ≥1000	β ₂₃ ≥1000	β ₂₃ ≥1000	β ₁₁ ≥1000	β ₁₁ ≥1000
FIK20	K030207	P171500 P766446	K030212	P171505 P766446	20	20	15	K030211	K030210	15	15	P171503 P766446	P171502 P766446	10	10	P171501 P766446	P171501 P766446	
	K030329	P171500 P766446	K030332	P171505 P766446	20	20	15	K030331	K030379	15	15	P171503 P766446	P171502 P766446	10	10	K030378	P171501 P766446	
	K030213	P171500 P766447	K030218	P171505 P766447	30	30	20	K030217	K030216	20	20	P171503 P766447	P171502 P766447	15	15	K030214	P171501 P766447	
	K030333	P171500 P766447	K030337	P171505 P766447	30	30	20	K030336	K030335	20	20	P171503 P766447	P171502 P766447	15	15	K030334	P171501 P766447	
FIK30	K040506	P171518 P766448	K040511	P171523 P766448	50	50	35	K040510	K040509	35	35	P171521 P766448	P171520 P766448	30	30	P171519 P766448	P171519 P766448	
	K040868	P171518 P766448	K040867	P171523 P766448	50	50	35	K040866	K040865	35	35	P171521 P766448	P171520 P766448	30	30	K040871	P171519 P766448	
	K040512	P171524 P766449	K040517	P171529 P766449	60	60	40	K040516	K040515	40	40	P171522 P766449	P171521 P766449	35	35	K040513	P171525 P766449	
	K040873	P171524 P766449	K040872	P171529 P766449	60	60	40	K040871	K040870	40	40	P171522 P766449	P171521 P766449	35	35	K040869	P171525 P766449	
FIK60	K040518	P171530 P766450	K040523	P171535 P766450	80	80	55	K040522	K040521	55	55	P171533 P766450	P171532 P766450	50	50	P171531 P766450	P171531 P766450	
	K040878	P171530 P766450	K040877	P171535 P766450	80	80	55	K040876	K040875	55	55	P171533 P766450	P171532 P766450	50	50	K040885	P171531 P766450	
	K040500	P171530 P766451	K040505	P171535 P766451	100	100	65	K040504	K040503	65	65	P171533 P766451	P171532 P766451	60	60	K040501	P171531 P766451	
	K040884	P171530 P766451	K040883	P171535 P766451	100	100	65	K040882	K040881	65	65	P171533 P766451	P171532 P766451	60	60	K040879	P171531 P766451	
FIK100	K040884	P171530 P766451	K040883	P171535 P766451	100	100	65	K040882	K040881	65	65	P171533 P766451	P171532 P766451	60	60	P171531 P766451	P171531 P766451	
	K040884	P171530 P766451	K040883	P171535 P766451	100	100	65	K040882	K040881	65	65	P171533 P766451	P171532 P766451	60	60	P171531 P766451	P171531 P766451	
	K040884	P171530 P766451	K040883	P171535 P766451	100	100	65	K040882	K040881	65	65	P171533 P766451	P171532 P766451	60	60	P171531 P766451	P171531 P766451	
	K040884	P171530 P766451	K040883	P171535 P766451	100	100	65	K040882	K040881	65	65	P171533 P766451	P171532 P766451	60	60	P171531 P766451	P171531 P766451	

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO



		WIRED MESH		CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/09	/6	/3	/1	/03			
		90µm	60µm	Ø8 _{µm} ≥ 1000	Ø6 _{µm} ≥ 1000	Ø23 _{µm} ≥ 1000	Ø11 _{µm} ≥ 1000		
FIK150	Assembly	150	K051109	100	K051113	100	K051112	90	K051110
	Mix&Match		P171536 P766452		P171540 P766452		P171539 P766452		P171537 P766452
	Assembly	150	K051238	100	K051236	100	K051235	90	K051233
	Mix&Match		P171536 P766452		P171540 P766452		P171539 P766452		P171537 P766452
FIK180	Assembly	180	K051115	120	K051119	120	K051118	110	K051116
	Mix&Match		P171536 P766453		P171540 P766453		P171539 P766453		P171537 P766453
	Assembly	180	K051242	120	K051229	120	K051232	110	K051239
	Mix&Match		P171536 P766453		P171540 P766453		P171539 P766453		P171537 P766453
FIK200	Assembly	200	K070003	140	K070007	140	K070006	130	K070004
	Mix&Match		P171542 P766454		P171546 P766454		P171545 P766454		P171543 P766454
	Assembly	200	K070280	140	K070284	140	K070283	130	K070281
	Mix&Match		P171542 P766454		P171546 P766454		P171545 P766454		P171543 P766454
FIK250	Assembly	250	K070009	160	K070013	160	K070012	140	K070010
	Mix&Match		P171548 P766455		P171552 P766455		P171551 P766455		P171549 P766455
	Assembly	250	K070286	160	K070289	160	K070288	140	K070355
	Mix&Match		P171548 P766455		P171552 P766455		P171551 P766455		P171549 P766455
FIK325	Assembly	330	K070015	200	K070019	200	K070018	180	K070016
	Mix&Match		P171554 P766456		P171558 P766456		P171557 P766456		P171555 P766456
	Assembly	330	K070291	200	K070294	200	K070293	180	K070356
	Mix&Match		P171554 P766456		P171558 P766456		P171557 P766456		P171555 P766456
FIK330	Assembly	330	K070021	200	K070025	200	K070024	180	K070022
	Mix&Match		P171560 P766457		P171564 P766457		P171563 P766457		P171561 P766457
	Assembly	330	K070296	200	K070300	200	K070299	180	K070297
	Mix&Match		P171560 P766457		P171564 P766457		P171563 P766457		P171561 P766457

Return Line Filters

Low Pressure Filters In-Tank FIK-FIO



		WIRED MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA			
		/09	/6	/3	/1	/03	/02				
		90µm	60µm	IS8 _{µm(e)} ≥ 1000	IS6 _{µm(e)} ≥ 1000	IS23 _{µm(e)} ≥ 1000	IS11 _{µm(e)} ≥ 1000				
FIK500	Assembly	500	500	400	400	350	350	350			
	Mix&Match	P171566 P766458	K070027 P171571 P766458	P171570 P766458	P171569 P766458	P171568 P766458	P171567 P766458	P171567 P766458			
	Assembly	500	500	400	400	350	350	350			
	Mix&Match	K070302 P171566 P766458	K070307 P171571 P766458	P171570 P766458	P171569 P766458	P171568 P766458	P171567 P766458	P171567 P766458			
FIK600	Assembly	600	600	500	500	400	400	400			
	Mix&Match	P171572 P766459	K070033 P171577 P766459	P171576 P766459	P171575 P766459	P171574 P766459	P171573 P766459	P171573 P766459			
	Assembly	600	600	500	500	400	400	400			
	Mix&Match	K070308 P171572 P766459	K070311 P171577 P766459	P171576 P766459	P171575 P766459	P171574 P766459	P171573 P766459	P171573 P766459			
FIK600 SAE Flange	Assembly	600	600	500	500	400	400	400			
	Mix&Match	K070045 P171572 P766460	K070050 P171577 P766460	P171576 P766460	P171575 P766460	P171574 P766460	P171573 P766460	P171573 P766460			
	Assembly	600	600	500	500	400	400	400			
	Mix&Match	K070358 P171572 P766460	K070357 P171577 P766460	P171576 P766460	P171575 P766460	P171574 P766460	P171573 P766460	P171573 P766460			
FIK800	Assembly	800	800	600	600	500	500	500			
	Mix&Match	K070039 P171578 P766461	K070044 P171583 P766461	P171582 P766461	P171581 P766461	P171580 P766461	P171579 P766461	P171579 P766461			
	Assembly	800	800	600	600	500	500	500			
	Mix&Match	K070359 P171578 P766461	K070316 P171583 P766461	P171582 P766461	P171581 P766461	P171580 P766461	P171579 P766461	P171579 P766461			
FIK800 SAE Flange	Assembly	800	800	600	600	500	500	500			
	Mix&Match	K070051 P171578 P766462	K070055 P171583 P766462	P171582 P766462	P171581 P766462	P171580 P766462	P171579 P766462	P171579 P766462			
	Assembly	800	800	600	600	500	500	500			
	Mix&Match	K070363 P171578 P766462	K070362 P171583 P766462	P171582 P766462	P171581 P766462	P171580 P766462	P171579 P766462	P171579 P766462			
		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



Family	WIRED MESH		CELLULOSE MEDIA				SYNTHETIC MEDIA				
	/09	/6	/3	/1	/03	/02					
	90µm	60µm	β ₈ _{µm} ≥1000	β ₆ _{µm} ≥1000	β ₂₃ _{µm} ≥1000	β ₁₁ _{µm} ≥1000					
Version	Version	RMF	RMF	RMF	RMF	RMF	RMF	RMF	RMF	RMF	
FIK20	Assembly	without predrilled holes	20	K030225	K030230	15	K030229	K030228	K030227	10	K030226
	Mix.&Match			P171505 P766463	P766463		P171504 P766463	P766463	P171502 P766463	10	P171501 P766463
	Assembly	predrilled holes plugged	20	K030341	K030394	15	K030342	K030389	K030388	10	K030387
	Mix.&Match			P171500 P766463	P766463		P171504 P766463	P766463	P171502 P766463	10	P171501 P766463
FIK30	Assembly	without predrilled holes	30	K030231	K030236	20	K030235	K030234	K030233	15	K030232
	Mix.&Match			P171500 P766464	P766464		P171504 P766464	P766464	P171502 P766464	15	P171501 P766464
	Assembly	predrilled holes plugged	30	K030343	K030346	20	K030345	K030344	K030396	15	K030385
	Mix.&Match			P171500 P766464	P766464		P171504 P766464	P766464	P171502 P766464	15	P171501 P766464
FIK50	Assembly	without predrilled holes	50	K040536	K040541	35	K040540	K040539	K040538	30	K040537
	Mix.&Match			P171518 P766465	P766465		P171522 P766465	P766465	P171520 P766465	30	P171519 P766465
	Assembly	predrilled holes plugged	50	K040892	K040895	35	K040894	K040893	K040994	30	K040993
	Mix.&Match			P171518 P766465	P766465		P171522 P766465	P766465	P171520 P766465	30	P171519 P766465
FIK60	Assembly	without predrilled holes	60	K040542	K040547	40	K040546	K040545	K040544	35	K040543
	Mix.&Match			P171524 P764666	P764666		P171528 P764666	P764666	P171526 P764666	35	P171525 P764666
	Assembly	predrilled holes plugged	60	K040896	K040900	40	K040899	K040898	K040897	35	K041008
	Mix.&Match			P171524 P764666	P764666		P171528 P764666	P764666	P171526 P764666	35	P171525 P764666
FIK80	Assembly	without predrilled holes	80	K040548	K040553	55	K040552	K040551	K040550	50	K040549
	Mix.&Match			P171530 P766467	P766467		P171534 P766467	P766467	P171532 P766467	50	P171531 P766467
	Assembly	predrilled holes plugged	80	K040901	K040904	55	K040903	K040902	K041017	50	K041016
	Mix.&Match			P171530 P766467	P766467		P171534 P766467	P766467	P171532 P766467	50	P171531 P766467
FIK100	Assembly	without predrilled holes	100	K040530	K040535	65	K040534	K040533	K040532	60	K040531
	Mix.&Match			P171530 P766468	P766468		P171534 P766468	P766468	P171532 P766468	60	P171531 P766468
	Assembly	predrilled holes plugged	100	K040889	K040891	65	K040890	K040884	K041023	60	K040889
	Mix.&Match			P171530 P766468	P766468		P171534 P766468	P766468	P171532 P766468	60	P171531 P766468

Return Line Filters

Return Filters In-Tank FIK FIOT



		WIRED MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA			
		/09	/6	/3	/1	/03	/02				
		90µm	60µm	β _{0.8} ≥1000	β _{0.6} ≥1000	β _{2.0} ≥1000	β _{1.0} ≥1000				
FIK150	Assembly	150	150	100	100	90	90	90	β _{1.0} ≥1000		
	Mix.&Match	K051121 P171536 P766469	K051127 P171541 P766469	K051126 P171540 P766469	K051125 P171539 P766469	K051124 P171538 P766469	K051123 P171537 P766469	K051122 P171536 P766469			
	Assembly	150	150	100	100	90	90	90	K041029		
	Mix.&Match	K051243 P171536 P766469	K051247 P171541 P766469	K051246 P171540 P766469	K051245 P171539 P766469	K051244 P171538 P766469	K051243 P171537 P766469	K051242 P171536 P766469			
FIK180	Assembly	180	180	120	120	110	110	110	K051129		
	Mix.&Match	K051128 P171536 P766470	K051133 P171541 P766470	K051132 P171540 P766470	K051131 P171539 P766470	K051130 P171538 P766470	K051129 P171537 P766470	K051128 P171536 P766470			
	Assembly	180	180	120	120	110	110	110	K051249		
	Mix.&Match	K051248 P171536 P766470	K051250 P171541 P766470	K051227 P171540 P766470	K051231 P171539 P766470	K051263 P171538 P766470	K051249 P171537 P766470	K051248 P171536 P766470			
FIK200	Assembly	200	200	140	140	130	130	130	K070058		
	Mix.&Match	K070057 P171542 P766471	K070062 P171547 P766471	K070061 P171546 P766471	K070060 P171545 P766471	K070059 P171544 P766471	K070058 P171543 P766471	K070057 P171542 P766471			
	Assembly	200	200	140	140	130	130	130	K070459		
	Mix.&Match	K070458 P171542 P766471	K070461 P171547 P766471	K070460 P171546 P766471	K070322 P171545 P766471	K070319 P171544 P766471	K070459 P171543 P766471	K070458 P171542 P766471			
FIK250	Assembly	250	250	160	160	140	140	140	K070064		
	Mix.&Match	K070063 P171548 P766472	K070068 P171553 P766472	K070067 P171552 P766472	K070066 P171551 P766472	K070065 P171550 P766472	K070064 P171549 P766472	K070063 P171548 P766472			
	Assembly	250	250	160	160	140	140	140	K070463		
	Mix.&Match	K070462 P171548 P766472	K070325 P171553 P766472	K070324 P171552 P766472	K070323 P171551 P766472	K070322 P171550 P766472	K070463 P171549 P766472	K070462 P171548 P766472			
FIK325	Assembly	330	330	200	200	180	180	180	K070070		
	Mix.&Match	K070069 P171554 P764673	K070074 P171559 P764673	K070073 P171558 P764673	K070072 P171557 P764673	K070071 P171556 P764673	K070070 P171555 P764673	K070069 P171554 P764673			
	Assembly	330	330	200	200	180	180	180	K070326		
	Mix.&Match	K070465 P171554 P764673	K070330 P171559 P764673	K070329 P171558 P764673	K070328 P171557 P764673	K070327 P171556 P764673	K070326 P171555 P764673	K070325 P171554 P764673			
FIK330	Assembly	330	330	200	200	180	180	180	K070076		
	Mix.&Match	K070075 P171560 P766474	K070080 P171565 P766474	K070079 P171564 P766474	K070078 P171563 P766474	K070077 P171562 P766474	K070076 P171561 P766474	K070075 P171560 P766474			
	Assembly	330	330	200	200	180	180	180	K070331		
	Mix.&Match	K070385 P171560 P766474	K070335 P171565 P766474	K070334 P171564 P766474	K070333 P171563 P766474	K070332 P171562 P766474	K070331 P171561 P766474	K070330 P171560 P766474			

Return Line Filters

Return Filters In-Tank FIK FIOT



		WIREF MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA			
		/09		/6		/3		/1		/03		/02	
90µm		60µm		β ₈ _{µm} ≥1000		β ₆ _{µm} ≥1000		β ₂₃ _{µm} ≥1000		β ₁₁ _{µm} ≥1000			
FIK500	Assembly	K070081	K070086	400	K070085	K070084	350	K070083	350	K070082			
	Mix.&Match	P171566 P766475	P171571 P766475	400	P171570 P766475	P171569 P766475	350	P171568 P766475	350	P171567 P766475			
	Assembly	K070366	K070339	400	K070338	K070337	350	K070367	350	K070336			
	Mix.&Match	P171566 P766475	P171571 P766475	400	P171570 P766475	P171569 P766475	350	P171568 P766475	350	P171567 P766475			
FIK600	Assembly	K070087	K070092	500	K070091	K070090	400	K070089	400	K070088			
	Mix.&Match	P171572 P766476	P171577 P766476	500	P171576 P766476	P171575 P766476	400	P171574 P766476	400	P171573 P766476			
	Assembly	K070343	K070454	500	K070342	K070341	400	K070369	400	K070340			
	Mix.&Match	P171572 P766476	P171577 P766476	500	P171576 P766476	P171575 P766476	400	P171574 P766476	400	P171573 P766476			
FIK800 SAE Flange	Assembly	K070089	K070104	500	K070103	K070102	400	K070101	400	K070100			
	Mix.&Match	P171572 P766477	P171577 P766477	500	P171576 P766477	P171575 P766477	400	P171574 P766477	400	P171573 P766477			
	Assembly	K070466	K070345	500	K070344	K070469	400	K070468	400	K070467			
	Mix.&Match	P171572 P766477	P171577 P766477	500	P171576 P766477	P171575 P766477	400	P171574 P766477	400	P171573 P766477			
FIK800	Assembly	K070083	K070098	600	K070097	K070096	500	K070095	500	K070094			
	Mix.&Match	P171578 P766478	P171583 P766478	600	P171582 P766478	P171581 P766478	500	P171580 P766478	500	P171579 P766478			
	Assembly	K070455	K070457	600	K070348	K070347	500	K070456	500	K070346			
	Mix.&Match	P171578 P766478	P171583 P766478	600	P171582 P766478	P171581 P766478	500	P171580 P766478	500	P171579 P766478			
FIK800 SAE Flange	Assembly	K070105	K070110	600	K070109	K070108	500	K070107	500	K070106			
	Mix.&Match	P171578 P766479	P171583 P766479	600	P171582 P766479	P171581 P766479	500	P171580 P766479	500	P171579 P766479			
	Assembly	K070470		600	K070472	K070350	500	K070471	500	K070349			
	Mix.&Match	P171578 P766479	P171583 P766479	600	P171582 P766479	P171581 P766479	500	P171580 P766479	500	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)



		WIREF MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA					
		/09	/6	/3	/1	/03	/02								
		90µm	60µm	β _{0.6} µm(e) ≥ 1000	β _{0.6} µm(e) ≥ 1000	β _{2.0} µm(e) ≥ 1000	β _{1.0} µm(e) ≥ 1000	β _{0.6} µm(e) ≥ 1000	β _{0.3} µm(e) ≥ 1000	β _{0.1} µm(e) ≥ 1000					
Family	Version	RMF		RMF		RMF		RMF		RMF		RMF		RMF	
FIK 4 110	Assembly	K051560	K041561	K041562	K041563	K041564	K041565	K041566	K041567	K041568	K041569	K041570	K041571	K041572	K041573
	Mix&Match	P171530 P766677	P171535 P766677	P171534 P766677	P171533 P766677	P171532 P766677	P171531 P766677	P171530 P766677	P171529 P766677	P171528 P766677	P171527 P766677	P171526 P766677	P171525 P766677	P171524 P766677	P171523 P766677
	Assembly	K041536	K041538	K041539	K041540	K041541	K041542	K041543	K041544	K041545	K041546	K041547	K041548	K041549	K041550
	Mix&Match	P171530 P766677	P171535 P766677	P171534 P766677	P171533 P766677	P171532 P766677	P171531 P766677	P171530 P766677	P171529 P766677	P171528 P766677	P171527 P766677	P171526 P766677	P171525 P766677	P171524 P766677	P171523 P766677
FIK 4 140	Assembly	K041566	K041567	K041568	K041569	K041570	K041571	K041572	K041573	K041574	K041575	K041576	K041577	K041578	K041579
	Mix&Match	P171831 P766675	P171834 P766675	P171833 P766675	P171832 P766675	P171831 P766675	P171830 P766675	P171829 P766675	P171828 P766675	P171827 P766675	P171826 P766675	P171825 P766675	P171824 P766675	P171823 P766675	P171822 P766675
	Assembly	K041542	K041543	K041544	K041545	K041546	K041547	K041548	K041549	K041550	K041551	K041552	K041553	K041554	K041555
	Mix&Match	P171831 P766675	P171834 P766675	P171833 P766675	P171832 P766675	P171831 P766675	P171830 P766675	P171829 P766675	P171828 P766675	P171827 P766675	P171826 P766675	P171825 P766675	P171824 P766675	P171823 P766675	P171822 P766675
FIK T 4 110	Assembly	K041572	K041573	K041574	K041575	K041576	K041577	K041578	K041579	K041580	K041581	K041582	K041583	K041584	K041585
	Mix&Match	P171530 P766676	P171535 P766676	P171534 P766676	P171533 P766676	P171532 P766676	P171531 P766676	P171530 P766676	P171529 P766676	P171528 P766676	P171527 P766676	P171526 P766676	P171525 P766676	P171524 P766676	P171523 P766676
	Assembly	K041548	K041549	K041550	K041551	K041552	K041553	K041554	K041555	K041556	K041557	K041558	K041559	K041560	K041561
	Mix&Match	P171530 P766676	P171535 P766676	P171534 P766676	P171533 P766676	P171532 P766676	P171531 P766676	P171530 P766676	P171529 P766676	P171528 P766676	P171527 P766676	P171526 P766676	P171525 P766676	P171524 P766676	P171523 P766676
FIK T 4 140	Assembly	K041578	K041579	K041580	K041581	K041582	K041583	K041584	K041585	K041586	K041587	K041588	K041589	K041590	K041591
	Mix&Match	P171831 P766674	P171834 P766674	P171833 P766674	P171832 P766674	P171831 P766674	P171830 P766674	P171829 P766674	P171828 P766674	P171827 P766674	P171826 P766674	P171825 P766674	P171824 P766674	P171823 P766674	P171822 P766674
	Assembly	K041554	K041555	K041556	K041557	K041558	K041559	K041560	K041561	K041562	K041563	K041564	K041565	K041566	K041567
	Mix&Match	P171831 P766674	P171834 P766674	P171833 P766674	P171832 P766674	P171831 P766674	P171830 P766674	P171829 P766674	P171828 P766674	P171827 P766674	P171826 P766674	P171825 P766674	P171824 P766674	P171823 P766674	P171822 P766674

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-Line FIK FLS



		WIRES MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/09	/6	/3	/1	/03	/02			
		90µm	60µm	$\beta_{10} \geq 1000$	$\beta_{10} \geq 1000$	$\beta_{23} \geq 1000$	$\beta_{11} \geq 1000$			
Family	Version	RMF	RMF	RMF	RMF	RMF	RMF	RMF	RMF	RMF
FLS 50	Version									
	Assembly	K030259	K030264	K030263	K030262	K030261	K030260			
	Mix&Match	P171518 P766995	P171523 P766995	P171522 P766995	P171521 P766995	P171520 P766995	P171519 P766995			
	Assembly	K030372	K030325	K030376	K030375	K030374	K030373			
FLS100	Version									
	Assembly	K030271	K030276	K030275	K030274	K030273	K030272			
	Mix&Match	P171530 P766996	P171535 P766996	P171534 P766996	P171533 P766996	P171532 P766996	P171531 P766996			
	Assembly	K030385	K030371	K030326	K030368	K030367	K030366			
FLS150	Version									
	Assembly	P171530 P766673	P171535 P766673	P171534 P766673	P171533 P766673	P171532 P766673	P171531 P766673			
	Mix&Match	K040596	K040601	K040600	K040599	K040598	K040597			
	Assembly	P171584 P766997	P171589 P766997	P171588 P766997	P171587 P766997	P171586 P766997	P171585 P766997			
FLS180	Version									
	Assembly	K040948	K040953	K040952	K040951	K040950	K040949			
	Mix&Match	P171584 P766671	P171589 P766671	P171588 P766671	P171587 P766671	P171586 P766671	P171585 P766671			
	Assembly	K040608	K040613	K040612	K040611	K040610	K040609			
FLS200	Version									
	Assembly	P171536 P766998	P171541 P766998	P171540 P766998	P171539 P766998	P171538 P766998	P171537 P766998			
	Mix&Match	K040954	K040959	K040958	K040957	K040956	K040955			
	Assembly	P171536 P766670	P171541 P766670	P171540 P766670	P171539 P766670	P171538 P766670	P171537 P766670			
FLS250	Version									
	Assembly	K040620	K040625	K040624	K040623	K040622	K040621			
	Mix&Match	P171596 P766999	P171601 P766999	P171600 P766999	P171599 P766999	P171598 P766999	P171597 P766999			
	Assembly	K040960	K040963	K040962	K040961	K041125	K041124			
FLS330	Version									
	Assembly	P171596 P766666	P171601 P766666	P171600 P766666	P171599 P766666	P171598 P766666	P171597 P766666			
	Mix&Match	K070159	K070164	K070163	K070162	K070161	K070160			
	Assembly	P171590 P767000	P171595 P767000	P171594 P767000	P171593 P767000	P171592 P767000	P171591 P767000			

Return Line Filters

Return Filters In-Line FIK FLS



		WIRE MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/09	/6	/3	/1	/03	/02			
		90µm	60µm	β ₈ µm _{ic} ≥1000	β ₆ µm _{ic} ≥1000	β ₂₃ µm _{ic} ≥1000	β ₁₁ µm _{ic} ≥1000			
FLS500	Assembly	K070183	K070188	K070187	K070186	K070185	K070184			
	Mix&Match	P171566 P767004	P171571 P767004	P171570 P767004	P171569 P767004	P171568 P767004	P171567 P767004			
	Assembly	K070426	K070431	K070430	K070429	K070428	K070427			
	Mix&Match	P171566 P766665	P171571 P766665	P171570 P766665	P171569 P766665	P171568 P766665	P171567 P766665			
FLS250 SAE Flange	Assembly	K070195	K070200	K070199	K070198	K070197	K070196			
	Mix&Match	P171590 P767001	P171595 P767001	P171594 P767001	P171593 P767001	P171592 P767001	P171591 P767001			
	Assembly	K070432	K070433	K070564	K070563	K070562	K070561			
	Mix&Match	P171590 P766663	P171595 P766663	P171594 P766663	P171593 P766663	P171592 P766663	P171591 P766663			
FLS330 SAE Flange	Assembly	K070207	K070212	K070211	K070210	K070209	K070208			
	Mix&Match	P171560 P767003	P171565 P767003	P171564 P767003	P171563 P767003	P171562 P767003	P171561 P767003			
	Assembly	K070569	K070568	K070434	K070567	K070566	K070565			
	Mix&Match	P171560 P766662	P171565 P766662	P171564 P766662	P171563 P766662	P171562 P766662	P171561 P766662			
FLS500 SAE Flange	Assembly	K070219	K070224	K070223	K070222	K070221	K070220			
	Mix&Match	P171566 P767005	P171571 P767005	P171570 P767005	P171569 P767005	P171568 P767005	P171567 P767005			
	Assembly	K070571	K070439	K070438	K070437	K070436	K070435			
	Mix&Match	P171566 P766668	P171571 P766668	P171570 P766668	P171569 P766668	P171568 P766668	P171567 P766668			
FLS800 SAE Flange	Assembly	K070231	K070236	K070235	K070234	K070233	K070232			
	Mix&Match	P171578 P767006	P171583 P767006	P171582 P767006	P171581 P767006	P171580 P767006	P171579 P767006			
	Assembly	K070440	K070445	K070444	K070443	K070442	K070441			
	Mix&Match	P171578 P766664	P171583 P766664	P171582 P766664	P171581 P766664	P171580 P766664	P171579 P766664			
	Sparepart	Housing	Housing	Housing	Housing	Housing	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



		WIRES MESH MEDIA			CELLULOSE MEDIA			SYNTHETIC MEDIA			BOX					
		/6			/3			/1			/03			/02		
		60µm			$\beta_{50\mu m(c)} \geq 1000$			$\beta_{30\mu m(c)} \geq 1000$			$\beta_{25\mu m(c)} \geq 1000$			$\beta_{10\mu m(c)} \geq 1000$		
Family	Version	RMF		RMF		RMF		RMF		RMF		RMF		RMF		
FRCA60	no Indicator holes	60	K040635	60	K040634	50	K040633	40	K040632	40	K040631	40	P171602	P173441	E509389	
	Mix&Match		P171607	P173441	P171606	P173441	P550288	P173441	P171604	P173441	P171604	P173441				
FRCA80	no Indicator holes	80	K040645	70	K040644	60	K040643	50	K040642	50	K040641	50	P171608	P173441	E771397	
	Mix&Match		P171612	P173441	P171611	P173441	P171610	P173441	P171609	P173441	P171609	P173441				
FRCA108				100												
FRCA118				100												
FRCA160	no Indicator holes	160	K051155	150	K051154	140	K051153	120	K051152	120	K051151	120	P171613	P176846	E771403	
	Mix&Match		P171617	P176846	P171616	P176846	P550148	P176846	P171614	P176846	P171614	P176846				
FRCA200	no Indicator holes	200	K051165	190	K051164	160	K051163	140	K051162	140	K051161	140	P171618	P176846	E771404	
	Mix&Match		P171622	P176846	P171621	P176846	P171620	P176846	P171619	P176846	P171619	P176846				
FRCA380	no Indicator holes	380	K250035	340	K250034	300	K250033	280	K250032	280	K250031	280	P171613	P766293	E771406	
	Mix&Match		P171617	P766293	P171616	P766293	P550148	P766293	P171614	P766293	P171614	P766293				
FRCA400	no Indicator holes	400	K250040	360	K250039	320	K250038	300	K250037	300	K250036	300	P171618	P766293	E507967	
	Mix&Match		P171622	P766293	P171621	P766293	P171620	P766293	P171619	P766293	P171619	P766293				
FRCA220				200												
FRCA250				230												
		Sparepart	Head		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



Family	Version	WIRED MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/9	/6	/3	/1	/03	XP10			
FHK 30	Assembly	RMF 30	60µm	RMF 20	RMF 20	RMF 15	RMF 15	RMF 15	RMF 15	RMF 15
	Mix&Match									
FHK 60	Assembly	RMF 60	60µm	RMF 40	RMF 40	RMF 35	RMF 35	RMF 35	RMF 35	RMF 35
	Mix&Match									
FHK 100	Assembly	RMF 100	60µm	RMF 65	RMF 65	RMF 60	RMF 60	RMF 60	RMF 60	RMF 60
	Mix&Match									
FHK 180	Assembly	RMF 180	60µm	RMF 120	RMF 120	RMF 110	RMF 110	RMF 110	RMF 110	RMF 110
	Mix&Match									
FHK 500	Assembly	RMF 500	60µm	RMF 400	RMF 400	RMF 350	RMF 350	RMF 350	RMF 350	RMF 350
	Mix&Match									
		Sparepart	Housing	Sparepart	Housing	Sparepart	Housing	Sparepart	Housing	Sparepart
		Sparepart	Housing	Sparepart	Housing	Sparepart	Housing	Sparepart	Housing	Sparepart

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



Family	WIRED MESH				CELLULOSE MEDIA				SYNTHETIC MEDIA				
	/09	/6	/3	/1	/3	/1	/3	/1	/3	/1	/3	/1	XP10
	90µm	60µm	IS ₆ (µm) ≥ 1000	IS ₆ (µm) ≥ 1000	IS ₆ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₂ (µm) ≥ 1000	IS ₁₁ (µm) ≥ 1000
FLA 50	Version	RMF											
	Assembly		K030253		K030258		K030257		K030256		K030255		K030254
	Mix&Match	20	P171518 P766484	15	P171523 P766484	15	P171522 P766484	15	P171521 P766484	10	P171520 P766484	10	P171519 P766484
	Assembly		K030361		K030364		K030363		K030362		K030426		K030355
FLA100	Version	RMF											
	Assembly		K030265		K030270		K030269		K030268		K030267		K030266
	Mix&Match	40	P171530 P766485	30	P171535 P766485	30	P171534 P766485	30	P171533 P766485	25	P171532 P766485	25	P171531 P766485
	Assembly		K030356		K030360		K030359		K030358		K030427		K030357
FLA150	Version	RMF											
	Assembly		K040590		K040595		K040594		K040593		K040592		K040591
	Mix&Match	65	P171584 P766486	55	P171589 P766486	55	P171588 P766486	55	P171587 P766486	45	P171586 P766486	45	P171585 P766486
	Assembly		K040932		K040936		K040935		K040934		K04113		K040933
FLA180	Version	RMF											
	Assembly		K040602		K040607		K040606		K040605		K040604		K040603
	Mix&Match	90	P171536 P766487	60	P171541 P766487	60	P171540 P766487	60	P171539 P766487	55	P171538 P766487	55	P171537 P766487
	Assembly		K040937		K040941		K040940		K040939		K04114		K040938
FLA200	Version	RMF											
	Assembly		K040614		K040619		K040618		K040617		K040616		K040615
	Mix&Match	100	P171596 P766488	70	P171601 P766488	70	P171600 P766488	70	P171599 P766488	80	P171598 P766488	80	P171597 P766488
	Assembly		K040942		K040945		K040944		K040943		K04116		K04115
FLA250	Version	RMF											
	Assembly		K070153		K070158		K070157		K070156		K070155		K070154
	Mix&Match	125	P171590 P766489	80	P171595 P766489	80	P171594 P766489	80	P171593 P766489	70	P171592 P766489	70	P171591 P766489
	Assembly		K070396		K070399		K070398		K070397		K04116		K070496
FLA330	Version	RMF											
	Assembly		K070165		K070170		K070169		K070168		K070167		K070166
	Mix&Match	170	P171560 P766491	110	P171565 P766491	110	P171564 P766491	110	P171563 P766491	90	P171562 P766491	90	P171561 P766491
	Assembly		K070400		K070404		K070403		K070402		K070497		K070401

Suction Line Filters

Suction Filters In-Line FLK FLA



		WIRES MESH			CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/09	/6	/3	/1	/03	XP10			
		90µm	60µm	β ₈ ≥1000	β ₆ ≥1000	β ₂₃ ≥1000	β ₁₁ ≥1000			
FLA500	Assembly	K070177	K070182	K070181	K070180	K070179	K070178			
	Mix&Match	P171566 P766493	P171571 P766493	P171570 P766493	P171569 P766493	P171568 P766493	P171567 P766493			
	Assembly	K070405	K070410	K070409	K070408	K070407	K070406			
	Mix&Match	P171566 P766493	P171571 P766493	P171570 P766493	P171569 P766493	P171568 P766493	P171567 P766493			
FLA250 SAE Flange	Assembly	K070189	K070194	K070193	K070192	K070191	K070190			
	Mix&Match	P171590 P766490	P171595 P766490	P171594 P766490	P171593 P766490	P171592 P766490	P171591 P766490			
	Assembly	K070503	K070502	K070501	K070500	K070499	K070498			
	Mix&Match	P171590 P766490	P171595 P766490	P171594 P766490	P171593 P766490	P171592 P766490	P171591 P766490			
FLA330 SAE Flange	Assembly	K070201	K070206	K070205	K070204	K070203	K070202			
	Mix&Match	P171560 P766492	P171565 P766492	P171564 P766492	P171563 P766492	P171562 P766492	P171561 P766492			
	Assembly	K070510	K070509	K070508	K070507	K070506	K070505			
	Mix&Match	P171560 P766492	P171565 P766492	P171564 P766492	P171563 P766492	P171562 P766492	P171561 P766492			
FLA500 SAE Flange	Assembly	K070213	K070218	K070217	K070216	K070215	K070214			
	Mix&Match	P171566 P766494	P171571 P766494	P171570 P766494	P171569 P766494	P171568 P766494	P171567 P766494			
	Assembly	K070515	K070411	K070514	K070513	K070512	K070511			
	Mix&Match	P171566 P766494	P171571 P766494	P171570 P766494	P171569 P766494	P171568 P766494	P171567 P766494			
FLA800 SAE Flange	Assembly	K070225	K070230	K070229	K070228	K070227	K070226			
	Mix&Match	P171578 P766495	P171583 P766495	P171582 P766495	P171581 P766495	P171580 P766495	P171579 P766495			
	Assembly	K070412	K070416	K070415	K070414	K070413	K070412			
	Mix&Match	P171578 P766495	P171583 P766495	P171582 P766495	P171581 P766495	P171580 P766495	P171579 P766495			
		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)

In-Line Filters

Medium Pressure Filters FMK FM



Family	Version Assembly	WIRE MESH MEDIA			CELLULOSE MEDIA			SYNTHETIC MEDIA		
		/6 60µm	/3M 30µm	/1 336 _{µm} ≥1000	/03 323 _{µm} ≥1000	/02 311 _{µm} ≥1000	/01 38 _{µm} ≥1000			
FMK140	Assembly	RMF		RMF		RMF		RMF		
	Mix&Match	50	K020083 P171706 P766661	40 K020081 P171704 P766661	40 K020080 P171703 P766661	40 K020079 P171702 P766661	40 K020078 P171701 P766661			
FMK180	Assembly	RMF		RMF		RMF		RMF		
	Mix&Match	80	K020089 P171712 P766660	60 K020087 P171710 P766660	60 K020086 P171709 P766660	60 K020085 P171708 P766660	60 K020084 P171707 P766660			
		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



		SYNTHETIC MEDIA												Box										
		#10				#20				#7				XP10				XP05						
		$\beta_{2\mu m} \geq 1000$				$\beta_{2\mu m} \geq 1000$				$\beta_{2\mu m} \geq 1000$				$\beta_{2\mu m} \geq 1000$				$\beta_{2\mu m} \geq 1000$						
Family	Assembly	Version	RMF				RMF				RMF				RMF				RMF					
K405	Mix&Match	no indicator installed	100	K045741				K045739				K045743				K045745				K045747				E509389
	Assembly	indicator P162400 installed	100	P163419 P762554	120			P165335 P762554	110			P164381 P762554	110			P164375 P762554	100			P165354 P762554				
	Mix&Match	indicator P162400 installed	100	K045794	120			K045795	110			K045793	110			K045792	100			K045791	E509389			
	Assembly	indicator P162896 installed	100	P163419 P766295	120			P165335 P766295	110			P164381 P766295	110			P164375 P766295	100			P165354 P766295	E509389			
K409	Mix&Match	no indicator installed	110	K045742	140			K045740	130			K045744	130			K045746	120			K045748	E507971			
	Assembly	indicator P162400 installed	110	P163324 P173438	140			P165338 P173438	130			P164384 P173438	130			P164378 P173438	120			P165332 P173438				
K409	Mix&Match	indicator P162400 installed	110	K045799	140			K045800	130			K045798	130			K045797	120			K045796	E507971			
	Assembly	indicator P162896 installed	110	P163324 P766296	140			P165338 P766296	130			P164384 P766296	130			P164378 P766296	120			P165332 P766296	E507971			
				Sparepart	Head+Indicator		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	
		$\beta_{25\mu m} \geq 1000$		$\beta_{30\mu m} \geq 1000$		$\beta_{25\mu m} \geq 1000$		$\beta_{30\mu m} \geq 1000$		$\beta_{7\mu m} \geq 1000$	
Family	Version	RMF		RMF		RMF		RMF		RMF	
HMK513	no indicator installed	K053124		K053123		K053125		K053126		K053127	
	Mix&Match	P165705 P766297		P165672 P766297		P165569 P766297		P165659 P766297		P165675 P766297	
	indicator P162400 installed	K053143		K053144		K053142		K053141		K053140	
	Mix&Match	P165705 P766299+P162400	100	P165672 P766299+P162400	120	P165569 P766299+P162400	110	P165659 P766299+P162400	100	P165675 P766299+P162400	
	Assembley	K053147		K053148		K053146		K053132		K053145	
	Mix&Match	P165705 P766298		P165672 P766298		P165569 P766298		P165659 P766298		P165675 P766298	
		Spare part	Head+Indicator	Spare part	Head+Indicator	Spare part	Head+Indicator	Spare part	Head+Indicator	Spare part	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		
		$\beta_{23} \geq 1000$			$\beta_{11} \geq 1000$			$\beta_8 \geq 1000$			$\beta_6 \geq 1000$		
Family	Version	RMF		RMF		RMF		RMF		RMF			
AP358	Assembly	30	K020104		K020103								
	Mix&Match		P171715	P766377	P171714	P766377	P171713	P766377	P169429	P766377	P167838	P766379	
AP359	Assembly	50	K020110		K020109								
	Mix&Match		P165136	P766378	P165006	P766378	P165041	P766378	P169429	P766378	P167838	P766379	
AP360	Assembly	90	K020116		K020115								
	Mix&Match		P165138	P766379	P165015	P766379	P165043	P766379	P167838	P766379	P167838	P766379	
			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

High Pressure Filters In-Line FPK02-04



SYNTHETIC MEDIA									
		/03			/02			/01	
		β23 _{µm(c)} ≥ 1000			β11 _{µm(c)} ≥ 1000			β8 _{µm(c)} ≥ 1000	
Family	Version	RMF			RMF			RMF	
	Assembly		K020173			K020172			K020171
FPK221	Mix&Match	50	P169797	P766385	40	P169447	P766385	P169446	P766385
	Assembly	50	X770617		40	X779053			
FPK221	Mix&Match		P169797	P766385 + P761058		P169447	P766385 + P761058		
	Assembly	90	K020177		80	K020176		K020175	
FPK222	Mix&Match		P169450	P766386		P169449	P766386	P169798	P766386
	Assembly				80	K020212		K020230	
FPK222	Mix&Match				80	P169449	P766381+ P761306	P169798	P766381 + P761306
	Assembly	180	K041585		150	K041588		K041591	
FPK223	Mix&Match		P164172	P766382		P164164	P766382	P164592	P766382
	Assembly	350	K041586		300	K041589		K041592	
FPK224	Mix&Match		P164174	P766383		P164166	P766383	P164594	P766383
	Assembly	450	K041587		400	K041590		K041593	
FPK225	Mix&Match		P164176	P766384		P164168	P766384	P164596	P766384
	Assembly		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)

Pressure Line

High Pressure Filters In-Line FPK03-04



SYNTHETIC MEDIA										
/03			/02				/01			
Family	Version	RMF	$\beta_{23, \geq 1000}$		RMF	$\beta_{11, \geq 1000}$		RMF	$\beta_{8, \geq 1000}$	
AP361	Assembly	50	K030286	P766427	50	K030285	P766427	40	K030284	P766427
	Mix&Match		P171733			P171732			P171731	
AP362	Assembly	80	K030289	P766428	80	K030288	P766428	60	K030287	P766428
	Mix&Match		P171736			P171735			P171734	
AP362 SAE Flange	Assembly	80	K030292	P766439	80	K030291	P766439	60	K030290	P766439
	Mix&Match		P171736			P171735			P171734	
AP363	Assembly	120	K030295	P766429	120	K030294	P766429	80	K030293	P766429
	Mix&Match		P171739			P171738			P171737	
AP363 SAE Flange	Assembly	120	K030298	P766440	120	K030297	P766440	80	K030296	P766440
	Mix&Match		P171739			P171738			P171737	
AP364	Assembly	180	K040676	P766430	180	K040675	P766430	160	K040674	P766430
	Mix&Match		P171742			P171741			P171740	
AP364 SAE Flange	Assembly	180	K040679	P766441	180	K040678	P766441	160	K040677	P766441
	Mix&Match		P171742			P171741			P171740	
AP365	Assembly	300	K040682	P766431	300	K040681	P766431	270	K040680	P766431
	Mix&Match		P171745			P171744			P171743	
AP365 SAE Flange	Assembly	300	K040685	P766442	300	K040684	P766442	270	K040683	P766442
	Mix&Match		P171745			P171744			P171743	
AP366	Assembly	400	K040688	P766432	400	K040687	P766432	320	K040686	P766432
	Mix&Match		P171748			P171747			P171746	
AP366 SAE Flange	Assembly	400	K040691	P766443	400	K040690	P766443	320	K040689	P766443
	Mix&Match		P171748			P171747			P171746	
			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)

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K010006	FCK-LC	144	P162696	DURAMAX – HMK 04	118	P167186	FPK 02 & 04 – AP220	132	P171504	FIK-FIO	34
K020121	FCK-LC	144	P162696	DURAMAX – HMK 04	119	P167412	FPK 02 & 04 – AP220	132	P171504	FIK-FIOT	42
K020126	FCK-LC	144	P162696	DURAMAX – HMK 05	122	P167413	FPK 02 & 04 – AP220	132	P171504	FHK-FIR	74
K020200	FCK-LC	114	P162696	DURAMAX – HMK 05	123	P167415	FPK 02 & 04 – AP220	132	P171505	FIK-FIO	34
K030300	FCK-LC	144	P163324	DURAMAX – HMK 04	118	P167455	SRK-COMBO	79	P171505	FIK-FIOT	42
K041301	SRK Combo	81	P163419	DURAMAX – HMK 04	118	P167455	DURAMAX – HMK 04	118	P171505	FHK-FIR	74
K041511	SRK Combo	81	P163839	FLK-FLS	64	P167455	DURAMAX – HMK 04	119	P171518	FIK-FIO	34
K041528	SRK Combo	81	P163839	FBK-FRCA	68	P167455	DURAMAX – HMK 05	122	P171518	FIK-FIOT	42
K041535	SRK Combo	81	P163839	FBK-FRCA	70	P167455	DURAMAX – HMK 05	123	P171518	FLK-FLS	62
K041595	SRK Combo	81	P163839	DURAMAX – HMK 04	118	P167473	DURAMAX – HMK 04	118	P171518	FLK-FLA	98
K041596	SRK Combo	81	P163839	DURAMAX – HMK 04	119	P167580	SRK Combo	82	P171519	FIK-FIO	34
K041597	SRK Combo	81	P163839	DURAMAX – HMK 05	122	P167580	DURAMAX – HMK 04	119	P171519	FIK-FIOT	42
K041598	SRK Combo	81	P163839	DURAMAX – HMK 05	123	P167580	DURAMAX – HMK 05	123	P171519	FLK-FLS	62
K041599	SRK Combo	81	P164164	FPK 02 & 04 – AP220	132	P167838	FPK 02 – AP280	126	P171519	FLK-FLA	98
K041600	SRK Combo	81	P164166	FPK 02 & 04 – AP220	132	P167843	FPK 02 & 04 – AP220	132	P171520	FIK-FIO	34
K041601	SRK Combo	81	P164168	FPK 02 & 04 – AP220	132	P169429	FPK 02 – AP280	126	P171520	FIK-FIOT	42
K041602	SRK Combo	81	P164172	FPK 02 & 04 – AP220	132	P169446	FPK 02 & 04 – AP220	132	P171520	FLK-FLS	62
K041603	SRK Combo	81	P164174	FPK 02 & 04 – AP220	132	P169447	FPK 02 & 04 – AP220	132	P171520	FLK-FLA	98
K041604	SRK Combo	81	P164176	FPK 02 & 04 – AP220	132	P169449	FPK 02 & 04 – AP220	132	P171521	FIK-FIO	34
K041605	SRK Combo	81	P164375	DURAMAX – HMK 04	118	P169450	FPK 02 & 04 – AP220	132	P171521	FIK-FIOT	42
K041606	SRK Combo	81	P164378	DURAMAX – HMK 04	118	P169797	FPK 02 & 04 – AP220	132	P171521	FLK-FLS	62
K041607	SRK Combo	81	P164381	DURAMAX – HMK 04	118	P169798	FPK 02 & 04 – AP220	132	P171521	FLK-FLA	98
K041608	SRK Combo	81	P164384	DURAMAX – HMK 04	118	P170926	DURAMAX – HMK 04	118	P171522	FIK-FIO	34
K041609	SRK Combo	81	P164592	FPK 02 & 04 – AP220	132	P170926	DURAMAX – HMK 04	119	P171522	FIK-FIOT	42
K041610	SRK Combo	81	P164594	FPK 02 & 04 – AP220	132	P170926	DURAMAX – HMK 05	122	P171522	FLK-FLS	62
K041659	SRK Combo	81	P164596	FPK 02 & 04 – AP220	132	P170926	DURAMAX – HMK 05	123	P171522	FLK-FLA	98
K041660	SRK Combo	81	P165006	FPK 02 – AP280	126	P171087	DURAMAX – HMK 04	118	P171523	FIK-FIO	34
K041661	SRK Combo	81	P165015	FPK 02 – AP280	126	P171087	DURAMAX – HMK 04	119	P171523	FIK-FIOT	42
K041662	SRK Combo	81	P165041	FPK 02 – AP280	126	P171087	DURAMAX – HMK 05	122	P171523	FLK-FLS	62
K041663	SRK Combo	81	P165043	FPK 02 – AP280	126	P171087	DURAMAX – HMK 05	123	P171523	FLK-FLA	98
K041664	SRK Combo	81	P165136	FPK 02 – AP280	126	P171087	FPK 02 & 04 – AP220	133	P171524	FIK-FIO	34
K041665	SRK Combo	81	P165138	FPK 02 – AP280	126	P171087	FPK 02 & 04 – AP220	134	P171524	FIK-FIOT	42
K041666	SRK Combo	81	P165194	SRK-COMBO	79	P171143	FLK-FLS	64	P171524	FIK-FIS	56
K041667	SRK Combo	81	P165194	SRK Combo	82	P171143	DURAMAX – HMK 04	118	P171524	FHK-FIR	74
K041668	SRK Combo	81	P165194	DURAMAX – HMK 04	118	P171143	DURAMAX – HMK 04	119	P171525	FIK-FIO	34
K041669	SRK Combo	81	P165194	DURAMAX – HMK 04	119	P171143	DURAMAX – HMK 05	122	P171525	FIK-FIOT	42
K041670	SRK Combo	81	P165194	DURAMAX – HMK 05	122	P171143	DURAMAX – HMK 05	123	P171525	FIK-FIS	56
K041671	SRK Combo	81	P165194	DURAMAX – HMK 05	123	P171500	FIK-FIO	34	P171525	FHK-FIR	74
K041672	SRK Combo	81	P165332	DURAMAX – HMK 04	118	P171500	FIK-FIOT	42	P171526	FIK-FIO	34
K041673	SRK Combo	81	P165335	DURAMAX – HMK 04	118	P171500	FHK-FIR	74	P171526	FIK-FIOT	42
K041674	SRK Combo	81	P165338	DURAMAX – HMK 04	118	P171501	FIK-FIO	34	P171526	FIK-FIS	56
P162400	FLK-FLS	64	P165354	DURAMAX – HMK 04	118	P171501	FIK-FIOT	42	P171526	FHK-FIR	74
P162400	FBK-FRCA	68	P165569	DURAMAX – HMK 05	122	P171501	FHK-FIR	74	P171527	FIK-FIO	34
P162400	FBK-FRCA	70	P165659	DURAMAX – HMK 05	122	P171502	FIK-FIO	34	P171527	FIK-FIOT	42
P162400	DURAMAX – HMK 04	118	P165672	DURAMAX – HMK 05	122	P171502	FIK-FIOT	42	P171527	FIK-FIS	56
P162400	DURAMAX – HMK 04	119	P165675	DURAMAX – HMK 05	122	P171502	FHK-FIR	74	P171527	FHK-FIR	74
P162400	DURAMAX – HMK 05	122	P165705	DURAMAX – HMK 05	122	P171503	FIK-FIO	34	P171528	FIK-FIO	34
P162400	DURAMAX – HMK 05	123	P167181	FPK 02 – AP280	126	P171503	FIK-FIOT	42	P171528	FIK-FIOT	42
P162696	FBK-FRCA	70	P167183	FPK 02 – AP280	126	P171503	FHK-FIR	74	P171528	FIK-FIS	56

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P171529	FIK-FIOT	42	P171536	FHK-FIR	74	P171553	FIK-FIO	34	P171568	FIK-FIO	34
P171529	FIK-FIS	56	P171536	FLK-FLA	98	P171553	FIK-FIOT	42	P171568	FIK-FIOT	42
P171529	FHK-FIR	74	P171537	FIK-FIO	34	P171554	FIK-FIO	34	P171568	FLK-FLS	62
P171530	FIK-FIO	34	P171537	FIK-FIOT	42	P171554	FIK-FIOT	42	P171568	FHK-FIR	74
P171530	FIK-FIO	34	P171537	FLK-FLS	62	P171555	FIK-FIO	34	P171568	FLK-FLA	98
P171530	FIK-FIOT	42	P171537	FHK-FIR	74	P171555	FIK-FIOT	42	P171569	FIK-FIO	34
P171530	FIK-FIO/FIOT	50	P171537	FLK-FLA	98	P171556	FIK-FIO	34	P171569	FIK-FIOT	42
P171530	FIK-FIS	56	P171538	FIK-FIO	34	P171556	FIK-FIOT	42	P171569	FLK-FLS	62
P171530	FLK-FLS	62	P171538	FIK-FIOT	42	P171557	FIK-FIO	34	P171569	FHK-FIR	74
P171530	FHK-FIR	74	P171538	FLK-FLS	62	P171557	FIK-FIOT	42	P171569	FLK-FLA	98
P171530	FLK-FLA	98	P171538	FHK-FIR	74	P171558	FIK-FIO	34	P171570	FIK-FIO	34
P171531	FIK-FIO	34	P171538	FLK-FLA	98	P171558	FIK-FIOT	42	P171570	FIK-FIOT	42
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P171531	FIK-FIO/FIOT	50	P171539	FIK-FIOT	42	P171559	FIK-FIOT	42	P171570	FHK-FIR	74
P171531	FIK-FIS	56	P171539	FLK-FLS	62	P171560	FIK-FIO	34	P171570	FLK-FLA	98
P171531	FLK-FLS	62	P171539	FHK-FIR	74	P171560	FIK-FIOT	42	P171571	FIK-FIO	34
P171531	FHK-FIR	74	P171539	FLK-FLA	98	P171560	FLK-FLS	62	P171571	FIK-FIOT	42
P171531	FLK-FLA	98	P171540	FIK-FIO	34	P171560	FLK-FLA	98	P171571	FLK-FLS	62
P171532	FIK-FIO	34	P171540	FIK-FIOT	42	P171561	FIK-FIO	34	P171571	FHK-FIR	74
P171532	FIK-FIOT	42	P171540	FLK-FLS	62	P171561	FIK-FIOT	42	P171571	FLK-FLA	98
P171532	FIK-FIO/FIOT	50	P171540	FHK-FIR	74	P171561	FLK-FLS	62	P171572	FIK-FIO	34
P171532	FIK-FIS	56	P171540	FLK-FLA	98	P171561	FLK-FLA	98	P171572	FIK-FIOT	42
P171532	FLK-FLS	62	P171541	FIK-FIO	34	P171562	FIK-FIO	34	P171573	FIK-FIO	34
P171532	FHK-FIR	74	P171541	FIK-FIOT	42	P171562	FIK-FIOT	42	P171573	FIK-FIOT	42
P171532	FLK-FLA	98	P171541	FLK-FLS	62	P171562	FLK-FLS	62	P171574	FIK-FIO	34
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P171533	FIK-FIOT	42	P171541	FLK-FLA	98	P171563	FIK-FIO	34	P171575	FIK-FIO	34
P171533	FIK-FIO/FIOT	50	P171542	FIK-FIO	34	P171563	FIK-FIOT	42	P171575	FIK-FIOT	42
P171533	FIK-FIS	56	P171542	FIK-FIOT	42	P171563	FLK-FLS	62	P171576	FIK-FIO	34
P171533	FLK-FLS	62	P171543	FIK-FIO	34	P171563	FLK-FLA	98	P171576	FIK-FIOT	42
P171533	FHK-FIR	74	P171543	FIK-FIOT	42	P171564	FIK-FIO	34	P171577	FIK-FIO	34
P171533	FLK-FLA	98	P171544	FIK-FIO	34	P171564	FIK-FIOT	42	P171577	FIK-FIOT	42
P171534	FIK-FIO	34	P171544	FIK-FIOT	42	P171564	FLK-FLS	62	P171578	FIK-FIO	34
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P171534	FIK-FIO/FIOT	50	P171545	FIK-FIOT	42	P171565	FIK-FIO	34	P171578	FLK-FLS	62
P171534	FIK-FIS	56	P171546	FIK-FIO	34	P171565	FIK-FIOT	42	P171578	FLK-FLA	98
P171534	FLK-FLS	62	P171546	FIK-FIOT	42	P171565	FLK-FLS	62	P171579	FIK-FIO	34
P171534	FHK-FIR	74	P171547	FIK-FIO	34	P171565	FLK-FLA	98	P171579	FIK-FIOT	42
P171534	FLK-FLA	98	P171547	FIK-FIOT	42	P171566	FIK-FIO	34	P171579	FLK-FLS	62
P171535	FIK-FIO	34	P171548	FIK-FIO	34	P171566	FIK-FIOT	42	P171579	FLK-FLA	98
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P171535	FIK-FIO/FIOT	50	P171549	FIK-FIO	34	P171566	FLK-FLS	62	P171580	FIK-FIOT	42
P171535	FIK-FIS	56	P171549	FIK-FIOT	42	P171566	FHK-FIR	74	P171580	FLK-FLS	62
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P171582	FIK-FIO	34	P171606	FBK-FACA	104	P171705	FMK-FM	110	P171831	FIK-FIS	56
P171582	FIK-FIOT	42	P171606	FFCA	152	P171706	FMK-FM	110	P171832	FIK-FIS	56
P171582	FLK-FLS	62	P171607	FBK-FRCA	68	P171706	FCK-LC	114	P171833	FIK-FIS	56
P171582	FLK-FLA	98	P171607	FBK-FACA	104	P171707	FMK-FM	110	P171834	FIK-FIO/FIOT	50
P171583	FIK-FIO	34	P171607	FFCA	152	P171708	FMK-FM	110	P171834	FIK-FIS	56
P171583	FIK-FIOT	42	P171608	FBK-FRCA	68	P171709	FMK-FM	110	P171835	FIK-FIS	56
P171583	FLK-FLS	62	P171608	FBK-FACA	104	P171710	FMK-FM	110	P171836	FIK-FIS	56
P171583	FLK-FLA	98	P171608	FFCA	152	P171711	FMK-FM	110	P171837	FIK-FIO/FIOT	50
P171584	FLK-FLS	62	P171609	FBK-FRCA	68	P171712	FMK-FM	110	P171837	FIK-FIS	56
P171584	FLK-FLA	98	P171609	FBK-FACA	104	P171713	FPK 02 – AP280	126	P171838	FIK-FIS	56
P171585	FLK-FLS	62	P171610	FBK-FRCA	68	P171714	FPK 02 – AP280	126	P171839	FIK-FIS	56
P171585	FLK-FLA	98	P171610	FBK-FACA	104	P171715	FPK 02 – AP280	126	P171840	FIK-FIO/FIOT	50
P171586	FLK-FLS	62	P171610	FFCA	152	P171731	FPK 03 & 04 – AP420	138	P171840	FIK-FIS	56
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P171587	FLK-FLS	62	P171611	FBK-FACA	104	P171733	FPK 03 & 04 – AP420	138	P171842	FIK-FIS	56
P171587	FLK-FLA	98	P171611	FFCA	152	P171734	FPK 03 & 04 – AP420	138	P171843	FIK-FIO/FIOT	50
P171588	FLK-FLS	62	P171612	FBK-FRCA	68	P171735	FPK 03 & 04 – AP420	138	P171843	FIK-FIS	56
P171588	FLK-FLA	98	P171612	FBK-FACA	104	P171736	FPK 03 & 04 – AP420	138	P171844	FIK-FIS	56
P171589	FLK-FLS	62	P171612	FFCA	152	P171737	FPK 03 & 04 – AP420	138	P171845	FIK-FIS	56
P171589	FLK-FLA	98	P171613	FBK-FRCA	68	P171738	FPK 03 & 04 – AP420	138	P171846	FIK-FIO/FIOT	50
P171590	FLK-FLS	62	P171613	FBK-FRCA	68	P171739	FPK 03 & 04 – AP420	138	P171846	FIK-FIS	56
P171590	FLK-FLA	98	P171613	FBK-FACA	104	P171740	FPK 03 & 04 – AP420	138	P171847	TCO	148
P171591	FLK-FLS	62	P171613	FFCA	152	P171741	FPK 03 & 04 – AP420	138	P171848	TCO	148
P171591	FLK-FLA	98	P171614	FBK-FRCA	68	P171742	FPK 03 & 04 – AP420	138	P171850	TCO	148
P171592	FLK-FLS	62	P171614	FBK-FACA	104	P171743	FPK 03 & 04 – AP420	138	P171851	TCO	148
P171592	FLK-FLA	98	P171616	FBK-FRCA	68	P171744	FPK 03 & 04 – AP420	138	P171852	TCO	148
P171593	FLK-FLS	62	P171616	FBK-FACA	104	P171745	FPK 03 & 04 – AP420	138	P171853	TCO	148
P171593	FLK-FLA	98	P171616	FFCA	152	P171746	FPK 03 & 04 – AP420	138	P171854	TCO	148
P171594	FLK-FLS	62	P171617	FBK-FRCA	68	P171747	FPK 03 & 04 – AP420	138	P171855	TCO	148
P171594	FLK-FLA	98	P171617	FBK-FACA	104	P171748	FPK 03 & 04 – AP420	138	P171856	TCO	148
P171595	FLK-FLS	62	P171617	FFCA	152	P171767	FCK-LC	144	P171857	TCO	148
P171595	FLK-FLA	98	P171618	FBK-FRCA	68	P171768	FCK-LC	144	P171858	TCO	148
P171596	FLK-FLA	98	P171618	FBK-FACA	104	P171769	FCK-LC	144	P171859	TCO	148
P171597	FLK-FLS	62	P171618	FFCA	152	P171771	FCK-LC	144	P171860	TCO	148
P171597	FLK-FLA	98	P171619	FBK-FRCA	68	P171772	FCK-LC	144	P171861	FIOA	88
P171598	FLK-FLS	62	P171619	FBK-FACA	104	P171773	FCK-LC	144	P171865	FIOA	88
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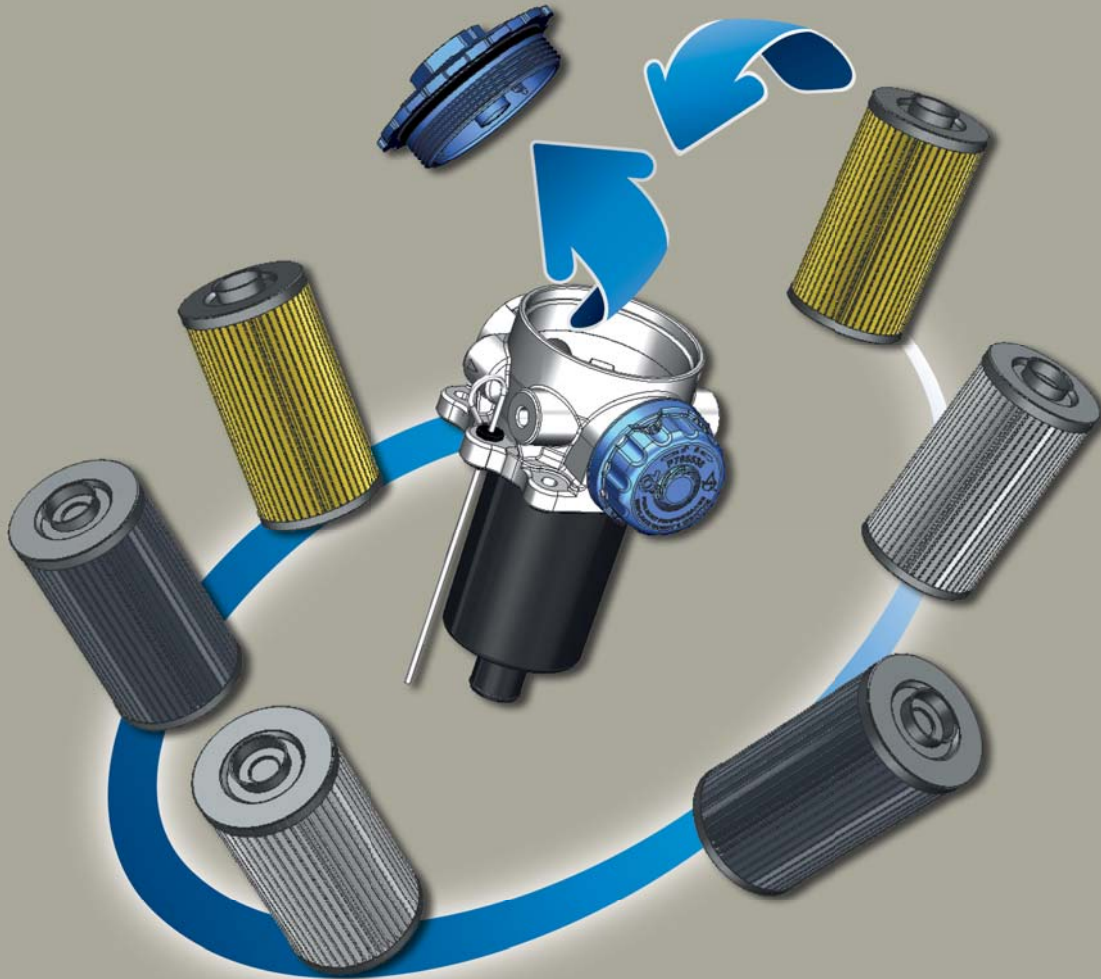
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